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„ V. ————————————	„	31 Mar.	„

ENTOMOLOGICAL SOCIETY OF LONDON

FOUNDED, 1833.

INCORPORATED BY ROYAL CHARTER, 1885.

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List of Fellows

OF THE

ENTOMOLOGICAL SOCIETY OF LONDON.

HONORARY FELLOWS.

Date of Election. *Marked * have died during the year.*

1900 Aurivillius, Professor Christopher, *Stockholm.*

1905 Bolivar, Ignacio, *Museo nacional de Historia natural, Hipodromo,* 17, *Madrid.*

1911 Comstock, Professor J. H., *Cornell University, Ithaca, New York, U.S.A.*

1901 Fabre, J. H., *Sérignan, Vaucluse, France.*

1894 Forel, Professor Auguste, M.D., *Chigny, près Morges, Switzerland.*

1912 Frey-Gessner, Dr. Emile, *La Roseraie, Genève, Switzerland.*

1906 * Ganglbauer, Custos Ludwig, *Hof-Museum, Vienna.*

1898 Grassí, Professor Battista, *The University, Rome.*

1908 Oberthür, Charles, *Rennes, Ille-et-Vilaine, France.*

1906 Reuter, Professor Odo Morannal, *The University, Helsingfors, Finland.*

1911 Wasmann, Fr. Erich, S.J., *Valkenburg (L.) Ignatius Kolleg, Holland.*

1893 Wattenwyl, Hoffrath Carl Brunner von, *Schönburgstrasse* 3, *Vienna.*

1898 Weismann, Dr. August, *Freiburg, Baden.*

FELLOWS.

Marked † have compounded for their Annual Subscriptions.

*Marked * have died during the year.*

Date of Election.

1908 Ackerley, F. B., c/o *Imperial Tobacco Co., P. O. Box* 1159, *Johannesburg, South Africa.*

1901 † Adair, Sir Frederick E. S., Bart., *Flixton Hall, Bungay.*

1877 Adams, Frederick Charlstrom, F.Z.S., 50, *Ashley-gardens, Victoria-street,* S.W.

1902 Adkin, Benaiah Whitley, *Trenoweth, Hope-park, Bromley, Kent.*

1885 Adkin, Robert, (Council, 1911–), *Wellfield, Lingards-road, Lewisham,* S.E.

1904 Agar, E. A., *La Haut, Dominica, B. W. Indies.*

1912 Allen, T. W., M.A., 30, *Blenheim-gardens, Cricklewood*, N.
1911 Anderson, T. J., Entomologist, Dept. of Agriculture, *Nairobi, British East Africa.*
1910 † Andrewes, H. E., 8, *North Grove, Highgate*, N.
1899 Andrews, Henry W., *Shirley, Welling S.O., Kent.*
1901 Anning, William, 39, *Lime Street*, E.C.
1908 † Antram, Charles B., *Somerdale Estate, Ootacamund, Nilgiri Hills, S. India.*
1911 Armstrong, Lionel, 25, *Bourne Hall-road, Bushey, Herts.*
1907 Arnold, G., M.Sc., A.R.C.S., Curator, *Rhodesia Museum, Bulawayo, S. Africa.*
1899 † Arrow, Gilbert J., (Council, 1905–7), 87, *Union-grove, Clapham*, S.W.; and *British Museum (Natural History), Cromwell-road*, S.W.
1911 Ashby, Edward Bernard, *St. Bernards, Bulstrode-road, Hounslow, Middlesex.*
1907 † Ashby, Sydney R., 119, *Greenvale-road, Eltham-park, Kent.*
1886 Atmore, E. A., 48, *High-street, King's Lynn.*
1850 † Avebury, The Right Honble. Lord, D.C.L., F.R.S., F.L.S., F.G.S., etc., (Pres., 1866–7, 1879–80; V.-Pres., 1862, 1868, 1876, 1881, 1888; Council, 1855–7, 1859–61), *High Elms, Farnborough, Kent.*

1901 Bacot, Arthur W., *York Cottage, York-hill, Loughton, Essex.*
1904 † Bagnall, Richard S., *Oldstead, Park Town, Oxford.*
1909 Bagwell-Purefoy, Capt. Edward, 34, *Sloane-Court*, S.W.
1903 Baldock, G. R., *Oakburn Villa, Enfield Highway, Middlesex.*
1912 Ballard, Edward, *Zomba, Nyassaland, Africa.*
1886 Bankes, Eustace R., M.A.
1890 Barclay, Francis H., F.G.S., *The Warren, Cromer.*
1886 Bargagli, Marchese Piero, *Piazza S. Maria, Palazzo Tempi No.* 1, *Florence, Italy.*
1895 Barker, Cecil W., *The Bungalow, Escombe, Natal, South Africa.*
1902 Barraud, Philip J., *Bushey Heath, Watford.*
1911 Barrett, J. Platt, *Westcroft, South-road, Forest Hill*, S.E.
1907 Bartlett, H. Frederick D., 1, *Myrtle-road, Bournemouth.*
1894 † Bateson, Prof. William, M.A., F.R.S., Fellow of St. John's College, Cambridge, *The Manor House, Merton, Surrey.*
1908 Bayford, E. G., 2, *Rockingham-street, Barnsley.*
1904 Bayne, Arthur F., c/o Messrs. Freeman, *Castle-street, Framlingham, Suffolk.*
1912 Baynes, Edward Stuart Augustus, 120, *Warwick-street, Eccleston-square*, S.W.
1896 † Beare, Prof. T. Hudson, B.Sc., F.R.S.E., (V.-Pres., 1910; Council, 1909–11), 10, *Regent Terrace, Edinburgh.*
1908 Becher, Major Edward F., *Cranfield House, Polzeath, St. Minver, Cornwall.*
1908 Beck, Richard, *Red Lodge, Porchester-road, Bournemouth.*
1905 Bedford, The Duke of, K.G., Pres. Z.S., etc., *Woburn Abbey, Beds.*

1912 BEDFORD, Gerald, Entomologist to the Union of South Africa, Veterinary Bacteriological Laboratory, *Ondestepoort*, *Pretoria*, *Transvaal.*

1899 BEDWELL, Ernest C., *Bruggen*, *Brighton-road*, *Coulsdon*, *Surrey.*

1904 BENGTSSON, Simon, Ph.D., Lecturer, University of Lund, Sweden ; Curator, Entomological Collection of the University.

1906 BENTALL, E. E., *The Towers*, *Heybridge*, *Essex.*

1885 BETHUNE-BAKER, George T., F.L.S., F.Z.S., (V.-PRES., 1910–11 ; COUNCIL, 1895, 1910–), 19, *Clarendon-road*, *Edgbaston*, *Birmingham.*

1895 BEVAN, Lieutenant H. G. R., R.N., 38, *The Common*, *Woolwich.*

1891 BLABER, W. H., F.L.S., 34, *Cromwell-road*, *Hove*, *Brighton.*

1904 BLACK, James E., *Nethercroft*, *Peebles.*

1904 BLAIR, Kenneth G., 23, *West Hill*, *Highgate*, N.

1885 BLATHWAYT, Lt.-Col. Linley, F.L.S., *Eagle House*, *Batheaston*, *Bath.*

1909 BLENKARN, Stanley A., *Norham*, *Cromwell-road*, *Beckenham.*

1904 BLISS, Maurice Frederick, *Coningsburgh*, *Montpelier-road*, *Ealing*, W.

1886 BLOOMFIELD, The Rev. Edwin Newson, M.A., *Guestling Rectory*, *Hastings.*

1912 BODKIN, G. C., Govt. Entomologist, *Georgetown*, *British Guiana.*

1903 BOGUE, W. A., *The Bank House*, *Watchet.*

1911 BOILEAU, H., 99, *Rue de la Côte St. Thibault*, *Bois de Colombes*, *Seine*, *France.*

1907 BONNET, Alexandre, 54, *Boulevard Bineau*, *Neuilly-sur-Seine*, *Seine*, *France.*

1891 BOOTH, George A., *Whalley Range*, *Longton*, *Lancashire.*

1902 BOSTOCK, E. D., *Oulton Cross*, *Stone*, *Staffs.*

1888 BOWER, Benjamin A., *Langley*, *Willow Grove*, *Chislehurst.*

1894 † BOWLES, E. Augustus, M.A., *Myddelton House*, *Waltham Cross.*

1912 † BOWRING, C. Talbot, Acting Commissioner of Customs, *Wenchow*, *China.*

1910 BOYD, A. Whitworth, *The Alton*, *Altrincham*, *Cheshire.*

1852 * BOYD, Thos., *Woodvale Lodge*, *South Norwood Hill*, S.E.

1893 * BRABANT, Édouard, *Château de Morenchies*, *par Cambrai* (*Nord*), *France.*

1905 BRACKEN, Charles W., B.A., 5, *Carfrae Terrace*, *Lipson*, *Plymouth.*

1904 BRIDGEMAN, Commander The Hon. Richard O. B., R.N., 44, *Lowndes-square*, *S.W.*, and *H.M.S.* "*Druid*," *1st Destroyer Flotilla*, *Home Fleet.*

1877 BRIGGS, Charles Adolphus, *Rock House*, *Lynmouth S.O.*, *N. Devon.*

1912 BRIGGS, Miss Margery H., B.Sc., 7, *Winterstoke-gardens*, *Mill Hill*, N.W.

1870 BRIGGS, Thomas Henry, M.A., *Rock House*, *Lynmouth S.O.*, *N. Devon.*

1894 BRIGHT, Percy M., *Fairfield*, *Wimborne-road*, *Bournemouth.*

1909 Britten, Harry, *Prospect House, Salkeld Dykes, Penrith.*
1902 Broughton, Major T. Delves, R.E., *Rodney Hall, Filton, nr. Bristol.*
1878 Broun, Major Thomas, *Mount Albert, Auckland, New Zealand.*
1904 Brown, Henry H., *Sheriff Court House, George IV Bridge, Edinburgh.*
1910 Browne, Horace B., M.A., *Park Hurst, Morley, Yorks.*
1911 Brutzer, Rev. Henry William, *Great Bowden Vicarage, Market Harborough.*
1909 Bryant, Gilbert E., *Fir Grove, Esher, Surrey.*
1898 † Buchan-Hepburn, Sir Archibald, Bart., J.P., D.L., *Smeaton-Hepburn, Prestonkirk.*
1907 Bulleid, Arthur, F.S.A., *Wimboro, Midsomer Norton, Somersetshire.*
1896 † Burr, Malcolm, D.Sc., F.L.S., F.Z.S., F.G.S., A.R.S.M., Vice-President, (Council, 1903, 4, 1910–12), *Castle Hill House, Dover.*
1909 Burrows, The Rev. C. R. N., *The Vicarage, Mucking, Stanford-le-Hope, Essex.*
1868 † Butler, Arthur G., Ph.D., F.L.S., F.Z.S., (Sec., 1875; Council, 1876), *The Lilies, Beckenham-road, Beckenham.*
1883 Butler, Edward Albert, B.A., B.Sc., 56, *Cecile-Park, Crouch End*, N.
1902 Butler, William E., *Hayling House, Oxford-road, Reading.*
1905 Butterfield, Jas. A., B.Sc., *Comrie, Eglinton Hill, Plumstead.*
1912 Buxton, Patrick Alfred, M.B.O.U., *Fairhill, Tonbridge*, and *Trinity College, Cambridge.*
1904 Byatt, Horace A., B.A., *Berbera* (viâ *Aden*), *Somaliland Protectorate.*

1902 Cameron, Malcolm, M.B., R.N., *H.M.S.* "*Formidable*," 5*th Battle Squadron.*
1885 Campbell, Francis Maule, F.L.S., F.Z.S., etc., *Byrnllwydwyn, Machynlleth, Montgomeryshire.*
1898 Candèze, Léon, *Mont St. Martin* 75, *Liège.*
1880 Cansdale, W. D., *Sunny Bank, South Norwood*, S.E.
1889 Cant, A., 33, *Festing-road, Putney*, S.W.; and c/o Fredk. Du Cane Godman, Esq., F.R.S., 45, *Pont-street*, S.W.
1894 Caracciolo, H., *H.M. Customs, Port of Spain, Trinidad, British West Indies.*
1910 Carlier, E. Wace, M.D., F.R.S.E., *Morningside, Granville-road, Dorridge*, and *The University, Birmingham.*
1892 Carpenter, The Honble. Mrs. Beatrice, 22, *Grosvenor-road*, S.W.
1910 Carpenter, Geoffrey D. H., B.A., *Uganda Medical Service, Uganda Protectorate.*
1895 Carpenter, Prof. G. H., B.Sc., B.M., B.Ch., *Royal College of Science, Dublin.*
1898 Carpenter, J. H., *Redcot, Belmont-road, Leatherhead.*
1868 Carrington, Charles, *Meadowcroft, Horley, Surrey.*
1911 Carson, George Moffatt, Entomologist to the Government of New Guinea, *Port Moresby, New Guinea.*

1895 Carter, Sir Gilbert, K.C.M.G., *Greycliffe, Lower Warberry-road, Torquay.*

1912 Carter, Henry Francis, Assistant Lecturer and Demonstrator in Medical and Economic Entomology, *Liverpool School of Tropical Medicine, University of Liverpool.*

1906 Carter, H. J., B.A., *Ascham, Darling Point, Sydney, N.S. Wales.*

1900 Carter, J. W., 15, *Westfield-road, Manningham, Bradford.*

1900 Cassal, R. T., M.R.C.S.

1903 Cattle, John Rowland, *The Priory, West Tarring, Worthing.*

1889 † Cave, Charles J. P., *Ditcham Park, Petersfield.*

1900 Chamberlain, Neville, *Westbourne, Edgbaston, Birmingham.*

1871 Champion, George C., F.Z.S., A.L.S., (Council, 1875–7; Librarian, 1891–), *Heatherside, Horsell, Woking;* and 45, *Pont-street*, S.W.

1891 Chapman, Thomas Algernon, M.D., F.Z.S., (V.-Pres., 1900, 1904–5, 1908; Council, 1898–1900, 1903–5, 1907–9), *Betula, Reigate.*

1910 Charnley, J. R.

1897 Chawner, Miss Ethel F., *Forest Bank, Lyndhurst, R.S.O., Hants.*

1902 Cheesman, E. M., c/o Mr. John Garson, 150, *Umbilo-road, Durban.*

1908 Chetty, B. Chourappa, *The Government Museum, Bangalore, India.*

1889 Christy, William M., M.A., F.L.S., *Watergate, Emsworth.*

1909 Chubb, Ernest C., Curator, *Durban Museum, Natal, South Africa.*

1909 Clark, C. Turner, F.Z.S., *Hillcrest, St. Augustine's-avenue, S. Croydon.*

1908 Clark, Edgar L., *Congella, Natal.*

1908 Clutterbuck, Charles G., *Heathside*, 23, *Heathville-road, Gloucester.*

1908 Clutterbuck, P. H., *Indian Forest Department, Naini Tal, United Provinces, India.*

1904 Cockayne, Edward A., 16, *Cambridge-square, London*, W.

1899 Collin, James E., (Council, 1904–6), *Sussex Lodge, Newmarket.*

1906 Collinge, Walter E., M.Sc., F.L.S., 8, *Newhall-street, Birmingham.*

1911 Cotton, Sidney Howard, 1a, *Chesterfield-street, Mayfair*, W.

1892 Cowan, Thomas William, F.L.S., F.G.S., F.R.M.S., *Upcott House, Taunton.*

1867 Cox, Herbert Ed., *Claremont, Jamaica.*

1895 Crabtree, Benjamin Hill, *The Oaklands, Levenshulme, Manchester.*

1909 Crawley, W. C., 16, *Albany-mansions, Albert Bridge-road*, S.W.

1890 Crewe, Sir Vauncey Harpur, Bart., *Calke Abbey, Derbyshire.*

1880 † Crisp, Sir Frank, LL.B., B.A., J.P.

1907 Croft, Edward Octavius, M.D., 28, *Clarendon-road, Leeds.*

1908 Culpin, Millais, M.B., F.R.C.S., *The Palace Hotel, Shanghai.*

1908 Curtis, W. Parkinson, *Aysgarth, Poole, Dorset.*

1901 Dadd, Edward Martin, *Hohenzollernstrasse* 18, *Zehlendorf, bei Berlin.*

1900 Dalglish, Andrew Adie, 7, *Keir-street, Pollokshields, Glasgow.*

1907 Dames, Felix L., 13, *Humboldtstrasse, Steglitz, Berlin.*

1886 Dannatt, Walter, 45, *Manor Park, Lee*, S.E.

1911 Davey, H. W., Inspector of Department of Agriculture, *Geelong, Victoria, Australia.*

1905 Davidson, James D., 32, *Drumsheugh Gardens, Edinburgh.*

1912 Davis, Frederick Lionel, J.P., M.R.C.S., L.R.C.P., *Belize, British Honduras.*

1910 Dawson, William George, *Manor House, Abbots Morton, Worcester.*

1903 Day, F. H., 26, *Currock-terrace, Carlisle.*

1898 Day, G. O., *Sahlatston, Duncan's Station, Vancouver Island, British Columbia.*

1912 Dewitz, Dr. John, Director German Govt. Experimental Station, *Devant-les-Ponts, Metz, Lorraine.*

1875 Distant, William Lucas, (V.-Pres., 1881, 1900; Sec., 1878–80; Council, 1900–2), *Shannon-lodge, Selhurst-road, South Norwood,* S.E.

1887 Dixey, Frederick Augustus, M.A., M.D., F.R.S., Fellow and Bursar of Wadham College, (Pres., 1909–10; V.-Pres., 1904–5, 1911; Council, 1895, 1904–6), *Wadham College, Oxford.*

1895 Dobson, H. T., *Ivy House, Acacia Grove, New Malden S.O., Surrey.*

1909 Dobson, Thomas, 1, *Grant-street, Farnworth, Bolton.*

1905 Dodd, Frederick P., *Kuranda, viâ Cairns, Queensland.*

1912 Doig, Capt. Kenneth Alan Crawford, R.A.M.C., M.R.C.S., L.R.C.P., c/o Messrs. Holt & Co., 3, *Whitehall-place, London, S.W.*

1906 Dollman, Hereward, *Hove House, Newton-grove, Bedford-park,* W.

1903 Dollman, J. C., *Hove House, Newton-grove, Bedford-park,* W.

1906 Doncaster, Leonard, M.A., *The University Museum of Zoology, Cambridge.*

1891 Donisthorpe, Horace St. John K., F.Z.S., (V.-Pres., 1911; Council, 1899–1901, 1910–), 58, *Kensington-mansions, South Kensington,* S.W.

1908 Douglas-Crompton, Sydney.

1910 Downes-Shaw, Rev. Archibald, *Gt. Horton Vicarage, Bradford.*

1884 Druce, Hamilton H. C. J., F.Z.S., (Council, 1903–5), 43, *Circus-road, St. John's Wood,* N.W.

1867 Druce, Herbert, F.L.S., F.Z.S., (Council, 1885, 1892), 43, *Circus-road, St. John's Wood,* N.W.

1900 Drury, W. D., *Rocquaine, West Hill Park, Woking.*

1894 Dudgeon, G. C., Director General, *Dept. of Agriculture, Cairo.*

1906 Dukinfield Jones, E., *Castro, Reigate.*

1883 Durrant, John Hartley, Vice-President, (Council, 1911–), *Merton,* 17, *Burstock-road, Putney,* S.W., and *British Museum (Natural History), Cromwell-road, South Kensington,* S.W.

1910 Eales-White, J. Cushny, 47, *Chester-terrace, Eaton-square,* S.W.

1912 Earl, Herbert L., 35, *Leicester-street, Southport, Lancs.*

1890 Eastwood, John Edmund, *Enton Lodge, Witley, Godalming.*

1865 Eaton, The Rev. Alfred Edwin, M.A., (Council, 1877–9), *Richmond Villa, Northam S.O., N. Devon.*

1904 Eckford, George, F.Z.S., c/o Sir Morgan Tuite, Bart., *Kilruane, Nenagh, Co. Tipperary, Ireland.*

1902 Edelsten, Hubert M., *The Elms, Forty Hill, Enfield, Middlesex.*

1911 Edwards, F. W., *Kingswear, Cornwall-road, Harrow.*

1886 Edwards, James, *Colesborne, Cheltenham.*

1884 Edwards, Stanley, F.L.S., F.Z.S., (Council, 1912–), 15, *St. Germans-place, Blackheath*, S.E.

1900 Elliott, E. A., 16, *Belsize Grove, Hampstead*, N.W.

1900 Ellis, H. Willoughby, *Holly Hill, Berkswell, Warwickshire.*

1886 Ellis, John W., M.B., L.R.C.P., 18, *Rodney-street, Liverpool.*

1903 Eltringham, Harry, M.A., F.Z.S., *Eastgarth, Westoe, South Shields,* and *Hope Department, University Museum, Oxford.*

1878 Elwes, Henry John, J.P., F.R.S., F.L.S., F.Z.S., (Pres., 1893–4; V.-Pres., 1889–90, 1892, 1895; Council, 1888–90), *Colesborne, Cheltenham.*

1886 Enock, Frederick, F.L.S., 13, *Tufnell Park Road, London*, N.

1903 Etheridge, Robert, *Curator, Australian Museum, Sydney, N.S.W.*

1908 Eustace, Eustace Mallabone, M.A., *Challacombe Rectory, Parracombe S.O., N. Devon*, and *Wellington College, Berks.*

1909 Evans, Frank J., Superintendent of Agriculture, *Calabar, Eastern Province, S. Nigeria.*

1907 Feather, Walter, *Voi, British East Africa.*

1900 Feltham, H. L. L., *P. O. Box* 46, *Johannesburg, Transvaal.*

1861 Fenn, Charles, *Eversden House, Burnt Ash Hill, Lee*, S.E.

1886 Fenwick, Nicolas Percival, *The Gables, New-road, Esher.*

1908 Fenwick, Norman Percival, Junior, *Hillside, St. Ann's-road, Eastbourne.*

1910 Fenyes, A., M.D., 170, *North Grange Grove-Avenue, Pasadena, California, U.S.A.*

1889 Fernald, Prof. C. H., *Amherst, Mass., U.S.A.*

1900 Firth, J. Digby, F.L.S., *Boys' Modern School, Leeds.*

1874 * Fitch, Edward A., F.L.S., (Sec., 1881–5; Council, 1879, 1886) *Brick House, Maldon, Essex.*

1905 Fleet, Wilfred James, F.H.A.S., F.C.S., *Toynton, Felixstowe, Suffolk.*

1900 Flemyng, The Rev. W. Westropp, M.A., *Coolfin, Portlaw, co. Waterford.*

1898 Fletcher, T. Bainbrigge, R.N., *Agricultural College and Research Institute, Coimbatore, Madras, S. India.*

1883 † Fletcher, William Holland B., M.A., *Aldwick Manor, Bognor.*

1905 Floersheim, Cecil, 16, *Kensington Court Mansions*, S.W.

1885 Fokker, A. J. F., *Zierikzee, Zeeland, Netherlands.*

1912 Foster, C. A., Worcestershire Regiment, Beechwood, Iffley, Oxford.

1900 Foulkes, P. Hedworth, B.Sc., *Harper-Adams Agricultural College, Newport, Salop.*

1898 Fountaine, Miss Margaret, 1, *The Studios, Sheriff-road, West Hampstead*, N.W.

1880 Fowler, The Rev. Canon, D.Sc., M.A., F.L.S., (Pres., 1901-2; V.-Pres., 1903; Sec., 1886-96), *Earley Vicarage, near Reading.*
1908 Fraser, Frederick C., Capt., M.D., I.M.S., Assist. Superint., *Govt. Maternity Hospital, Madras, India.*
1896 Freke, Percy Evans, *Southpoint, Limes-road, Folkestone.*
1888 Fremlin, H. Stuart, M.R.C.S., L.R.C.P., *The Elms, Kingsbury,* N.W.
1903 French, Charles, F.L.S., Government Entomologist, *Melbourne, Victoria, Australia.*
1910 Frisby, G. E., 40, *Windmill-street, Gravesend.*
1908 Froggatt, Walter W., F.L.S., Government Entomologist, 138, *George-street, Sydney, New South Wales.*
1891 Frohawk, F. W., *Stanley House, Park-road, Wallington, Surrey.*
1906 † Fry, Harold Armstrong, *P.O. Box* 46, *Johannesburg, Transvaal Colony.*
1900 Fryer, H. Fortescue, *The Priory, Chatteris, Cambs.*
1907 Fryer, John Claud Fortescue, *The Priory, Chatteris, Cambs.*
1876 Fuller, The Rev. Alfred, M.A., *The Lodge,* 7, *Sydenham-hill, Sydenham,* S.E.
1898 Fuller, Claude, Government Entomologist, *Pietermaritzburg, Natal.*

1887 Gahan, Charles Joseph, M.A., (Sec., 1899-1900; Council, 1893-5, 1901), 8, *Lonsdale-road, Bedford Park,* W.; and *British Museum (Natural History), Cromwell-road,* S.W.
1910 Garcke, Emile, M.I.E.E., *Witton House, Maidenhead.*
1892 Garde, Philip de la, R.N., 8, *Queen's-terrace, Exeter.*
1890 Gardner, John, *Laurel Lodge, Hart, West Hartlepool.*
1901 † Gardner, Willoughby, F.L.S., *Deganwy, N. Wales.*
1910 Geary, T. H., *Enderby, Leicestershire.*
1899 Geldart, William Martin, M.A., 10, *Chadlington-road, Oxford.*
1906 † Gibbs, Arthur Ernest, F.L.S., F.Z.S. (Council, 1912-), *Kitchener's Meads, St. Albans.*
1908 Giffard, Walter M., *P.O. Box* 308, *Honolulu, Hawaii.*
1907 Giles, Henry Murray, Head Keeper of Zoological Gardens, *South Perth, W. Australia.*
1902 Gillanders, A. T., *Park Cottage, Alnwick.*
1904 Gilliat, Francis, B.A., c/o Rev. G. Gilliat, *Haselbury Vicarage, Crewkerne, Somerset.*
1865 † Godman, Frederick Du Cane, D.C.L., F.R.S., F.L.S., F.Z.S., (Pres., 1891-2; V.-Pres., 1882-3, 1886, 1889-90, 1902; Council, 1880-1, 1900), *South Lodge, Lower Beeding, Horsham*; and 45, *Pont-street,* S.W.
1886 † Goodrich, Captain Arthur Mainwaring, *Brislington House, near Bristol.*
1904 Goodwin, Edward, *Canon Court, Wateringbury, Kent.*
1898 Gordon, J. G. McH., *Corsemalzie, Whauphill S.O., Wigtownshire.*
1898 Gordon, R. S. G. McH., *Corsemalzie, Whauphill S.O., Wigtownshire.*

1855 Gorham, The Rev. Henry Stephen, F.Z.S., (Council, 1882–3), *High-croft, Great Malvern.*

1910 Göttmann, A. M. S., 94, *Niddastrasse, Frankfurt-am-Main, Germany.*

1909 Gowdey, Carlton C., B.Sc., Govt. Entomologist, *Entebbe, Uganda, Africa.*

1911 Graves, P. P., *Club de Constantinople, Constantinople, Turkey.*

1891 † Green, E. Ernest, Government Entomologist, *Mote Hall, Bearsted, Kent*; and *Royal Botanic Gardens, Peradeniya, Ceylon.*

1910 Green, Herbert A., *The Central Fire Station, Durban, Natal.*

1894 Green, J. F., F.Z.S., 38, *Pont-street, London, S.W.*

1898 Greenshields, Alexander, 38, *Blenheim-gardens, Cricklewood* N.W.

1893 † Greenwood, Henry Powys, F.L.S., *Whitsbury House, Salisbury.*

1888 Griffiths, G. C., F.Z.S., *Penhurst*, 3, *Leigh-road, Clifton, Bristol.*

1894 Grimshaw, Percy H., *Royal Scottish Museum, Edinburgh.*

1905 Grist, Charles J., *Elgin House, Knockholt, Sevenoaks.*

1909 * Grosvenor, G. H., M.A., *Blakedown, nr. Kidderminster.*

1906 Gurney, Gerard H., *Keswick Hall, Norwich.*

1910 Gurney, William B., Asst. Govt. Entomologist, *Department of Agriculture, Sydney, Australia.*

1912 Hacker, Henry, *Bowen Bridge-road, Brisbane, Queensland.*

1906 Hall, Arthur, 7, *Park-lane-mansions, Croydon.*

1890 † Hall, Albert Ernest, *Cranfield House, Southwell, Notts.*

1885 Hall, Thomas William, *Stanhope, The Crescent, Croydon.*

1912 Hallett, Howard Mountjoy, 13, *Earl-road, Penarth, Glamorgan-shire.*

1898 Hamlyn-Harris, R., D.Sc., F.L.S., F.Z.S., F.R.M.S., Director of the Queensland Museum, *Brisbane, Australia.*

1891 Hampson, Sir George Francis, Bart., B.A., F.Z.S., (V.-Pres., 1898; Council, 1896–8), 62, *Stanhope-gardens*, S.W.

1891 Hanbury, Frederick J., F.L.S., *Brockhurst, E. Grinstead.*

1905 † Hancock, Joseph L., 5466, *Lexington Avenue, Chicago, U.S.A.*

1903 Hare, E. J., *Dunham, Boscombe, Hants.*

1904 Harris, Edward, *St. Conan's, Chingford, Essex.*

1910 Harwood, Philip, 23, *Northgate End, Bishop's Stortford.*

1910 Hawkshaw, J. C., *Hollycombe, Sussex.*

1910 Hedges, Alfred van der, *Stoke House, Stoke Mandeville, Bucks.*

1910 Henderson, J., *Clifton, Ashbourne, Derby.*

1898 Heron, Francis A., B.A., 16, *Kenilworth-road, Ealing, W.*

1903 Herrod, William, *W.B.C. Apiary, Old Bedford-road, Luton, Beds.*

1908 Hewitt, C. Gordon, D.Sc., *Central Experimental Farm, Dept. of Agriculture, Ottawa, Canada.*

1876 † Hillman, Thomas Stanton, *Eastgate-street, Lewes.*

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1912 Hodge, Harold, *Chapel Place Mansion*, 322, *Oxford-street*, W.

1888 Hodson, The Rev. J. H., B.A., B.D., *Rhyddington, Clifton Drive, Lytham.*
1902 Hole, R. S., c/o Messrs. King and Co., *Bombay.*
1910 Holford, H. Oliver, *Elstead Lodge, Godalming, Surrey.*
1887 Holland, The Rev. W. J., D.D., Ph.D., *5th Avenue, Pittsburg, Penn., U.S.A.*
1898 Holman-Hunt, C. B., Asst. Entomologist, Department of Agriculture, *Kuala Lumpur, Federated Malay States.*
1910 Holmes, Edward Morrell, *Ruthven, Sevenoaks.*
1901 Hopson, Montagu F., L.D.S., R.C.S.Eng., F.L.S., 64, *Harley-street*, W.
1897 Horne, Arthur, 60, *Gladstone-place, Aberdeen.*
1903 Houghton, J. T., 1, *Portland-place, Worksop.*
1907 † Howard, C. W., Entomological Division, *College of Agriculture, St. Anthony Park, Minn., U.S.A.*
1900 Howes, W. George, 432, *George-street, Dunedin, New Zealand.*
1907 Howlett, Frank M., M.A., *Wymondham, Norfolk.*
1865 † Hudd, A. E., 108, *Pembroke-road, Clifton, Bristol.*
1888 Hudson, George Vernon, *Hill View, Karori, Wellington, New Zealand.*
1907 Hughes, C. N., 3, *Wyndham Place, Bryanston-square*, W.
1912 Huie, Miss Lily, *Hollywood, Colinton-road, Edinburgh.*

1897 Image, Prof. Selwyn, M.A., (Council, 1909–11), 20, *Fitzroy-street, Fitzroy-square*, W.
1912 † Imms, A. D., D.Sc., B.A., F.L.S., Forest Zoologist to the Govt. of India, *Forest Research Institute, Dehra Dun, U.P., India.*
1908 Irby, Captain Leonard Paul, *Brook House, Eastry S.O., Kent.*
1891 Isabell, The Rev. John, *Sunnycroft, St. Sennen S.O., Cornwall.*

1907 Jack, Rupert Wellstood, Government Entomologist, Department of Agriculture, *Salisbury, Rhodesia.*
1907 Jackson, P. H., 112, *Balham-park-road*, S.W.
1907 Jacobi, Professor A., Ph.D., Director of the R. Zoological and Anthrop.-Ethnographical Museum, *Dresden, Saxony.*
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1910 Jacobs, Lionel L., *P. O. Box* 445, *Sault Ste. Marie, Ontario, Canada.*
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1898 Janson, Oliver J., *Cestria, Claremont-road, Highgate*, N.
1912 Jardine, Nigel K., 2, *Castle-street, Ashford, Kent.*
1912 Jemmett, C., *Ashford, Kent;* and *Agricultural College, Wye, Kent.*
1886 Jenner, James Herbert Augustus, *East Gate House, Lewes.*
1899 Jennings, F. B., 152, *Silver-street, Upper Edmonton*, N.
1909 Jepson, Frank P., *Department of Agriculture, Suva, Fiji Islands.*

1886 John, Evan, *Llantrisant S.O., Glamorganshire.*
1907 Johnson, Charles Fielding, *Mayfield, Brinington Crescent, Stockport.*
1889 Johnson, The Rev. W. F., M.A., *Acton Rectory, Poyntz Pass, co. Armagh.*
1908 Joicey, James J., *The Homestead, Abbot's Brook, Bourne End, Bucks.*
1888 Jones, Albert H., Vice-President, (Council, 1898–1900; Treasurer, 1904–), *Shrublands, Eltham, Kent.*
1910 Jones, Ernest P., 7, *Sherwin-street, Nantwich-road, Crewe.*
1894 † Jordan, Dr. K., (V.-Pres., 1909; Council, 1909–11), *The Museum, Tring.*
1910 Joseph, E. G., 23, *Clanricarde-gardens*, W.
1910 Joy, Ernest Cooper, *Eversley, Dale-road, Purley.*
1902 Joy, Norman H., M.R.C.S., L.R.C.P., *Bradfield, Reading.*

1884 Kappel, A. W., F.L.S., *Linnean Society, Burlington House*, W.
1876 † Kay, John Dunning, *Leeds.*
1896 † Kaye, William James, (Council, 1906–8), *Caracas, Ditton Hill, Surbiton.*
1907 Kelly, Albert Ernest McClure, Assistant Entomologist, Department of Agriculture, *Pietermaritzburg, Natal, S.A.*
1902 Kemp, Stanley W., *The Indian Museum, Calcutta.*
1890 Kenrick, Sir George H., *Whetstone, Somerset-road, Edgbaston, Birmingham.*
1904 Kershaw, G. Bertram, *Ingleside, West Wickham, Kent.*
1906 Keynes, John Neville, M.A., D.Sc., 6, *Harvey-road, Cambridge.*
1900 Keys, James H., *Morwell, Freedom-villas, Lipson-road, Plymouth.*
1911 Khunan, Kunui, M.A., Asst. Entomologist to the Govt. of Mysore, *Bangalore, South India.*
1912 King, Harold H., Govt. Entomologist, *Gordon College, Khartoum, Sudan.*
1889 King, J. J. F. X., Lecturer on Economic Entomology at the West of Scotland Agricultural College, 1, *Athole Gardens-terrace, Kelvinside, Glasgow.*
1861 * Kirby, William F., F.L.S., (Sec., 1881–5; Council, 1886), *Hilden*, 46, *Sutton Court-road, Chiswick*, W.
1889 Klapálek, Professor Franz, *Karlín* 263, *Prague, Bohemia.*
1887 † Klein, Sydney T., F.L.S., F.R.A.S., *Hatherlow, Raglan-road. Reigate.*
1908 Knüdsen, Jens Marius.
1911 Kung, Thien Cheng, Guardian Superintendent of Chinese Students in British India, c/o The Curator, *Mysore Govt. Museum, Bangalore, India.*

1910 Laidlaw, William, *The Cedars, Eastern-road, Romford, Essex.*
1910 Lakin, C. Ernest, M.D., F.R.C.S., 2, *Park-crescent, Portland-place*, W.
1911 † Lamborn, W. A., M.R.C.S., L.R.C.P., *Oni Camp, Lagos, W. Africa.*
1868 Lang, Colonel A. M., C.B., R.E., *Box Grove Lodge, Guildford.*

1912 Latour, Cyril Engelhart, *Port of Spain, Trinidad, British West Indies.*

1895 Latter, Oswald H., M.A., *Charterhouse, Godalming.*

1908 Lawn, G. W., *Tudor House, Wealdstone, Harrow.*

1899 Lea, Arthur M., Government Entomologist, *Museum, Adelaide, S. Australia.*

1901 Leigh, George F., 45, *Cuthbert's Buildings, West-street, Durban, Natal.*

1910 Leigh, H. S., *The University, Manchester.*

1909 Leigh-Clare, Reginald L., c/o *Messrs. Allen & Gledhill, Solicitors, Singapore.*

1900 Leigh-Phillips, Rev. W. J., *Capstan House, Copse-road, Clevedon, Somerset.*

1892 Leslie, J. Henry, 84, *Huron-road, Tooting Common,* S.W.

1898 Lethbridge, Ambrose G.

1903 † Levett, The Rev. Thomas Prinsep, *Frenchgate, Richmond, Yorks.*

1876 Lewis, George, F.L.S., (Council, 1878, 1884), 87, *Frant-road, Tunbridge Wells.*

1908 † Lewis, John Spedan, *Spedan Towers, Hampstead,* N.W., and 277, *Oxford-street,* W.

1892 Lightfoot, R. M., *Bree-st., Cape Town, Cape of Good Hope.*

1908 Lister, W. K., *Street End House, Ash, near Dover.*

1903 Littler, Frank M., *Box* 114, *P.O., Launceston, Tasmania.*

1865 † Llewelyn, Sir John Talbot Dillwyn, Bart., M.A., F.L.S., *Penllergare, Swansea.*

1881 † Lloyd, Alfred, F.C.S., *The Dome, Bognor.*

1885 † Lloyd, Robert Wylie, (Council, 1900–1), I, 5 and 6, *Albany, Piccadilly,* W.

1903 Lofthouse, Thomas Ashton, *The Croft, Linthorpe, Middlesbrough.*

1908 Longsdon, D., *The Flower House, Southend, Catford,* S.E.

1904 † Longstaff, George Blundell, M.D., (V.-Pres., 1909; Council, 1907–9), *Highlands, Putney Heath,* S.W.

1899 Lounsbury, Charles P., B.Sc., Government Entomologist, *Box* 513, *Pretoria, S. Africa.*

1894 Lowe, The Rev. Frank E., M.A., *St. Stephen's Vicarage, Guernsey.*

1893 Lower, Oswald B., *Argent-street, Broken Hill, New South Wales.*

1901 Lower, Rupert S., *Davonport-terrace, Wayville, South Australia.*

1909 Lucas, Dr. T. P., *Wakefield-buildings, Adelaide-street, Brisbane, Australia.*

1898 Lucas, William John, B.A., (Council, 1904–6), 28, *Knight's Park, Kingston-on-Thames.*

1880 Lupton, Henry, *Courtlands, Chelston, Torquay.*

1903 Lyell, G., *Gisborne, Victoria, Australia.*

1912 Lyle, George Trevor, *Bank House, Brockenhurst.*

1901 Lyman, Henry H., M.A., F.R.G.S., 74, *McTavish-street, Montreal, Canada.*

1909 LYON, Francis Hamilton, 89, *Clarence Gate-gardens, Upper Baker-street*, N.W.

1906 MCCARRISON, D. L., *Indian Police Forces, Madras Club, Madras.*
1887 M'DOUGALL, James Thomas, *Dunolly, Morden-road, Blackheath*, S.E.
1910 MACDOUGALL, R. Stewart, M.A., D.Sc., F.R.S.E., *Edinburgh University.*
1888 MACKINNON, P. W., *Lynndale, Mussoorie, N.W.P., India.*
1900 MACKWOOD, The Hon. F. M., M.L.C., *Colombo, Ceylon.*
1911 MACLEAN, Dr. Ivan Clarkson, M.D., B.Sc., M.R.C.S., L.R.C.P., 28, *Hill-street, Knightsbridge*, S.W.
1899 † MAIN, Hugh, B.Sc., (COUNCIL, 1908–10), *Almondale, Buckingham-road, South Woodford*, N.E.
1905 MALLY, Charles Wm., M.Sc., *Graham's Town, Cape Colony.*
1887 MANDERS, Lieut.-Colonel Neville, R.A.M.C., F.Z.S., 4, *South-road, Curragh Camp, Co. Kildare, Ireland.*
1892 MANSBRIDGE, William, 4, *Norwich-road, Wavertree, Liverpool.*
1894 † MARSHALL, Alick, 18, *Hazeldene-road, Chiswick, W.*
1895 MARSHALL, Guy Anstruther Knox, F.Z.S., (COUNCIL, 1907–8), 6, *Chester-place, Hyde Park-square*, W.
1896 MARSHALL, P., M.A., B.Sc., F.G.S., *University School of Mines, Dunedin, New Zealand.*
1856 † MARSHALL, William, V.M.H., F.R.H.S., *Auchinraith, Bexley S.O., Kent.*
1897 MARTINEAU, Alfred H., 54, *Holly-lane, W. Smethwick.*
1910 † MASON, C. W., *St. Denis, Shaftesbury, Dorset.*
1895 MASSEY, Herbert, *Ivy-Lea, Burnage, Didsbury, Manchester.*
1865 MATHEW, Gervase F., F.L.S., Paymaster-in-chief, R.N., (COUNCIL, 1887), *Lee House, Dovercourt, Harwich.*
1887 MATTHEWS, Coryndon, *Stentaway, Plymstock, S. Devon.*
1912 MAULIK, Samarenda, c/o Messrs. T. Cook & Son, *Ludgate-circus*, E.C., and *Fitzwilliam Hall, Cambridge.*
1900 MAXWELL-LEFROY, H., *Imperial College of Science and Technology, South Kensington*, S.W.
1899 MAY, Harry Haden, *Blackfriars House, Plymouth.*
1904 MEADE-WALDO, Geoffrey, *Hever Warren, Edenbridge, Kent*, and *British Museum (Natural History), Cromwell-road*, S.W.
1872 † MELDOLA, Professor Raphael, Hon. D.Sc. Oxon, Hon. LL.D. St. Andrews, F.R.S., F.C.S., F.I.C., F.R.A.S., etc. (PRES., 1895–6; V.-PRES., 1881, 1884, 1897, 1903, 1908; SEC., 1876–80; COUNCIL, 1874–5, 1884–5, 1889–92, 1903, 1907–8), 6, *Brunswick-square*, W.C.
1885 MELVILL, James Cosmo, M.A., F.L.S., *Meole Brace Hall, Shrewsbury.*
1887 MERRIFIELD, Frederic, (PRES., 1905–6; V.-PRES., 1893, 1907; SEC., 1897–8; COUNCIL, 1894, 1899), 14, *Clifton-terrace, Brighton.*
1906 MERRIMAN, Gordon, *The Quick Laboratory, New Museums, Cambridge.*

1905 Merry, Rev. W. Mansell, M.A., *St. Michael's, Oxford.*
1912 Metcalfe, Rev. J. W., *The Vicarage, Ottery St. Mary, Devon.*
1888 Meyer-Pacini, G., 5, *Viale Poggio Imperiale, Florence.*
1880 Meyrick, Edward, B.A., F.R.S., F.Z.S., *Thornhanger, Marlborough.*
1894 Miall, Louis Compton, F.R.S., (Council, 1903, 1908), *Norton Way N., Letchworth.*
1908 Middleton, Ivan E., 11, *High-street, Serampore, Bengal.*
1883 Miles, W. H., *The New Club, Calcutta.*
1910 Millar, F. Grahame, The Tangga Batu Rubber Co., *Malacca, Straits Settlement.*
1906 Mitchell-Hedges, Frederic Albert.
1905 Mitford, Robert Sidney, C.B., 35, *Redcliffe-square*, S.W.
1879 Monteiro, Dr. Antonio Augusto de Carvalho, 70, *Rua do Alecrinar, Lisbon.*
1902 Montgomery, Arthur Meadows, 34, *Shalimar Gardens, Pembridge-road, North Acton*, W.
1899 Moore, Harry, 12, *Lower-road, Rotherhithe.*
1907 Moore, Mrs. Catharine Maria, *Holmefield, Oakholme-rd., Sheffield.*
1886 Morgan, A. C. F., F.L.S., 135, *Oakwood-court, Kensington*, W.
1889 † Morice, The Rev. F. D., M.A., Fellow of Queen's College, Oxford, President, (V.-Pres., 1902, 1904; Council, 1902–4), *Brunswick, Mount Hermon, Woking.*
1895 † Morley, Claude, F.Z.S., *Monk Soham House, Suffolk.*
1910 Morner, Count Birger, Consul for H.M. the King of Sweden, *Sydney, Australia.*
1912 Morrell, R. D'A., *Authors' Club*, 1, *Whitehall-court*, S.W.
1907 Mortimer, Charles H., *Royton Chase, Byfleet, Surrey.*
1893 Morton, Kenneth J., 13, *Blackford-road, Edinburgh.*
1910 Mosely, Martin E., 21, *Alexandra-court, Queen's-gate*, S.W.
1900 Moser, Julius, 59, *Bulow-strasse, Berlin.*
1882 Mosley, S. L., *The Museum and Technical College, Huddersfield.*
1911 Moss, Rev. A. Miles, *Helm, Windermere.*
1907 Moulton, John C., *The Hall, Bradford-on-Avon, Wilts.*
1911 Mounsey, J. Jackson, c/o *Messrs. Booth & Co., Manáos, N. Brazil.*
1901 † Muir, Frederick, *H.S.P.A. Experiment Station, Honolulu, Oahu, H.T.*
1912 † Mullan, Jal Phirozshah, M.A., Assistant Professor of Biology, *St. Xavier's College, Chunam Kiln-road, Grant-road, Bombay, India.*
1869 † Müller, Albert, F.R.G.S., (Council, 1872–3), c/o Herr A. Müller-Mechel, *Grenzacherstrasse* 60, *Basle, Switzerland.*
1906 Muschamp, Percy A. H., *Institut, Stäfa*, nr. *Zurich, Switzerland.*
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1901 Nevinson, E. B., *Morland, Cobham, Surrey.*

1907 Newman, Leonard Woods, *Bexley, Kent.*
1909 Newstead, Alfred, *The Grosvenor Museum, Chester.*
1890 Newstead, Robert, M.Sc., A.L.S., Hon. F.R.H.S., Dutton Memorial Professor of Entomology, *The School of Tropical Medicine, University of Liverpool.*
1909 Nicholson, Gilbert W., M.A., M.D., *Cancer Hospital Research Institute, Brompton*, S.W.
1886 Nicholson, William E., *School Hill, Lewes.*
1906 Nix, John Ashburner, *Tilgate, Crawley, Sussex.*
1912 Noakes, Alfred, *The Hill, Witley, Surrey.*
1878 Nottidge, Thomas, *Ashford, Kent.*
1895 Nurse, Lt.-Colonel C. G., *Timworth Hall, Bury St. Edmunds.*
1908 Nurse, H. A., *Botanical Department, Trinidad, B.W.I.*

1877 Oberthür, René, *Rennes (Ille-et-Vilaine), France.*
1893 † Ogle, Bertram S., *Steeple Aston, Oxfordshire.*
1910 Oldaker, Francis A., M.A., *The Red House, Haslemere.*
1873 Olivier, Ernest, *Ramillons, près Moulins (Allier), France.*

1895 Page, Herbert E., *Bertrose, Gellatly-road, St. Catherine's Park*, S.E.
1912 Paterson, Edward J., *Fairholme, Crowborough.*
1907 Pead, Clement H., *Box 252, Bulawayo, South Africa.*
1911 Pearson, Douglas, *Chilwell House, Chilwell, Notts.*
1883 Péringuey, Louis, D.Sc., F.Z.S., Director, *South African Museum, Cape Town, South Africa.*
1903 † Perkins, R. C. L., M.A., D.Sc., F.Z.S., *Park Hill House, Paignton, Devon*, and Board of Agriculture, Division of Entomology, *Honolulu, Hawaii.*
1879 Perkins, Vincent Robert, *Wotton-under-Edge.*
1907 † Perrins, J. A. D., 3rd Seaforth Highlanders, *Daxenham, Malvern.*
1897 Phillips, Hubert C., M.R.C.S., L.S.A., 262, *Gloucester-terrace, Hyde-park*, W.
1903 † Phillips, Montagu A., F.R.G.S., F.Z.S., 22, *Petherton-road, Highbury New Park*, N.
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1891 Pierce, Frank Nelson, 1, *The Elms, Dingle, Liverpool.*
1903 Pilcher, Colonel Jesse George, I.M.S., F.R.C.S., 133, *Gloucester-road, Kensington*, S.W.
1910 Pillai, A. Raman, *University Union, Edinburgh*, and *Trivandram, India.*
1885 Poll, J. R. H. Neerwort van der, *Driebergen, Netherlands.*
1870 † Porritt, Geo. T., F.L.S., *Elm Lea, Dalton, Huddersfield.*
1884 † Poulton, Professor Edward B., D.Sc., M.A., F.R.S., F.L.S., F.G.S., F.Z.S., Hope Professor of Zoology in the University of Oxford, (Pres., 1903–4 ; V.-Pres., 1894–5, 1902, 1905 ; Council, 1886–8, 1892, 1896, 1905–7), *Wykeham House, Banbury-road, Oxford.*
1905 Powell, Harold, 7, *Rue Mireille, Hyères (Var), France.*

1906 Pratt, H. C., Government Entomologist, Federated Malay States, *Kuala Lumpur, Malay States.*
1908 Pratt, William B., 10, *Lion Gate Gardens, Richmond, Surrey.*
1878 Price, David, 48, *West-street, Horsham.*
1908 Prideaux, Robert M., *Woodlands, Brasted Chart, Sevenoaks.*
1904 Priske, Richard A. R., 9, *Melbourne Avenue, West Ealing.*
1893 Prout, Louis Beethoven, (Council, 1905–7), 62, *Graham-road, Dalston*, N.E.
1910 Punnett, Professor Reginald Crundall, M.A., *Caius College, Cambridge.*

1912 Querci, Orazio, *Macerata, Marche, Italy.*

1900 Rainbow, William J., *The Australian Museum, Sydney, N.S.W.*
1912 Rait-Smith, 86, *Gladstone-street, Abertillery, Monmouthshire.*
1907 Rayward, Arthur Leslie, *Rockford, Beechwood-road, Sanderstead.*
1893 Reid, Captain Savile G., late R.E., *The Elms, Yalding, Maidstone.*
1898 Relton, R. H., c/o Perkins and Co., Ltd., *Brisbane, Queensland.*
1898 Reuter, Professor Enzio, *Helsingfors, Finland.*
1910 de Rhé-Philipe, G. W. V., c/o Grindlay & Co., *Hastings-street, Calcutta.*
1912 Riley, Norman Denbigh, 94, *Drakefield-road, Upper Tooting*, S.W., and *British Museum (Natural History), S. Kensington*, S.W.
1908 Rippon, Claude, M.A., 28, *Walton-street, Oxford.*
1905 Robinson, Herbert C., *Curator of State Museum, Kuala Lumpur, Selangor.*
1904 Robinson, Lady, *Worksop Manor, Notts.*
1892 Robinson, Sydney C., 10, *Inchmory-road, Catford*, S.E.
1869 † Robinson-Douglas, William Douglas, M.A., F.L.S., F.R.G.S., *Orchardton, Castle Douglas.*
1908 Rogers, The Rev. K. St. Aubyn, M.A., *Rabai, Mombasa, British East Africa.*
1886 Rose, Arthur J., 1, *Harewood-road, S. Croydon.*
1912 Rosen, Kurt, Baron, *Zoologische Staatssammlung, Munich.*
1907 Rosenberg, W. F. H., 57, *Haverstock-hill*, N.W.
1868 Rothney, George Alexander James, *Pembury, Tudor-road, Upper Norwood*, S.E.
1894 † Rothschild, The Honble. Nathaniel Charles, M.A., F.L.S., F.Z.S., (Council, 1904), *Arundel-house, Kensington Palace Gardens*, W.
1888 † Rothschild, The Honble. Walter, D.Sc., F.R.S., F.L.S., F.Z.S., (Council, 1900), *Zoological Museum, Tring.*
1890 Routledge, G. B., *Tarn Lodge, Heads Nook, Carlisle.*
1887 Rowland-Brown, Henry, M.A., (V.-Pres., 1908, 1910; Sec., 1900–10), *Oxhey-grove, Harrow Weald.*
1910 Rudge, Miss Carlotta, 1, *Hamilton House, Grove-end-road, St. John's Wood*, N.W.
1910 Rudge, Charles Henry, 1, *Hamilton House, Grove-end-road, St. John's Wood*, N.W.

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1892 Russell, S. G. C., 19, *Lombard-street*, E.C.

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1906 Sampson, Lt.-Colonel F. Winn, 74, *Vineyard Hill-road, Wimbledon Park.*
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1886 Saunders, Prof. Wm., *Central Experimental Farm, Ottawa, Canada.*
1901 Schaus, W., F.Z.S., 97, *Elm Park Gardens*, S.W.
1907 Schmassman, W., *Beulah Lodge, London-road, Enfield*, N.
1912 Schunck, Charles A., *Ewelme, Wallingford.*
1881 Scollick, A. J., 8, *Mayfield-road, Merton Park, Wimbledon.*
1911 Scorer, Alfred George, *Hill Crest, Chilworth, Guildford.*
1909 Scott, Hugh, B.A., *University Museum of Zoology, Cambridge.*
1911 Scott, Percy William Affleck, Chinese Imperial Customs Service, *Hangchow, China.*
1912 Seitz, Dr. Adalbert, 59, *Bismarckstrasse, Darmstadt, Germany.*
1911 Selous, Cuthbert F., M.D., M.R.C.S., L.R.C.P., *Agra, Barton-on-Sea, New Milton, Hants.*
1911 † Sennett, Noel Stanton, 32, *Bolton-gardens, S. Kensington*, S.W.
1862 Sharp, David, M.A., M.B., F.R.S., F.L.S., F.Z.S., (Pres., 1887–8; V.-Pres., 1889, 1891–2, 1896, 1902–3; Sec., 1867; Council, 1893–5, 1902–4), *Lawnside, Brockenhurst, Hants.*
1902 Sharp, W. E., (Council, 1912–), 9, *Queen's-road, South Norwood*, S.E.
1886 Shaw, George T. (Librarian of the Liverpool Free Public Library), *William Brown-street, Liverpool.*
1905 Sheldon, W. George, *Youlgreave, South Croydon.*
1901 * Shelford, Robert, M.A., F.Z.S., (Council, 1907–8), *University Museum (Hope Department), Oxford.*
1900 † Shepheard-Walwyn, H. W., M.A., *Dalwhinnie, Kenley, Surrey.*
1887 † Sich, Alfred, (Council, 1910–12), *Corney House, Chiswick*, W.
1911 Simes, James A., *Mon Repos, Monkham's-lane, Woodford-green, Essex.*
1904 Simmonds, Hubert W., c/o. Messrs. Jas. Bruce & Co., *Adderley-street, Cape Town.*
1902 Sladen, Frederick William Lambart, *Dept. of Agriculture, Central Experimental Farm, Ottawa, Canada.*
1902 Sloper, Gerard Orby, F.Z.S., J.P., *Badminton Club, Piccadilly*, W.
1907 Sly, Harold Baker, *Mapledean, Ringley-avenue, Horley.*
1906 Smallman, Raleigh S., *Eliot Lodge, Albemarle-road, Beckenham, Kent.*
1901 Smith, Arthur, *County Museum, Lincoln.*
1911 Smith, B. H., B.A., *Edgehill, Warlingham, Surrey.*
1912 Smith, Roland T., 54, *Osbaldeston-road, Stoke Newington*, N.
1898 Sopp, Erasmus John Burgess, F.R.Met.S., 16, *Irving-road, Bournemouth.*

1885 South, Richard, (Council, 1890–1), 96, *Drakefield-road, Upper Tooting*, S.W.

1908 Speyer, Edward R., *Ridgehurst, Shenley, Herts.*

1889 Standen, Richard S., F.L.S., (Council, 1906), *Townlands, Lindfield, Sussex.*

1910 Stanley, The Rev. Hubert George, *Marshfield Vicarage, Cardiff.*

1898 Stares, C. L. B., M.R.C.S., L.R.C.P., *The Limes, Swanley Junction, Kent.*

1898 Stebbing, Henry, *Chasewood, Round Oak Wood, Weybridge.*

1910 Stenton, Rupert, *St. Edward's, St. Mary Church, Torquay.*

1910 Stoneham, Hugh Frederick, Lieut. E. Surrey Regt., *Wellington Barracks, Dublin.*

1896 Strickland, T. A. Gerald, *Southcott, Poulton, Fairford.*

1900 Studd, E. A. C., *Kerremens, British Columbia.*

1895 Studd, E. F., M.A., B.C.L., *Oxton, Exeter.*

1882 Swanzy, Francis, *The Quarry, Sevenoaks.*

1908 Swierstra, Corn. J., 1st Assistant, *Transvaal Museum, Pretoria.*

1884 Swinhoe, Colonel Charles, M.A., F.L.S., F.Z.S., (V.-Pres., 1894; Council, 1891–3; 1902–4), 6, *Gunterstone-road, Kensington*, W.

1894 Swinhoe, Ernest, 6, *Gunterstone-road, Kensington*, W.

1876 Swinton, A. H., *Oak Villa, Braishfield, Romsey, Hants.*

1911 Swynnerton, C. F. M., *Gungunyana, Melsetter, S.-E. Rhodesia.*

1910 Tait, Robt., junr., *Roseneath, Harborough-road, Ashton-on-Mersey.*

1908 Talbot, G., 17, *Steeles-road, Haverstock-hill*, N.W.

1911 Tautz, P. H., *Cranleigh, Pinner, Middlesex.*

1893 Taylor, Charles B., *Gap, Lancaster County, Penn., U.S.A.*

1911 Taylor, Frank H., Australian Institute of Tropical Medicine *Townsville, Queensland.*

1903 Taylor, Thomas Harold, M.A., *Yorkshire College, Leeds.*

1909 Tetley, Alfred, M.A., 22, *Avenue-road, Scarborough.*

1910 Theobald, F. V., M.A., *Wye Court, Wye.*

1901 Thompson, Matthew Lawson, 40, *Gosford-street, Middlesbrough.*

1892 Thornley, The Rev. A., M.A., F.L.S., "*Hughenden,*" *Coppice-road, Nottingham.*

1907 Tillyard, R. J., B.A., *Kuranda, Mount Errington, Hornsby, New South Wales.*

1911 Todd, R. G., *The Limes, Hadley Green*, N.

1897 Tomlin, J. R. le B., M.A., (Council 1911–), *Lakefoot, Hamilton-road, Reading.*

1907 Tonge, Alfred Ernest, *Aincroft, Reigate, Surrey.*

1907 Tragardh, Dr. Ivar, *The University, Upsala, Sweden.*

1859 † Trimen, Roland, M.A., F.R.S., F.L.S., (Pres., 1897–8; V.-Pres., 1896, 1899; Council, 1868, 1881, 1890), *Fawley, Onslow-crescent, Woking.*

1906 Tryhane, George E., *Pedro Miguel Canal Zone, Panama.*

1906 Tulloch, Major James Bruce Gregorie, *The King's Own Yorkshire Light Infantry; Head Quarters, South China Command, Hong Kong.*

1895 Tunaley, Henry, 13, *Begmead-avenue, Streatham*, S.W.

1910 Turati, Conte Emilio, 4, *Piazza S. Alessandro, Milan, Italy.*

1898 Turner, A. J., M.D., *Wickham Terrace, Brisbane, Australia.*

1893 Turner, Henry Jerome, (Council, 1910–12), 98, *Drakefell-road, St. Catherine's Park, Hatcham*, S.E.

1906 Turner, Rowland E., (Council, 1909–10).

1893 Urich, Frederick William, C.M.Z.S., *Port of Spain, Trinidad British West Indies.*

1904 † Vaughan, W., *The Old Rectory, Beckington, Bath.*

1909 Vidler, Leopold A., *The Carmelite Stone House, Rye, Sussex.*

1911 Vitalis, R., Commis de 1re classe, *Pnom-Penk, Cambodia, French Indo-China.*

1895 Wacher, Sidney, F.R.C.S., *Dane John, Canterbury.*

1899 Wade, Albert, 12, *Cadogan-place, Preston, Lancashire.*

1897 Wainwright, Colbran J., (Council, 1901, 1912–), 45, *Handsworth Wood-road, Handsworth, Birmingham.*

1878 Walker, James J., M.A., R.N., F.L.S., (Council, 1894; Secretary, 1899, 1905–), *Aorangi, Lonsdale-road, Summertown, Oxford.*

1863 † Wallace, Alfred Russel, O.M., D.C.L. Oxon., F.R.S., F.L.S., F.Z.S., (Pres., 1870–1; V.-Pres., 1864, 1869; Council, 1866, 1872), *Broadstone, Wimborne, Dorset.*

1912 Wallace, Henry S., 17, *Kingsley-place, Heaton-on-Tyne.*

1866 † Walsingham, The Right Honble. Lord, (Pres., 1889–90; V.-Pres., 1882, 1888, 1891–2, 1894–5; Council, 1896), *British Museum (Natural History), Cromwell-road*, S.W.

1910 Ward, John J., *Rusinurbe House, Somerset-road, Coventry.*

1908 Warren, Brisbane C. S., *Villa Romaine, sur Clarens, Switzerland.*

1886 Warren, Wm., M.A., *East Croft, Langdon-street, Tring, Herts.*

1912 Waterfield, Mrs. Ellen N., c/o. W. M. Crowfoot, Esq., *Blyburgate House, Beccles*, and *The Hospital, Port Sudan.*

1869 Waterhouse, Charles O., I.S.O., (Pres., 1907–8; V.-Pres., 1900, 1909; Council, 1873, 1882–3; 1898–1900), *Ingleside, Avenue-gardens, Acton*, W.

1901 † Waterhouse, Gustavus A., B.Sc., F.C.S., *Allonrie, Stanhope-road, Killara, New South Wales, Australia.*

1904 Watson, The Rev. N. Beresford, *St. Martin's Vicarage, St. Philip Barbados, W. Indies.*

1893 Webb, John Cooper, 218, *Upland-road, Dulwich*, S.E.

1908 Wellman, F. Creighton, M.D., *U.S. Museum, Washington, U.S.A.*

1876 † Western, E. Young, 24, *Pembridge-square, Notting Hill Gate*, W.

1906 Wheeler, The Rev. George, M.A., F.Z.S., (Secretary, 1911–), 37, *Gloucester-place*, W.

1910 White, Edward Barton, M.R.C.S., *Cardiff City Mental Hospital, Cardiff.*

1907 White, Harold J., 42, *Nevern-square, Kensington*, S.W.

1911 Whitehouse, H. Beckwith, M.S., F.R.C.S., 52, *Newhall-street, Birmingham.*

1911 Whittingham, Rev. W. G., *Knighton Rectory, Leicester.*

1906 Wickwar, Oswin S., *Charlemont, Gregory-road, Colombo, Ceylon.*

1903 Wiggins, Clare A., M.R.C.S., *Entebbe, Uganda.*

1896 Wileman, A. E., H.B.M. Consul, *Manila, Philippine Islands.*

1910 Willcocks, Frank C., Entomologist to the Khedivial Agricultural Society, *Cairo, Egypt.*

1911 Williams, C. B., *The John Innes Horticultural Institute, Mostyn-road, Merton, Surrey.*

1894 Wolley-Dod, F. H., *Millarville P. O., Alberta, N.W.T., Canada.*

1900 Wood, H., *Kennington, near Ashford, Kent.*

1881 Wood, The Rev. Theodore, *The Vicarage, Lyford-road, Wandsworth Common*, S.W.

1905 Woodbridge, Francis Charles, *The Briars, Gerrard's Cross, S.O., Bucks.*

1912 Woodruffe-Peacock, Rev. E. Adrian, F.L.S., F.G.S., *Cadney Vicarage, Brigg, Lincolnshire.*

1888 Yerbury, Colonel John W., late R.A., F.Z.S., (Council, 1896, 1903–5), 2, *Ryder-street, St. James's*, S.W.

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ERRATA.

TRANSACTIONS.

Page 12, top line, and page 14, line 10 from bottom, for *oncea* read *oncaea.*

Page 144, transfer lines 1 to 5 (under f. *bella*) to precede line 5 from bottom, under *A. acrita bellona.*

Page 394, line 19 from top, for *C. orbitulus* read *L. orbitulus.*

Page 440, line 10 from bottom, *for* São Pavlo *read* São Paulo.

Page 497, line 17 from bottom, *for* jointed *read* pointed.

Page 501, line 10 from bottom, *for* isde *read* side.

Page 507, line 12 from bottom, for *thorica* read *thoracica.*

Page 550, line 4 from top, *for* RHYSOPAUSIDAE *read* RHYSOPAUSSIDAE.

Page 561, line 13 from bottom, for *longimanus* read *longimana.*

Page 573, line 7 from bottom, for *parryi* read *parryanus.*

Page 579, line 21 from top, for *mnizechi* read *mniszechi.*

PROCEEDINGS.

Page xlvi, line 16 from top, for *uranius* read *uranus.*

Page xlviii, line 15 from top, for *caenia* read *coenia.*

ADDITIONS AND CORRECTIONS

Page 57, line 20. *Add* Aurivillius, Rhop. Aeth., p. 86 (1898).

Page 94. Under f. *urungensis* read GERMAN E. AFRICA (Kitungulu, Urungu).

Page 129. *For* MAHAKATA R. *read* (Mahakata R.).

Page 129. Under *A. nohara punctellata* read NYASSALAND (Angoniland, Zomba).

Page 154, line 3. *Read* TANGANYIKA; N. RHODESIA: CONGO (Katanga); NYASSALAND (Zomba); GERMAN E. AFRICA.

Page 169, line 13. Lowombwa *is usually spelt* Luwumbu.

Page 169, line 28. Witu *should be under* BRITISH E. AFRICA.

Page 327, line 34. *For* Kisuma *read* Kisumu.

Plate 10, f. 9. For *ambiga* read *ambigua.*

Plate 12, f. 5. For *oncea* read *oncaea.*

TRANSACTIONS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR 1912.

I. *A Monograph of the African species of the Genus* Acraea, *Fab., with a supplement on those of the Oriental Region.* By HARRY ELTRINGHAM, M.A., F.Z.S.

[Read November 1st, 1911.]

PLATES I—XVI.

INTRODUCTION.

IN the study of biological problems, it is of the utmost importance that adequate information should be available in regard to the affinities, variability, and geographical distribution of the forms of life which may be useful as material for such investigations. A mere list of described "species," without any more intimate knowledge of the inter-relationships of the forms so designated, can be but of small service as a storehouse of reference, just as a collection of specimens, however extensive, unless accurately labelled with essential data, can furnish little more than an exhibition of the beautiful or curious in nature. The older naturalists, secure in the comfortable belief in the fixity of species, occupied themselves with the compilation of voluminous catalogues of all the forms then known to them, the result being a mere list of names, which in too many cases leave considerable doubt as to the identity of the forms to which they are assigned. The necessity for specialisation having once been realised, no facts concerning the creatures studied are now deemed too small or unimportant to be worthy of record. We aim at minute and careful classification, and though such classification is an artificial process of segregation having convenience as its aim, it is based on natural features, the study of which reveals those very facts which can enlarge our knowledge of nature's methods. Such considerations indicate the desirability of carefully compiled monographs of natural groups, and of such works there are, fortunately, many splendid examples. To students of the Lepidoptera the publications of Messrs. Rothschild and Jordan have furnished an example of perfection, which others may well find difficult of imitation; but those who, like the present writer, are conscious of a lesser capacity for achievement, may at least endeavour to follow, to the best of their ability, the path which has been thus so fully indicated.

To the comfort of those who would undertake such labours, naturalists are ever ready to place at each other's disposal, the resources which they individually possess, and it is thus that the pleasant duty devolves upon me of thanking most sincerely the many friends who have furnished me with material and assistance. It has been my privilege to carry out the present work under ideal conditions provided by the kindness of Professor Poulton in the Hope Department at Oxford, where I have had the free use of the whole of the vast store of material there accumulated. To him also I am indebted for kindly reading portions of the proofs, and for many valuable suggestions. Mr. Walter Rothschild has generously placed the whole of his collection of Acraeas at my disposal, not only for examination, but also for dissection and anatomical study. The authorities of the Natural History Museum at South Kensington have allowed me to make microscopic preparations from many valuable duplicates, and I am also deeply indebted to many other collectors and workers amongst whom I would especially mention Mr. G. T. Bethune-Baker, Dr. F. A. Dixey, Mr. G. C. Dudgeon, Mr. Herbert Druce, Mr. H. H. Druce, Mr. C. J. Grist, Mr. J. J. Joicey, Dr. Karl Jordan, Mr. G. A. K. Marshall, Mr. S. A. Neave, Miss E. M. Bowdler Sharpe, Mr. Roland Trimen, and Commander J. J. Walker.

Continental authorities have been no less generous in their assistance, and permission was granted me to work through the whole of the large collection in the Berlin

Natural History Museum, where Dr. Brauer, Professor Karsch, Dr. Strand, and Dr. Grünberg gave me much useful help. Herr Wichgraf permitted me to examine his extensive collection; Herr Ertl of Munich has sent me many interesting examples, including some types, whilst Professor Aurivillius at Stockholm, and M. Charles Oberthür at Rennes, have rendered constant and ungrudging assistance. To all I would tender my heartfelt thanks for having thus rendered my work a pleasure rather than a labour.

The genus *Acraea* was founded by Fabricius in Illiger's Magazine (1807). His definition is, "Taser zwei, lang, gefranzt, dreigliedrig; drittes Glied klein, nackt. Fühler geknopft. (Putzfüsse.)"

He gives as types *Pap. horta, terpsichore,* and *brassolis,* and states that there are 34 species. The *P. brassolis* here referred to appears in Kirby's catalogue as a synonym of the Pierine butterfly *Archonias bellona,* Cram.

Latreille in the "Encyclopédie Méthodique" defines the genus as follows:—"Borde interne des ailes inférieures n'embrassant presque le dessous de l'abdomen; palpes inférieurs grèles et presque cylindriques; antennes peu allongées et terminées brusquement en bouton."

Doubleday, Hewitson, and Westwood in the "Genera of Diurnal Lepidoptera" having given a preliminary description, divide the species into six groups or subgenera, viz. *Hyalites, Planema, Gnesia, Telchinia, Actinote,* and *Pareba.* The definitions of these subgenera are quite useless, as may be gathered from the fact that *A. lycia* is included under *Hyalites,* whilst *A. sganzini* is included in *Telchinia,* although both forms belong to the same species, *A. encedon.* The definition of *Telchinia* differs only from that of *Hyalites* in the statement that the latter has the second joint of the labial palpi "considerably swollen and but little scaly," whilst in the former the same structure is "considerably swollen and clothed in front with scales," much being thus left to the imagination of the observer. Moreover the distinctive features of the genus *Planema* are not recognised, since it is divided into two subsections, one of which contains *A. lycoa,* and *A. jodutta.*

Mabille, in his article on the genus in the "Histoire Naturelle de Madagascar," states that the Acraeas are well divided into groups, perhaps genera, by the male and female genital organs, but his conclusions seem to be based on an inadequate study of these structures. His groups are, (1) *Solenites*, in which the ventral part of the termination of the male abdomen is occupied by a chitinous plate curved round in the form of a tube, the orifice of which is closed by the uncus. He gives *A. igati* as a type of this formation. (2) *Phanopeltis*, which includes *A. ranavalona*. (3) *Aphanopeltis*, in which the plate is reduced to a structure of variable form. This group includes *horta*, *zetes*, *egina*, and *pseudegina*. (4) *Acraea*. The impossibility of these groups is evident from the instability of the characters suggested. Schatz and Röber recognise five groups but admit that they are but slightly separated. The characters given are for the most part inconstant. Careful examination of all the features which have been utilised in the past for the purpose of subdividing the genus convinces me that they do not in fact provide grounds for such subdivision. *Acraea* is distinct from *Planema*, as Professor Aurivillius has pointed out in his "Rhopalocera Aethiopica." The latter genus may be known by the palpi, which are black with a lateral grey line; by the position of the first branch of the fore-wing subcostal, which is given off at or beyond the end of the cell; and by the relatively much smaller discoidal cell in the hind-wing. The pupae of *Planema* are also distinguished by the presence of long hooked spines which appear never to be present in *Acraea*. As to the genus *Pardopsis*, the only reason for associating it with the *Acraeinae* seems to be the closed condition of the hind-wing cell. The one known species of the genus was originally included in *Acraea* because it looked like a member of that genus—the worst of all possible reasons. Trimen separated it and founded the genus *Pardopsis*, pointing out the very curious neuration of the fore-wing. That author, however, states that the legs are as in *Acraea*, an error very easily made, even by an acute observer, if opportunities were unavailable for the microscopic study of these appendages. The fore-feet are of the usual Nymphalid kind, but the middle- and hind-feet have the tarsal extremities of a structure quite different from that in *Acraea*. The claws are slender and without the characteristic lobes, whilst there is a well-developed pulvillus, and peculiar curved and flattened spines on each side somewhat resembling true paronychia. Unless the closed hind-wing cell can be shown to be of special taxonomic significance, it would almost appear that *Pardopsis punctatissima* should have a sub-family to itself.

The South American genus *Actinote* is less distinct from *Acraea* than is *Planema*. The distinguishing features are black palpi, the presence of a rudimentary nervule in the hind-wing between the submedian and the first branch of the median,* and the heavily marked black nervules and internervular rays on the underside of the hind-wing. The neuration in *Actinote* is similar to that in *Acraea* but is more unstable, the sixth and seventh nervules being sometimes stalked in both fore- and hind-wings. In other respects the genus resembles *Acraea*. The female has the peculiar wax-like seal after pairing, and the male tarsal claws are unequal. The pupae also are white, with black lines and yellow-centred black rings.

The characters of the genus *Acraea* may be stated as follows:—Fore-wings either rounded or elongate, the inner-margin straight or very slightly concave. The palpi ochreous, very rarely blackish, the short terminal joint usually set with black hairs. No lateral greyish white line. The fore-legs rudimentary, their tarsi in the female with much reduced joints, and spined beneath; in the male hairy and brush-like with rudimentary joints. The second and third pairs of legs are of normal size and their tarsi terminate in the female in two equal and similar claws, lobed at the base. In the male these claws are also equal and similar in a few species, but in the majority they are unequal, one being long and regularly curved, the other short and bent down almost at right angles to the upper or anterior edge of the basal lobe (in one species, *servona*, with normally equal claws, unequal claws are occasionally found). In the fore-wing the discoidal cell is of medium length. The upper discocellular is very short, and the subcostal nervure is five-branched, the first branch being given off before the end of the cell. In the hind-wing the discoidal cell is usually longer than in *Planema* and reaches to about the middle of the wing. The sixth and seventh nervules usually arise from independent points, but in some species from a common stalk. In one species, *A. burni*, they vary in this respect in different individuals, and even in the two wings of the same individual. In others such as *A. iturina* the stalked condition appears to be constant. In some species nervules 3 and 4 arise

* This feature is also present in *Acraea mirifica*.

from a point at the end of the cell. The scales are normally of uniform size and nearly round. In those species which exhibit transparency of the wing, this result is attained by a variety of different methods. The scales may be reduced in width, may be mere hairs, may be normal in size but reduced in number, normal in size but raised up so as to allow the light to pass between them, or they may be absent altogether. In a few species large special scales are found on the median nervure on the underside of the fore-wing. The antennae are short and rather abruptly clubbed. The male genital armature varies from a state of extreme complexity to one of primitive simplicity, but in the majority of species exhibits little individual variation. In most if not all species special scales are found attached to the underside of the last abdominal tergite. These scales are sometimes present in enormous numbers. They are easily detached and may be scent-producing organs. The female usually possesses a chitinous plate on the seventh sternite surrounding the external orifice of the bursa copulatrix. The form of this plate is specifically constant in most species. Those females which possess such a plate have upon it after pairing a hard wax-like structure (see p. 7), often containing scales and hairs from the body of the male. The larvae * have two dorsal, two lateral, and two sub-lateral rows of branched spines, and the pupae are white or whitish with black spots, often in the form of rings enclosing yellow or pink centres. The neuration of the wings and the position of the other appendages are more or less outlined in black on the pupal skin. In many cases the pupa bears short blunt spines or processes, but so far as is known never has long hooked spines as in *Planema*.

The genus *Acraea* is almost confined to the Ethiopian region. In the Oriental region there occur four or perhaps five species, according as to whether we regard *A. meyeri* and *A. moluccana* as one species or two. Of these *A. vesta* is interesting as appearing to be closely allied to the African *A. anacreon*. *A. andromache*, which extends into the Pacific Islands as far as Samoa, shows in the structure of the male armature a close alliance with *A. igati* from Madagascar. I have dealt with the probable synonymy of the Oriental species in the Supplement to the present monograph.

* See F. Müller, Stettin Ent. Zeit., 38, p. 492, etc. (1877).

Observations in the field show that the larvae of *Acraea* are gregarious. The perfect insects are slow of flight and indifferent to pursuit. Many emit an acrid juice when injured, and all appear to be remarkably tenacious of life, being not only protected by the extreme toughness of their integuments from any mechanical injury, but also exhibiting a great power of resistance to the effects of toxic substances. Some small and apparently delicate species have been observed to remain in full possession of their faculties after more than half-an-hour's confinement in a cyanide bottle. Such species as have been utilised for experiments in palatibility provide evidence of a high degree of distastefulness. Some of Marshall's experiments with a butterfly-eating Mantis, suggest that when driven by the absence of other food to an exclusively Acraeine diet, a diseased condition, followed by death, ensued. In habits, some Acraeas are fond of the open, whilst others are woodland and forest species, and one or two are partial to marshy districts. Trimen in his work on the South African Butterflies describes them as of a peculiarly quarrelsome disposition, fighting desperately for the possession of a particular leaf on which to roost or to deposit their ova. From Marshall's observations in his well-known paper on the "Bionomics of South African Insects" the courtship of Acraeas would appear to be carried out on the principle, as he expresses it, of "marriage by capture," the male seizing the female in the air.

A very remarkable feature of the genus is the presence on the female, in the majority of species, after pairing, of a mass of hard wax-like material on the underside of the abdomen. This secretion or seal * as it may be called, occurs also in *Planema*, *Actinote*, *Amauris*, *Parnassius*, *Thais*, *Eurycus*, and *Euryades*. It seems to be composed of similar material in all the genera mentioned, though in *Acraea* and *Actinote* it frequently also contains a mass of hairs and scales derived from the abdomen of the male, these being often arranged in a beautifully symmetrical manner. Whatever may be the purpose of this secretion in *Parnassius* and in the other genera mentioned, its object in *Acraea* would appear to be, as originally suggested by Professor Poulton,†

* I submit the word *sphragis* as a technical term for this structure (Gr. σφραγìς = *a seal*). The term has been kindly suggested to me by Professor Poulton after consultation with Mr. Arthur Sidgwick.

† See Trans. Ent. Soc., p. 539, 1902.

the prevention of the amorous attentions of subsequent males after once the female has been paired. In this view Marshall concurs (*l. c.*), pointing out that if courtship always takes place in the forcible manner he has observed, some such provision would appear to be a necessity. In another note on the subject * Marshall records that such protection is not, however, absolute, since he has taken three female Acraeas in which the sac has been duplicated, though in these cases both sacs were more or less distorted in shape indicating that the second pairing must have taken place immediately after the first and whilst the first secretion was still in a viscous condition. This being so, as the author points out, the exceptions need not invalidate the theory that the secretion, when hardened, would offer a sufficient obstruction to the use of the complicated male claspers. I am further inclined to believe that the *sphragis* may act in another way. As a result of a recent observation Mr. W. A. Lamborn has recorded † that a female *Planema alcinoe* was observed to have four males, all clinging to it at the same time, some even holding on to its wings and endeavouring to attach their claspers to its body. Now such behaviour appears to argue the emission by the female of some powerful sexually exciting scent, and if such be the case, the *sphragis* may well serve to inhibit the emission of this odour and thus free the female from further attentions.

From the investigations of Elwes on *Parnassius* we may, I think, conclude that this "seal" is formed by a secretion from the male, and this view is confirmed by an interesting note by Dr. Fritz Müller ‡ who has studied the matter in the genus *Actinote*. Speaking of the appendage the quotation is as follows: "The female of *Acraea* (*Actinote*) *thalia* has this appendage. It is shaped something like a hollow tile, and is fastened by one end, close behind the female orifice, then directed forward, usually at a very acute angle with the body, rarely standing out at right angles. Ever since I first bred this species from the larvae many years ago, I have known that the female does not emerge from the pupa bearing this appendage but that as in *Parnassius* it is a sign of completed copulation. It

* See Entomologist, p. 73, 1901.

† Proc. Ent. Soc., p. xcv, 1911.

‡ Carus, Zool. Anzeiger, p. 415, 1893. (I am indebted to Professor Poulton for kindly calling my attention to this reference.)

is only during this last season that I have been able to inquire into its origin. By pressing the abdomen of the *Acraea* males, one can force out from under the posterior margin of the last dorsal plate a very large gland, which is entirely similar to that which the females of the 'Maracujá butterflies' (*Heliconius*, *Eucides*, *Colaenis*, and *Dione*) exert at the same spot when seized. This gland is sometimes bare, sometimes covered with brown or blackish scales and hairs, which fall off at the slightest touch. The appendage of the female, when treated with hot soda-lye and crushed between glass plates, proves to be composed of hairs and scales of the same form. Among hundreds of males which I examined for this purpose, almost all showed the gland either entirely covered or entirely bare: twice only I found the hairs stuck together in small isolated patches, and twice joined together in a structure similar to the female appendage but thinner and more fragile. Probably in the act of pairing one of the sexes emits a rapidly drying fluid which gives it the subsequent thickness and solidity."

At one time I hoped to find in *Acraea* some correlation between the inequality of the male tarsal claws, and the occurrence of the *sphragis* in the female. I find however that in some species in which the male claws are unequal, the *sphragis* is not formed in the female, at least so far as I am able to judge from the extensive material which has been at my disposal. I have examined the claws in the other genera mentioned, and find that whilst the male *Parnassius* has unequal claws, those of *Eurycus*, *Euryades*, and *Amauris* are equal. *Thais* has only a slight development of the *sphragis*, and has unequal claws in the male, whilst the genus *Doritis* has unequal claws in the male, but I can find no secretion in the female.

The peculiarity of the male tarsal claws is one to which I am still unable to assign a satisfactory explanation. The few species of the genus which have the claws equal, do not present any other feature which would serve to separate them, however slightly, from the remaining members of the genus. Moreover if, as seems inevitable, we are to regard all the examples of the *serrona* form as of one species, we have in this one case an instance of unequal claws appearing occasionally as a reversion, in a species in which the claws are normally equal.

Whilst the meaning of this structure must for the present remain unexplained, a knowledge of it is of material assistance in determining the sex of a specimen, in the event of the abdomen and front-feet being missing, as in a damaged example. In the great majority of species the male claws are unequal, and thus if a single leg remains, the sex can in those species be determined. Probably in no genus is the question of sex more easily decided. The female cloacal valves are very different in appearance from the arched and hirsute tergite of the male. Should this test fail the difference of structure between the fore-feet of male and female is easily observed, in many cases even with the unaided sight. Finally the tarsal claws are, as stated, a certain guide in the majority of species. In spite of these facts, which are by no means new, many published works abound in errors as to the sex of the species therein described, such errors adding greatly to the difficulties of the systematist, more especially in cases of unique types difficult of access.

A phenomenon common to many Lepidoptera and known as "seasonal dimorphism" is exhibited to a greater or less extent by many species of *Acraea*, especially those which may be said to belong to the *acrita* and *caldárena* groups. I do not propose on the present occasion to enter upon a discussion of this interesting and complicated subject, which constitutes a special study in itself. It is, however, necessary briefly to allude to the phenomenon as manifested in this genus.

A. atolmis presents a dry-season male in which the spots are exceedingly small, and a female, the ground-colour of which is yellowish brown. The corresponding wet forms are a male, in which the black marks are all more highly developed, and a female which is actually black, often with a whitish subapical bar. Seventeen examples of the species taken at the Victoria Falls in September are all distinctly of the dry-season form. The only record I have for that locality is 1906–7 when Sept. 1906 showed barely ·6 in., whilst in the previous May, June, July, and August the fall was nil. The maximum occurred in February 1907 when 14·7 in. of rain fell. Of five males taken on the Lualaba R. in October, one is of the dry form, one intermediate and two wet, whilst of five specimens taken in May, four are wet and one intermediate. In this region May, June, July, and August are the dry months and March and November have the maximum rainfall, viz. 7·9 in. and 8·6 in. respectively, so that the specimens, having occurred at the beginning and end of the dry season, show a variable and intermediate condition. In Angola wet and dry examples have been taken together in September which is the beginning of the rains, so that the correspondence of the forms is here not well marked. Black females bear date January to April, and September to November. February, March, and April are the wettest months, but the rainfall is extremely variable in different years, and also differs greatly in different localities. Thus inner Angola is within the 40-inch line, but towards the coast there are three distinct belts of decreasing rainfall, the mean at Loanda being only one-sixth of that at Comber Station (6° 16′ S., 15° 17′ E., alt. 3,100 ft.).

A. petraea and *A. aglaonice* correspond fairly well with the seasons, the latter tending to lose the subapical translucent fore-wing spots in the dry season. *A. equatorialis* varies very little in the male sex, but the females may be either yellow like the male, or grey, with an incipient fore-wing subapical pale bar. A long series taken near Kisumu in November, December, January, and March shows great variation in this respect. Whilst in this locality these months are amongst the wettest, there is no month in which rain does not fall, the minimum being 1·77 in. in July, and the maximum 7·09 in December.

A. caldarena is rather variable. Marshall refers to the wet-season males in Mashonaland as having a brighter pink ground-colour, whilst Neave speaks of this feature as characteristic of the specimens he took in the "hot dry Luangwa Valley." Unfortunately this pink colour fades rapidly, and cabinet specimens rarely furnish good illustrations of this particular feature. September (dry) males from Mashonaland have a brownish basal suffusion and January (wet) specimens are without this character. March (wet) examples usually have the basal brown. All the females corresponding to the above have the ground-colour brownish. Ft. Jameson examples taken in March (wet) have grey and white females and ochreous males. On the Alala plateau both wet and dry forms are found in November (early rains). February (wet) specimens from Angoniland include both pink and ochreous males, the females being dark but not grey and white. Kisumu examples taken in November (wet) are both pink and ochreous, with and without basal brown, thus showing a lack of differentiation similar to that in *equatorialis*.

A. oncea shows a moderately good correspondence with the seasons in its various localities, the wet form of female being black with a white subapical bar, whilst the dry-season forms have the ground-colour reddish brown. Examples from near Tete on the Zambesi, and from Ft. Jameson correspond very nearly with the climatic conditions, though on the other hand specimens from Chirui Island, L. Bangweolo, taken in July, have wet-season males, *i. e.* heavily spotted, and dry-season females, the latter however, showing but little indication of the fore-wing white bar. The same condition occurs in May (dry) specimens from Awemba, North-East Rhodesia.

The foregoing examples seem to show that many species do, in a general way exhibit a dimorphism which may be termed seasonal, but before any profitable study of this subject can be made, very much larger series of examples must be available, labelled, not merely with the precise locality, but also with the date of capture, and further with what I think will prove to be of equal importance, the elevation of the locality; and here I may remark that though of late years, satisfactory labelling has received much greater attention than formerly, and in one institution with which I am acquainted may be said to have reached perfection, there seems still to remain in the minds of some owners and keepers of collections a very inadequate conception of the necessity of full and correct labelling.

Turning from seasonal to sexual dimorphism, we find that this phenomenon is of very frequent occurrence in the genus, in fact a marked difference in the appearance of the sexes may be said to be the rule. Moreover, whilst the females differ from the males one or both may be polymorphic. Female polymorphism reaches its greatest development in *Acraea terpsichore,* of which it is possible to arrange a long series in which no two individuals are alike, and although the male of this species is also polymorphic, it presents nothing like the range of variation exhibited by the female. In this case the different forms seem to indicate merely a condition of extreme instability. I cannot associate any one form of female with a particular form of male, nor do any of the variations seem to be governed by either seasonal or geographical conditions.*

* In the ♂ the *rougeti* form is certainly more characteristic of the East and South, though the difference is not quite constant.

A more interesting case is that of *Acraea alciope*, the male of which varies but slightly throughout its range, whilst the female, though still variable, appears in two predominant forms, the western form being dark brown and mimetically associated with dominant western forms of *Planema*, whilst the eastern or *aurivillii* form has an orange band on the fore-wings and a white band on the hind-wings, thus resembling the male of the dominant eastern *Planema macarista*.

A very remarkable case of sexual dimorphism is that discovered by my friend Mr. S. A. Neave, who pointed out that the transparent and almost immaculate *A. crystallina* is the female of *A. chilo*. *A. bonasia* has two forms of female, one of which is near the *cynthius* of Drury. *Acraea peneleos* has many female forms, one of which has just been discovered in a long series of specimens bred by Mr. W. A. Lamborn near Lagos, and two others are represented by examples in the Hewitson collection, but appear never to have been recognised or described. The first-named has a lemon-yellow band across the hind-wings, in the second the band is white and better developed, whilst the third has the wings nearly black. It was the appearance of the yellow-banded form which gave me the clue to the identity of the white-banded examples, intermediates between this and the black form leaving no doubt as to the identity of the latter. Polymorphism of both sexes is of common occurrence, and in some cases the forms are so extreme that only by careful anatomical study can their true relationship be established. Thus I have found that Butler's *A. astrigera*, a brilliant orange and red eastern species, is specifically identical with the same author's *pseudolycia*, the latter a black and white form of very different appearance. Perhaps still more remarkable is the discovery that Hewitson's little red, black and transparent *orestia* is specifically identical with Miss Sharpe's *humilis*, which in its extreme form is almost devoid of colour, spots, or markings.

One instance is known to me of polymorphism of both sexes, accompanied by a geographically limited sexual dimorphism. This complicated condition obtains in *A. lycoa*. From its western limit to Mount Kilimandjaro it presents a series of six different forms, in which however the sexes are constantly different, the female having the fore-wing spots white whilst those of the male are yellow of various shades. In Abyssinia both sexes are alike, the fore-wing spots being yellow. Polymorphism in *Acraea* is, as in other genera, frequently associated with obvious mimetic resemblance in the forms produced. *A. alciope* presents a remarkable case in point. Another instance almost comparable to that of *Papilio dardanus*, except that the mimicry is found in both sexes, is exhibited by *A. johnstoni* which produces forms which closely resemble two different Planemas and three Danaines. An isolated but no less interesting case is the *acritoides* form of *A. periphanes*, which is so modified as to be easily mistaken for that form of *A. acrita* which occurs in its locality. *A. jodutta* has two different females resembling two Planemas, whilst *A. althoffi* has several female forms, one of which is like the male, the others resembling and habitually flying with the above-named females of *jodutta* and their models.

Island forms of *Acraea* include several interesting species and races. In the Island of Saõ Thomé three species occur which have not so far been found on the mainland, viz. *insularis*, *niobe*, and *newtoni*. Of these the latter may well be a local race of *A. penelope*, but the others are quite peculiar and unlike any other known species. From the Ilha do Principe comes the *medea* form of *A. egina*, characterised by its greatly enlarged and confluent spots. Figures of the female of this form occur in several of the older publications, though all seem to be copies of an original figure and not of separate examples. The older works usually give Senegal as the habitat, but if it ever occurred on the mainland, it appears no longer to do so. The peculiar *lactimaculata* form of *peneleos* ♀ seems to occur only on Fernando Po. The *masaris* form of *A. esebria* occurs in the Comoro Islands. Two islands in L. Bangweolo, Chirui and Chishi, have furnished examples of *A. oncea* which are more brilliantly coloured than any others I have seen, whilst from Chishi Island we have received a form of *A. zetes acara* which is of special interest in having the hind-wing spots so greatly reduced as to make it at the first glance almost indistinguishable from *A. astrigera*, with which it is doubtless very nearly allied.

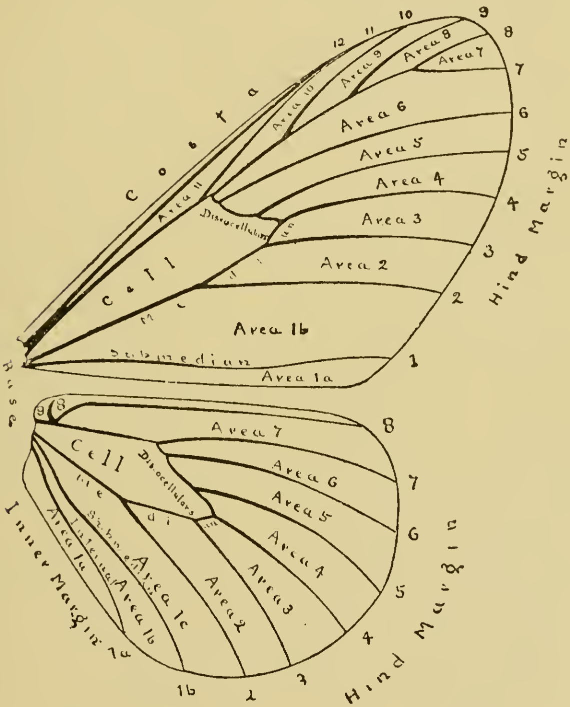
Indications of a general correspondence of colour with geographical distribution seem to be afforded by the dark fore-winged forms of *zetes*, *egina*, and *natalica* from the extreme West, the extent of the red colour increasing as the species ranges East and South, not only in the three species mentioned, but to a less extent in *pharsalus,* which develops into *pharsalus pharsaloides.* On the other hand this change is in the opposite direction in *A. lycoa,* which, beginning in the West as a pale semitransparent form, gradually becomes more heavily and darkly pigmented until it is represented at Mount Kilimandjaro by its subspecies *fallax. A. penelope* is a similar case in point. Two of the black and yellow Acraeas, viz. *oreas* and *servona,* exhibit a very marked change in the hind-wing underside colour in passing eastwards. Western examples are lemon-ochreous beneath, the colour changing to brown, or even nearly black, at Entebbe. *A. servona* retains its pale yellow colour in German E. Africa, whilst *A. oreas* is of a slightly warmer tint in that locality.

So extremely complicated is the variation of species of the genus, that it has been more than once suggested to me that hybrids are occasionally produced. I can only say that after careful examination of over fifteen thousand examples, I have seen no single individual which would lend support to such a view. I have dissected out and mounted the genital armatures of nearly five hundred specimens, and have only once found an abnormal or aborted example. So far as my observations enable me to judge I should say that individual variation in these organs is, except in one species, very slight and of rare occurrence. I refer to *A. acrita,* as to the true taxonomy of which, after examining hundreds of examples, I am still in doubt. I am of opinion that each species can always recognise a mate of its own kind, and it seems to me that such infallibility may be not unconnected with the production of some special exciting scent in one or both sexes.

With regard to the determination of species it may be well to explain the general principles which I have adopted in the present monograph.

Without attempting to formulate a definition of the meaning of the word species, I regard a species as a community of individuals, of which at least the geographically contiguous, and most probably, all the contemporary members, are capable of, and, on the opportunity arising, disposed to, syngamy. I am compelled to leave in doubt the question of the syngamy of forms widely separated geographically, since, to take a special instance, we have at present no means of proving that *pseudolycia astrigera* would pair and prove fertile with *pseudolycia pseudolycia*, though there seems no reason to doubt the probability, if each of these forms is ordinarily syngamic with the intermediate form *pseudolycia brunnea*. In the consideration of evidences of such syngamy we must, I think, be prepared to give full value to each particular point, and to consider all the items in relation to the whole, rather than allow ourselves to be bound, in all cases, by the indications of one particular feature to the exclusion of others.

Thus it may be assumed that constant differences in the male armature are good evidences of specific distinction, though when these organs are of a primitively simple structure, similarity does not necessarily argue specific identity. In some cases the structure of the female genital plate enables us to confirm or modify views based on that of the male organ. In some cases the male tarsal claws provide valuable indications. Again, intermediate types of pattern and colour leave no doubt as to the specific identity of forms which, but for such connecting links, would appear to be very distinct. Where I have reason to believe that a particular form of a species is peculiar to a certain geographical area, I have called it a subspecies. Where, as frequently happens, a form of a species seems liable to occur in various parts of that species' range, and not to the exclusion of other forms, I have merely styled such variations from the type as "*forma*," thus leaving the way open to the ultimate establishment of whatever more particular definition the acquisition of subsequent material and data may enable us to adopt. I have avoided as far as possible the use of the word "variety," since the limitation of its meaning is too ill defined. I am aware that such a system is not infallible, or indeed capable of universal application, since cases may occur where a variety is a mere form in one locality, and entitled to be regarded as a subspecies in another. Nevertheless it is not without a certain convenience, and, with our present conception of the evolutionary nature of species-formation, the precise limitation of what is called a "species" has necessarily lost much of its importance, as compared with the recognition of the degrees of affinity which appear to obtain between the forms studied. In the case of the genus *Acraea* we have many species which are quite clearly defined and exhibit no close alliance with others. On the other hand, such a community of forms as are grouped together under the name of *Acraea acrita* offers material for prolonged and careful study—a study to which we cannot hope to do justice, until we possess a vastly greater material from every part of the range, and taken at various seasons. Again, whether



we regard *zetes*, *chilo*, *oscari*, and *hypoleuca*, as four species or as one, must remain largely a matter of the convenience of the moment. In a few such cases I fear that I may be accused of a certain amount of inconsistency in the arrangement of the genus. If so, I can only say that in many cases it is extremely difficult, if not impossible, to decide whether a form has yet passed over that dividing line which separates one true species from another. The difficulty experienced is merely a confirmation of our theories of species formation. The information that, on the one hand, *zetes* and *chilo* had been definitely proved to be the same species, or, on the other, that *welwitschii welwitschii* and *welwitschii alboradiata* were certainly specifically distinct, would, though interesting, not alter the existing fact of their close relationship.

It only remains to give certain explanations of some remaining features of the work. The appended chart of the wing neuration is merely a diagram to illustrate the numbers and terms used in the descriptions. The drawings of genitalia have been made from the actual preparations by means of a Leitz reflector, and are intended to illustrate the characteristic form in each case, though it must be borne in mind that such conclusions as have been based on these structures, have not been arrived at from the drawings, but from the preparations themselves, examined from various points of view. In a very few cases, paucity of material has precluded the preparation of more than one specimen. In the majority of species, series of preparations have been made, not only from different individuals, but also, where possible, from different localities. Only by so doing, can a correct estimate be made of the range of individual variation, which, though small in *Acraea*, does occur, and is not to be confused with specific difference. It may be objected that the figures are not all drawn from the same point of view. The view adopted however, is that, which in each case, seems best to show the characteristic structure.

In addition to the figures of male genitalia I have made a small number of drawings of the chitinous plates which, in the female, surround the external opening of the *bursa copulatrix*. These structures, though very characteristic of some species, are in others but slightly developed. Unfortunately the latter condition persists in many species of which the male armature furnishes little guide to specific distinction. I have also illustrated a few examples of the peculiar structure of the *sphragis* or copulatory seal, though this feature, even when well developed is not, I think, of much systematic importance.

For the opportunity of illustrating the larvae on Plate VI, I am entirely indebted to my friend Mr. W. A. Lamborn, who, with praiseworthy care, has preserved and forwarded the specimens together with notes as to colour, corresponding to a colour chart with which I provided him. The illustrations of imagines have been drawn in every case from the actual specimen. Of some sixty forms represented, very few have been previously figured. The synonymy tables do not profess to give every known reference, though it is hoped that none of geographical or synonymic importance has been omitted. In this and other respects I have not hesitated to make use of Professor Aurivillius' catalogue, the constant employment of which has served to increase, if possible, my intense admiration for the almost incredible labour of which that work is the record. The key to the species has proved by no means the least difficult portion of my task. I doubt whether any approach to perfection could be attained in a key to so variable a genus. A key, to be quite satisfactory, presupposes a certain stability of colour and pattern which is sadly lacking in the genus *Acraea*; nevertheless I trust it will be found of some assistance as a mere mechanical aid to identification. An attempt has been made to arrange the species in groups, and though some of these appear to be fairly natural, others are much less convincing, whilst in certain cases a "group" has but one representative. Our knowledge of the true affinities of the species is at present very elementary, and but little importance can be attached to this feature of the arrangement.

In the preparation of such a paper as the present we can but make the best use in our power of the material at our disposal. It must be borne in mind that our largest collections contain but a small number of samples, the ratio of which to the bulk occurring in nature is almost infinitely small. Many of our conclusions are based on the assumption that this ratio, though small, is correct. I have spared no pains to follow up whatever line of research the work has suggested. If the result is to increase, even slightly, our knowledge of a singularly interesting and difficult group of insects, I shall be amply repaid.

KEY TO THE AFRICAN SPECIES OF *ACRAEA*.

[The portions printed in italics with names of species in roman letters refer to female characteristics. The numbers after the species' names refer to the pages on which the descriptions will be found.]

The two following species can be at once recognised by their peculiar characteristics.

H.-w. underside dull metallic gold with a submarginal row of crimson spots . . . . *mirifica* (208)

H.-w. underside ochre-yellow with a central band of grey flecked with red and enclosed basally and distally by narrow black lines. Marginal border grey with black nervule ends. A submarginal series of narrow, black, transverse internervular streaks, followed inwardly by elongate internervular orange marks . . . . *mirabilis* (216)

KEY TO SECTIONS.

H.-w. without black spots I

H.-w. with black spots . . . . (*a*)

(*a*) H.-w. underside with dark internervular rays at least in some of the spaces, such rays not being bifurcated at or near margin . . . . (*h*)

H.-w. underside without internervular rays, or with such rays bifurcated . . . . (*b*)

(*b*) F.-w. upperside fully scaled and not transparent * . . (*d*)

F.-w. partially transparent, usually on outer half (in *camaena* and *niobe* smoky translucent). . . . . . . (*c*)

(*c*) H.-w. hind margin at least partially transparent, without spots or black border II

H.-w. hind margin with spots or black border (in *cinerea* h.-w. border not separated from remainder of ground-colour) . III

(*d*) H.-w. hind marginal border on underside enclosed by a black line without enclosed spots IV

(Some examples of *asboloplintha* have green h.-w. marginal spots, but this species is quite unlike any other form of *Acraea*.)

H.-w. hind marginal border on underside with enclosed spots (*e*)

(*e*) The black or dark colour enclosing spots is not produced inwardly to form a bifurcated internervular mark or ray and the spots are submarginal, *or*, if marginal, the h.-w. also bears discal spots . . . . (*f*)

The black or dark colour enclosing spots is usually produced inwardly forming a bifurcated ray the submarginal portion of which may contain or consist of, red or yellowish streaks. The spots are always marginal. *Or* if the border is sharply defined black with marginal spots, and without inward processes, then the h.-w. has no discal spots . . VIII

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* The following are included in this section of key although owing to variability some examples are partially transparent.

Aglaonice sometimes, *amicitiae*, and most examples of *doubledayi* have a partly transparent subapical patch.

Pudorella and *equatorialis anaemia* are sometimes so thinly scaled as to be partially transparent.

(*f*) Basal spots of h.-w. underside are more or less confluent and enclose or tend to enclose pale spots. (Some examples of *turna* are thus but the species usually comes under Section VI.) V
Basal spots of h.-w. underside are not confluent . . (*g*)

(*g*) Discal spot in 1b of f.-w. is much nearer margin than that in 2 so that a line joining their centres would pass through cell* VI
Discal spot in 1b of f.-w. is beneath or nearly beneath that in 2 so that a line joining their centres would pass outside cell VII

(*h*) Internervular rays not connected with hind margin or at least reduced to a fine point at margin . . . IX
Internervular rays connected with hind margin and not narrower there than elsewhere X

I.

H.-w. with a discal black band . . . *zonata* (42)
H.-w. without a discal black band . . . . . (*a*)

(*a*) H.-w. transparent and uncoloured except at margin *rabbaiae rabbaiae* (43)
H.-w. thinly scaled with whitish ochreous *rabbaiae mombasae* (43)

II. *The ♂ key will serve for ♀ characteristics if it be borne in mind that the* ♀ unimaculata *generally has no spots on either wing, and that in* damii *and* cuva *the red of the ♂ is usually replaced by yellowish or whitish.*

II.

F.-w. without spots . . . . (*c*)
F.-w. with spots . . . . (*a*)

(*a*) H.-w. margin transparent, broad, and not well defined *kraka* (52)
H.-w. margin transparent, or partly transparent, narrow, usually well defined, and tapering to a point at anal angle . . . . (*b*)

(*b*) H.-w. nervules 6 and 7 not stalked . . . *cerasa* (54)
H.-w. nervules 6 and 7 stalked . . *iturina iturina* (57)

(*c*) H.-w. generally with only one spot . . . . . (*d*)
H.-w. with more than one spot . . . . . (*e*)

(*d*) Wings almost entirely transparent *orestia humilis* (part) (305)
Basal part of f.-w. and most of h.-w. brick red *unimaculata* (56)

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* *A. anacreon anacreon* should be sought under this section, though owing to variability the discal spots in many examples would indicate Section VII.

(*e*) H.-w. without a spot in middle of cell . . . . . (*f*)
H.-w. with a spot in middle of cell . . . . . . (*h*)

(*f*) H.-w. with a large spot in area 7 immediately above and contiguous with the spot in 6 . . . . *igati* (49)
H.-w. with a large spot in area 7 widely separated from that in 6 . . . . (*g*)

(*g*) F.-w. only slightly suffused with red (or whitish), h.-w. transparent margin broad . . . . *damii damii* (50)
F.-w. broadly suffused with red (or whitish), h.-w. transparent margin narrow . . . . . *damii cuva* (50)

(*h*) Wings translucent and finely dusted all over with dusky ochreous without a tinge of red . . . *eugenia* (53)
F.-w. with at least the outer half, and h.-w. marginal border, quite transparent . . . . (*i*)

(*i*) F.-w. very slightly suffused with red (or brownish) *quirina quirina* (59)
F.-w. rather broadly suffused with red . *quirina rosa* (59)

III.

F.-w. entirely transparent, without markings except for a few brownish scales at base . . . *extreme* f. *of* chilo (89)
Not so . . . . (*a*)

III.

Abdomen long, extending well beyond anal angle of h.-w., its distal half white . . . . *braesia* (169)
Abdomen not unusually long, extending little, if at all, beyond anal angle of h.-w., its distal half not white . . . (*a*)

(*a*) H.-w. border not black, but having small blackish triangles at nervule ends . . . . (*b*)
H.-w. border black, spotted or unspotted . . . . (*c*)

(*b*) Large (70–75 mm.), h.-w. with a regular curved row of large rounded submarginal spots . . . . . *hova* (60)
Small (about 50 mm.), h.-w. without submarginal spots *mahela* (71)

(*c*) H.-w. border bearing marginal red spots, and submarginal black spots. The latter distinct and well developed . . (*d*)
H.-w. border not so formed . . . . . . (*e*)

(*d*) F.-w. but slightly suffused with red . . *ranavalona* (64)
F.-w. suffused with red, at least to end of cell *machequena* (66)

(*e*) Base of f.-w. transparent, not scaled with yellow, red, or black . . . . (*f*)
Base of f.-w. not transparent, scaled with yellow, red, or black . . . . (*g*)

(*f*) H.-w. all black on upperside . . . . *cinerea* (307)
H.-w. black with a crimson central patch *cinerea alberta* (307)

(*f*) *H.-w. dusted with milky white, and beneath with well-developed black spots on a yellowish ground splashed with reddish* diogenes (156)
H.-w. not so marked. All black on upperside . cinerea (307)
(*g*) F.-w. with a blackish transverse bar (in *satis* not always quite continuous) from costa to inner margin . . . (*h*)
F.-w. without such bar . . . . (*i*)
(*h*) A very irregular transverse bar across h.-w. . . *satis* (44)
H.-w. without such bar . . . . . . *cerita* (55)
(*i*) F.-w. uniformly smoky translucent with only one spot *camaena* (82)
F.-w. not so . . . . (*j*)
(*j*) H.-w. border on underside bearing black arches surmounted by large red internervular marks . . . . *lia* (67)
H.-w. border not so marked . . . . . . (*k*)
(*k*) H.-w. basal spots on underside more or less confluent and enclosing or tending to enclose pale spots of ground-colour (*l*)
H.-w. basal spots on underside well separated . . . (*p*)
(*l*) F.-w. with discal spots (sometimes very faint) in areas 4, 5, and 6 . . . . (*m*)
F.-w. without such discal spots . . . . . (*n*)
(*m*) Nearly the whole of outer half of f.-w. transparent *neobule neobule* (72)
Transparent part of f.-w. limited to a narrow subapical band *neobule seis* (72)
(*m*) *At least the outer half of f.-w. transparent* . . . (1)
Transparent part of f.-w. limited to a narrow subapical band. neobule seis (72)
(1) *Only outer half of f.-w. transparent* . . neobule neobule (72)
Whole ground of f.-w. transparent . . . . chilo (89)
(*n*) H.-w. discal spots confluent and forming a bar across wing *iturina kakana* (57)
H.-w. discal spots not forming such a bar . . . . (*o*)
(*o*) H.-w., marginal border beneath with large distinct pale spots, and with a discal row of spots beyond cell . . *horta* (76)
H.-w. marginal border narrow and unspotted. No separate discal spots . . . . *insignis* (81)
(*p*) H.-w. border formed of large black rings enclosing round spots of ground-colour . . . . (*q*)
H.-w. border narrow, blackish, with or without small rounded spots of yellow or reddish . . . . . . (*r*)
(*q*) H.-w. without a white patch at anal angle *admatha admatha* (78)
H.-w. with a white patch at anal angle *admatha leucographa* (79)
(*r*) H.-w. partially transparent, or smoky translucent . . (*s*)
H.-w. fully scaled . . . . (*t*)

(*s*) Entire ground-colour smoky translucent, large rounded black spots on both wings. End of abdomen red . *niobe* (344)
F.-w. transparent except for a reddish flush at base *obeira obeira* (68)
(*t*) F.-w. with discal spots in 5, 6, and 7 . . *neobule arabica* (73)
F.-w. without such spots . . . . *obeira burni* (68)
(*t*) *F.-w. with discal spots in* 5, 6, *and* 7 . . . braesia (169)
F.-w. without such spots . . . . obeira burni (68)

IV. [Occasinal aberrant examples of *egina* might be referred to this section. Such specimens may be distinguished from the other species in the section by the pale green underside of h.-w. hind marginal border.]
Discal spots of h.-w. form a regular line which traverses areas 7, 6, and 5 parallel to apical margin, and then bends sharply inwards at less than a right angle and runs straight across to inner margin . . . . (*a*)
H.-w. discal spots not so arranged . . . . . (*b*)
(*a*) Pale central band of h.-w. underside is outwardly bordered with black at least in 1b to 4 . . . . . *rahira* (202)
Pale central band of h.-w. underside not bordered with black *zitja* (part) (204)
(*b*) Area 7 of h.-w. with three black spots . . *rohlfsi* (136)
Area 7 of h.-w. with less than three black spots . . (*c*)
(*c*) F.-w. ground-colour black or olive-brown . . . (*d*)
F.-w. ground-colour not so . . . . (*e*)
(*d*) F.-w. with very little (if any) inner marginal red *asboloplintha asboloplintha* (196)
F.-w. with a rosy inner marginal suffusion extending as far as, or into cell . . . . *asboloplintha rubescens* (196)
♀ *has the rose colour replaced by white.*
(*e*) F.-w. with three or four small quadrate transparent or semi-transparent subapical spots . . *amicitiae* (part) (317)
F.-w. without such spots . . . . (*f*)
(*f*) Well marked black internervular rays on apex of f.-w. on upperside . . . . . . *atergatis* (part) (188)
F.-w. without such rays . . . . *atolmis* (part) (137)

V.
F.-w. brown black above, without red or yellow markings though with a trace of whitish subapical marks *zetes zetes* (83)
♀ *has f.-w. paler and subapical white better developed.*
F.-w. not so . . . . (*a*)
(*a*) Base of f.-w. beneath with an unbroken black patch . . (*b*)
Base of f.-w. beneath with separated black spots . . (*e*)

(*b*) H.-w. upperside with a central white patch . . . (*c*)
H.-w. upperside without a central white patch . . . (*d*)

(*c*) White patch large, white streaks on f.-w. subapical area. A series of faintly developed reddish spots along inner edge of h.-w. hind marginal border on underside
welwitschii alboradiata (97)

White patch small, no white streaks on f.-w. apical area. A series of well-developed bright red spots along inner edge of h.-w. hind marginal border on underside
welwitschii welwitschii (97)

(*d*) Ground-colour of f.-w. rich rose pink, fringes of h.-w. between nervules very prominently white . *welwitschii lobemba* (97)
Ground-colour of f.-w. orange ochreous, fringes of h.-w. between nervules less prominently white . . . *anemosa* (94)

(*d*) *Basal ground-colour of f.-w. beneath, reddish*
welwitschii lobemba (97)
Basal ground-colour of f.-w. beneath, ochreous . anemosa (94)

(*e*) Ground-colour of f.-w. black brown with yellowish or reddish submarginal spots . . . . . *zetes menippe* (83)
♀ *has ground-colour paler and duller than in* ♂.
Ground-colour of f.-w. not black-brown . . . . (*f*)

(*f*) F.-w. with ground-colour of basal half white
pseudolycia pseudolycia (102)
F.-w. without white on basal half . . . . . (*g*)

(*g*) F.-w. hind margin at least in areas 1b and 2 without marginal spots of ground-colour or of yellow enclosed by black . (*m*)
F.-w. hind margin with spots of ground-colour or of yellow enclosed by black . . . . (*h*)

(*h*) Subapical area of f.-w. not separated, nor of a different shade, from the ground-colour which is rose pink or yellow . (*i*)
Subapical area of f.-w. separated and containing a patch of colour which is either rather paler than the ground-colour or is bright orange . . . . (*k*)

(*i*) F.-w. hind margin without an enclosed spot of orange in area 6
zetes barberi (84)
F.-w. area 6 with such spot . . . . . . (*j*)

(*j*) Base of f.-w. cell upperside suffused with black. F.-w. spots large and partly confluent . . . . *oscari* (91)
Base of f.-w. cell upperside not suffused with black. F.-w. spots smaller and well separated. *For* ♀ *see Section III.* *chilo* (89)

(*k*) F.-w. with a small subapical patch of red or reddish white
zetes jalema (84)
F.-w. with a large orange subapical patch . . . . (*l*)

(*l*) H.-w. without a white patch . . . *zetes acara* (84)

H.-w. with a white patch . . . *zetes acara* f. *caffra* (84)
(*m*) Discal portion of h.-w. red . . *pseudolycia* f. *astrigera* (101)
Discal portion of h.-w. dusky ochreous
pseudolycia f. *brunnea* (102)
(*m*) *Discal portion of h.-w. reddish* . pseudolycia f. astrigera (101)
Discal portion of h.-w. ochreous . pseudolycia f. brunnea (102)

VI.

Ground-colour white or cream. H.-w. hind-marginal border black, or sepia, with a submarginal row of white dots followed inwardly by yellow spots. F.-w. hind-margin markedly concave. . . . . (*a*)
Not so . . . . (*b*)
(*a*) Ground-colour white . . . . . *turna* (105)
Ground-colour cream . . . *turna* f. *marmorata* (105)
(*b*) F.-w. apex on underside with well-marked black internervular rays which reach margin . . . . (*c*)
F.-w. apex beneath without such black rays . . . (*e*)
(*c*) H.-w. with three spots in area 7 . . . *cepheus* (111)
H.-w. with two spots in area 7 . . . . (*d*)
(*d*) H.-w. marginal border beneath with green spots
egina egina (part) (106)
H.-w. marginal border beneath with orange spots *perenna* (part)
(*e*) F.-w. with submarginal spots at least in 1b and 2 . . (*f*)
F.-w. without submarginal spots . . . . . . (*k*)
(*f*) F.-w. nervules at apex well marked with black . . (*g*)
F.-w. nervules at apex not specially black . . . (*h*)
(*g*) Ends of h.-w. nervules well marked with black *petraea* (114)
Ends of h.-w. nervules not specially black . *büttneri* (118)
(*h*) H.-w. marginal black border on upperside with little or no trace of pale spots . . . . (*i*)
H.-w. marginal border on upperside with distinct, though sometimes small, pale spots . . . . (*j*)
(*i*) H.-w. marginal border about 2·5 mm. wide. End of abdomen whitish . . . . *omrora omrora* (124)
H.-w. marginal border 3–5 mm. wide. End of abdomen yellowish . . . . . . *omrora umbrata* (124)
(*j*) Black spots of both wings large and well developed *violarum* (120)
Black spots of both wings comparatively small . *asema* (122)
(*k*) H.-w. with a broad black marginal border nearly reaching middle of wing and having on underside, small, submarginal, greyish white triangular spots . . . *lofua* (127)
H.-w. without such border . . . . (*l*)
(*l*) Discal spot in h.-w. area 4 lies nearer to cell than that in 3 or 5 . . . . (*m*)

Discal spot in h.-w. area 4 lies not nearer to cell than that in 3 or 5 . . . . (*u*)

(*m*) F.-w. without discal spot in area 1b . *nohara halali* (128)

F.-w. with discal spot in area 1b . . . . . . (*n*)

(*n*) Ends of nervules at apex of f.-w. not markedly black on the ground-colour . . . . (*o*)

Ends of nervules in f.-w. markedly black . . . (*p*)

(*o*) A fairly broad black apex in f.-w. Extremity of abdomen white *leucopyga* (157)

A fairly broad black apex in f.w. Extremity of abdomen not white . . . . *intermedia* (part) (159)

F.-w. apex narrowly black. Extremity of abdomen not white *mansya* (134)

(*o*) *F.-w. apex broadly black, with a white subapical patch* intermedia (*part*) (159)

F.-w. apex broadly black, no subapical white . leucopyga (157)

F.-w. apex narrowly black, no subapical white . mansya (134)

(*p*) H.-w. margin above, with well-marked black arches on wings enclosing spots of ground-colour . . . . . (*q*)

H.-w. margin above, black, with at most a trace of pale inter-nervular marks . . . . (*r*)

(*q*) Black spots of both wings large and well developed *guillemei* (117)

Black spots very small . . . . . *onerata* (135)

(*r*) H.-w. nervule ends markedly black for some distance from margin . . . . *atolmis* (part) (137)

H.-w. nervule ends not so . . . . (*s*)

(*s*) F.-w. discal spots rounded and not confluent *nohara punctellata* (129)

F.-w. discal spots more or less quadrate and confluent . (*t*)

(*t*) Spot in h.-w. area 4 touches that in 5. Expanse about 48 mm. *nohara pseudatolmis* (129)

Spot in h.-w. area 4 nearer base than, and not touching that in 5. Expanse about 56 mm. . . *nohara nohara* (128)

(*u*) F.-w. black, rather thinly scaled in middle, and having a scarlet inner marginal patch in 1a, 1b, and part of 2. No subapical red patch . . . . (*v*)

F.-w. not so marked . . . . (*w*)

(*v*) F.-w. at apex without red streaks . *egina egina* (part) (106)

F.-w. at apex with red streaks . . *egina* f. *harrisoni* (107)

(*w*) *H.-w. beneath with quadrate greenish spots on the black border* (1)

H.-w. beneath with spots on the black border which, inwardly, are either pointed or rounded . . . . (*y*)

(1) *Black spots large, quadrate and confluent.* egina medea (107)

Black spots rounded and separate . . . . . (2)

(2) *F.-w. ground-colour blackish or dusky* . egina egina (106)
F.-w. ground-colour reddish . . . egina areca (107)

(*w*) H.-w. margin on underside encloses square spots the inner edge of which is neither rounded nor pointed . . . (*x*)
Spots of h.-w. underside margin rounded or pointed on inner edge . . . . (*y*)

(*x*) H.-w. spots large, quadrate, and confluent . *egina medea* (107)
H.-w. spots small, rounded, and separated . *egina areca* (107)

(*y*) F.-w. underside ground-colour orange ochreous with a white subapical patch. H.-w. underside ground-colour white *hypoleuca* (92)
Underside not so coloured . . . . . . (*z*)

(*z*) On h.-w. underside the discal spots form a regular row which proceeds from costa to area 4 in a line parellel to apical margin, then bends sharply inwards at an angle of less than 45°, and runs straight across to inner margin. Between this row and the more basally placed spots are red splashes which form a more or less broken though characteristic red band . (*a′*)
Spots of h.-w. underside not forming such a pattern . (*e′*)

(*a′*) F.-w. with a white subapical patch . . . *wigginsi* (206)
F.-w. without a white subapical patch . . . . (*b′*)

(*b′*) F.-w. apex broadly black without spots *anacreon* f. *induna* (198)
F.-w. apex narrowly black with spots or streaks of ground-colour or paler . . . . (*c′*)

(*c′*) F.-w. apical spots or streaks so large as almost to displace the black, leaving such colour only on nervule ends and on margin . . . . . . *anacreon speciosa* (198)
Apical spots or streaks well surrounded with black . . (*d′*)

(*d′*) Pale apical spots but slightly developed. Black spots of rest of wings very small . . . . *anacreon bomba* (198)
Pale apical spots (streaks) well developed. Black spots of both wings large . . . . . *anacreon anacreon* (198)

(*e′*) F.-w. with either faintly indicated or very small spots . (*f′*)
F.-w. with well-developed spots . . . . . (*g′*)

(*f′*) H.-w. margin rather broad and formed of large black rings enclosing more or less distinct spots of ground-colour (orange red). Discal spots of f.-w. absent or exceedingly faint *acrita pudorina* (144)
♀ *may be orange red to greyish black.*
H.-w. margin narrower and black, with, at most, microscopic indications of paler spots. F.-w. discal spots small but quite black and distinct . . . . . *chambezi* (132)

(*g′*) F.-w. nervules in apical region very distinctly blackened (*h′*)
F.-w. nervules in apical region not blackened . . . (*l′*)

(*h′*) F.-w. without discal subapical spots *periphanes* f. *acritoides* (140)
F.-w. with discal subapical spots . . . . . . (*i′*)
(*i′*) F.-w. with black apical patch . . . . . (*j′*)
F.-w. without black apical patch . . . . . (*k′*)
(*j′*) H.-w. margin narrowly black, with spots of ground-colour *periphanes periphanes* (139)
H.-w. margin broadly black without spots of ground-colour *periphanes* f. *melaina* (139)
(*k′*) H.-w. margin narrowly black with spots of ground-colour *periphanes* f. *beni* (139)
H.-w. margin broadly black without spots of ground-colour *periphanes* f. *umida* (140)
(*l′*) F.-w. with discal subapical spots . . . . . (*m′*)
F.-w. without discal subapical spots . . . . (*n′*)
(*m′*) F.-w without black apical patch . *acrita manca* (part) (144)
F.-w. with black apical patch . . . *lualabae* (155)
(*n′*) Apical black 9–10 mm. deep. F.-w. spots, especially the outer spot in area 1b, very small or absent . *chaeribula* * (153)
Apical black patch very variable but at most not so deep as in the above. Outer spot in f.-w. 1b well developed . (*o′*)
(*o′*) Spots in f.-w. cell, on discocellular, and in area 2 are so large as to be almost or quite confluent . . *acrita bellona* (144)
These spots not so large . . . . (*p′*)
(*p′*) F.-w. with a white or whitish subapical band *acrita ambigua* (143)
F.-w. without such band . . . . (*q′*)
(*q′*) Central process of last dorsal abdominal plate short *acrita littoralis* (144)
Central process of last dorsal abdominal plate long *acrita acrita* † (143)
acrita manca (part) (144)
acrita bella (144)
(*p′*) *Genital plate in the form of a short chitinous cylinder* acrita manca (144)
Genital plate broad, carinate, and bifid . acrita ambigua (143)
acrita littoralis (144)
acrita acrita (143)

VII.

F.-w. with hind marginal spots at least in 1b and 2 . . (*a*)

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* Owing to the variability of *acrita* it is not possible to give absolutely constant characters of difference between it and this species. Occasionally some examples of *acrita* have no spots in f.-w. 1b, but in these the apical black is only about 5 mm. deep.

† It is not possible to completely separate the forms of *A. acrita* on merely outward characteristics, or indeed in any other manner, with absolute certainty. See under *A. acrita* in descriptive portion.

[Occasional examples of *stenobea* have f.-w. hind marginal spots ; see (*f*).]

F.-w. without hind marginal spots . . . . . . (*i*)

(*a*) F.-w. with distinct black internervular rays on the apical region . . . . (*b*)

F.-w. without such internervular rays . . . . . (*c*)

(*b*) Spots of h.-w. margin underside (if present at all) are whitish, narrow, and streak-like, being enclosed by fine black transverse internervular lines which are straight and not arched *atergatis* (part) (188)

Spots of h.-w. margin underside large, their inner edges rounded, being enclosed by black well-arched lines . *oncaea* (174)

[*A. equatorialis anaemia* sometimes has f.-w. submarginal spots, but can be distinguished by its pale, very delicately scaled f.-w.]

(*c*) H.-w. marginal border above, not sharply defined, merely dusky with an indication of blackish rings . . . . (*d*)

H.-w. with well-defined dark hind-marginal border . . (*e*)

(*d*) F.-w. sepia-black (sometimes with yellowish subapical marks) . *natalica pseudegina* (192)

F.-w. dull red (greyish towards apex, with yellow markings) *natalica abadima* (192)

(*e*) F.-w. discal spots widely separated from end of cell . . (*f*)

F.-w. discal spots close to, or confluent with end of cell . (*h*)

(*e*) *F.-w. discal spots widely separated from end of cell* . . (*f*)

F.-w. discal spots close to, or confluent with end of cell natalica natalica (192)

(*f*) F.-w. apical black narrow and well defined *caecilia pudora* (182)

[Occasional examples of *stenobea* would be entered here, but they would be distinguished from *caecilia* by the much broader basal black and the absence of a spot in h.-w. area 3.]

F.-w. apical black broad and inwardly suffused . . (*g*)

(*g*) Ground-colour white to pink or dull red *caecilia caecilia* (182)

Ground-colour uniformly clay-yellow . . *marnois* (184)

(*h*) A grey transverse band in apical area beyond discal spots *natalica umbrata* (192)

Without such grey band . . . *natalica natalica* (192)

(*i*) F.-w. with black internervular streaks in apical area . (*j*)

F.-w. without such streaks . . . . (*q*)

(*j*) Inner edge of h.-w. marginal border is very markedly sinuous, and the margin between nervules is somewhat indented, especially towards anal angle, so that the border has an undulating appearance . . . . . . (*k*)

Border not having such appearance . . . . . (*m*)

(*k*) Without a whitish or partially transparent subapical patch *doubledayi sykesi* (171)
With such whitish or partly transparent patch . . . (*l*)

(*l*) Ground-colour dark brick-red . . *doubledayi arabica* (172)
Ground-colour orange red . *doubledayi doubledayi* (171)

(*l*) *Ground-colour chocolate brown* . doubledayi arabica (172)
Ground-colour dull reddish to grey doubledayi doubledayi (171)

(*m*) H.-w. marginal border above, black, well defined, and without spots, or at most with a faint indication of such spots . (*n*)
H.-w. marginal border above, formed of delicate black arches not always complete at inner edge . . . . . . (*p*)

(*n*) Ground-colour of f.-w. red . *braesia* f. *regalis* (part) (169)
Ground-colour of f.-w. not red . . . . . . (*o*)

(*o*) F.-w. very thinly scaled. Ground-colour faintly ochreous. Spots small . . . . . *equatorialis anaemia* (177)
F.-w. generally fully scaled. Ground-colour pinkish-ochreous. Spots large . . . . . . *axina* (part) (180)

(*o*) *F.-w. very thinly scaled. Ground-colour faintly ochreous. Spots small* . . . . . equatorialis anaemia (177)
F.-w. generally fully scaled. Ground-colour pinkish ochreous to grey. Spots small or large . equatorialis equatorialis (177)
axina (180)

[*I can find no perfectly constant character to distinguish these two* ♀♀, *but in* axina *the inner edge of h.-w. marginal border is almost always more sharply defined than in* equatorialis equatorialis.]

(*n*) A well-marked grey submarginal band in f.-w. 5, 4, and 3. Ground-colour red. Expanse about 60 mm.
braesia f. *regalis* (part) (169)
Without such grey band. Ground-colour not red. Expanse about 50 mm. or less . . . . *axina* (part) (180)

(*p*) Line of discal subapical spots in f.-w. 4, 5, and 6 makes, outwardly, an acute angle with costa. Wings thickly scaled
ella (179)
Line of discal subapical spots in f.-w. 4, 5, and 6 makes, outwardly, a right or obtuse angle with costa. Wings very thinly scaled . . . . . *equatorialis equatorialis* (177)

(*q*) *F.-w. discal spots close to, or confluent with end of cell* . . (1)
F.-w. discal spots smaller and well removed from end of cell (3)

(1) *F.-w. spots beyond end of cell not contiguous* intermedia (*part*) (159)
F.-w. spots beyond cell contiguous . . . . . (2)

(2) *F.-w. subapical patch white* . . . . . mima (167)
F.-w. subapical patch pale but not white . rhodesiana (166)

(3) *F.-w. apical black narrow* . . . . (4)
F.-w. apical black broad . . . . (5)

(4) *F.-w. ground-colour, where not suffused with black, very uniform right up to margin* . . . . . stenobea (190)
F.-w. with more or less distinct tendency to orange spots towards hind margin . . . . aglaonice (186)
(5) *H.-w. discal spot in 2 some distance from base of that area* caldarena (161)
H.-w. discal spot in 2 in angle at base of that area pudorella detecta (164)
(*q*) Distal half of abdomen white . . . . (*r*)
Distal half of abdomen not white . . . . . (*s*)
(*r*) F.-w. with a well-defined subapical white patch *mima* (part) (167)
[Some forms of *caldarena* have distal part of abdomen white, but there is no white patch in f.-w.]
F.-w. without white patch . . . . *rhodesiana* (166)
(*s*) A broad smoky black basal suffusion reaching at least to middle of cell in both wings . . . . . *stenobea* (190)
Without such suffusion . . . . (*t*)
(*t*) A broad white subapical patch in f.-w. . *mima* (part) (167)
Without such patch . . . . (*u*)
(*u*) Only two h.-w. discal spots (one in 6 and one in 7). A V-shaped black spot in middle of cell on underside, apex outwards *aureola* (142)
More than two h.-w. discal spots. Central spot of h.-w. cell not V-shaped . . . . (*v*)
(*v*) H.-w. spots almost always small and obsolescent, and in any case far removed from outer margin . . *aglaonice* (186)
H.-w. spots always well developed, at least on underside, and the most distally placed are nearer to margin than to cell (*w*)
(*w*) Discal spots in f.-w. areas 4 and 5 are close to cell and the spot in 3 much more distally placed . *intermedia* (part) (159)
Discal spots in f.-w. 4 and 5 are much further removed from cell, and lie almost, or quite, in a straight line with that in 3. (*x*)
(*x*) Wings fully scaled and quite opaque. Spot in h.-w. area 2 is somewhat removed from the base of that area *caldarena* (161)
Wings thinly scaled and somewhat translucent. Spot in h.-w. area 2 is in the angle at base of that area. . . . (*y*)
(*y*) F.-w. with a broad blackish apical patch *pudorella detecta* (164)
F.-w. without such patch (only slightly blackened at apex) *pudorella pudorella* (163)

VIII.

H.-w. margin on underside black, with a sharply defined inner edge and pale triangular marginal spots (no submarginal spots), no striation . . . . (*a*)
H.-w. margin on underside not plain black, with only marginal

spots. Striated, or the dark colour produced inwardly as red or black internervular marks, at least in areas 2 and 3 . (*c*)

(*a*) Little or no basal black in f.-w. area 1b . . *lumiri* (219)

With basal black in f.-w. area 1b, at least along lower half of that area . . . . (*b*)

(*b*) Basal black of f.-w. forms a patch, the outer edge of which is more or less continuous with that of the h.-w. basal black, and is not deeply indented, on the median, by the reddish ground-colour . . . . *uvui uvui* (217)

Basal black of f.-w. is deeply indented on the median by the ground-colour . . . . . . *bonasia alicia* (221)

[Also *bonasia banka*, and sometimes *bonasia bonasia*, but the latter is distinguished by character *a'*.]

(*b*) A. uvui ♀ *has the h.-w. border beneath bearing broad brown internervular marks and very faint indications of marginal pale spots.*

A. bonasia alicia ♀ *has the border deeply striated, but may usually be recognised by the paucity of basal black in f.-w.*

(*c*) F.-w. with a broad black apical patch bearing three small semi-transparent subapical spots in areas 4, 5, and 6 *fornax* (309)

F.-w. not so marked . . . . (*d*)

(*d*) H.-w. underside bears at costa a crimson triangle enclosed by a black line. Base of triangle on costal nervure. Ground-colour of h.-w. lemon-yellow . . . . *excelsior* (215)

H.-w. underside not so marked . . . . . . (*e*)

(*e*) H.-w. margin beneath bears broad red internervular marks. That in area 4 is not, or very little, shorter than that in 3, and is not heavily bordered with black . . . . (*f*)

H.-w. margin beneath without broad red internervular marks, or if with such marks that in area 4 is very much shorter than that in area 3, or at least is heavily bordered with black . . . . (*g*)

(*f*) F.-w. without a separated subapical patch of the ground-colour, and h.-w. with a well-developed row of discal spots *zitja* (part) (204)

F.-w. with a separated subapical patch of ground-colour, and h.-w. without discal spots . . . . *goetzi* (213)

(*g*) H.-w. border beneath bears long internervular rays which are bifurcated at margin and enclose pale spots, such spots being for the most part wider before than at the margin *althoffi* (251)

(This species is polymorphic. For the various forms see descriptive portion.)

If h.-w. border beneath bears long bifurcated rays, the pale spots they enclose are triangular and widest at the margin . (*h*)

(*h*) The edges of the pale h.-w. discal band are practically parallel, the outer edge showing no tendency to be angulated at nervule 3 . . . . *oberthüri* (249)
The edges of pale h.-w. band are not parallel, the outer edge being slightly or greatly angulated at nervule 3 . . (*i*)
(*i*) F.-w. has little or no basal black . . . . (*j*)
F.-w. with basal black . . . . (*p*)
(*j*) F.-w. with a completely separated subapical patch of ground-colour (or paler) . . . . (*k*)
F.-w. with ground-colour (or paler) not separated off to form a patch . . . . (*m*)
(*k*) Apical patch in the form of long narrow streaks paler than ground-colour . . . . *terpsichore rangatana* (240)
Apical patch same tint as ground-colour and not in long narrow streaks . . . . (*l*)
(*l*) H.-w. underside with a central band of red more or less definitely enclosed by narrow transverse black streaks *terpsichore* f. *ventura* (240)
H.-w. underside with rounded and separated black spots *terpsichore terpsichore* (239)
♀♀ *of this species excessively variable. See description.*
(*m*) Ground-colour of both wings pale creamy ochreous *terpsichore ochrascens* (240)
Ground-colour not pale creamy ochreous . . . . (*n*)
(*n*) No discal spots in h.-w . . *terpsichore* f. *subserena* (239)
With discal spots in h.-w. . . . . (*o*)
(*o*) H.-w. underside suffused in centre with brownish scales *terpsichore* f. *intermediana* (240)
H.-w. underside not so suffused . *terpsichore* f. *rougeti* (239)
(*p*) F.-w. basal black with outer edge regular and not deeply indented at median . . . . (*q*)
F.-w. basal black deeply indented at median, or at least the median nervure not blackened . . . . . (*s*)
q) Paler patches of both wings red . . . *uvui balina* (217)
Paler patches of both wings yellow . . . . . (*r*)
(*r*) Pale patches very large. Outline of f.-w. basal black not forming an angle with that of h.-w. ditto . . . *viviana* (233)
Pale patches small. Outline of f.-w. basal black makes an angle with that of h.-w. ditto . . . . *cabira karschi* (230)
(*s*) H.-w. upperside with little or no black at base, or if with an appreciable amount of black, then also having a deep orange triangular marginal spot in each internervular space . (*t*)
H.-w. upperside with a triangular basal black patch . . (*w*)
(*t*) Ground-colour pale creamy ochreous or nearly white *acerata tenella* (235)

Ground-colour yellow to red brown . . . . . (u)

(u) F.-w. without apical patch separated off from ground-colour . . . . *acerata acerata* (235)

F.-w. with separated apical patch . . . . . . (v)

(v) Ground-colour yellow to orange . . *acerata vinidia* (235)

Ground-colour red brown . . . *acerata brahmsi* (235)

(w) F.-w. basal black after extending for some distance along nervure 1, does not bend upwards towards the cell . (x)

F.-w. basal black after extending for some distance along nervure 1, bends upwards towards cell . . . (a′)

(x) The subbasal black spots on underside of h.-w. do not form a double row enclosing spots of scarlet . . . . . (y)

Subbasal black spots of h.-w. underside form a double row containing scarlet spots . . . . (z)

(y) Ground-colour very pale. H.-w. margin on underside narrow *bonasia alicia* f. *tenelloides* (221)

Ground-colour not so pale, underside with a deep striated margin . . . . *bonasia alicia* f. *cabiroides* (221)

(z) Pale patches of both wings yellow . . *cabira cabira* (229)

F.-w. inner marginal patch and h.-w. central band red or reddish . . . . *cabira apecida* (229)

(a′) F.-w. with a yellow subapical patch . . . . . (b′)

F.-w. with a red subapical patch . . . . . . (c′)

(b′) H.-w. central band red . . . *sotikensis sotikensis* (227)

H.-w. central band, or at least its inner marginal half, pale yellow . . . . *sotikensis rowena* (227)

(c′) On h.-w. underside, three large black spots at bases of areas 6, 5, and 4 beneath the outer spot in 7 *sotikensis supponina* (227)

H.-w. with spots not so arranged . . . . . . (d′)

(d′) F.-w. basal black after extending along nervule 1 ends in an upwardly directed point (which rarely reaches cell) *bonasia bonasia* (220)

F.-w. basal black after extending along nervule 1 has a blunt or bifurcated termination . . . *sotikensis katana* (227)

IX.

F.-w. with transparent or partially transparent areas or spots, at least in 6, 5, and 4 . . . . (a)

F.-w. without transparent or partially transparent areas . *buschbecki* (291)

(a) F.-w. with three very small, well-defined, semitransparent spots in 6, 5, and 4. A rather larger similar spot at base of 2. Remainder of f.-w black brown . . . *newtoni* (285)

F.-w. not so marked . . . . (b) (*b*) F.-w. with a large well-defined spot in cell, distinctly separated from subapical spots . . . . (*c*)

F.-w. without such spot in cell . . . . (*e*)

(*c*) The f.-w. cell spot and that at base of area 2 fully scaled with lemon-yellow. The h.-w. underside internervular rays reach the margin in a fine point . . . *melanoxantha* (288)

F.-w. cell spot and that at base of area 2 are transparent or very sparsely scaled with whitish. The h.-w. underside rays end well before margin . . . . (*d*)

(*d*) H.-w. central band yellow . . . *mairessei mairessei* (286)

H.-w. central band red . . . *mairessei dewitzi* (286)

(*e*) F.-w. with cell and most of areas 2 and 1b fully scaled with red . . . . (*f*)

F.-w. basal red, if any, much broken up and obsolescent . (*h*)

(*f*) F.-w. area 3 transparent, not scaled with red *igola* (part) (302)

F.w. area 3 scaled with red or black . . . . . . (*g*)

(*g*) Nervule ends on h.-w. underside broadly black with short thick black rays between . . . . . *conradti* (289)

Nervule ends on h.-w. underside narrowly black with narrow rays between . . . . *aubyni* (304)

(*h*) Black margin of h.-w. very narrow (not more than 2 mm.) *peneleos* (part) (268)

[A. *peneleos* rarely comes into this section, the rays nearly always fully reaching the margin.]

Black margin of h.-w. more than 2 mm. wide (usually about 4 mm.) . . . . (*i*)

(*h*) *F.-w. cell transparent* . . penelope translucida (281)

F.-w. cell not transparent . . . . (1)

(1) *H.-w. central band yellowish white* penelope *f.* exalbescens (281)

H.-w. central band red . . . . (2)

(2) *Base of h.-w. underside reddish brown* penelope *f.* penella (281)

Base of h.-w. beneath, but little, if at all, darker than central band . . . . (3)

(3) *Ground-colour of h.-w. beneath yellowish* . penelope penelope

Ground-colour of h.-w. beneath silvery grey penelope *f.* argentea (281)

(*i*) F.-w. with a large red spot in areas 1b and 2, and a very small transparent spot in 3 (sometimes absent). Three small transparent subapical spots. Rest of f.-w. black brown *penelope penelope* (281)

F.-w. spots in 1b and 2 transparent, and a very large transparent spot in 3 . . . . (*j*)

(*j*) F.-w. cell also transparent, with an indication of a black spot in middle. H.-w. central band of medium width *penelope translucida* (281)

F.-w. cell fully scaled with black, except occasionally at extreme end . . . . (*k*)

(*k*) H.-w. central band very narrow (about 4 mm.) *penelope derubescens* (281)

H.-w. central band so broad as to leave a black margin of only about 3 mm. . . . . . . *penelope vitrea* (281)

X.

F.-w. with a peculiar pattern formed as follows. Cell and a short distance beyond it sepia. A central band of tawny brown outwardly deeply identate on the nervules. Outer half of wing sepia. An irregular spot near base of area 2 and a V-shaped spot beneath it in 1b . . . . alciope alciope (322)

F.-w. with a similar pattern, but with a white suffusion of the central band . . . . . alciope *f.* cretacea (323)

X.

F.-w. bears subapical spots in 6, 5, and 4, and discal spots in 1*b* and 2, just as in species of Sections VI or VII . . (*a*)

F.-w. not bearing such spots . . . . (*m*)

(*a*) F.-w. bears large submarginal spots in 1b and 2, and the h.-w. ditto at least in 1c, 2, and 3 . . . . (*b*)

No submarginal spots . . . . (*d*)

(*b*) Central band of h.-w. red . . . . *rogersi rogersi* (61)

Central band of h.-w. not red . . . . (*c*)

(*c*) H.-w. with a whitish central band . *rogersi lamborni* (62)

H.-w. central band not differentiated, the whole ground-colour of both wings being sepia-brown . *rogersi* f. *salambo* (61)

(*d*) H.-w. discal spot in 4 stands nearer to cell than that in 3 or 5 (*e*)

H.-w. discal spot in 4 stands not nearer to cell than that in 3 or 5 . . . . (*i*)

(*e*) H.-w. underside with a black border bearing orange spots (*f*)

H.-w. margin without orange spots . . . . . . (*g*)

(*f*) Red of f.-w. not extending beyond subapical spots *perenna perenna* (261)

Red of f.-w. extending beyond subapical spots *perenna thesprio* (262)

(*g*) H.-w. with a white inner marginal patch *pharsalus vuilloti* (257)

H.-w. without white patch . . . . . . (*h*)

(*h*) F.-w. with a white or whitish band beyond the subapical spots, the red ground-colour not extending into apical area *pharsalus pharsalus* (256)

F.-w. without white subapical band, the corresponding area being occupied by an extension of the red ground-colour *pharsalus* f. *pharsaloides* (256)

(*i*) F.-w. with a white subapical band . . . . . . (*j*)
F.-w. without a white subapical band . . . . . (*l*)
(*j*) Ground-colour of f.-w. white . . *encedon* f. *lycia* (210)
Ground-colour of f.-w. tawny . . . . (*k*)
(*k*) H.-w. with a white patch . . . *encedon* f. *alcippina* (210)
H.-w. without a white patch . . *encedon encedon* (209)
(*l*) Nervules ending in broad black triangles at margin. H.-w. with a white patch . . . . *encedon* f. *radiata* (211)
Nervules not so. No h.-w. white patch *encedon* f. *daira* (210)
(*m*) F.-w. may be brown or black with a subapical pale patch or spots and an inner marginal pale patch, or the inner marginal and subapical pale patches may be confluent forming a broad angulated pale central band . . . . (*n*)
F.-w. not so marked . . . . (*r*)
(*n*) F.-w. with a broad angulated confluent band . *alciope* (322)
F.-w. with subapical and inner marginal pale marks separated (*o*)
(*n*) *F.-w. with a broad confluent pale band* . . . . . (1)
F.-w. with subapical and inner marginal pale marks separated (2)
(1) *F.-w. band orange, h.-w. band white* alciope ♀ *f.* aurivillii (323)
Both bands orange . . . . alciope *f.* tella (323)
alciope ♀ *f.* macarina (322)
[*In* macarina *the pattern, especially of f.-w. is much less definite than in* tella.]
(2) *F.-w. subapical pale marks include a spot near margin in area* 4, *well separated from a series of three spots close to costa* . (3)
F.-w. subapical pale spots only separated by the nervules, and so forming a patch . . . . (*p*)
(3) *H.-w. with a broad dark border* . . . conjuncta (319)
H.-w. without a broad dark border . . . ansorgei (318)
(*o*) F.-w. subapical pale marks include a spot near margin in area 4 well separated from a series of three spots close to costa *conjuncta* (319)
F.-w. subapical spots only separated by the nervules, and so forming a patch . . . . (*p*)
(*p*) Expanse not exceeding 48–50 mm. The dark transverse band from costa to hind margin in f.-w. which cuts off the subapical patch is reduced towards margin to so fine a point that the subapical patch is only just separated from the inner marginal . . . . . . *disjuncta* (321)
The f.-w. subapical patch is separated from the inner marginal by a dark transverse band of considerable width, and though the end of the band may be somewhat broken by a whitish streak it is not reduced to a point as above. Expanse almost always much more than 50 mm. . . . . . . (*q*)
(*q*) H.-w. dark border fairly sharply defined inwardly, or in the

forms in which it is not so, then the f.-w. subapical patch is very narrow, rarely exceeding about 3·5 mm. in width. Border in h.-w. never so broad as almost to reach end of cell . . . . *esebria* * (331)

H.-w. dark border if present is not sharply defined inwardly except in forms in which it is so broad as almost to touch cell, and in such cases the f.-w. subapical patch is much more than 3·5 mm. in width . . . . *jodutta* * (327)

(*r*) F.-w. perfectly transparent and scaleless except for a narrow, intensely black apical and hind marginal border and a very little black at base . . . . . *semivitrea* (300)

F.-w. not as above . . . . (*s*)

(*s*) H.-w. cell beneath with not more than one spot . . . (*t*)

[Some examples of *lycoa* have a second spot in cell, but this is usually accompanied by a blackish streak. Or the streak may be broken up giving the appearance of several spots.]

H.-w. cell beneath with more than one spot . . . (*w*

(*t*) F.-w. with a subapical patch of three elongated transparent spots . . . . *servona* (part) (292)

[*A. servona* nearly always has more than one spot in cell. See under (*w*).]

F.-w. without such subapical transparent patch . . . (*u*)

(*u*) H.-w. beneath with a narrow elongated central yellow patch and an inner marginal red brown patch . *oreas* (298)

H.-w. beneath not so marked . . . . (*v*)

(*v*) Distal outline of h.-w. pale patch has a tendency to be angulated at area 4, giving the patch a somewhat quadrate appearance. This angulation is most easily seen beneath *johnstoni* (339)

[*A. johnstoni* is polymorphic. For forms see descriptive section.]

Distal outline of h.-w. pale patch is regularly rounded *lycoa* (part) (336)

[*A. lycoa* is also polymorphic. See descriptions.]

(*w*) Both wings fully scaled without any partially or wholly transparent patches or spots . . . . (*x*)

Transparent or partially transparent areas in one or both wings (*z*)

(*x*) F.-w. without any red or orange marks . *lycoa* (part) (336)

F.-w. with red or orange marks . . . . (*y*)

(*y*) *F.-w. with elongated red patches between the nervules* . . (1)

(1) *H.-w. discal spots large and forming a band which extends well beyond cell* . . . . . . orina orina (263)

H.-w. discal spots not extending well beyond cell . . . (2)

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* For the various named forms of *esebria* and *jodutta* see descriptive portion. It is scarcely possible to give concise characters which constantly differentiate between them, and some little experience is required before the two species can be separated at sight.

(2) *H.-w. spots confluent in a large black basal patch*
orina orineta (264)
H.-w. spots though obscured by basal suffusion are obviously not confluent . . . . . parrhasia *f.* oppidia (278)
(*y*) F.-w. with elongated red patches between the nervules *orina* (263)
F.-w. with orange spots between the nervules . *insularis* (345)
(*z*) *F.-w. fully and thickly scaled with the exception of three small quadrate well-defined transparent or semitransparent subapical spots in* 6, 5, *and* 4 . . . safie antinorii (316)
F.-w. not so . . . . (1)
(1) *On the underside the base and margin of h.-w. are dark brown enclosing between them a narrow ochreous central band*
peneleos pelasgius (269)
H.-w. beneath not so marked . . . . . . (*d'*)
(*z*) The transparent areas are confined to three or four very small, very sharply defined subapical spots in f.-w. . . . (*a'*)
Transparent areas not so confined or at least considerably elongated . . . . (*d'*)
(*a'*) F.-w. ground-colour reddish brown . . *amicitiae* (317)
F.-w. ground-colour brown black . . . . . (*b'*)
(*b'*) H.-w. with a red band . . . *peneleos pelasgius* (269)
H.-w. without a red band . . . . (*c'*)
(*c'*) H.-w. with a fairly broad yellow central band *safie safie* (315)
H.-w. with a very narrow, or no band . . *safie antinorii* (316)
(*d'*) Large forms with an expanse of wing of about 60–90 mm. F.-w. for the most part transparent but having two irregularly outlined transverse oblique dark bands, one from costa at a point just beyond middle of cell, to the hind angle. The second just beyond cell. (These bands may be rather faint.) Apex and hind margin usually somewhat darkened (*e'*)
Expanse of wing usually much less. In any case pattern not as above . . . . (*g'*)
(*e'*) H.-w. fully scaled all over . . . . . *vesperalis* (48)
H.-w. partly transparent . . . . (*f'*)
(*f'*) F.-w. dark bars and h.-w. basal scaling heavily developed
pentapolis epulica (46)
F.-w. dark bars and usually h.-w. basal scaling lightly developed
pentapolis pentapolis (46)
(*g'*) H.-w. with a quite well-defined transparent or semitransparent marginal border more or less dusted with black scales . (*h'*)
H.-w. with margin at least as fully scaled as rest of wing . (*i'*)
(*h'*) H.-w. border broad and the blackish dusting quite evenly distributed. (Tarsal claws equal) . . *quirinalis* (308)
H.-w. border narrow, the blackish dusting concentrated towards anal angle. (Tarsal claws unequal) . . *orestia* (305)

(*i'*) Base of h.-w. above not broadly blackened and discal spots well developed . . . . (*j'*)
Base of h.-w. above broadly black or if not then without well-developed discal spots . . . . (*l'*)

i') *Base of h.-w. above not suffused with black or brown* . . (1)
Base of h.-w. above suffused with black or brown . . . (6)

(1) *H.-w. with a central pale yellowish band* peneleos helvimaculata (269)
H.-w. without such band . . . . (2)

2) *At h.-w. margin on upperside the dark internervular rays project inwardly for some distance* . . . . (3)
H.-w. margin without such well-developed rays on upperside (4)

(3) *H.-w. discal spots well developed* . . peneleos peneleos (268)
H.-w. discal spots not developed . . parrhasia *f.* leona (278)

(4) *H.-w. border not continuously black but bearing black triangles at nervule ends* . . . . sambavae (314)
H.-w. marginal border continuously black . . . . (5)

(5) *Outer spot of h.-w. cell lies at or beyond origin of nervule 2* strattipocles (311)
Outer spot of h.-w. cell lies distinctly before origin of nervule 2 masamba (312)

(6) *H.-w. without a red, yellow, or white central area* peneleos *f.* sepia (269)
H.-w. with such area . . . . (7)

(7) *Central area almost white* . . peneleos *f.* lactimaculata (269)
Central area yellow . . . . (8)
Central area red . . . . (10)

(8) *Yellow area narrow with nearly parallel edges* . circeis (297)
Yellow area broad with outer edge curved . . . . (9)

(9) *F.-w. with patches of lemon yellow in areas* 1b, *and* 2 servona *f.* limonata (293)
F.-w. areas 1b *and* 2 *sparsely scaled with white* servona servona (292)

(10) *H.-w. with V-shaped black spots on underside midway between cell and border. Usually with a pink central band* baxteri (*part*) (267)
H.-w. without such V-shaped spots and never with a pink band . . . . (11)

(11) *F.-w. with elongated reddish streaks in* 1b, 2, *and* 3 parrhasia parrhasia (277)
F.-w. with a rounded reddish spot in 2 *but no streaks* servona rubra (293)

(*j'*) H.-w. marginal border not continuously black but bearing black triangles at nervule ends . . . *sambavae* (314)

H.-w. marginal border continuously black . . . . (k')

(k') Outer spot of h.-w. cell lies at or beyond origin of nervule 2 *strattipocles* (311)

Outer spot of h.-w. cell lies distinctly before origin of nervule 2 *masamba* (312)

(l') H.-w. without a yellow or red central patch or band *lycoa lycoa* (336)

H.-w. with a yellow or red central patch or band . . (m')

(m') H.-w. with a yellow central patch or band . . . (n')

H.-w. with a red central patch or band . . . . (o')

(n') H.-w. central patch narrow, its edges nearly straight *circeis* (297)

H.-w. central patch broad, at least its outer edge curved *serrona* (292)

(o') Transparent portion of f.-w. confined to three large elongated subapical spots . . . . . *baxteri* (part) (267)

Transparent portion of f.-w. not so confined . . . (p')

(p') Tarsal claws equal . . . . (q')

Tarsal claws unequal . . . . (r')

(q') F.-w. with an even and regular red basal flush extending to end of cell . . . . . . *igola* (part) (302)

F.-w. with basal red (if present at all) much broken up especially by a black mark in middle of cell *parrhasia* (277)

(r') Central portion of h.-w. on underside is not paler than base or margin . . . . *grosvenori* (276)

Central portion of h.-w. underside is paler than base or margin . . . . (s')

(s') Nervule ends on h.-w. underside not broadly dusted with black so as to have a swollen appearance *peneleos peneleos* (part) (268)

Nervule ends on h.-w. underside broadly dusted with black so as to have a swollen appearance

peneleos peneleos (part) (268)

pelopeia (274)

GROUP I.

1. Acraea zonata. Pl. VIII, f. 11.

Acraea zonata, Hewitson, Ent. Mo. Mag., xiv, p. 154 (1877); Aurivillius, Rhop. Aeth., p. 83 (1898).

= *makupa*, Gr.-Smith, Ann. Nat. Hist. (6), 3, p. 126 (1889); Smith & Kirby, Rhop. Exot., 9 (*Acraea*), p. 3, pl. 1, f. 6 (1889).

German E. Africa (Dar-es-Salaam, Mikindani); British E. Africa (Rabai, Witu, Wasin, Zanzibar, Pemba I.).

♂. Expanse about 55 mm. Wings thinly scaled, orange brown. Nervures well marked, dark brown. F.-w. costa and base, black.

A large transverse black spot about middle of cell. An irregular band of black spots crossing the discal area at the discocellular nervules and extending to the hind angle. Apical area and hind margin rather broadly dusted with black and bearing eight rather suffused spots of the ground-colour. H.-w. black at base and slightly dusted with black on margin. A very minute black dot at point where nervure 5 leaves the cell. An irregular zigzag discal band of black extending from the costa to the anal angle. Thorax black, spotted with pale brown beneath. Abdomen black above, brown beneath, and bearing segmental spots of pale brown. Claws unequal.

The underside resembles the upper but has a vitreous surface and the markings are less distinct.

♀. I have seen only two ♀♀ of this species. One is in the general collection of the Berlin Museum and differs from ♂ examples only in the fact that in the f.-w. the space between the central bar and the apical brown is transparent.

The other is in Mr. J. J. Joicey's collection and resembles the ♂ but is larger, paler, and duller.

Acrea zonata appears to be a rather rare insect. The type in the Hewitson collection was taken at Zanzibar. The example figured by Grose-Smith is from Mombasa, one specimen in the Oxford collection is from Rabai, whilst the Tring collection contains examples from Dar-es-Salaam and Pemba I., and the British Museum specimens are from Zanzibar and Witu. *A. zonata* is certainly closely allied to *rabbaiae*. The claspers in the ♂ armature are without the large processes so characteristic of that species.

2. Acraea rabbaiae. Pl. VIII, f. 10.

Acraea rabbaiae, Ward, Ent. Mo. Mag., x, p. 152 (1873); Oberthür, Etud. d'Ent., 3, p. 25, pl. 2, f. 1 (1878); Trimen, S. Af. Butt., 1, p. 133 (1887); Monteiro (metam.), Del. Bay p. 219 (1891); Aurivillius, Rhop. Aeth., p. 83 (1898).

Portuguese E. Africa (Delagoa Bay, Mozambique); German E. Africa (Islikundani, Usarama); Rhodesia (Chirinda).

A. rabbaiae mombasae, subsp.

Gr.-Smith, Ann. Nat. Hist. (6), 3, p. 127 (1889); Smith & Kirby, Rhop. Exot., 21 (*Acraea*), p. 14, pl. 4, f. 9, 10 (1892); Aurivillius, Rhop. Aeth., p. 83 (1898).

British E. Africa (Rabai, Zanzibar, Sabaki R. Witu); German E. Africa (Islikundani, Usarama).

A. rabbaiae rabbaiae.

♂. Expanse about 64 mm. F.-w. transparent. H.-w. transparent or thinly scaled. Nervures well marked, dark brown. A more or less well-marked series of black spots across centre of f.-w. confluent round the discocellulars. One crescentic spot in 2, below junction of 3 and the median. One spot below this and slightly nearer base, in 1b, and another, more rounded spot in same area, near junction of 2 and the median. One spot in area 11 just before end of cell. Apices slightly dusted with brownish ochreous. H.-w. more or less scaled with whitish. Margin with large internervular ochreous spots bordered inwardly with a blackish suffusion. Underside the same. Thorax black with a few reddish spots above and spotted with pale ochreous below. Abdomen black with pale lateral spots and brown beneath. Claws unequal.

♀. Resembles the ♂.

The extent of the scaling of the h.-w. in *rabbaiae* varies from a condition approaching transparency to a fairly thickly scaled surface. These scales are, in all the examples I have seen, distinctly paler in colour than in the subsp. *mombasae*.

A. rabbaiae mombasae, subsp.

This form resembles *rabbaiae* but the black markings in the f.-w. are less well defined and the h.-w. is always thickly scaled with creamy brown scales distinctly darker than in *rabbaiae*. The apices of the f.-w. are darker and frequently bear traces of a marginal band of pale spots.

The example of this form figured and described by Grose-Smith has both wings moderately scaled and this is apparently the case in the remaining examples in his collection. Most of the specimens I have seen show a greater transparency in the f.-w.

The form appears to be confined to the neighbourhood of Mombasa, Rabai, and Zanzibar. I have seen no specimen of the typical *rabbaiae* taken so far north as this. The latter occurs at Delagoa Bay and inland to Chirinda.

The genital armature is the same in both forms.

The type is in the collection of M. Oberthür. The larva of *rabbaiae* is briefly referred to by Mrs. Monteiro in "Delagoa Bay" as "bright red with black spines."

3. ACRAEA SATIS. Pl. XIV, ff. 14, 14a, 14b, 14c.

Acraea satis, Ward, Ent. Mo. Mag., viii, p. 35 (1871); Af. Lep., p. 6, pl. 6, f. 1 (1875); Mabille, Hist. Nat. Mad. Lep., 1, p.

115, pl. 10, f. 10, 11 (1885–7); Aurivillius, Rhop. Aeth. p. 90 (1898); Aurivillius, Voeltzkow Exp., p. 315 (1909).
= *corona*, Staudinger, Exot. Schmett, 1, p. 83, pl. 33 (1885).

GERMAN E. AFRICA (Dar-es-Salaam, Lindi, Bondu, Bagamoyo, Saadani, Mafia I.); BRITISH E. AFRICA (Rabai, Zanzibar, Witu); RHODESIA (Chirinda); ZULULAND.

♂. Expanse 55–70 mm. F.-w. thinly scaled. Base and costa black, area 1b sometimes yellowish. A short black basal streak in 1b. From base to end of cell, base of area 2, two-thirds of 1b, and a slightly less extent of 1a, bright red. The red area bounded by an irregular discal band of black from subcostal to hind angle, and darkest on end of cell. A rather broad sinuous transverse black mark in cell near end. Areas 4, 5, and 6, from transverse band to middle of discal area, red, followed by a slight dusting of blackish scales. All the f.-w. black markings may be very faint, the spot on discocellular being the least liable to obsolescence. Remainder of f.-w. semitransparent, scales being slightly reduced, scattered, and sometimes replaced by bifid hairs. H.-w. red, yellowish at inner margin. A hind marginal black border bearing a variable number of internervular spots of the ground-colour. An irregular discal band of black sometimes enclosing spots of the ground-colour. Base black, with a subbasal spot in 7, one in cell, and one in 1a.

Underside, f.-w. scaled only at base and costa. H.-w. as on upperside, but scaled only at base, margins, and discal band. Costal and inner marginal scales dull ochreous, black spots as on upperside. Hind margin as on upperside but with seven large rounded dull ochreous spots. Thorax black spotted with yellowish beneath, and with two to four whitish spots above. Abdomen black above, paler below, and laterally and ventrally spotted with yellowish. Claws unequal.

♀. Expanse about 84 mm. Markings similar to those of ♂ but the red colour everywhere replaced by white. In f.-w. the cell spot may coalesce with discal band, or may enclose a small white spot. Abdomen white spotted.

Acraea satis is a remarkably distinct species not only in the character of the markings but also in the structure of the genitalia. A very peculiar modification of the parts has taken place. The true uncus and claspers have become much reduced, whilst the dorsal and ventral abdominal plates have become greatly modified, so as to resemble false uncus and claspers respectively.

Mabille describes this species as occurring in Madagascar, but I have been unable to find any authentic example from that island. M. Oberthür has specimens so labelled, but informs me that in this case the labelling is not reliable, and that he is of opinion that the species occurs only on the mainland.

GROUP II.

4. ACRAEA PENTAPOLIS. Pl. XIV, f. 2.

Acraea pentapolis, Ward, Ent. Mo. Mag., viii, p. 60 (1871); Af. Lep., p. 7, pl. 6, f. 2 (1873); Aurivillius, Rhop. Aeth., p. 111 (1898); Lathy, Trans. Ent. Soc., p. 186 (1903); Neave, Novit. Zool., xi, p. 346 (1904); Aurivillius, Ann. Mus. Genov., p. 3 (527), (1910).

= *thelestis*, Oberthür, Etud. d'Ent., 17, p. 17, pl. 3, f. 33 (1893); Aurivillius, Rhop. Aeth., p. 111 (1898).

S. LEONE; GOLD COAST; ASHANTI; NIGERIA; TOGO; CAMEROON; GABOON; CONGO (Bopoto, Luebo, Leopoldville); UGANDA.

A. pentapolis epidica, subsp.

= *A epidica*, Oberthür, Etud. d'Ent., 17, p. 18, pl. 3, f. 27 (1893); Aurivillius, Rhop. Aeth., p 111 (1898).

GERMAN E. AFRICA (Pangani, Usambara, Ukami Mt.).

A. pentapolis pentapolis. Pl. VI, f. 1. (larva).

♂. Expanse 60–76 mm. Wings semitransparent, due to absence of scales. F.-w. costa, apex, and hind margin powdered with brownish. Several ill-defined dusky marks varying much in intensity but usually consisting of the following. A broad irregular mark in cell over origin of 2, a blackish mark on discocellulars, a series of rudimentary marks beyond cell in the form of an oblique discal band of spots in 6, 5, 4, and 3, a mark at base of area 2 and beneath it running downwards and outwards a mark in 1b. In the same area a short indistinct longitudinal streak at base.

H.-w. with a dusky powdering round hind margin, and more or less evident darker internervular rays showing their greatest development in 2, 1c, and 1b. Lower half of cell, base of 3, basal half of 2, and the greater part of 1c, 1b, and 1a covered with scales which vary in colour from pale lemon-ochreous to brick red. In some cases this patch is very fully developed and of definite outline, whilst in others it is merely indicated. Numerous black spots corresponding to those on underside but varying much in size and number.

Underside. F.-w. almost devoid of scales. H.-w. as above but the yellow or red patch paler and less developed. Black spots very variable in number. In the case of maximum development the following may be observed. A spot in 9, a subbasal and a central (very small) in 7, one at extreme base of 5, and a double spot at base of 4, two in cell before middle, three or four discal spots progressively larger in size, in 6, 5, 4, and 3, a large spot at base of 2 followed by a spot in 1c and 1b, these three nearly in a straight line, but that in 1c slightly nearer base. A basal and a subbasal in 1c, ditto in 1b, and a basal and two other spots in 1a.

Head black with a few whitish dots and two tufts on collar, thorax black with whitish marks, abdomen black above with whitish segmental lines and lateral spots. Claws unequal.

♀ like the ♂ and presenting the same variations of pattern.

In some examples of this species there is a faint reddish or yellowish flush in the f.-w. especially along the main nervures. Long series have lately been bred by Mr. Lamborn near Lagos, and presented by him to the Oxford Museum. It is clear from these examples that Oberthür's *thelestis* cannot be distinguished from *pentapolis* even as a form. From that author's description the principal distinction between *thelestis* and *pentapolis* is the presence in the former of a tawny rather than yellowish patch in h.-w. In the series before me every gradation of colour may be observed, from a mere whitish appearance to a definite brick-red patch.

A. pentapolis epidica, subsp.

This is the extreme eastern form of the species and differs in the following respects. It is generally much larger, having an expanse of 80–90 mm. The blackish markings in f.-w. are much darker and more definite. In the h.-w. the basal spots are large and confluent, forming a conspicuous basal black mark. The patch of pale scales is lemon-ochreous and well developed, and there are usually a few tawny scales on the hind margin on underside.

The larvae of the specimens received from Lagos may be described as follows:—

Upper half dark umber brown with a few irregular dark markings on the upper part of each segment, and a whitish lateral mark on segments 4–12. Head reddish brown with a white, ventrally bifurcated, white line. Legs yellow at base, extremities black. Pro-legs yellow. Spines all black. The dorsal pair on segment 2 longer than the rest and somewhat curved.

Pupa whitish with black lines representing nervures, antennae, legs, etc. A ventral, two lateral, and two dorsal rows of segmental black marks, each with a yellowish centre. From the inner or dorsal side of each of these centres in the two dorsal rows of spots, there arises a short blunt black process or spine. The general appearance of the pupa is as variable as that of the imago, sometimes the white and sometimes the black predominating.

A dipterous parasite emerged from one of the pupae.

5. ACRAEA VESPERALIS. Pl. XIV, f. 3.

Acraea vesperalis, Gr. Smith, Proc. Zool. Soc., p. 466 (1890); Smith & Kirby, Rhop. Exot., 19 (*Acraea*), p. 7, pl. 3, f. 1, 2 (1892); Aurivillius, Rhop. Aeth., p. 112 (1898); Grünberg, Sitzb. Ges. Nat. Fr., p. 150 (1910). (? *pentapolis*.)

S. LEONE; CONGO (Zongo, Mokoanga, Zambuiya to Albert Nyanza, Kassai R., Usongoda); UGANDA (Sesse I.). (?)

A. vesperalis catori, subsp.

Bethune-Baker, Ann. Nat. Hist., 14, p. 223 (1904); Dudgeon (*vesperalis*), Proc. Ent. Soc., p. liv (1909).

S. LEONE (Mano-Ronietta).

A. vesperalis vesperalis.

♂. Expanse 70–76 mm. F.-w. slightly brownish at base. Costa dusky brown passing into sepia at apex. From end of cell to apex, the whole of area 3, and the marginal part of areas 2, 1b, and 1a, sepia. A discal band of elongated transparent spots in 6, 5, and 4, and a trace of a transparent mark in 3. Cell, greater part of 2, nearly the whole of 1b, and 1a, transparent and devoid of scales. An irregular sepia patch in cell above origin of 2. Beginning at base of area 2 and ending at hind angle a sepia band about 2 mm. wide.

H.-w. black at base and having a hind marginal border of sepia brown about 4–5 mm. wide, its inner edge interrupted by the extension of the brown along the nervules and internervular rays. The remainder of the wing brownish ochreous of somewhat variable depth. Indications of the black spots of the underside are visible in the discal area.

Underside. F.-w. resembles upperside but the apical and hind marginal areas dusted with chestnut brown. H.-w. chestnut brown, of a rather richer tint towards base and inner margin Nervules and internervular rays well marked, brownish black.

Black spots very variable. When attaining maximum development, usually as follows. One in 9, one in 8, two (small) in 7, the outermost just beyond origin of 7. Three just beyond cell in 5. 4, and 3. One at base of 5, and 4 on discocellulars, two in cell before the middle, one at base of 2 followed by one in 1c and 1b, all three in a straight line. A basal and a subbasal in 1c, a subbasal in 1b, and two spots near middle of 1a. Some irregular black at base of nervures.

Head and thorax black with a few pale dots. Abdomen black above, with pale segmental lines and lateral spots. Claws unequal.

♀ resembles the ♂.

A. vesperalis catori, subsp.

Differs from typical *vesperalis* in having the ground colour of h.-w. pale instead of brownish-ochreous.

A. vesperalis is so nearly allied to *pentapolis* that but for the fact that the h.-w. patterns are so consistently different, and also that both species occur in the same place without intermediates, I should have regarded them as two forms of the same species. The male armatures are in this case somewhat unsatisfactory guides though they do seem to show slight differences. Such differences are, however, much less than would appear from the figures on Plate XIV.

GROUP III.

6. Acraea igati. Pl. VII, f. 12.

Acraea igati, Boisduval, Faune Mad.,* p. 29, pl. 4, f. 3, pl. 5, f. 3 (1833); Staudinger, Exot. Schmett, 1, p. 83, pl. 33 (1885); Mabille, Hist. Nat. Mad. Lep., p. 82, 89, pl. 10, f. 1, 2 (1885–7); Oberthür, Etud. d'Ent., 13, p. 13, pl. 4, f. 22 (1890); Aurivillius, Rhop. Aeth., p. 85 (1898).

Madagascar (Ambinanindrano).

♂. Expanse about 60 mm. Wings transparent, the transparency being caused by reduction in number and size of the scales. F.-w. slightly smoky towards costa and apex and with an orange brown basal suffusion extending to about the middle of the wing. H.-w. with about the same amount of basal orange suffusion. Some irregular black spotting at base, including a large well-rounded spot at base of area 1c, and an elongated narrow black spot at base of area 1b. In area 6 and 7 and between end of cell and margin, two large confluent black spots, and two somewhat

* The text is published separately. The plates are in the "Nouvelles Annales du Musée d'Histoire Naturelle, Paris."

similar but more elongated spots in areas 2 and 3. In some examples there is a small spot in area 5. Thorax black, spotted with white beneath. Abdomen black with white lateral segmental spots. Claws unequal.

♀. Expanse about 65 mm. The spots on the h.-w. are similar to those in the ♂ but that in area 5 is often larger. The orange suffusion in the f.-w. is replaced by pale yellow and that in the h.-w. by white. In some examples the coloured areas are entirely replaced by white.

Acraea igati is found only in Madagascar. Boisduval and Mabille describe it as frequenting wooded districts, and producing two broods, the first in April and May, the second in July and August. Boisduval states that it is found on Ste. Marie I. and on the mainland. He appears to have confused the sexes, describing the orange suffused form as the female. His figure is that of the male.

The male armature is peculiar, as will be seen from a reference to the figure in Plate VII. The velum is much larger than in *A. damii* and both uncus and claspers are more highly developed. The entire structure resembles that of the Australasian *A. andromache*.

7. Acraea damii. Pl. VII, ff. 11a, b, c.

Acraea damii, Vollenhoven, Pollen and Van Dam, Faune Mad., 5, Ins., p. 12, pl. 2, f. 4 (1869); Mabille, Hist. Nat. Mad. Lep., 1, p. 83, 88, pl. 10, f. 3, 4 (1885–7); Oberthür, Etud. d'Ent., 13, p. 12, pl. 3, f. 11–16 (1890); Aurivillius, Rhop. Aeth., p. 85 (1898).

= *percussa*, Keferstein, Jahrb. Akad. Erfurt (2), 6, p. 13, pl. 1, f. 1, 2 (1870).

= *masonala*, Ward, Ent. Mo. Mag., ix, p. 3 (1872); Af. Lep., p. 10, pl. 7, f. 5 (1874).

Mayotta I.; Comoro I.; Madagascar.

A. damii cuva, subsp.

Gr. Smith (*A. cuva*), Ann. Nat. Hist. (6), 3, p. 126 (1889); Smith & Kirby, Rhop. Exot. (*Acraea*), p. 2, pl. 1, f. 5 (1889); Aurivillius, Rhop. Aeth., p. 86 (1898); Smith & Kirby, Rhop. Exot., 3 (*Acraea*), p. 24, pl. 7, f. 4 (1901).

British E. Africa (Rabai, Zanzibar); German E. Africa (Dar-es-Salaam); (?) Katanga.

f. *nidama*. Suffert, Iris., p. 19 (1904).

Type from Dar-es-Salaam. (Liable to appear wherever *cuva* occurs.)

A. damii damii.

♂. Expanse 50–60 mm. Wings transparent owing to reduction in number and size of scales. F.-w. slightly suffused from base to about middle with brick red. Nervures reddish brown. H.-w. more densely scaled with brick red from base to about midway between end of cell and margin. Five black spots at base more distinct on underside. One behind the precostal, 2 in area 1c, and one in 1a and 1b, respectively. One large rounded spot in area 7 near middle of costa, one rather larger and nearer margin in area 6, one very small spot below this, in area 5. Two large spots somewhat produced distally and placed in areas 2 and 3 respectively. Underside similar but spots smaller and more sharply outlined. H.-w. dusted with whitish scales. Thorax black, with a few pale spots above and below, abdomen black above and yellow beneath, with whitish lateral segmental spots. Claws unequal.

♀ similarly marked but wanting the brick red suffusion, this being replaced by a dusting of white scales. Expanse 65–75 mm.

Acraea damii is a very variable insect. The above description is taken from an average pair in the Oxford collection. M. Oberthür (*l. c.*) figures one ♂ and five ♀♀. The ♂ example has an elongate spot in the h.-w. cell; in the ♀♀ the number of discal spots varies from four to eight, and in some cases the spots are different in opposite wings of the same individual. The author further points out that in two examples the neuration is abnormal, and occasionally the two ♀♀ have the reddish colouring of the ♂♂. In one ♂ example in the National collection the brick red suffusion extends completely over both wings, whilst the h.-w. spots are reduced in number to three. M. Oberthür states that the type of Ward's *masonala* is in his collection and that there is no doubt that it is an example of *damii*.

Keferstein's figures (*l. c.*) are of ♂ and ♀ examples taken in Madagascar by Herr Tolin in 1862. The ♂ comes nearest to Oberthür's fig. 11, and the ♀ to fig. 16.

The species is probably extremely distasteful. It is described as settling on certain trees in large numbers, when it can easily be picked off with the fingers.

It occurs in Mayotta, Comoro, and Madagascar, examples from the latter region being usually smaller than those from Comoro.

The ♂ armature is quite distinctive, especially in the possession of two small horn-like processes on the margin of the velum, or ventral abdominal plate.

Acraea damii cura, subsp.

♂. Expanse 50–60 mm. Resembles *damii* but the red suffusion is usually of greater extent, sometimes extending nearly to the margin in the f.-w. In the h.-w. it is often rather sharply defined leaving a transparent margin of moderate width. The black spots on the h.-w. are more sharply outlined than in *damii damii*, but exhibit as in the latter considerable variation in size and number. Grose-Smith's type, which is described in the text and on the plate as a ♀, appears in fact to be a ♂. It has eight black spots on the h.-w. An example before me from the Tring collection has five spots (= *nidama*, Suff.), whilst others have rather conspicuous basal spots, notably a large rounded one in area 1c.

♀. Resembles ♂, but is rather larger and has the red replaced by creamy yellow. The black spots are larger, and the base of the h.-w. is much suffused with black. An example before me has a small black spot in the h.-w. cell near the base, and in *one wing* another spot near the end of cell. Occasionally the ♀ is red like the ♂.

I have followed Aurivillius in regarding *cura* as a form of *damii*, though in view of its geographical distribution it must be considered a subspecies of the Madagascar form. It occurs only on the mainland and Zanzibar. There are fifteen examples in the National collection, five of which are ♀♀ and the localities given are, Zanzibar, Dar-es-Salaam, and Rabai. The type was received from Mombasa, and there are examples in the Tring collection labelled "Katanga, Tanganyika," and though the exact meaning of the locality is rather vague, it would appear that the species has a considerable westward range. I have dissected out the genitalia of one of these examples and find no difference from those of *damii* taken in Madagascar.

8. Acraea kraka. Pl. VII, f. 15.

Acraea kraka, Aurivillius, Ent. Tidskr., 14, p. 272, pl. 6, f. 3 (1893); Rhop. Aeth., p. 86 (1898).

Cameroon (Bibundi, Bonge); Fernando Po.

♂. Expanse about 50 mm. Wings transparent. Transparency caused by the scales being reduced to fine hairs. F.-w. black at base and dusted with black for a short distance along the costa. Slightly darker suffusion at apex caused by a reappearance of scales which however are still very narrow and elongated. A reddish basal suffusion (probably bright red in fresh examples) extending to nearly half the length of the cell and distally to nearly the whole length of area 1a. A black spot in the cell about the middle, and two spots in area 1b, one near the base and one about the middle. H.-w. black at base and with a basal reddish suffusion extending a little beyond the end of cell. Numerous black spots arranged as follows. Two in area 7, two in cell, and two in 1b, and 2, three in 1c, one in 3, 4, 5, and 6, and one near the base in 1a.

The underside is similar but without the reddish suffusion which only shows through from the upperside. A fourth spot is visible in 1c at the base.

Thorax black, abdomen black above and brown beneath, with brown lateral segmental spots. Claws unequal.

♀. Expanse about 62 mm. According to Aurivillius' figure (*l. c.*) there is a small additional spot in area 2 in the f.-w. The basal suffusion is described as ochreous.

The three ♀♀ from which Aurivillius described the type were taken in May and July (1891) at Bibundi and Bonge in N.W. Cameroon, and are in the Stockholm Museum. There are six ♂ examples in the National collection taken at Fernando Po, and a few specimens in the Tring collection.

The above are the only examples known to me. The female genital armature is sufficiently distinct in form though showing a fairly close resemblance to that of *A. cerasa*. The transparency of the wings in this latter species is however produced in a different manner. Aurivillius regards *kraka* as a near ally of *quirina*, and in support of this it may be noted that in both species the transparency is caused in the same manner, though on the other hand the structure of the respective male armatures is very different.

9. Acraea eugenia. Pl. IV, f. 13 (♀).

Acraea eugenia, Karsch, Berl. Ent. Zeit., 38, p. 196 (1893) Aurivillius, Rhop. Aeth., p. 86 (1898).

Togoland (Bismarckburg); Angola (Canhoca).

♂. Expanse about 49 mm. Wings translucent and well rounded. F.-w. with yellow nervures and nervules and very sparsely dusted with sepia, and a few yellowish white scales.

These are of the normal size and the transparency is due to a reduction in their number. H.-w. with an ill-defined basal area of whitish or light yellowish scales shaded into a dusky marginal border. Black spots as on underside.

Underside, f.-w. almost devoid of scales. H.-w. as above but with fewer scales. Black spots as follows. Four spots graduated in size in 7, 6, 5, and 4 lying beyond cell and parallel to apical margin. A larger spot at base of 3, and of 2. Beneath the latter a spot in 1c followed by a smaller spot in 1b rather further from margin. A subbasal in 7, two in cell, the second over origin of nervule 2, a large subbasal in 1c, and beneath it a small spot in 1b, and a subbasal in 1a. A little irregular black at base.

Head black with two white dots between the eyes and two yellowish tufts on collar. Thorax black with a few pale marks. Abdomen black above with white lateral spots. Claws unequal.

♀ resembles ♂ but larger (about 54–60 mm.). One ♀ in the Berlin Museum has the spot in area 5 of h.-w. almost obsolete.

The only example I have seen besides those in the Berlin Museum is a single ♀ in the Tring collection. The species appears to be rare, and I have had no opportunity of making a preparation of the ♂ armature. The ♀ plate is of peculiar structure and the orifice of the *bursa copulatrix* appears to be somewhat eccentric, as in *A. horta*.

10. Acraea cerasa. Pl. VIII, f. 14. Pl. XVI, f. 1.

Acraea cerasa, Hewitson, Exot. Butt. (*Acraea*), pl. 2, f. 10 (1861); Trimen, S. Af. Butt., 1, p. 139 (1887); Smith & Kirby, Rhop. Exot., 21 (*Acraea*), p. 11, pl. 4, f. 1 (non f. 2), (1892); Aurivillius, Rhop. Aeth., p. 86 (1898).

Natal; German E. Africa; British E. Africa (Nairobi, Kikuyu, Machakos).

♂. Expanse 37–52 mm. F.-w. semitransparent, due to reduction of scales to hairs; black scaling at base and for a short distance along inner margin. Costa and hind margin dusted with brownish black scales. A brick red basal suffusion extending to end of cell and downwards and outwards nearly to hind angle. A variable number of black spots, usually one a little beyond middle of cell and one at extremity of cell on discocellulars. Sometimes a small spot near base below median, and rarely two on edge of red area, one on each side of nervure 2. H.-w. brick red, thinly scaled, and more transparent towards margin. A variable number of spots arranged, when all present, as follows. A submarginal row of six or seven parallel to hind margin and becoming very minute towards apex. A discal row of seven, the first in 1b and in a straight line with the next two which are much larger, the fourth in area 3 and somewhat variable in position, the next three in areas 4, 5, and 6, the middle one more distally placed. Two spots in area 7, two in cell, and one basal spot in 1a, 1b, and 1c. Some of these spots, especially the submarginal row, may be absent. Underside devoid of scales but spots in h.-w. smaller and blacker. Thorax and abdomen black above and paler below, with yellowish lateral spots. Claws unequal.

♀. Usually resembles ♂ but is somewhat larger and has the red areas paler and duller. One example from Nairobi has all the red replaced by pale ochreous.

The larva and pupa are fully described by Trimen (*l. c.*). From this description the following is taken.

Larva, livid purplish above, with a dull greenish dorsal streak edged by a series of small white marks, followed by a second lateral series of similar marks at edge of purplish area. Below this, olive greenish, underside pale green. Head black, striped with white. The usual dorsal and lateral spines.

Pupa, orange yellow, with bright orange black-ringed spots, neuration of wings and a dorsal stripe, black.

A. cerasa is very variable in the number and size of the black spots. The submarginal spots in h.-w. are often entirely absent, whilst many of the others may be absent or very small.

11. Acraea cerita. Pl. IV, f. 9 (♂).

Acraea cerita, E. M. B. Sharpe, Ann. Nat. Hist., 7, xviii. p. 75 (1906).

Toro Region.

♂. Expanse 46 mm. F.-w. basal half brick red, extending not quite to end of cell, projecting into the basal part of area 2, and occupying about half of areas 1b and 1a. This red area is sharply defined and is enclosed outwardly by a dusting of black scales forming a transverse bar right across the wing from costa to inner margin which it meets just before inner angle. Costa and apex also dusted with blackish. Outer half of wing transparent and very iridescent, the scales reduced to fine hairs. The hind margin very slightly darker. In the cell a small black spot over origin of nervule 2. In area 1b a small spot lying in the line between the cell spot and the hind angle. In the same area another spot midway between base and nervule 2. H.-w. brick red with a very little blackish at base and a narrow grey-black hind marginal border. A few black spots as on underside.

Underside. Both wings almost scaleless. H.-w. spots as follows. Two in 7, the second just beyond origin of nervule 7. Two in cell on one wing and one on the other, the second spot just before origin of nervule 2. In areas 3, 2, 1c, and 1b a row of discal spots lying almost in a horizontal line and beyond these in 3, 2, and 1c traces of submarginal dots are visible with a lens. A subbasal spot in 1c, 1b, and 1a, that in 1b more distally placed than the others.

Head and thorax black with a few pale dots, abdomen black above with yellowish white lateral dots. Claws unequal.

The foregoing description and the figure on Plate IV are from the type now in Mr. J. J. Joicey's collection. This example is the only one I have seen and bears the label Entebbe 1906, though I have reason to suppose it was taken in the Toro region. I strongly suspect it to be a form or aberration of *A. cerasa.* I have not seen an example of the latter from Entebbe, although I have handled many thousands of specimens from that locality. The specimen of *A. cerita* remains unique and until further material becomes available I must allow it to stand as a species.

12. Acraea unimaculata. Pl. VII, f. 16.

Acraea unimaculata, Gr. Smith, Novit. Zool., v. p. 350 (1898); Aurivillius, Rhop. Aeth. (= *humilis*), p. 86, 1898; Smith & Kirby, Rhop. Exot. (*Acraea*), vi. pl. 6, f. 1, 2, 3 (1901).

British E. Africa (15 m. N. of Kisumu, Kabras, Nandi).

♂. Expanse about 50 mm. F.-w. transparent owing to reduction of scales to hairs. Costal margin and apex slightly dusted with black scales. Basal area dull red (probably brighter in life) extending nearly to end of cell, just beyond origin of first median, and nearly to hind angle. Base slightly dusted with black. H.-w. of the same red as f.-w. A semitransparent margin, slightly dusted with black scales, nearly $\frac{1}{8}$ in. wide at apex and tapering to nothing at inner angle. Base blackish. Underside devoid of scales and vitreous. Two black spots in cell, one in 1c and two or three basal spots at junction of wing and thorax. All except the inner cell spot may be absent. Thorax and abdomen black above, paler beneath, with yellowish lateral segmental spots. Claws unequal.

♀. Expanse 56 mm. Resembles ♂ but red areas paler and duller and less well defined outwardly. Spots of h.-w. underside may be entirely absent.

The types which are in the Tring collection were taken at Kabras in British E. Africa. Co-types from Rau, Nandi country. In his catalogue of the African Rhopalocera Prof. Aurivillius placed this species as a synonym of *A. humilis*, not having then seen either insect. Its nearest allies are *A. cerasa*, and *A. kraka*. The similarity between the male armature and that of the latter species entitles *unimaculata* to be regarded as the eastern representative of *kraka*, though at the same time the differences are sufficient to give the two forms specific rank. Until recently the only example known to me besides those in the Tring Museum was a ♀ in the Oxford collection, taken by Dr. Wiggins on the Uganda Ry. 15 m. N. of Kisumu. Latterly, however, the species has been taken in some numbers by Neave in British E. Africa, on the Yala R., N. Kavirondo.

13. Acraea iturina. Pl. VII, f. 13.

Acraea iturina, Gr. Smith, Proc. Zool. Soc., p. 465 (1890); Smith & Kirby, Rhop. Exot., 21 (*Acraea*), p. 12, pl. 4, f. 3, 4 (1892); Grünberg, Sitzb. Ges. Nat. Fr., p. 148 (1910).

S. Cameroon; Belgian Congo (near Ft. Beni); Uganda (Sesse I, Albert to Victoria Nyanza).

A. iturina kakana, subsp.

Eltringham, Novit. Zool., xviii. p. 150 (1911).

Abyssinia (Adie Kaka, Kaffa).

A. iturina iturina.

♂. Expanse about 50 mm. F.-w. rather transparent clouded with smoky brown along costa and hind margin. This clouding varies in intensity in different examples. Transparency caused by narrowing of the scales. The basal area having a brownish red suffusion (probably bright red in fresh specimens) extending nearly to end of cell and two-thirds of length of inner margin. A large black spot in the cell somewhat beyond the middle, and varying considerably in intensity. (One example before me has a minute black spot in area 2, near the cell, and a black powdering on the discocellulars.) A small black linear spot at base of area 1b.

H.-w. red with semitransparent smoky brown margin considerably widened near apex. Base black. Two black spots in area 7 rather close together. A discal row of seven spots, the first four usually smaller than the rest and the fourth nearer the margin. Two spots in the cell, that nearer the base often very small. One basal spot in 1a, 1b, and 1c, the second of these sometimes confluent with the last discal spot. Nervures 6 and 7 arise from a common stalk. Underside vitreous and without coloured scales, the h.-w. spots repeated. Thorax and abdomen black above, pale below, and with lateral pale spots. Claws unequal.

♀. The only ♀ I have seen resembles the ♂ and is of the same size, but the wings are more transparent and the spot in f.-w. cell is almost divided longitudinally.

A. iturina kakana, subsp.* Pl. IV, f. 14 (♂).

♂. F.-w. base and costa blackish. Apical half semitransparent, basal half including cell, dull orange red ; apex, hind margin, and distal edge of red area rather more thickly scaled with black than the remainder. The transparency is caused by reduction in width of the scales. The red colour extends slightly into area 3, about half the length of areas 1b, and 2, and nearly to hind angle in area 1a.

H.-w. dull orange red ; a basal aggregation of confluent black spots ; a discal band of large confluent spots, the first in area 7 about the middle, the remainder lie almost in a straight line across the wing, except that in area 3, which is more distally placed ; a blackish hind marginal border about 2 mm. wide at apex, becoming rather suddenly narrower at nervule 5, and tapering to anal angle.

Underside resembles the upper, but is sparsely scaled, and the red areas are dull pink ; the h.-w. basal spots are somewhat less confluent and can be resolved into a large subbasal spot in 7, two confluent subbasal spots in cell, one in 1c, 1b, and 1a ; in the latter area also a minute dot beneath end of nervule 1a ; a little black at origin of main nervures.

Head, thorax, and abdomen black, the latter with indistinct brownish lateral spots ; tarsal claws asymmetrical. In f.-w. nervures 6 and 7 arise not from cell but from a common stalk about 1 mm. long as in *iturina*.

This form differs from *iturina* in the absence of the spot in f.-w. cell, the deeper colour and greater extent of the red areas, and the larger size of the spots.

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* Since the above was printed I have had an opportunity of making a further careful comparison of the type with specimens of *iturina*, with the result that I incline to the belief that *iturina kakana* may ultimately prove to be a distinct species. Pending the acquisition of further material there seems, however, no objection to allowing it to retain the above position.

The type of *A. iturina*, now in the Joicey collection, is a ♂. The locality in Grose-Smith's original description is somewhat vaguely given as the "great forest of Central Africa." Two ♂ ♂ in the Tring collection are labelled "2 days from Fort Beni," and a third "15 days" from the same locality. A ♀ in the Oxford collection was taken in 1905 in Uganda between Lakes Albert and Victoria Nyanza. The species may readily be distinguished from other somewhat similar forms by the peculiarity of the h.-w. neuration. This feature is faithfully represented in the figure in Rhop. Exot. The claspers of the ♂ armature have a peculiar toothed structure on the inner edge. Aurivillius (*l. c.*) suggests that *iturina* may be a variety of *cerasa*. It is however quite a distinct species, as shown by the structure of the male armature and the complete reduction of the scales to hairs in the latter species.

14. Acraea quirina. Pl. VII, f. 18. Pl. XVI, f. 6.

Acraea quirina, Fabricius (*Pap.*), Spec. Ins., 2, p. 36 (1781); Godart (*A.*), Enc. Méth., 9, p. 231 (1819); Karsch, Berl. Ent. Zeit., 38, p. 193 (1893); Aurivillius, Rhop. Aeth., p. 86 (1898); Butler, Proc. Zool. Soc., p. 923 (1900); Aurivillius, Ann. Mus. Genov., p. 19 (512), (1910).

= *dice*, Drury (*Pap*), Ill. Exot. Ins., 3, p. 23, pl. 18, f. 3, 4 (1782); Herbst, Naturs. Schmett, 5, p. 24, pl. 83, f. 3, 4 (1792).

Trimen (*A.*), Rhop. Afr., Austr., p. 95 (1862).

Senegal; S. Leone; Lagos; Liberia; Togoland; Gaboon; Congo (Mukenge, Kassai, Kwidgwi I.); German E. Africa (Dar-es-Salaam); British E. Africa (Kisumu).

A. quirina rosa, subsp. nov.

British E. Africa (Kitui, Rabai).

A. quirina quirina.

♂. 34–50 mm. F.-w. transparent, the transparency caused by the scales being reduced in width in the discal area and represented by hairs in the marginal area. Base powdered with black, and beneath the median a basal black streak extending nearly to a point below the origin of nervure 2. (Drury describes the f.-w. as having a round black spot below this streak but I have not seen an example with any spots on the f.-w.) The h.-w. is rosy red dusted with black at the base and having a broad well-defined transparent margin. Upon the red area are numerous black spots usually better defined in the ♀ (for position of these spots see description of ♀). The underside resembles the upper but there is a whitish basal suffusion in the h.-w. Thorax and abdomen black above with lateral pale spots, and paler beneath. Claws unequal.

♀. Expanse 37–53 mm. Resembles the ♂, but the red of the h.-w. usually replaced by dull brown, though occasionally the ♀ is almost as brightly coloured as the ♂. In brown ♀♀ the underside of the h.-w. is whitish ochreous. The h.-w. black spots as follows. On the margin of the coloured area a row of seven internervular spots nearly parallel to the hind margin, those near costa sometimes obsolete. A discal row of eight internervular spots, the first in area 7, the spot in area 2 much nearer base than the rest. Eight basal spots, one in area 8, one in area 7, two in cell, two in area 1c, and one each in 1a, and 1b.

A common and widely distributed species occurring from Sierra Leone to the Kikuyu Escarpment.

A. quirina rosa, subsp.

Distinguished from the typical form by the greater extent of the red suffusion in the f.-w., reaching to end of cell and nearly to hind angle. Eight ♂ examples in the Hope Department, from British E. Africa (Kitui and Rabai). The male armature in *quirina* and its subspecies is characterised by the modification of the uncus into two hooks as large as the claspers. The ventral abdominal plate is large and contains a dense mass of hairs, probably of a glandular nature.

Speaking of *A. quirina* (or its subspecies), (Proc. Zool. Soc., p. 923, 1900) Butler quotes from the MS. of the collector Mr. R. Crawshay. "All these *Acraeinae* were taken in the gloom of the forest, flitting about feebly, and settling on the bushes. Spherical yellow ova." The locality was Ruarka R., Kikuyu, 5,500 ft. (April 1900).

15 Acraea hova. Pl. VII, f. 17.

Acraea hova, Boisduval, Faune Mad., p. 29, pl. 4, f. 1, 2 (1833); Blanchard, Hist. Nat. Ins., 3, p. 438, pl 11, f. 1 (1840); Lucas in Chenu, Enc. Hist. Nat., p. 3, f. 6, pl. 27, f. 3 (1852); Guenée, Vinson Voy. Annex., p. 35 (1864); Ward, Af. Lep., p. 10, pl. 7, f. 6 (1874); Mabille, Hist. Nat. Mad. Lep., 1, p. 94, pl. 9, f. 1–3, pl. 9a, f. 6 (1885–7); Aurivillius, Rhop. Aeth., p. 87 (1898).

Madagascar.

♂. Expanse about 75 mm. F.-w. semitransparent, due to scales being reduced in number but not in size. Base and basal part of hind margin black. Costa and hind margin slightly dusted with blackish. Basal area to slightly beyond end of cell, and extending downwards to hind angle, suffused with brick red.

A large ovate black spot in cell slightly beyond middle, a sublinear spot on l.d.c., sometimes extending to u.d.c. A discal row of two to three spots, (sometimes absent) beyond cell in 4, 5, and 6. A spot in 2 and another in 3 near cell, and a larger spot in 1b near middle. H.-w. brick red, blackish along costa and creamy at inner margin. Black spots arranged as follows. On margin, indistinct spots at end of nervules, a submarginal row of seven spots parallel to margin, the first in 1c. A discal row of eight, the first in 1b, very small, and those in 2 and 3 much larger than the rest, seven or eight spots at or near base five of which form a subbasal row, the first and second (in 1a and 1b) small or obsolete, the fourth in the cell, the fifth in 7. Underside of f.-w. devoid of scales. H.-w. thinly scaled with milky white, spots smaller than on upperside, many absent altogether. Thorax black, spotted with reddish yellow beneath. Abdomen black above, reddish or yellowish beneath and with white lateral segmental spots. Claws unequal.

♀. Expanse 90 mm. Most examples resemble the ♂ but the red areas are paler and duller. Rarely the red is absent in f.-w. and replaced by creamy white in h.-w.

Mabille figures (*l. c.*) a curious aberration of the ♂ in which the spots are coalescent, forming curved and zigzag lines. The figure in Chenu's Encyc. of Nat. Hist. (uncoloured) apparently shows a very dark hind-winged aberration. Ward's figure, a ♀, is near Mabille's fig. 3, but has two black spots beyond cell in f.-w. which are absent in Mabille's figure.

This very distinct species is one of the largest of the genus. It is described by Mabille as comparatively rare, inhabiting wooded regions in Eastern Madagascar, and flying with rapidity in the glades. The structure of the ♂ armature is quite distinctive.

16. ACRAEA ROGERSI.* Pl. XIV, f. 17.

Acraea rogersi, Hewitson, Ent. Mo. Mag., x. p. 57 (1873); Aurivillius, Rhop. Aeth., p. 110 (1898).

= *ehmckei*, Dewitz, Ent. Nachr., 15, p. 103, pl. 1, f. 6–8 (1889).

S. LEONE; GOLD COAST; CAMEROON; ANGOLA; CONGO (Kassai, Aruwimi, Bopoto, Stanley Pool).

f. *salambo*. Gr. Smith, Ann. Nat. Hist. (5), 19, p. 62 (1887); Smith & Kirby, Rhop. Exot., 10 (*Acraea*), p. 5, pl. 2, f. 3, 4 (1889); Karsch, Berl. Ent. Zeit., 38, p. 194 (1893). Aurivillius, Rhop. Aeth., p. 110 (1898).

(Localities as above.)

* The position of this species is difficult to decide. I am inclined to modify my original view and isolate it altogether.

A. rogersi lamborni, subsp. n.

LAGOS.

A. rogersi rogersi.

♂. Expanse 70–82 mm. F.-w. Sepia black, darker at base, costa, and in apical area. A red patch at hind angle occupying outer third of 1a, outer half of 1b (except just at margin), and extending slightly into 2. Large black spots as follows. One in cell above origin of 2, one on discocellulars occupying whole width of cell. Just beyond cell three subquadrate spots (the uppermost sometimes missing) divided by nervules 5 and 6, and beneath them a spot in 3. Beneath this and rather further from margin a large spot in 2, and in same area a second spot nearer margin. In 1b, a submarginal, a central, and a subbasal spot. H.-w. Base dark sepia, obscuring a mass of large black spots which correspond to those beneath. Beyond this a broad red band on which at inner edge are some spots lying beyond the basal black. On outer edge of the red area are eight round internervular black spots. In some examples only those in 3, 2, and 1c are present, in others each is produced outwardly into a broad black internervular mark. A dark sepia hind marginal band of variable width, its inner edge rather suffused. Underside f.-w. Dull ochreous sepia, with spots as above. Reddish at hind angle. Between the discocellular spot and the discal spots, and also beyond the latter, whitish. H.-w. Base as far as the inner edge of discal band dull red. Discal band greyish in 7 and 1b, remainder pale brown dusted with greyish, and with an outer row of spots as above but smaller. Margin dark sepia brown. The red basal area has the following black spots. One in 8 against precostal, two in 7, one in 6, 5, 4, 3, 2, two in cell before the middle, one on discocellulars, two in 1c, 1b, and 1a; those in 1b further from base than those in 1c and 1a. Some black at base of nervures.

Head black with a few white marks, thorax black, abdomen black above at base, with ochre yellow lateral spots, remainder ochre yellow. Claws unequal.

♀. Upperside resembles ♂ but the red is much fainter amounting usually to a mere tinge of colour. On the underside the h.-w. ground-colour is dusky ochreous with very little indication of hind marginal black. Some of the spots of outer row may be absent.

f. *salambo.*

♂. Like the typical form but without the red, though the basal part of f.-w. and the discal area of h.-w. have a rather warm brown tinge. Underside pale sepia ochreous somewhat dark on f.-w. apex, and h.-w. base and margin.

♀. Like the ♂.

A. rogersi lamborni, subsp. n. Pl. VI, f. 2 (larva), f. 16 (pupa).

Long series of this form have lately been bred by Mr. W. A. Lamborn near Lagos and presented by him to the Oxford Museum.

The ♂ has the f.-w. sooty black, rather paler in the central area. H.-w. base and marginal border sooty black with a broad discal band of dusky cream colour. The spot near base of 3 usually absent. Underside f.-w. apical area to end of nervule 2 sepia grey with darker internervular rays, remainder pale greenish grey. H.-w. pale creamy grey with a yellowish tinge, and a faint pinkish tint at base of 1c, 1b, and 1a.

Head and thorax black with some whitish spots. Abdomen, basal half black with whitish segmental lines and lateral spots, remainder pale creamy grey.

♀ resembles the ♂.

The larva of *A. rogersi lamborni* is dark brown somewhat blacker on the dorsal area, with a few irregular rather paler dorsal transverse markings, and has the usual spines which are all black and arise from black-brown tubercles. The base of the legs and prolegs is yellowish, remainder black. Head black with a white central line bifurcated ventrally, and a posterior white line where it joins segment 2.

The pupa differs from other *Acraea* pupae which I have examined. It is light brown in colour, and the usual black lines are wanting, except those outlining the antennae, and a trace of some of the nervular lines. There are two dorsal and two lateral rows of small black markings consisting of minute dots and short fine transverse streaks, and a ventral row of dots and streaks, the latter longitudinal. On the head are two short, blunt, widely separated, outwardly curved processes giving the pupa a "horned" appearance. There are very slightly raised dorsal abdominal tubercles visible only with a lens.

The species is not uncommon and is easily distinguished from other Acraeas by the large round black spots in h.-w.

There is one ♂ example in the Staudinger collection labelled German E. Africa, but the occurrence of the species in that region is extremely doubtful.

17. Acraea ranavalona. Pl. VII, f. 7. Pl. XVI, f. 2.

Acraea ranavalona, Boisduval, Faune Mad., p. 30, pl. 6, f. 3, 4, 5 (1833); Geyer, Hübner Zutr., 5, p. 31, f. 925, 926 (1837); Blanchard, Hist. Nat. Ins., 3, p. 438 (1840); Staudinger, Exot. Schmett, 1, p. 83 (1885); Mabille, Hist. Nat. Mad. Lep., 1, p. 92, pl. 9, f. 4, 5, pl. 9a, f. 5 (var.) (1885–7); Oberthür, Etud. d'Ent., 13, p. 11, pl. 5, f. 25–30 (1890); Aurivillius, Rhop. Aeth., p. 87, 88 (1898); Aurivillius, Voeltzkow Exp., p. 315 (1909).

= *manandaza* (part), Ward, Ent. Mo. Mag., ix. p. 147 (1872).

f. *maransetra*, Ward, Ent. Mo. Mag., ix. p. 2 (1872).

♀ f. *manandaza*, Ward, Af. Lep., p. 9, pl. 7, f. 1, 2 (1874); Oberthür, Etud. d'Ent., 13, p. 11, pl. 5, f. 23–24 (near) (1890) (*nec* Mabille *l. c.*, pl. 9a, f. 5).

Madagascar (Andranohinaly, Ste. Marie, N. Mahafaly, and generally); Comoro I.

A. ranavalona ranavalona.

♂. Expanse 40–50 mm. F.-w. nearly transparent owing to reduction in width of scales. These modified scales are rarely bifid and are attached to the wing in a partially upright position. A bright basal red suffusion bounded by a line drawn from costa about half way along the cell to a point just short of the hind angle. A slight dusting of black scales along costa and in apical region. Base slightly black. H.-w. bright rose-red with a very narrow semitransparent dusky margin ending at 1b and bearing five or six spots in areas 2, 3, 4, 5, 6 (7); the outer half of these spots is red and the inner half black, the black portion lying mainly on the red discal ground colour. In area 1c a somewhat smaller black spot in the red ground colour. A discal and basal series of black spots, placed as follows;—five discal spots beyond cell in 7, 6, 5, 4, and 3 respectively, and roughly parallel to hind margin, followed by three, more basally placed, in 2, 1c, and 1b. In addition to these, two in cell, one in 8 and 9, one in 7, two in 1c, one in 1b, and two in 1a. Underside resembles upper but f.-w. is devoid of scales, and h.-w. discal area is pinkish, due to white scales on the background of the red of the upperside. Thorax black with faint reddish lateral, and pale yellowish ventral spots. Abdomen shading into reddish, with red lateral spots and pale yellowish beneath. Claws unequal. The spots in the ♂ h.-w. are somewhat variable, especially those of the discal and basal area, these being more or less confluent in most examples but fairly well separated in others.

♀. Expanse 40–50 mm. (very variable). F.-w. like that of ♂ but red suffusion replaced by yellowish. H.-w. usually powdered with white scales, having the dusky marginal border bearing half black and half red spots as in ♂, though the border extends a little further towards the inner margin and has a well-developed black and red spot in area 1c. The discal black spots are well separated leaving an extra dot at base of nervure 5 (this dot is occasionally recognisable in ♂ examples). The basal spots and those of the cell are in various degrees of obsolescence, some of those nearest the base being altogether wanting.

From this normal appearance of the ♀ a long series shows practically every degree of red suffusion to a form which has as much red as the ♂. Ward's *manandaza* is a ♀ presenting the minimum amount of red.

A. ranavalona f. *maransetra.*

In this form the basal and discal spots are confluent. It would appear to be if anything commoner than the typical form.

Boisduval describes the species as generally found in the forest in Ste. Marie and on the mainland of Madagascar in April and May, reappearing in July and August. Fond of settling on grasses.

Mabille states that it is common all over Madagascar, flying during a large part of the year in woods and cultivated places, and having several broods.

The male armature is of very peculiar form and resembles that of no other *Acraea* except its near ally *machequena.*

It is a matter of some difficulty to unravel the confusion which has arisen in the synonymy of this species, owing to Ward's description of his *Acraea manandaza.* Boisduval's original description of the ♀ states that the base and nervules of the f.-w. are rufous and the h.-w. white or very rarely flushed with a reddish tinge. Ward received two alleged pairs of the species, stated to have been taken *in coitu.* Of the first pair both ♂ and ♀ were of the red type of coloration and this red ♀ is now known to be a somewhat rare variety, a figure of which will be found on Plate 9a, in Mabille's volume (Hist. Nat. Mad.). To this pair Ward assigned the original name *ranavalona.* His second "pair" (subsequently proved to be two ♀♀) he describes as having the "f.-w. transparent suffused with carmine," "hind-wing powdered with white, the outer margin bordered with carmine," "♀ colour and markings the same as ♂." These he regarded as a different species and gave them the name *manandaza*. Unfortunately his figures do not agree with his descriptions, but M. Oberthür (who possesses the types) states that one of them (the supposed ♀ of the "pair") is a large example rather less accentuated in coloration than fig. 23 of his Plate V, whilst the "♂" is an ordinary though small ♀. Now Oberthür's fig. 23 has an extremely faint pink tinge at base of f.-w. and a slight pink suffusion in h.-w. and therefore the true "*manandaza*" of Ward is a very faintly pink-tinged ♀ of *ranavalona*.

18. Acraea machequena. Pl. VII, f. 8.

Acraea machequena, Gr. Smith, Ann. Nat. Hist. (5), 9, p. 62 (1887); Smith & Kirby, Rhop. Exot., 9 (*Acraea*,) p. 2, pl. 1, f. 3, 4 (1889); Trimen, S. Af. Butt., 3, p. 377 (1889); Monteiro, Del. Bay, Frontispiece, f. 9 (1891); Aurivillius, Rhop. Aeth., p. 88 (1898).

Portuguese E. Africa (Delagoa Bay); Rhodesia (Chirinda); Nyassaland (Mlanji Boma).

♂. Expanse about 50 mm. F.-w. semitransparent owing to reduction in width of scales, these are set in a partially upright position, and rarely bifid. Costa, apex, and sometimes discal area more or less faintly powdered with scales. Basal suffusion of dull or bright red extending from the costa at end of cell to the hind angle. Base black. H.-w. dull red or reddish ochreous, never so bright as in *ranavalona*, with a very narrow marginal border of blackish, much more heavily scaled than in *ranavalona*. Six internervular marginal spots half black and half red, the red portion lying on the black border and sometimes very indistinct, the black portion projecting into the discal ground colour. Black discal and basal spots arranged as in *ranavalona* but well separated, that at base of nervure 5 being usually quite distinct. The basal spot in area 7 of h.-w. often absent. A marked black basal suffusion not present in *ranavalona*.

The underside of h.-w. resembles the upper, but is very thickly scaled. Thorax and abdomen blacker than in *ranavalona*. Abdomen with yellowish lateral spots. Claws unequal.

♀. Expanse 50–60 mm. F.-w. either almost transparent, or with a brownish basal suffusion corresponding in area to the red of the ♂. H.-w. varying from semitransparent white (the normal form) to pale reddish, a slight black basal suffusion (not present in *ranavalona*). Spots as in ♂ but smaller. Discal spot in area 7 sometimes absent. Underside as upper but almost devoid of scales except at the spots. Lateral abdominal spots white.

In distinguishing between *machequena* and its near ally *ranavalona*, Trimen states (*l. c.*) that in both sexes of the former the basal spot in area 7 is absent, and that in the ♀ the discal spot in the same area is also wanting. I find however that these characteristics are variable. One ♂ now before me has the basal spot well defined, whilst one ♀ has the discal spot. Some ♀ ♀ of *ranavalona* have both, though the basal spot seems to be always wanting in *machequena*. Perhaps the most constant features by which *machequena* may be distinguished from *ranavalona* are the greater extent of red or brown suffusion in the f.-w., the black basal suffusion in h.-w., the duller red of the h.-w. in the ♂ and of the hind marginal spots in both sexes.

The male armature is very like that of *ranavalona* but the claw-like claspers are slightly stouter, and the penis-sheath shorter.

19. Acraea lia. Pl. VII, f. 10.

Acraea lia, Mabille, Bull. Soc. Philom. (7), 3, p. 132 (1879); Hist. Nat. Mad. Lep., 1, p. 97, pl. 9a, f. 8, 8a (1885–7); Smith & Kirby, Rhop. Exot., 29 (*Acraea*), p. 15, pl. 5, f. 1–3 (1894); Aurivillius, Rhop. Aeth., p. 88 (1898).

S. W. Madagascar (Andranohinaly, Morondava).

♂. Expanse 30–40 mm. F.-w. transparent owing to reduction in width of scales which are very rarely bifid. Costa, apex, and hind margin dusted with blackish. A basal red flush to a little beyond middle of cell, not extending into area 2, but slanting outwards from origin of 2 nearly to hind angle. H.-w. red with a narrow brownish marginal border, the dark colour extending slightly along each nervule. Black spots, more or less confluent, as follows:—A discal series of eight, the first large, in area 7, the second much smaller, in 6, and the next three gradually increasing in size, the fifth being as large as the first. These five are parallel to the hind margin. The sixth much nearer base, the seventh and eighth nearer margin. Two small spots on end of cell on discocellulars. Basal spots, one in area 8, one in 9, two in cell, two in 1c, one in 1b, and 1a. Underside f.-w. devoid of scales except in basal area which is nearly as red as on upperside. H.-w. ground colour pink, narrow marginal border of black spots and whitish spots arranged on and between nervules respectively. Within this border a series of seven red internervular spots, that in 1c more or less doubled. Black spots as on upperside, and three conspicuous red spots, one near base in area 7, and two in 1c. A few red scales at other points notably in cell near end. Thorax and abdomen black above and brownish below with lateral brownish yellow spots. Claws unequal.

♀. Expanse 40–46 mm. Resembles the ♂ but red colour may be replaced by tawny, h.-w. underside has the ground colour much whiter and the red submarginal spots duller and more elongate. The red colour would appear to vary considerably. Mabille's figure, stated to be that of a ♀, is nearly as red as an average ♂, Grose-Smith's figure is much paler, whilst an example before me from the Tring collection is intermediate between these.

The male armature is of a very simple character. *A. lia* would appear to be a rare species, and I have seen but few examples. Owing to its small size and the peculiar pattern of the h.-w. underside it is not difficult to distinguish from its nearest allies.

20. Acraea obeira. Pl. VII, f. 9. Pl. XVI, f. 21.

Acraea obeira, Hewitson, Proc. Zool. Soc., p. 65 (1863); Mabille, Hist. Nat. Mad., 1, p. 95, pl. 9a, f. 7, pl. 10, f. 5, 6 (1885–7); Aurivillius, Rhop. Aeth., p. 88 (1898).

= *pira*, Guenée, Vinson Vog. Mad. Annexe, p. 34 (1864).

= *andromba*, Gr. Smith, Ann. Nat. Hist. (6), 7, p. 124 (1891); Smith & Kirby, Rhop. Exot., 21 (*Acraea*), p. 13, pl. 4, f. 6–8 (1892); Aurivillius, Rhop. Aeth., p. 88 (1898).

Madagascar.

A. obeira burni, subsp.

Butler, Ann. Nat. Hist. (6), 18, p. 467 (1896); Proc. Zool. Soc., p. 841, pl. 50, f. 3 (1898); Aurivillius, Rhop. Aeth., p. 88 (1898).

Natal.

A. obeira obeira.

♂. 50–56 mm. F.-w. almost transparent, the scales very slightly reduced in width and never resembling hairs. Costa, apex and hind margin dusted with blackish. A rusty yellow basal suffusion reaching a little beyond middle of cell, just beyond origin of nervure 2, and not quite to the hind angle. H.-w. with a basal suffusion of the same rusty yellow, its outer limit in some cases nearly parallel to hind margin and extending a little beyond end of cell, in other cases almost reaching the margin at apex and anal angle, whitish on inner margin. Remainder of discal area transparent. A narrow dusky marginal border beset with internervular red spots. These vary in number from 3 or 4 to 7 and become less distinct towards the apex. That in area 1c may be doubled. Basal and discal black spots as follows. A discal row of eight, the first three (in 7, 6, and 5) lying parallel to margin, the fourth nearer to base, the fifth nearer to margin, and the sixth, seventh, and eighth nearer base and in a straight line which, if produced, would pass through tip of cell and apex. Two small spots, sometimes indistinct, on end of cell at origin of 6 and 5. Basal spots, two in cell close together, one in 7, one in 1c, 1b, and 1a, that in 1b more distally placed. One or two black spots against the thorax. These spots are often large and more or less confluent. A slight basal black suffusion (not always present). Underside f.-w. not scaled, h.-w. as on upperside but basal suffusion pale pinkish, creamy white along inner margin. Thorax black with yellowish lateral spots. Abdomen black above, paler beneath, with pale yellowish rings and lateral spots Claws unequal.

The size of the h.-w. spots is very variable. In some cases they are small and well separated, in others large and confluent.

♀. Expanse 63 mm. The rusty yellow of the ♂ replaced by yellowish white. The h.-w. spots sometimes larger than in the ♂, the red marginal spots of the h.-w. ochreous and obsolescent.

The examples figured by Mabille (*l. c.*) Plate 10 appear to be ♀♀ and not ♂♂ as there indicated.

Mabille states (*l. c.*) that he has examined Guenée's type and that the *Acraea pira* of that author is synonymous with *A. obeira.* Further I cannot separate Grose-Smith's *A. andromba.* The distinguishing feature of this form is the possession of six rounded red marginal spots, instead of three or four elongate spots in *obeira,* but even a small series of the latter species shows these spots to be extremely variable in number, shape, and depth of colour.

A curious feature of *Acraea obeira* is the instability of structure in the origin of nervures 6 and 7 in the h.-w. These may arise independently, or from a common stalk at some distance from the cell. They may even be stalked in one wing and independent in the other in the same specimen.

In 1891 (Trans. Ent. Soc., p. 172) Trimen described two ♀ Acraeas from Natal and Zululand and referred them to this species. Also in 1894 (Proc. Zool. Soc., p. 23) a similar ♀ from Manicaland. These examples have been subsequently found to be ♀♀ of *A. igola* Trim., so that true *obeira* would appear to be confined to Madagascar. Mabille describes the species as rare, and occurring in the east and north of Madagascar, Grose-Smith's examples (*andromba*) were from the N.W. coast of that island. Examples in the Tring Museum are from Morondava, so that the species must be distributed practically over the whole island.

A. obeira burni, subsp.

♂. Expanse 38–50 mm. F.-w. semitransparent, scales being few in number and slightly reduced but never resembling hairs. Costa, apex, and hind margin dusted with brownish-black scales. A pale ochreous basal suffusion extending to end of cell, slightly into area 2, and thence diagonally to hind angle. A blackish longitudinal streak in cell, and a black powdering at end of cell on discocellulars. A black basal streak in 1b. Sometimes a suggestion of submarginal yellowish spots, especially in 1b, and submarginal blackish spots in 1a and 2. H.-w. pale ochreous. A narrow blackish hind marginal border bearing seven reddish ochreous internervular spots, that in 1c doubled. Discal and basal black spots as follows :—A discal row of eight, the first three in 7, 6, and 5 nearly parallel to margin, the fourth in 4 nearer base, the fifth in 3 nearer margin, and the sixth, seventh, and eighth in 2, 1c, and 1b nearer base and in a straight line which, if produced, would pass through tip of cell and apex. Two spots, coalescent at end of cell on discocellulars, one subbasal in 7, two in cell close together, one in 1c, 1b, and 1a, that in 1b more distally placed. One or two spots against the thorax. These spots are smaller than in *obeira* and not confluent. A slight basal black suffusion (not always present). Thorax black with yellowish lateral spots. Abdomen black above, paler beneath, with pale yellowish rings and lateral spots. Underside. F.-w. not scaled, h.-w. as on upperside but paler.

♀. Expanse 55–65 mm. Much paler. H.-w. spots, especially those nearer, base smaller or obsolescent, hind marginal border paler and spots larger.

After the most careful consideration I cannot give more than subspecific rank to Butler's *Acraea burni*. The ground-colour of the wings and the size of the black spots is the only distinction between it and *obeira*. Even the peculiarity of the irregular structure in relation to nervules 6 and 7 is equally noticeable in both forms, and the male armatures are also similar.

The subspecies *burni* appears to be not uncommon on the Tugela River, Natal, from whence all the examples in the Oxford and National collections have been received.

21. Acraea mahela. Pl. VII, f. 6. Pl. XVI, f. 3.

Acraea mahela, Boisduval, Faune Mad., p. 31, pl. 6, f. 1 (1833); Mabille, Hist. Nat. Mad., Lep., 1, p. 90, pl. 11, f. 13 (1885–7); Aurivillius, Rhop. Aeth., p. 87 (1898).

= *A. madhela*, Staudinger, Exot. Schmett, 1, p. 83 (1885).

Madagascar (Jahora, Andranohinaly, Menabe, Marovoai) Juan de Nova I.; ? Mozambique.

♂. Expanse about 56 mm. F.-w. Semitransparent owing to substitution of elongated bifid scales for the usual rounded form. A basal suffusion of pale or medium ochreous extending some distance beyond cell and a little beyond hind angle. A slight dusting of pale ochreous at the apex. Black spots as follows, one transverse spot in cell beyond middle, one irregular spot on discocellulars, a row of three in 4, 5, and 6, not quite half way between end of cell and apex, one small spot in 3 and 2 near the cell, and in 1b a somewhat larger spot usually rather nearer margin than base. Occasionally there is a second spot in 1b half way between the base and the origin of nervure 2. H.-w. moderately thickly scaled with ochreous and spotted with black as follows. Six coalescent spots on hind margin on ends of nervules beginning with 2. An irregular discal band of eight, the first four in 7, 6, 5, and 4 respectively, and lying parallel to margin, the fifth in 3 and nearer to base, the sixth in 2 close to origin of nervule 3, the seventh in 1c and on a level with the fifth, the eighth in 1b and on a level with the sixth; one spot on end of cell at origin of nervule 5. Sometimes also a very small one at origin of 6. One spot near middle of cell and five basal spots, one in 1a, one in 1b more distally placed, one larger in 1c, one in cell, and one in area 7. These spots and also the lowest of the discal row are really on the under surface but are visible through the wing membrane. Underside resembles the upper. Thorax black, spotted above and below with ochreous. Abdomen black above for about half its length, the remainder and underside ochreous. Claws unequal.

♀. Resembles the ♂, sometimes rather larger and paler. Abdomen with less black and of a paler ochreous.

Acraea mahela is very closely allied to *A. neobule*, the position of the spots is precisely similar, though *mahela* lacks the spotted hind wing margin and basal black ringed white spots which characterise the former species. There is little constant difference in the male armatures of the two species. Mabille describes it as somewhat rare, having a swift flight, and inhabiting the eastern slopes of Madagascar. Specimens in the Oxford collection were taken in S.W. Madagascar. There is an example in the general collection in the Berlin Museum labelled "Mozambique," but the occurrence of the species on the mainland seems doubtful.

22. ACRAEA NEOBULE. Pl. VII, f. 3. Pl. XV, f. 18.

Acraea neobule, Doubl., Hew., and Westw., Gen. Di. Lep., pl. 19, f. 3 (1848); Guérin, in Lefeb. Voy. Abyss., 6, p. 378 (1849); Reiche, in Ferret et Galinier, Voy. Abyss. Ent., p. 466, pl. 33, f. 3, 4 (1849); Trimen, Trans. Ent. Soc., p. 345 (1870); Trimen, S. Af. Butt., 1, p. 137 (1887); Butler, Proc. Zool. Soc., p. 66 (1888); Aurivillius, Rhop. Aeth., p. 89 (1898); Butler, Proc. Zool. Soc., p. 192 (1898); *l. c.* p. 401 (1898); Dixey, Proc. Zool. Soc., p. 11 (1900); Butler, Proc. Zool. Soc., p. 923 (1900); Neave, Novit. Zool., xi. p. 346 (1904); Aurivillius, Voeltzkow Reise. Lep., p. 315 (1909); Neave, Proc. Zool. Soc., p. 11 (1910).

= *matuapa*, Gr.-Smith, Ann. Nat. Hist. (6), 3, p. 127 (1889); Smith & Kirby, Rhop. Exot., 10 (*Acraea*), p. 6, pl. 2, f. 5, 6 (1889).

? = *mhondana*, Vuillot, Ann. E. Fr. 60 Bull., p. 115 (1891).

DAMARALAND; ANGOLA; CONGO (Kassai); N.E. RHODESIA; BAROTSELAND; NATAL; TRANSVAAL; CAPE COLONY; PORTUGUESE E. AFRICA; GERMAN E. AFRICA; BRITISH E. AFRICA; SUDAN; SOMALILAND; ABYSSINIA; GRAND COMORO I.; PEMBA I.

f. *sokotrana*.

Rebel, Denksch. Akad. Wiss. Wien., 71, 2, p. 28 (1907).

= *neobule*, Butler, Proc. Zool. Soc., p. 177, pl. 18, f. 5 (1881); Dixey, Proc. Zool. Soc., p. 374 (1898); Grant, Nat. Hist. Sokotra, p. 304 (1903); Neave, Proc. Zool. Soc., p. 11 (1910) (part).

SOKOTRA I.; N.E. RHODESIA (Luangwa R).

A. neobule seis, subsp.

Feisthamel (*A. seis*), Ann. Ent. Fr., p. 247 (1850); Aurivillius (*neobule*, var. *seis*), Rhop. Aeth., p. 89 (1898).

= *calyce*, Godman & Salvin, Proc. Zool. Soc., p. 221, pl. 17, f. 1, 2 (1884).

Senegal; S. Leone; Liberia; Togo; Dahomey; Lagos; Ashanti; Gold Coast; Nigeria; ? Old Calabar; French Sudan (Bammako to Wagadugu).

A. neobule arabica, subsp.

= *A. arabica*, Rebel, Denksch. Akad. Wiss. Wien., 71, 2, p. 28, p. 29, f. 1, 2, p. 30, f. 3, 4, 5, pl. 1, f. 1, 2 (1907).*

S. Arabia.

A. neobule neobule.

♂. Expanse 50-65 mm. F.-w. semitransparent, scales being reduced in number and width, and near margins becoming slender and bifid. Costa and apex more or less dusted with black. A red basal suffusion, pale or bright, extending a little beyond cell, slightly into area 3, and thence in a nearly straight line to hind margin just beyond the angle. Often a slight ochreous suffusion at apex. Black spots more or less distinct, three beyond cell in 6, 5, and 4, one at end of cell on discocellulars, one in cell rather beyond middle, one small in 3 near to cell, one larger in 2 just below median, two in 1b, one discal and one subbasal, and a linear basal spot in same area. H.-w. pale to bright red. A narrow hind marginal black border bearing seven small spots of the ground-colour (the last in 1c doubled) which are more completely enclosed than in *horta*, and may even be obsolete. Basal and discal black spots varying greatly in size and arranged as follows:—A discal row of eight, the first four in 7, 6, 5, and 4 approximately parallel to margin and decreasing in size, the fifth slightly further from margin in 3, the sixth much further from margin in 2, the seventh in 1c and in line with the fifth, the eighth in 1b in line with the sixth. A minute spot just outside cell at origin of 6, a larger one on lower discocellular at origin of 4, a subbasal spot in 7, one median and one subbasal in cell, the rest confused on upperside in a basal suffusion. Near inner margin the spots may be absent on upperside and only showing through from beneath. Underside f.-w. scaled only at costa. H.-w. as upperside but powdered with whitish scales. Marginal border edged inwardly with reddish and spotted with white. Basal aggregation of spots enclosing three or four whitish marks. Thorax black with whitish lateral spots. Base of abdomen black with lateral yellow spots, remainder orange and rather paler beneath. Claws unequal.

♀. Expanse 50-70 mm. Resembles ♂ but red replaced by dull ochreous. Spots on h.-w. border usually larger.

* A previous reference is given in this publication to the Sitzberichtigungen Akad. Wiss. Wien., p. 359 (1899). There is no trace of such reference at the page and date given.

A. neobule, f. *sokotrana*.

Specimens of *A. neobule* from Sokotra have been described by Butler and by Dixey (*l. c.*). These differ from the normal form principally in the increased amount of black scaling at apex, little or no ochreous scaling in the same region, the ground-colour a richer red, the black spots larger, and the dark h.-w. border blacker and smoother in outline, its spots being less distinct. This Sokotra form has been named *neobule*, subspecies *sokotrana* by Prof. Rebel (*l. c.*) and in the absence of similar examples from other regions such a distinction would be quite justified. Examples however, taken by Neave in N.E. Rhodesia, are not distinguishable from these Sokotra forms. It is one of those cases in which a form or variety in one locality becomes the dominant race in another.

A. neobule seis, subsp.

Differs from the typical *neobule* in the following points. Average size generally smaller, f.-w. much less transparent, apical black more pronounced, a submarginal row of inter-nervular orange ochreous spots joining the much-extended reddish basal suffusion. H.-w. with marginal border much indented inwardly. The ♀ much nearer the ♂ in colour, often with a considerable black powdering along median and nervure 1 in f.-w.

A. neobule arabica, subsp.

Wings with the exception of transparent apical part of f.-w. uniform orange ochreous. Spots as in *neobule* but smaller. H.-w. marginal border formed of shallow black arches on a black marginal line enclosing internervular spots of ground-colour.

The h.-w. beneath is powdered with chalky white scales and the black spots at base are not confluent and therefore do not enclose white spots as in the typical form.

The ♀ is slightly larger and duller in colour, and the f.-w. transparent apical patch rather broader.

This form is represented by a ♂ and ♀ from Wadi Bagrên near Makálla and by four ♂ ♂ from Wadi Dhawrûten near Râs Fartak taken in March 1899. Prof. Rebel's description is accompanied by five excellent text figures showing the structure of the genitalia. These leave no doubt as to the specific identity of the form with *neobule*.

Acraea neobule is somewhat variable though none of the variations show sufficient constancy to enable the forms to be separated into races other than those above indicated.

The species is recorded (Trans. Ent. Soc., p. 330, 1902) as having been untouched after death by ants which had eaten every other specimen in a box except *A. admatha*. Mr. Bennett's note (Dixey, Proc. Zool. Soc., p. 374, 1898) describes the species in Sokotra as " mostly seen in the hills, at an elevation of about 2,000 ft. Not hard to get, the flight being slow and bold." Mr. Crawshay describes it at Nairobi (Butler, Proc. Zool. Soc., p. 923, 1900) as " common and fond of perching on a violet-coloured ' Devil's Bit '-like flower which grows on the plains."

The male armature shows a certain amount of individual variation, the length of claspers and uncus being somewhat inconstant. In the subspecies *seis* there is a tendency for the claspers to be shorter. *Neobule* is undoubtedly the mainland representative of *mahela*, from which it is rather doubtfully separable. Curiously enough the ♂ armature of the latter approaches more nearly the usually shorter structure shown in *neobule seis*.

23. Acraea zambesina.

Acraea zambesina, Aurivillius, Arkiv. för Zool., 5, No. 5, p. 123 (1908); Mendes, Brotéria. Ser. Zool., ix, fas. iii, p. 160, pl. 7, f. 1 (1910).

Portuguese E. Africa (Zumbo on Zambesi R.).

I have not had an opportunity of examining this specimen and can therefore only give Prof. Aurivillius' description of it.

♀. Expanse 56 mm. Allied to *A. neobule*, Doubl., but having the f.-w. fully clothed with scales and so devoid of transparent areas; it also differs from *neobule* in that the white centred basal spot of area 1c of the h.-w. underside is much smaller than in *neobule*, and scarcely larger than the basal spot in 1a.

F.-w. above dull reddish yellow with narrow border (only 1 m. broad), triangularly marked at the ends of nervules, the nervules near margin more or less black. F.-w. with the following black spots. One in middle of cell, two coalescent at end of cell, and five discal spots (in 1b, 3, 4, 5, and 6). The basal spot in 1b and the discal in 2 wanting in the present example. Spots arranged quite as in *neobule*, but larger, and somewhat as in the form *sokotrana*, Rebel. On the underside the f.-w. is coloured and marked quite as above except that it is more or less powdered with whitish yellow scales at the margin. The h.-w. is almost exactly like that of *neobule* but the marginal border is a little broader and the pale spots more distinct. Beneath, the h.-w. has a still wider border and very large pale marginal spots. Discal spots arranged as in *neobule*. The black, white-centred, basal spots in 1a, 1c, and cell are smaller, (especially in 1c) and almost of equal size.

One ♀ from Zumbo on the Zambesi R. in Portuguese E Africa. Mus. Colleg. St. Fiel.

A. neobule is a variable species, and the present example differing from it but slightly, will probably prove to be merely a local form of the same. The figure (*l. c.*) is a rather poor photograph which however shows the specimen to differ from both *neobule* and *seis* in having the f.-w. fully scaled, and in the h-.w. a broader black border and fewer spots.

24. Acraea horta. Pl. VII, f. 1. Pl. XV, f. 16.

Acraea horta, Linnaeus, (*Pap.*) Mus. Lud. Ulr., p. 234 (1764) ; Syst. Nat., ed. 12, p. 755 (1767); Fabricius, Syst. Ent., p. 459 (1775) ; Sulzer, Ges. Ins., p. 143, pl. 15, f. 1 (1776) ; Cramer, Pap. Exot., 4, p. 18, pl. 298, f. F, G. (1780) ; Drury, Ill. Exot. Ins., 3, p. 37, pl. 28, f. 1, 2 (1782) ; Wulfen, Ins. Cap., p. 31 (1786) ; Herbst, Naturs. Schmett 5, p. 22, pl. 83, f. 1, 2 (1792) ; Fabricius, in Illiger's Magazine (*Acraea*), 6, p. 284 (1807) ; Godart, Enc. Méth., 9, p. 231 (1819) ; Doubl., Hew., and Westw., Gen. Di. Lep., p. 140 (1848) ; Trimen, Rhop. Af. Austr., p. 93 (1862) ; Trimen, S. Af. Butt. (metam.), 1, p. 134–6 (1887) ; Staudinger Exot. Schmett, 1, p. 82, pl. 33 (1885) ; Brunner v. Wattenwyl, Farbenpr. der Ins., p. 5, pl. 4, f. 43 (1897) ; Aurivillius, Rhop. Aeth., p. 89 (1898) ; Butler, Proc. Zool. Soc., p. 192 (1908) ; Marshall, Trans. Ent. Soc., p. 337 (1902).

Cape Colony ; Natal ; Zululand ; Transvaal ; Pondoland.

♂. Expanse about 50 mm. F.-w. semitransparent, the discal scales being modified into a narrow bifid form. Some hairs present and the membrane of the wing speckled with brown at points of attachment of scales. Costa and hind margin slightly dusted with blackish, frequently a suggestion of red internervular spots at apex. Base black. A bright red (brick red in old specimens) basal suffusion extending a little beyond end of cell, very slightly into area 3, half way across 2, and almost completely filling 1a, and 1b. A transverse black spot at end of cell on discocellulars. A spot in cell beyond the middle, one immediately below median in area 2, and two in 1b, the first immediately below the median, the second much larger near the middle. These may be fused into one large longitudinal mark. All these spots except that on the end of cell may be very faint or in some examples absent altogether. The h.-w. bright red (duller in old specimens) with a narrow border of blackish not quite enclosing seven internervular spots of the ground-colour, that in 1c being doubled. Black discal and basal spots as follows:—A discal band of eight, the first rather larger than the next three, lying parallel to the hind margin in 7, 6, 5, 4, the fifth larger and nearer cell in area 3, the sixth still nearer base in 2, the seventh in 1c in line with the fifth, the eighth in 1b and in line with the sixth. In addition to the discal spots, two at end of cell on discocellulars, two in cell, one subbasal spot in 7, a large subbasal spot in 1c, a small one in 1b, and another in 1a. Internervular spaces at extreme base, black, usually coalescing with subbasal spots. The spots in 1a and 1b are also frequently confluent. Underside f.-w. devoid of scales, h.-w. dull ochreous. A narrow black margin set with ochreous spots, followed by a narrow red submarginal border. Some red also in areas 9, 8, 7, 1c, 1b, and 1a. Spots as on upperside, those at base usually confluent and enclosing spots of the ochreous ground colour. Thorax black with a few indistinct pale spots. Abdomen black above, orange ochreous beneath, and bearing small ochreous lateral spots. Claws unequal.

♀. Expanse about 60 mm. Resembles ♂ but has the red replaced by dull ochreous and the f.-w. spots are more frequently absent.

A description of the larva and pupa will be found in Trimen's S. Af. Butt., 1, p. 135–6, from which the following is abstracted.

Larva.—About 32 mm. long; with strong branched black spines. Dull brownish ochreous, closely striped with black transverse streaks. A pale ochreous dorsal line. A broad ochreous lateral band not crossed by the black streaks. Legs bright shining yellow; head shining black. Two spines on second segment, four on the last, and six on each of the other segments. Feeds on *Kigellaria africana* and on various passion-flowers.

Pupa.—About 20 mm. long. Head blunt, hardly bifid; lateral angles at base of wing covers prominent and acute. Back of thorax rather blunt and rounded. Pale creamy ochreous. Wing covers streaked with black along position of nervures. Two dorsal, one ventral and two lateral lines of black ochre centred spots.

"The silk to which the tail is attached often covers an area of an inch in diameter."

Trimen states that the species is extremely common in and about Cape Town. It flies slowly, and the larvae frequently do much damage to passion flowers. Fowls will not eat the larvae, which have a strong and disagreeable odour more perceptible than that of the pupa or even of the butterfly. Its distastefulness does not however preserve it from the attacks of parasites, as Marshall records (Trans. Ent. Soc., p. 337, 1902) that five out of eight pupae were killed by a dipterous parasite. The male armature, though almost indistinguishable from that of *insignis*, to which species it bears, in pattern, but little resemblance, is of very different structure from that of *A. neobule*, although in other respects *horta* and *neobule* bear an extremely close resemblance.

A. horta appears to be an essentially S. African species. Trimen gives S. Leone as a locality on the authority of the British Museum, but the specimens so labelled must have been removed as the twenty-six examples in the present series bear the labels Cape Colony, Natal, Zululand, and Transvaal.

Trimen (*l. c.*) thus describes the pairing of this species: "The ♀ rested on the ground with expanded wings, and the ♂ rested on the ♀ with his wings also flatly extended. In this position (which was maintained) the heads of the two were held in the same direction, and the extremity of the ♂ abdomen was twisted sideways as in the union of the saltatorial Orthoptera."

It is interesting to note in this connection that the orifice of the *bursa copulatrix* is at one side of the chitinous plate and not central as in most species.

25. ACRAEA ADMATHA. Pl. VII, f. 5.

Acraea admatha, Hewitson, Exot. Butt. (*Acraea*), pl. 3, f. 16, 17 (1865); Trimen, Trans. Ent. Soc., p. 171 (1891); Aurivillius Rhop. Aeth., p. 88 (1898); Gordon, Trans. Ent. Soc., p. 330 (1902).

S. LEONE; ASHANTI; GOLD COAST; OLD CALABAR;

Nigeria; Cameroon; Gaboon; Congo Region (Bena Bendi Zongo, Mokoange); Natal; Zululand; British E. Africa (Witu).

f. *leucographa.*

Ribbe (*A. leucographa*), Iris., 2, p. 181, pl. 4, f. 1 (1889); Snellen, Tijdschr. v. Ent., 38, p. 13 (1895); Aurivillius, Rhop. Aeth., p. 88 (1898).

S. Leone; Cameroon (Bitjé); Nyam Nyam Country; Congo (Sassa); Uganda (Unyoro, Nandi, Entebbe, Semiliki R., Kitala); British E. Africa (N. Kavirondo); German E. Africa (Ukerewe I.); Abyssinia (Scheko).

A. admatha admatha.

♂. Expanse 55-65 mm. F.-w. semitransparent, thinly scaled with scales of normal size standing partially erect, narrow bifid scales and fine hairs appear at hind margin. A rosy red basal flush (brick red in old specimens) extending nearly to end of cell at subcostal and median, but more basal in the middle, passing slightly beyond origin of 2 and just reaching the hind angle. Base, costa and apex dusted with black, and a small linear basal spot below median. A faint black spot in middle of cell and sometimes a blackish dusting at end of cell on discocellulars. A little beyond end of cell two faint black spots in 4 and 5, and sometimes a third nearer to cell in 3. Just below median in 2 a faint spot, and one in 1b rather nearer margin. These spots are very variable in intensity.

H.-w. rosy red (brick red in old examples) dusted with black at base, whitish in area 1a, and having a moderately broad black marginal border bearing six rounded red internervular spots. Black discal and basal spots as follows:—A discal series of eight, the first (large) in area 7 near the middle, the second in 6, rather nearer base (this spot is often wanting), third and fourth in 5 and 4 and lying in a straight line with the first, the fifth in 3 close to cell, the sixth, seventh, and eighth in 2, 1c, and 1b, large, nearer to base, and almost in a straight line (some of the discal spots are sometimes small or wanting), in addition to these two small spots at end of cell, one spot in 9, one in 7, two in cell, two in 1c, one in 1b (close to eighth of discal row), and two in 1a. Underside f.-w. almost devoid of scales but dusted with yellow near base, h.-w. pink with black border as on upperside, bearing six red spots outwardly edged with pinkish white. Black spots as on upperside but much more distinct. Thorax black, spotted above and below with yellowish white. Abdomen basal half black above with lateral orange spots, remainder orange, underside yellowish white. Claws unequal.

♀. Expanse 60–75 mm. F.-w. as in ♂ but red replaced by rusty yellow varying to brownish cream colour, and spots faint or absent. H.-w. colour modified in the same way. Spots often less distinct than in the ♂. Underside dusky white, marginal spots yellow, edged with whitish.

A. admatha f. *leucographa.*

This form differs from the above in having a white patch at anal angle of h.-w. This patch extends from the discal spots in 1b, 1c, and 2 to the black border, with sometimes a few white scales in area 3. On the upperside of h.-w. the first three or four discal spots may be faint or absent. The ♀ is a little larger, less brightly coloured, and has the white on h.-w. more suffused. I have before me a small series of examples from Entebbe showing a beautiful gradation in the extent of the white, one specimen having only a faint white scaling near the anal angle.

Though *A. admatha* is a somewhat variable species having a wide range, I have been unable to assign any of the variations to definite localities. Trimen states (*l. c.*) that his southern examples differ from typical W. African specimens in having less rounded spots in the h.-w., and also that the subbasal spot in the cell is wanting, also that in the f.-w. the red area is more extended and the discal spots wanting in the ♂ but present in the ♀. A pair before me from Zululand, show a tendency to confluence in the h.-w. spots especially in the ♂, but the spots in h.-w. are quite as rounded as in other examples, the second cell spot is not absent, the f.-w. red is of the usual extent and the f.-w. discal spots are present in the ♂ and wanting in the ♀. We must conclude therefore that these features are inconstant. The form *leucographa* is characteristic of the central area of the species' range. It has been taken in the Nyam Nyam country north of the Ubangi River, at Sassa in the extreme North of the Congo State, and at Kitala in Uganda. In Proc. Zool. Soc., p. 977, 1899, Butler mentions it as having been taken in the Nandi District by Captain Hobart, who found it quite common there. Examples occur sporadically in other parts of the species' range. The typical form with slight variation occurs from Ashanti to the Congo State, and southwards to Natal.

A. admatha is recorded by C. J. M. Gordon in Old Calabar (*l. c.*) as being untouched after death by ants which had eaten all the other specimens in a box except *A. neobule.*

The male armature is fairly distinctive having a characteristic dentate edge to the claspers.

26. Acraea insignis. Pl. VII, f. 2. Pl. XV, f. 17. Pl. XVI, f. 20.
Acrae insignis, Distant, Proc. Zool. Soc., p. 184, pl. 19, f. 6 (1880); Godman, Proc. Zool. Soc., p. 538 (1885); Butler, Proc. Zool. Soc., p. 66 (1888); Rogenhofer, Ann. Mus. Wien., 6, p. 457 (1891); Aurivillius, Rhop. Aeth., p. 89 (1898); Sjöstedt's Expedition, p. 3 (1910); Grünberg, Sitzb. Ges. Nat. Fr., p. 148 (1910).
= *balbina*, Oberthür, Etud. d'Ent., 12, p. 6, pl. 3, f. 8 (1888); Butler, Proc. Zool. Soc., p. 923 (1900).
= *buxtoni*, Hewitson, Ent. Mo. Mag., xiv, p. 155 (*nec* Butl.) (1877).
Nyassaland; German E. Africa (Bukoba, L. Kivu); British E. Africa (Kikuyu, Kangasi); Uganda (Entebbe).

f. *siginna*, Suffert, Iris., p. 19 (1904); Aurivillius, Sjöstedt's Expedition, p. 3 (1910).
German E. Africa (generally, and especially Kilimandjaro); British E. Africa (Tiriki Hills, Entebbe).

A. insignis insignis.

♂. Expanse 50–60 mm. F.-w. semitransparent. The scales in apical area being of normal size but few in number and set partially upright. Near margin numerous narrow forked scales. Base slightly blackish; costa from end of cell to apex, and sometimes apical portion of hind margin, often dusted with black scales. A brick red basal suffusion extending a little beyond end of cell and to hind angle. A black transverse spot on end of cell, and a black linear basal spot below median. H.-w. brick red with a narrow black marginal border the inner edge of which may be smooth or undulating. The base of wing has a black suffusion occupying lower half of cell, base of 2, 1c, and 1b, followed by a large oblique spot lying on the discocellulars. Underside. F.-w. almost devoid of scales. H.-w. as on upperside but with the discal area pink, separated from the marginal black by a narrow red submarginal band. Often one or two white spots near base. Thorax black with lateral and ventral yellowish spots. Abdomen black above, orange laterally and towards extremity and paler beneath. Claws unequal.

♀. Resembles ♂ but the red is replaced by a colour varying from slightly paler than that of the ♂, to a dull pale brown.

A. insignis f. *siginna*.

Differs from the typical form in having all the h.-w. basal black coalescent, forming a large black patch extending beyond cell with an irregular distal outline from costa to inner margin.

Aurivillius records the *siginna* form as occurring almost to the exclusion of the type, at great elevations (2,000 to 3,000 metres) on Mts. Meru and Kilimandjaro. Intermediates however appear to occur everywhere. When Distant described and figured this species, he pointed out that it was the same as that described by Hewitson as *A. buxtoni*. That name had however been previously used by Butler, and as Godman points out, Hewitson must have suppressed the species as it does not appear in Kirby's catalogue of his collection, its place being taken by four undetermined forms from Zanzibar. These are the same as the species described and figured by Distant. Butler records *A. insignis* as taken by Mr. R. Crawshay at Roromo, Kikuyu Forest in February 1900, that collector remarking that the species frequents the primaeval forest and that it is capable of resisting the fumes of strong cyanide for half-an-hour. The species is very nearly allied to *A. horta*, the ♂ armatures being with difficulty distinguishable. That of *insignis* is of a rather more slender construction.

27. Acraea camaena. Pl. VII, f. 4.

Acraea camaena, Drury, (*Pap.*) Ill. Exot. Ins., 2, p. 12, pl. 7. f. 2 (1773); Fabricius, Syst. Ent., p. 464 (1775) (?); Herbst, Naturs. Schmett, 5, p. 9, pl. 81, f. 3 (1792); Godart (*Acraea*), Enc. Méth., 9, p. 234 (1819); Aurivillius, Rhop. Aeth., p. 89 (1898); Lathy, Trans. Ent. Soc., p. 185 (1903).

= *murcia*, Fabricius, (*Pap.*) Spec. Ins., 2, p. 33 (1781).

S. Leone; Gold Coast; Liberia; Ashanti; Lagos; Nigeria; Fernando Po.

(There is apparently some confusion under *camaena* in the 1775 edition of Fabricius. *Camaena* is stated to have red on h.-w., and to be allied to *zetes*. Then follows a fuller description, which agrees with Drury's figure of *camaena*. In the Species Insectorum (Vol. II, p. 32) *camaena* is again described with red on h.-w., and on p. 33, "*Papilio murcia*" is described, the account and the type agreeing with Drury's figure of *camaena*.)

♂. Expanse 55–65 mm. F.-w. smoky brown, partially translucent, one black spot at end of cell on discocellulars. H.-w.

same colour as f.-w. A blackish marginal border the inner edge of which is deeply indented. On this margin seven internervular spots of dull ochreous, that in 1c being doubled. A submarginal band of dull ochreous, narrow or obsolete at apex and widening out so as to extend over the whole of the inner margin. Black discal and basal spots as follows :—A discal row of eight, the first four parallel to hind margin, and decreasing in size from area 7 to 4, the fifth in area 3 close to cell, the sixth larger near base of area 2, the seventh in 1c and in line with the fifth, the eighth in 1b, in line with the sixth, one small and one large spot on discocellulars. A subbasal spot in 7, near the first of discal row ; two spots in cell, and a basal aggregation of confluent black spots.

Underside, f.-w. almost devoid of scales, h.-w. as on upperside but pale submarginal band more extensive, occupying nearly the whole discal area. Black hind marginal border bears white internervular spots, and the basal black encloses four subtriangular white spots. Thorax black with lateral and ventral yellowish white spots. Abdomen black above, yellowish beneath, with lateral yellowish white spots increasing in size towards extremity. Claws unequal.

♀. Expanse about 65 mm. Resembles ♂ but paler ; the h.-w. submarginal band reaches costa, underside uniformly dull ochreous with spots and markings as in ♂.

This curious species would appear to be somewhat rare. It is closely allied to *A. neobule*, but is easily recognised by its sombre pattern and the dull brown unicolorous f.-w. relieved only by the blackish spot at end of cell.

The male armature is distinguished from those of its nearest allies by the slightly different structure of the claspers.

GROUP IV.

28. Acraea zetes. Pl. VI, f. 5 (larva).

Acraea zetes, Linnaeus, (*Pap.*) Syst. Nat., 10, p. 487 (1758) ; Mus. Lud. Ulr., p. 270 (1764) ; Clerck, Icones. Ins., 2, pl. 43, f. 1 (1764) ; Karsch (*Acraea*), Berl. Ent. Zeit., 38, p.195, 198 (1893) ; Aurivillius (metam.), Ent. Tidschr., 14, p. 275, pl. 4, f. 4, 4b (1893); Rhop. Aeth., p. 90 (1898) ; Lathy, Trans. Ent. Soc., p. 185 (1903) ; Eltringham, Af. Mim. Butt., p. 66 (1910) ; Grünberg, Sitzb. Ges. Nat. Fr., p. 148 (1910).

f. *menippe*, Drury, (*Pap.*) Ill. Exot. Ins., 3, pl. 13, f. 3, 4 (1782) ; Stoll, Cramer Suppl., p. 131, pl. 28, f. 1, 1a (1790); Herbst, Naturs. Schmett, 5, p. 11, pl. 81, f. 4, 5 (1792); Butler (*A. egina*), Proc. Zool. Soc., p. 46 (1902).

= *mycenaea*, Hübner, Verz., p. 27 (1816).

= *zethea*, Godart, Enc. Méth., 9, p. 236 (1819).

= *zethes*, Staudinger, Exot. Schmett, 1, p. 83 (1885).

S. LEONE; ASHANTI; TOGO; CAMEROON; GABOON, NIGERIA; CONGO (Kassai to Albert Nyanza); BAROTSELAND; UGANDA (Entebbe, Kangasi, Unyoro, Sesse I.).

f. *jalema*, Godart, Enc. Méth., 9, p. 234 (1819); Aurivillius, Ann. Mus. Genov., p. 16 (1910).

S. THOMÉ; NIGERIA; GABOON; UGANDA (Unyoro, Entebbe, Pt. Alice, Nandi); RHODESIA.

A. zetes acara, subsp. Pl. VIII, f. 2.

Hewitson (*A. acara*), Exot. Butt., pl. 3, f. 19, 20 (1865); Trimen (*zetes*), Rhop. Af. Austr., p. 99 (1862); Trans. Linn. Soc., p. 517, pl. 42, f. 8, 9 (1869); S. Af. Butt., 1, p. 160, pl. 1, f. 1, 1a (metam.), (1887); Monteiro, Del. Bay, p. 201 (1892); Aurivillius, Rhop. Aeth., p. 91 (1898); Marshall, Trans. Ent. Soc., p. 504 (1902); Rogers, Trans. Ent. Soc., p. 525 (1908); Aurivillius, Sjöstedt's Expedition, p. 3 (1910); Eltringham, Af. Mim. Butt., p. 66, pl. 6 (1910).

f. *mhondana*, Suffert, Iris., p. 20 (1904).

NATAL; DELAGOA BAY; TRANSVAAL; RHODESIA; NYASSALAND; GERMAN E. AFRICA; PEMBA I.; BRITISH E. AFRICA; UGANDA; WHITE NILE.

f. *caffra*, Felder, Reise Novara. Lep., p. 369, pl. 46, f. 10, 11 (1865); Eltringham (*acara*), Af. Mim. Butt., pl. 6, f. 3 (1910).

= *tescea*, Suffert, Iris., p. 20 (1904).

BAROTSELAND; TRANSVAAL; NATAL (and occasionally in other *acara* localities).

A. zetes barberi, subsp.

Trimen (*A. barberi*), Trans. Ent. Soc., p. 433 (1881); S. Af. Butt., 1, p. 162, pl. 3, f. 1, 1a (1887).

ab. *trimeni*, Aurivillius, Rhop. Aeth., p. 91 (1898).

TRANSVAAL; W. GRIQUALAND.

A. zetes sidamona, subsp.

Rothschild & Jordan, Novit. Zool., 12, p. 179 (1905).

ABYSSINIA (Sidama).

A. zetes, f. *menippe*.

♂. Expanse 70–80 mm. F.-w. brownish black, darker at base, costa, apex, and hind margin. A more or less distinct submarginal row of reddish orange spots, very small or obsolete at apex and increasing in size towards hind angle. Black spots (obscured by ground-colour) as follows. In cell one small spot at base (usually almost lost in basal suffusion), a larger subbasal spot, a still larger transverse spot between the latter and end of cell, and a transverse spot on the discocellulars. A transverse discal band of large confluent spots from costa almost to nervule 3, the area between this and apical black distinctly paler and in many cases white or yellowish. In area 2 a large spot below origin of nervule 3. Below this, in area 1b but nearer margin, a large reniform spot. Near base of same area and close to median, a small spot. Areas 1a, 1b, and 2 usually with a slight central red suffusion.

H.-w. vermilion red. A heavy black basal suffusion reaching nearly to end of cell, and a black marginal border about 3 mm. wide, (its inner edge not very sharply defined,) and bearing seven small internervular spots of the ground-colour. Black spots as on underside, those nearer base being lost in the basal suffusion.

Underside. F.-w. Basal and discal portion dull pink. Costa dull ochreous, black at base, and with a minute black subbasal spot. A slight black suffusion at base of area 1a, and 1b. Other spots as on upperside. Apical and hind marginal black largely displaced by orange ochreous internervular spots which are larger and more distinct than on upperside. H.-w. dull creamy ochreous, the black marginal border more sharply defined, bearing seven subtriangular spots of the ground-colour (that in 1c doubled) and bordered on its inner edge by seven corresponding red spots. Nine discal black spots those in 7, 6, 5, 4, and 3 roughly parallel to margin, one at origin of 5, one in 2 between 2 and median, one in 1c, rather nearer margin, and one in 1b, on a level with that in 2. A small spot in 8 above precostal. A black basal patch of confluent spots bordered outwardly with rose pink and enclosing six pale ochreous markings, one in 7, two in cell, and one in 1c, 1b, and 1a respectively. Area 9 and basal part of 8 rose pink.

Head black with a white spot between the eyes. Thorax black with whitish lateral spots more numerous beneath. Basal half of abdomen black, remainder deep orange, with a terminal fringe of black hairs. Claws unequal.

♀. Expanse 80–95 mm. F.-w. varying from dull reddish to brownish grey. Spots as in ♂ but much less distinct, and apical and hind marginal black paler and more suffused. An oblique subapical white bar from near costa to nervule 4. H.-w. dull reddish brown, with blackish marginal border bearing spots of ground-colour larger than in male. Discal spots as in male, but basal black suffusion wanting. Underside rather sparsely scaled but otherwise as in male though paler. Abdomen brown, paler beneath.

I have described the *menippe* form at length because it is much the commonest typically western form. True *zetes* agreeing with Clerck's original figure has the f.-w. all brown black without submarginal spots and with just a trace of whitish subapical spots. The paler areas of underside are almost white.

A. zetes f. *jalema*.

This form is intermediate in pattern between *zetes* and *acara*. It has the red f.-w. of the latter but much suffused with black. The apex is usually also blackish, and the white spots just beyond the discal black are still present.

A. zetes acara, subsp.

♂. Expanse 80–85 mm. Wings bright red with black spots as in *zetes*. F.-w. has the apex only narrowly black. The subapical area is deep orange, and the hind marginal border bears large spots of the same colour, leaving the black only as heavy internervular arches gradually decreasing towards apex. H.-w. marginal border 4 mm. wide, the internervular spots very faintly visible. Basal black extending barely half the length of cell. Discal area frequently suffused with white (= *caffra* and *tescea*).

Underside, f.-w. dull pink, black spots as in *zetes*. Subapical area pinkish white. Area 6 with a suffused orange streak, beneath which is a marginal row of well-marked internervular orange spots bordered inwardly with black, and interstitially with bluish grey. H.-w. almost white. The spots on marginal and basal area are white. Fringes of both wings tipped with white between the nervules. Thorax and abdomen as in *zetes*.

♀. Expanse 80–90 mm. Wings pale pinkish brown, spotted as in male. F.-w. Subapical area pale dull ochreous. Underside f.-w. from base to about middle of wing very sparsely scaled. Subapical area creamy white with internervular orange markings. H.-w. white with marginal black bearing white spots and edged inwardly with orange spots. Basal black having white spots and edged outwardly with pink.

f. *mhondana*.

In this form the f.-w. apical black joins the end of cell, a common variation which may be observed in almost any series.

f. *caffra.*

This form is merely *acara* with a white discal suffusion in the h.-w.

f. *barberi.*

This form was described by Trimen as a separate species but it cannot be separated from *acara*. In the ♂ the f.-w. apical yellow is less distinct from the ground-colour and the black spots are smaller. The ♀ has the f.-w. semitransparent and the basal black is almost obsolete. The h.-w. hind marginal black is almost absent.

In the example named ab. *trimeni* by Aurivillius the apical yellow is more pronounced, and the f.-w. hind marginal black is almost absent. Aurivillius includes under this an example from Rehoboth (German W. Africa) which is now in the Staudinger collection. If this is really *barberi* then the *hypoleuca* of Trimen must also be a form of *zetes* which indeed is highly probable, extremely different in appearance though it is. I have in fact only kept *hypoleuca* separate from *zetes* because it is so far a unique example and bears no locality. The example labelled *barberi* in the Staudinger collection differs very little from it. (See remarks under *A. hypoleuca*.)

A. zetes sidamona.

The Abyssinian subspecies is described by Messrs. Rothschild and Jordan (*l. c.*) as standing about half way between W. African *zetes* and E. African *zetes acara*. In f.-w. on basal side of cellular and postcellular spot is a red mark. The middle portion of the discal black band nearly touches the discocellular spot. Six isolated reddish orange submarginal spots larger than in *z. zetes*. H.-w. black basal area rather more extended than in *z. acara*. Underside with more red than in the other geographical forms, h.-w. marked with white as in *acara*; yellow submarginal spots all separated from disc by a broad black border except that in area 6 which is long.

The larva and pupa of *zetes* are described by Aurivillius (*l. c.*).

The former is yellowish red, with a shining red head and a dark transverse band in the middle of each segment. The spines are black and arise from black shining processes. The two dorsal spines of the first segment are somewhat elongated, the remainder bent slightly backwards.

My figure is from a Lagos example which agrees generally with Aurivillius' description.

The pupa is yellowish with black nervure lines, black markings on the head, a black band divided by two pale lines on thorax, and fine black lines ornamented with pale spots on the abdomen.

The larva and pupa of *z. acara* are described by Trimen (*l. c.*).

The former is ochreous yellow, each segment with a broad purplish red transverse band. Black spines long and branched arising from tubercles on the dark bands. The first two dorsal spines longer than the rest, erect. Head ochreous yellow, legs and prolegs purplish red. "Feeds on *Passiflora*." Pupa, pinkish white, with black neuration and limb markings. Lines of rose pink spots in rows of wide continuous black spots. Underside of abdomen tinged in middle with rose pink, and two pink dorsal spots on thorax and one at base of wings. Head ochreous yellow.

Allowing for the fact that Trimen's descriptions were made from live or fresh examples, the larva and pupa of *zetes* and *acara* may be regarded as very similar.

At the Hope Department at Oxford, examples of pupae of *z. zetes* have recently been received, together with several specimens of a dipterous parasite (Fam. *Tachinidae*), which had emerged therefrom, also a batch of small parasitic cocoons which had been formed from a larva of *zetes*. These cocoons appear to be those of a hymenopterous parasite but the insects had emerged and escaped.

Acraea zetes is a variable species, the subspecies *acara* showing a wider range of variation than the typical western form. Godart's *A. jalema* is intermediate between *z. zetes* and *z. acara*. Felder's *caffra* is the form of *acara* having a white discal patch in the h.-w. Suffert's *tescea* differs but little from this form. Examples from Entebbe show a distinctly intermediate form having the ground-colour of the f.-w. red, but lacking the orange subapical patch characteristic of true *z. acara*. Neave found *zetes* in the Katanga country W. of the Luapula R. and *z. acara* in the Chambesi and Luangwa valleys. On Chishi I., L. Bangweolo the same naturalist took examples of an interesting form, two of which are now in the Oxford collection. These specimens are peculiar in having the discal spots of the h.-w. reduced to mere dots, causing them to resemble very closely *A. astrigera.* Both specimens have a slight tendency to white discal suffusion in the h.-w. This and the f.-w. marginal black, surrounding large orange spots in areas 1b, and 2, are the principal features which serve to distinguish these examples from the other species named.

A. zetes is essentially the western form whilst *acara* is found in the south, east, and north-east. Godart's *jalema* is labelled Gaboon, whilst Aurivillius notes a similar specimen from Nyassaland. The *acara* subspecies also extends to German and British E. Africa, and northwards to the White Nile. Godart's types (two ♂♂ and one ♀) are in the Dufresne collection at Edinburgh.

Though some examples of *A. zetes* approximate very closely in appearance to typical specimens of *A. astrigera,* the male armature is very distinct, showing a much closer relationship with *chilo* and *hypoleuca.*

29. Acraea chilo. Pl. VIII, f. 4.

Acraea chilo, Godman, Proc. Zool. Soc., p. 184, pl. 19, f. 4, 5 (1880) ; Aurivillius, Rhop. Aeth., p. 96 (1898) ; E. M. B. Sharpe, Proc. Zool. Soc., p. 369 (1898) ; Butler, Proc. Zool. Soc., p. 401 (1898) ; Roth. & Jord., Novit. Zool., xii, p. 179 (1905).

= *rosina,* Rogenhofer, Verh. z. b. Ges. Wien., 41, p. 565 (1891); in Baumann, Usambara, p. 326 (1891).

= *zetes,* var. *acara,* Pagenstecher, Jahrb. Nass. Ver. Nat., p. 133 (1902), (part).

= *wissmanni,* Weymer, Iris., p. 223 (1903).

♀ = *crystallina,* Gr.-Smith, Ann. Nat. Hist. (6), 5, p. 167 (1890) ; Rhop. Exot., 19 (*Acraea*), p. 7, pl. 3, f. 3, 4 (1892) ; Aurivillius, Rhop. Aeth., p. 89 (1898) ; Neave, Ent. Mo. Mag., p. 171 (1909); Aurivillius, Sjöstedt's Expedition, p. 3 (1910).

♀. f. *hoeneli.*

= *A. hoeneli,* Holland, Proc. U. S. Nat. Mus., 18, p. 746 (1896).

Abyssinia (Mojo R., Atschabo, Harar) ; Somaliland (Sso-Omadu, Solole, Wagga, Rugga Pass, Hankadeely, Berbera) ; British E. Africa (Voi R., Maziwa, Mitati, Taita, Taveta, Mombasa, Witu) ; German E. Africa (Kilimandjaro).

A. chilo chilo.

♂. Expanse 50-70 mm. Wings rosy pink. F.-w. narrowly black along costa. Apex and hind margin black and bearing a marginal (submarginal at apex) row of seven deep orange spots. Black spots as follows. Two in cell, and one large obliquely transverse spot at end of cell on discocellulars. Midway between end of cell and apex a confluent oblique band of four spots. A large rounded spot in area 3, one slightly larger in area 2 touching median and nervule 1b. Beneath this and pointing towards hind angle an elongated slightly curved spot in area 1b. One subbasal spot in same area and a short black longitudinal basal streak between 1a and median.

H.-w. with a black basal area formed of more or less confluent spots and extending not quite half the length of cell. In Mombasa examples a subbasal spot in cell is usually well separated. Hind margin bordered with black about 3 mm. wide and bearing traces of paler internervular spots. Discal spots as follows. One in area 7, near middle. One in 6, 5, and 4, each respectively rather nearer margin than the one above it. One in 3 near end of cell, one in 2 nearer base, one in 1c nearer margin, and one in 1b, in a line with that in 2 (often obsolete on upperside). Usually a large spot at origin of nervule 5.

Underside. F.-w. as above but paler and sparsely scaled. Usually a very minute black dot near base above costal. H.-w. creamy ochreous. Hind margin black as on upperside but bearing seven distinct pale greenish spots, that in 1c doubled. Base black, enclosing six pale greenish spots. Area 9, and base of 8 rosy pink, with a black spot beyond precostal, a rose pink suffusion in areas 1a, 1b, 1c, adjacent to basal black.

Head and thorax black with a few pale spots above, and several beneath, basal half of abdomen black, with deep orange lateral spots, remainder deep orange. Claws unequal.

♀. Expanse 60–70 mm. Wings quite transparent, suffused with brown at base. F.-w. without spots, sometimes with a few scales at apex. H.-w. with spots as in ♂ but much smaller, the basal black being reduced to a spot in area 7, two in cell, and one in 1c, 1b, and 1a. Hind margin slightly scaled with blackish and bearing seven paler internervular spots. Underside as above but with a few rose pink scales at base in areas 9, 1c, and 1a. Head, thorax and abdomen dark brown, the white spots on head and thorax more distinct than in ♂.

This seems to be the usual form in British E. Africa.

A. chilo ♀. f. *hoeneli.*

Resembles the foregoing but the f.-w. black spots are present though much reduced. The hind marginal orange spots are also present but paler than in the male, whilst the h.-w. may be more or less scaled with pink, and the black spots as large as in the male. Some examples of this form of ♀ are distinctly intermediate in pattern between the entirely transparent ♀ and the ordinary ♂. This second form is usually found in Somaliland.

The discovery of the identity of Grose-Smith's *A. crystallina* with the ♀ *A. chilo* is due to my friend Mr. S. A. Neave who came to this interesting conclusion after studying the series of Somaliland ♀ ♀ now in the Hope Department. It should be noted that Grose-Smith (*l. c.*) described his *crystallina* as a ♂. Unfortunately in this otherwise admirable work the sexing is most unreliable. *A. chilo* is very closely allied to *A. zetes acara* the male armature presenting but little difference. The ♂ *chilo* is however very constant in markings, and until I have seen an example which shows a pattern distinctly intermediate between it and *A. zetes acara*, I do not feel justified in regarding them as one species. *Acraea oscari* is equally closely allied and the advent of fuller material may cause all three to be regarded as specifically identical.

30. Acraea oscari. Pl. III, f. 6 (♂). Pl. VIII, f. 5.
Acraea oscari, Rothschild, Novit. Zool., ix, p. 595 (1902); Eltringham, Novit. Zool., xviii, p. 151 (1911).
Abyssinia (Banka, Inderatcha, Charada).

♂. Expanse 60–70 mm. Wings dull red. F.-w. dusted with black along costa, basal black extending shortly into cell and rather further below median. A minute black spot on costa near base. Hind margin broadly black bearing seven submarginal dull orange-ochreous internervular spots. Large black spots as follows:—one subbasal and one median spot in cell, and one oblique transverse spot at end of cell on discocellulars. About midway between end of cell and apex an oblique transverse bar of confluent spots from costa to nervule 4. Below this and nearer end of cell a spot in area 3. In area 2 a spot, touching median and nervules 2 and 1b. In area 1b one submarginal and one subbasal spot, and between these, in area 1a, a median inner marginal spot. H.-w. with more or less confluent basal spots and a broad black hind margin bearing seven small whitish spots, that in 1c doubled. Discal area more or less suffused with whitish, and bearing black spots as follows:—in area 7 a subbasal and a median spot, followed by three in

6, 5, and 4, each progressively nearer to margin, one in area 3 rather more basally placed, a large spot in 2, touching median and nervules 2 and 1c. One spot in 1c, and one in 1b. Two spots obliquely placed on discocellulars, the upper one sometimes very small.

Underside, f.-w. as above but rather duller and the subapical area pinkish. H.-w. as above but discal area pinkish with red on inner margin, and along inner edge of hind marginal border; the latter bearing white spots larger than on the upperside. Black basal area bearing about four white spots. Areas 9 and 8 red, with a small black spot beyond precostal.

Head, thorax and abdomen black, the latter with white lateral spots. Claws unequal.

♀. Expanse 84 mm. Upperside resembles that of male but the ground-colour is brownish white (inclined to reddish in distal part of h.-w.), and the f.-w. submarginal spots are much paler yellow. Underside as in ♂ but ground-colour brownish white, base of f.-w. suffused with reddish, inner edge of h.-w. marginal black bordered with reddish ochreous; areas 9, 8, 1b, and 1a dull red.

This curious *Acraea* has the appearance of a very heavily marked and spotted example of *A. chilo*, but the wings are much more rounded. It is very closely allied to both *chilo* and *zetes acara*, indeed I am not quite satisfied that it is specifically distinct. The male armature is very similar to those of the two species named. *A. oscari* was described from Banka Malo, Abyssinia. Those in the National collection are from the Inderatcha and Charada Forests. (Kaffa.)

31. Acraea hypoleuca. Pl. VIII, f. 3.

Acraea hypoleuca, Trimen, Trans. Ent. Soc., p. 2, pl. 1, f. 1 (1898); Aurivillius, Rhop. Aeth., p. 96 (1898).

German S.W. Africa (Rehoboth).

♂. Expanse 60 mm. Wings orange ochreous. F.-w. costa very narrowly black. Subapical area somewhat paler than ground-colour. Hind margin very narrowly black and bearing a band of eight deep yellow spots, widest at apex and becoming very narrow at hind angle. This band of spots bordered inwardly with a narrow black suffusion. Black spots as follows. A minute and indistinct subbasal spot in cell followed by a large transverse spot, and another on discocellulars. About midway between end of cell and apex an oblique transverse band of five confluent rather small spots, the last almost separated. Beneath this but further from margin a spot in area 3. In area 2 a larger spot just below origin of nervule 3. In area 1b a reniform submarginal spot and a much smaller subbasal spot.

H.-w. very slightly suffused with black at base. Hind margin with a black border 2 mm. wide, bearing seven whitish internervular spots, that in 1c doubled. Discal spots, one in area 7 near middle, one in 6 nearer margin, one in 5 still nearer margin, one in 4 immediately beneath that in 5, one in 3 further from margin, one in 2 just beneath origin of nervule 3, and one in 1c nearer margin. An elongate transverse spot in cell and one at origin of nervule 5. A minute dot (in left wing only) below origin of nervule 6.

Underside. F.-w. as above but with subapical area creamy white. H.-w. creamy white with black spots as on upperside, and, in addition, basal and subbasal spots, one in area 8, one in 7, one in cell, and one each in 1c, 1b, and 1a.

Head and thorax black with pale spots. Basal part of abdomen blackish, remainder brownish yellow. Claws unequal.

The type, from which the above description is taken, still remains a unique example. Though closely allied to *A. chilo*, it has the appearance of being quite distinct from that species. Unfortunately no locality is marked on the label attached to the specimen, all the information there given being, "Coll. Watson, 1871." I think there is no doubt that the specimen was taken in Africa. There is in the Staudinger collection a specimen labelled *A. barberi*. This example is intermediate between Trimen's *A. barberi* ♂ and *hypoleuca*, and differs from the latter in the following points. There is a slight black basal suffusion, the black spots are larger, on the h.-w. underside the base is black enclosing white spots, and there are a few red internervular marks. I have carefully compared the specimen both with *barberi* and *hypoleuca*, and there is no doubt that it forms an almost perfect intermediate between them, with perhaps a somewhat stronger tendency towards the latter. This example was taken at Rehoboth in German S.W. Africa. It is most unfortunate that we are ignorant of the locality of *hypoleuca*. With the very small material at present at our disposal I consider it advisable to allow this form to remain separate, but at the same time I regard the specific distinction between *hypoleuca* and *zetes* as very doubtful in spite of the great difference between the typical patterns.

GROUP V.

32. Acraea anemosa. Pl. VIII, f. 6. Pl. XVI, f. 18.

Acraea anemosa, Hewitson, Exot. Butt. (*Acraea*), pl. 3, f. 14, 15 (1865); Trimen, S. Af. Butt., 1, p. 157 (1887); Rogenhofer, Verh. d. k. k. z. b. Ges. Wien., 42, p. 574 (♀ abd., f. 2) (1892); Aurivillius, Rhop. Aeth., p. 91 (1898); Butler, Proc. Zool. Soc., p. 54 (1898); *l. c.*, p. 192 (1898); *l. c.*, p. 401 (1898); Marshall, Trans. Ent. Soc., p. 413 (1902); Dixey, Proc. Ent. Soc., p. iii (1906); Longstaff, Proc. Ent. Soc., p. xii (1906); Rogers, Trans. Ent. Soc., p. 525 (1908); Neave, Proc. Zool. Soc., p. 12 (1910); Fountaine (metam.), Trans. Ent. Soc., p. 60, pl. 10, f. 16a, 16b (1911).

Damaraland; Khama's Country; Transvaal; Swaziland; Zambesi R. (Victoria Falls); Rhodesia; Portuguese E. Africa; German E. Africa; British E. Africa.

f. *arcticincta*, Butler (*A. arcticincta*), Ann. Nat. Hist. (5), 12, p. 103 (1883); Proc. Zool. Soc., p. 658 (1893); Aurivillius, Rhop. Aeth., p. 91 (1898).
= *anemosa*, Staudinger, Exot. Schmett, 1, p. 83, pl. 33 (1885).
(Appears not to be confined to any particular locality.)

f. *interrupta*, Thurau, Berl. Ent. Zeit., p. 301 (1903).
Uganda.

f. *mosana*, Suffert, Iris., p. 20 (1904).
(No loc.)

f. *dubiosa*, Suffert, *l. c.*
German E. Africa (Tanga); British E. Africa (Mombasa).

f. *ufipana*, Strand, Mitt. d. Zool. Mus., Berl., p. 279 (1911).
German E. Africa (Mwera); Rhodesia (Alala Plateau).

f. *urungensis*, Strand, *l. c.*, 1911.
German E. Africa (Kitungulu).

A. anemosa anemosa.

♂. Expanse 60–70 mm. F.-w. deep yellow to orange. Costa narrowly black. Hind margin black about 4 mm. wide at apex rapidly narrowing to a thin black line which reaches the hind angle. At base a black patch having a variably shaped but usually well-defined outline, extending into cell as far as origin of nervule 2, usually about the same distance into area 1b, but never into area 2. At end of cell on discocellulars a linear black spot of variable width (sometimes absent). Beyond cell an oblique transverse bar of coalescent black spots extending from costa to nervule 4, followed by a spot in area 3, which may be very minute or so large as to be confluent with those above it. In area 2, a little beyond origin of nervule 3, a spot of very variable size (sometimes absent). In 1b immediately below this there may be another spot. (In examples from Mombasa these two spots are nearly always large and well developed.)

H.-w. brick red. A fairly well-defined basal black patch, extending to nearly half the length of cell. A hind-marginal black border of very variable width (4 to 10 mm.) the inner edge of which may be well defined or much suffused. Rarely seven minute whitish submarginal dots. In one or two examples before me there are a few minute discal spots, visible only on the upperside, their position being the same as in *A. astrigera.*

Underside. F.-w. Black markings as on upperside. Ground-colour a little paler. The subapical area with a considerable powdering of white scales. H.-w. Black markings as on upperside. Marginal band bears seven small white spots, that in area 1c being doubled. In area 1b close to inner margin a narrow white streak. (Sometimes also in 1a.) Basal black patch bears about eight or nine white spots. Discal area pale pink bordered with darker pink basally, distally, and at inner margin. (Along the inner edge of the black hind-marginal border this dark pink nearly always forms a more continuous band than in *A. welwitschii.*) Thorax black with white spots above and below, abdomen black shading to deep ochreous towards extremity, brown to ochreous beneath, and bearing white lateral spots. Claws unequal.

♀. 65–70 mm. Ground-colour above and below duller than in ♂ and h.-w. sometimes dusky brown. Abdomen usually blacker. Other features as in ♂ and with about same range of variation.

A. anemosa f. *arcticincta*, Butl.

A form with an unusually narrow h.-w. hind-marginal border.

A. anemosa f. *interrupta*, Thur.

The reddish yellow ground-colour extends into cell as a narrow wedge-shaped spot in the black basal area of the f.-w. from the subcostal towards the median, so that an elongated quadrate spot about 2 mm. broad is thereby produced. (1 ♂ Uganda.)

A. anemosa f. *mosana*, Suff.

Discal spots absent in f.-w. (1 ♂ in Berl. Mus.)

A. anemosa f. *dubiosa*, Suff.

Five minute discal spots in h.-w. The author seems to suggest that this may be a hybrid between *anemosa* and *astrigera*. Of this I do not think there is any evidence. Three examples before me (from Mombasa) agree with Suffert's description. The ♂ armature is in no respect different from that of *anemosa*.

A. anemosa f. *ufipana*, Strand.

H.-w. border narrow as in *arcticincta*. A central transverse band of three black spots in f.-w. The first on discocellulars, the second beyond it in area 2, the third in 1b. In area 3 beyond the discal spot, a round black spot the same size as those in 1b, and 2. The black basal area of f.-w. reaches the middle of cell and is 9 mm. long. No white spots on h.-w. border.

There is a similar example in the Oxford Museum from the Alala Plateau.

A. anemosa f. *urungensis*.

Resembles f. *interrupta*, Thur., but the f.-w basal black is much reduced, somewhat as in *welwitschii*, Rogenhofer, forming a blackish streak in the upper half of cell. The h.-w. basal black is also reduced. The discocellulars only indistinctly dusted with black. At inner edge of marginal border of the h.-w. underside there are seven or eight white spots enclosed by crescentic red spots. This example is scarcely separable from the ♀ of *A. welwitschii lobemba*.

The early stages of *anemosa anemosa* are thus described by Miss Fountaine (*l. c.*)—

"This very handsome, extremely active little larva, occurred very commonly at Macequece, on almost every available piece of its food-plant, a creeper, identified at the Board of Agriculture at Pretoria as (most probably) *Modecca abyssinica*. I first discovered it, in the usual way, by watching a ♀ laying eggs; these are laid in batches of various sizes, some with about ten eggs together, others having as many as twenty-five or even more. The larva is very easy to rear, and feeds up very rapidly, and it remains only about eight days in pupa; but where the difficulty comes in, is that the supply of its food-plant should meet the demand, as it is a dark-coloured very inconspicuous little creeper, most difficult to find, and when a piece is discovered it is generally already sustaining two or three more larvae of the same species. In colour it is a bright shiny red-russet shaded into deep yellow at the extremities, the spines are long, furry and black. The pupa is dingy white in ground-colour, the wing case the same, but heavily outlined and veined in black, the rows of abdominal spots are deep orange, very heavily surrounded with black."

The species extends right across Africa from Damaraland to Delagoa Bay and thence northwards to British E. Africa. It has been noted by both Dixey and Marshall as having an unpleasant smell. Though distinct from *A. astrigera* it is so closely allied to *A. welwitschii* that it is somewhat doubtful whether each should be accorded specific rank. There is a slight difference in the structure of the respective ♀ genital plates. I have however seen specimens of *anemosa* ♀ which could not with certainty be distinguished by colour and pattern from some ♀♀ of *welwitschii lobemba.* The form *urungensis* has this appearance.

33. Acraea welwitschii. Pl. VIII, f. 7.

Acraea welwitschii, Rogenhofer, Verh. Ges. Wien, 42, p. 573–4, f. 1 (♀ abd.) (1892); Aurivillius, Rhop. Aeth., p. 91, f. 10 (?) (1898).

=*anemosa*, var. Dewitz, Nov. Act. Nat. Cur., 41, 2, p. (17) (189), (1879).*

Angola (Loanda, Ceramba, Bange Ngola, Bumba).

A. welwitschii alboradiata, subsp.

= *A. anemosa*, ab., Aurivillius, Rhop. Aeth., p. 91 (1898); Trimen, S. Af. Butt., 1, p. 158 (1887); Proc. Zool. Soc., p. 28 (1894).

Victoria Falls.

A. welwitschii lobemba, subsp. n.

= *A. welwitschii*, Neave, Proc. Zool. Soc., p. 12, pl. 1, f. 2 (1910).

L. Bangweolo; Lualaba R.

A. welwitschii welwitschii. Pl. II, f. 4 (♂), f. 5 (♀).

♂. Expanse 50–64 mm. F.-w. bright red. A basal black patch of somewhat irregular outline, extending about half the length of cell and thence to inner margin, not encroaching upon area 2. Costa dusted with black. A hind-marginal band of

* I have examined the example described by Dewitz, and it agrees with the typical ♀ of *welwitschii.*

black 4 to 6 mm. wide at apex and tapering to nothing at hind angle, its inner edge not sharply defined and tending to brownish, sometimes with red scales on the internervular folds. A little beyond cell an oblique discal bar of black, widest at costa and extending to nervure 4, followed by a small round spot in area 3. Below nervule 3 and a little beyond its origin, a rounded spot (sometimes absent). At end of cell on discocellulars an oblique transverse black spot. H.-w. with a broad inwardly suffused black hind-marginal border reaching nearly to the cell. Base suffused with black extending to half the length of cell. Discal area white, areas 7 and 6, and 1b at anal angle suffused with pink, sometimes a slight powdering of the same colour in 4 and 5, at outer edge of white. In some examples a faint discal row of greyish spots in 7, 6, 5, and 4 (gradually lost in marginal border). Fringes of both wings black touched with white between the nervules.

Underside. F.-w. deep pink, the subapical area powdered with greyish white, and marked on the internervular rays with orange ochreous. Apical black much reduced, remaining black markings as on upperside, a minute white subbasal spot above costal nervure. H.-w. Black basal and marginal areas as on upperside but sharply defined. Discal area milk white bordered basally and distally with internervular red markings. Basal black bears eight or nine white spots, and on marginal black is a row of seven minute white spots, that in 1c doubled. A submarginal white line in 1b, and sometimes also in 1a.

Thorax black with two or three white spots above and many below. Abdomen black at base shading into orange ochreous at extremity, and laterally spotted with white. Claws unequal.

♀. Expanse 55–60 mm. F.-w. dull ochreous. Black markings as in ♂. Sometimes a powdering of white at costa in subapical region. Basal black tends to be reduced between median and inner margin. H.-w. suffused with black at base extending to about one-third the length of cell. A broad hind-marginal black border more clearly defined than in ♂ and sometimes showing extremely minute internervular whitish dots. Remainder of wing dull ochreous with a central white suffusion from nervule 7 to inner margin.

Underside. F.-w. paler ochreous. A minute white spot near base above costa. Subapical area milk white, with internervular ochreous markings. Apical black much reduced. H.-w. as on upperside, but whole discal area creamy white bordered basally and distally with red. Basal black bears white spots and hind-marginal black border bears larger white spots than in the male, and between it and the red margin of the discal area are internervular crescentic spots of the ground-colour. Fringes of both wings spotted with white as in ♂. Thorax black, spotted with ochreous above and white below. Abdomen ochreous with lateral white spots.

A. welwitschii alboradiata, subsp.

♂. Expanse 58–60 mm. F.-w. deep pink. A black basal suffusion extending about one-third the length of cell and not reaching origin of nervule 2. Costa black. A black apical and hind-marginal border narrower at apex than in *welwitschii* and very narrow along margin, its inner edge rather clearly defined. At end of cell on discocellulars a transverse linear spot (sometimes absent). A little beyond cell a band of black, broadest at costa and ending at nervule 4. Subapical area suffused with white and marked between nervules with orange ochreous. Occasionally a black spot in 3 just below discal band, and a second in 2 a little further from margin. Very rarely a spot in 1b almost directly under that in 2. H.-w. white with a broad well-defined black border and a small black basal suffusion. Area 7 and distal portions of 6, 5, and 4 suffused with pink, the same colour sometimes extending along inner edge of black border even as far as inner margin.

Underside. F.-w. as on upperside but ground-colour paler. A minute white dot near base above costa. H.-w. as on upperside, but pink only at basal and distal edges of white area. Basal and marginal black with white spots as in *welwitschii*, but those on border larger than in type form. Thorax and abdomen as in *welwitschii*.

♀. Resembles ♂ but generally somewhat larger.

A. welwitschii lobemba, subsp.

♂. Expanse 56–70 mm. Wings deep cherry red. F.-w. with a sooty black basal suffusion extending in cell to origin of nervule 2, and thence to inner margin, costa black. Hind margin broadly black at apex gradually narrowing to hind angle. A little beyond cell, an oblique discal band of black broadest at costa and ending at nervule 4, followed by, and sometimes confluent with, a rounded spot in 3. Below nervule 3 and just beyond its origin a rounded spot. In area 1b about 6 mm. from margin a crescentic spot followed by a double spot nearer margin. (These last may be absent.)

H.-w. with black basal suffusion extending to half the length of cell and bearing numerous white hairs. A broad black hind-marginal border, rarely bearing minute white internervular spots.

Underside. F.-w. Rose pink. A minute white dot near base above costal. Black markings as on upperside but apical and marginal border much reduced. Subapical area bluish white with elongated triangular internervular orange marks. H.-w. Basal black very sharply defined and spotted with white as in previous forms. Broad black marginal border with medium-sized internervular white spots, a white submarginal streak in 1b, and 1a. Discal area pinkish white bordered basally and distally with red internervular marks. Fringes in both wings spotted with white. Thorax sooty black with two or four white spots above and many below. Abdomen black above, to near extremity, remainder deep orange.

♀. Resembles ♂ but f.-w. brownish ochreous, and basal black much reduced in areas 1a and 1b, hind-marginal border much narrower. H.-w. rather duller than in ♂. Underside with ground-colour of apical area of f.-w., and discal area of h.-w., creamy white. H.-w. hind margin spots creamy white and larger. Abdomen, and in some cases thorax, reddish ochreous. Dorsal thoracic spots more conspicuous.

Some ♀ examples are much paler and lack the discal spots in f.-w. An example of this kind before me is almost indistinguishable from some specimens of *A. anemosa.*

That *welwitschii* and *anemosa* are really different species seems to me extremely doubtful. Series of preparations of the genitalia show that, allowing for a narrow limit of individual variation, there is little or no constant difference. In the ♀ genital plate there is a small but noticeable difference, those of *welwitschii* and *alboradiata* being alike and differing slightly from that of *anemosa.* With our present conception of species-formation it is inevitable that we should occasionally find forms which are so near to the line of specific distinction that we cannot say with certainty, on which side they lie. Meanwhile I have kept *anemosa* separate from *welwitschii,* though it matters little whether we regard them as specifically distinct or not.

A single ♂ from Angollo (Angola) in the Tring collection is intermediate between *welwitschii* and *alboradiata* and has a white mark in area 1b of f.-w.

Neither Aurivillius' description nor figure of *welwitschii* quite agrees with the original reference of Rogenhofer. That author describes the ♀, and I have been fortunate enough to obtain a cotype from amongst the Felder specimens at Tring. With it is one ♀ and four ♂♂ from the same locality, and these specimens are as here described. All have white patches on the h.-w., and in this respect, as also in the ground-colour, they differ from the examples described by Neave. The latter I must therefore regard as a subspecies of typical *welwitschii.* Aurivillius' figure agrees more nearly with this form than with the type. So far as I am aware the typical ♂ is here described for the first time. Rogenhofer, in order to distinguish between his species and *anemosa* gives text figures of the female "seal" of each species and points out certain differences. This peculiar structure is not however reliable for the discovery of minute differences. I have placed a female of each form under the microscope, in such a position that the extremity of each abdomen could be clearly seen in the field at the same time, and in this case the two structures appeared to be identical as indeed we should expect when the male organs are so very similar.

The type form of *welwitschii* is known to me only from Angola, those before me bearing the labels Loanda, Ceramba, Bange Ngola, and Bumba. The subspecies *alboradiata* appears to occur only in the neighbourhood of the Victoria Falls on the Zambesi. The specimen described by Trimen as a variety of *anemosa,* is labelled Damaraland, and as a strip of the northern part of that province almost reaches the neighbourhood of the Falls, the example may have been taken in that region. The subspecies *lobemba* was taken in large numbers by Neave in the region of L. Bangweolo, and a few examples as far W. as the Lualaba River.

34. Acraea pseudolycia. Pl. VIII, f. 8.

Acraea pseudolycia, Butler, Cist. Ent., 1, p. 213 (1874); Proc. Zool. Soc., p. 658 (1893); Aurivillius (*A. zetes*, var.), Rhop. Aeth., p. 91 (1898); Eltringham, Novit. Zool., xviii, p. 151 (1911).

Angola (Pungo Andongo, Canhoca).

f. *astrigera*, Butler (*A. astrigera*), Proc. Zool. Soc., p. 421, pl. 25, f. 5 (1899); Suffert, Iris., p. 23 (1904); Neave, Proc. Zool. Soc., p. 12 (1910).

British E. Africa (Machakos, Campi-y-Simba, Ft. Hall, Kenya); Rhodesia (near L. Young); German E. Africa (Mpwapwa, Usambara, Mhonda, Uhehe, Ugogo, Rukwa).

♀ f. *emini*, Weymer, Iris., p. 221, pl. 2, f. 2 (1903); Suffert, Iris., p. 23 (1904); Eltringham, Novit. Zool., xviii, p. 151 (1911).

German E. Africa (Mhonda, Ugogo).

f. *brunnea*, Eltringham, Novit. Zool., xviii, p. 151 (1911).

German E. Africa (Rukwa Steppe, Masindi); British E. Africa (Kitui); Uganda (Unyoro, Entebbe); N.E. Rhodesia (Awemba); Angola (Makweta, Guimbungo, Pungo Andongo).

A. pseudolycia pseudolycia. Pl. I, f. 5 (♂).

Expanse about 74 mm. F.-w. white. Base suffused with black, costa powdered with blackish. Apex rather broadly black, and hind margin deeply suffused with sepia. There is a submarginal row of rather ill-defined deep ochreous spots. Black spots as follows:—One in cell near base, one, large, in cell over origin of nervule 2, an irregular patch of black beyond cell, partly confluent with a spot on discocellulars. A spot near base of area 2, a subbasal and a submarginal in 1b, and a central spot in 1a.

H.-w. white with some black at base, enclosing a white spot near base of cell. A discal row of black spots in 7, 6, 5, 4, and 3, and a spot in 2 near origin of nervule 3. A broad black marginal border edentate on the nervules, and inwardly edged with deep ochreous, and bearing white internervular dots. Underside resembles the upper, but in f.-w. there is less dark marginal suffusion, and in the h.-w. the basal black encloses six or seven white spots, and there is an additional black spot in 1b. The white spots in the border are larger.

Head and thorax black with white spots. Abdomen black at base, remainder ochreous, and bears white lateral spots. Claws unequal.

♀. Resembles ♂ but wings are more rounded.

A. pseudolycia astrigera. Pl. I, f. 1 (♂), f. 10 (♀).

♂. Expanse 55–70 mm. Wings rosy red (liable to vary much in intensity). F.-w. with a black basal suffusion. Costa narrowly black. A black hind-marginal border moderately wide at apex and very narrow from nervule 4 to hind angle. Black spots as follows:—In cell, one near base (often obscured), one a little beyond middle, and a linear spot at end on discocellulars. One in 1b near base (often absent or obscured by the basal black) and one near margin, sometimes followed by an indistinct submarginal spot. One in 2 close to median, and one in 3, above which, and a little beyond cell is a transverse patch widening towards and joining with the costal black. The subapical area between this patch and the apex is deep orange, this colour extending to the hind angle.

H.-w. with black basal patch extending to about middle of cell and a black marginal border about 3 mm. wide, bearing seven minute white dots (sometimes very indistinct). A discal row of small black spots, very variable in number and size, when all present one in each internervular space. (These spots are more distinct on underside.)

Underside. F.-w. rosy pink, spots as on upperside, with an additional minute dot near base above costal, preceded by a white dot at base, and in some specimens an extra black spot at base of cell. The separation of the basal black into spots distinguishes this species from *anemosa*. The deep orange subapical area powdered with white which divides the yellow ground-colour into more or less triangular spots. H.-w. with a sharply defined black basal patch edged with red and bearing at least six white spots, two in cell, one in 1a, 1b, 1c, and 7. Black margin as on upperside but with larger white spots (that in 1c doubled), and inner edge bordered with red internervular marks. Discal black spots, when all present, as follows :—One in 7, 6, 5, and 4, roughly parallel to margin, one in 3 rather nearer base, one in 2, close to median, one in 1c on a level with that in 3 (usually doubled), one in 1b nearer base, and one in 1a often joined to basal black.

Fringes, especially in h.-w., marked with white between nervules. Thorax black with four white spots above and about eight below. Basal portion of abdomen black, remainder deep orange, and having white or whitish lateral spots.

♀. Expanse 57–70 mm. Wings usually rather more rounded than in ♂, and margin of h.-w. tending to be somewhat serrated. Ground-colour variable but paler and much duller than in ♂. Basal black often very faint on upperside, discal spots of h.-w. usually larger than in ♂, though sometimes only showing through from underside. Underside f.-w. pale yellowish pink, the white subapical powdering more accentuated than in ♂. Discal portion of h.-w. creamy white. Distal portion of abdomen dull ochreous instead of orange.

A. pseudolycia ♀, f. *emini*. Pl. I, f. 2.

Differs from the *astrigera* form in its usually larger size, and in the great reduction or absence of dark basal suffusion especially in the f.-w. The outer edge of h.-w. has the appearance of being serrated though this is largely due to the depth of the white internervular fringes. The discal spots of h.-w. are well developed and the ground-colour tends to invade the marginal black along the nervules.

A. astrigera, f. *brunnea*. Pl. I, f. 4 (♂), f. 3 (♀).

The rosy red and orange of the *astrigera* form is here replaced by dull brownish ochreous, and the two sexes are alike in colour. In Angola examples there is sometimes a more or less distinct white subapical bar on the upperside of the f.-w. The f.-w. apical and hind-marginal black may be broader, suffused, and bear marginal yellowish marks. H.-w. discal spots often larger than in typical form.

It is not without much consideration that I have arrived at the conclusions embodied in the above synonymy. Isolated examples of the different forms would provide comparatively little evidence of specific identity, but I have been fortunate enough to secure from various sources a fine series numbering between thirty and forty examples, the localities ranging from German E. Africa to Angola. There are males and females of each form (except f. *emini*), and a series of preparations of the genitalia shows no differences of structure. Weymer assumed that his *Acraea emini* was a ♂, though owing to the imperfection of the specimen he was unable definitely to decide. It is larger, a little brighter in colour than the ordinary ♀ of the form *astrigera*, and has more rounded wings, but cannot be specifically separated. Moreover I have before me a ♀ which agrees precisely in shape, depth of colour, and in every detail of pattern with Weymer's description and figure of *Acraea emini*. This specimen is accompanied by two ♂♂ which, except for a slight difference in depth of tint of the ground-colour, agree precisely with *astrigera*. Suffert, on the assumption that Weymer's specimen was a male, recorded (*l. c.*) an example of the female which he described as very similar to the supposed male. From these facts I conclude that Weymer's *A. emini* is a female, and further that it is a ♀ form of *pseudolycia astrigera*.

An examination of the dates borne by examples before me shows that the different forms are not seasonal. The geographical distribution is somewhat peculiar. The red and orange form seems only to occur at the eastern end of the range of the species, but it is accompanied by the form *brunnea* and by intermediates. The white or typical form appears only to occur in Angola, but is there accompanied by the *brunnea* form and by intermediates. Thus strictly speaking *astrigera* is a subspecies in relation to the typical *pseudolycia* whilst *brunnea* is a form of both.

The male genital armature of all these forms is the same, but differs from that of *anemosa* and *welwitschii*.

35. Acraea turna. Pl. VIII, f. 9.

Acraea turna, Mabille, Pet. Nouv. Ent., 2, p. 158 (1877); Hist. Nat. Mad. Lep., 1, p. 99, pl. 12, f. 8, 9 (1885–7); Aurivillius, Rhop. Aeth., p. 95 (1898).

f. *marmorata*, Smith & Kirby (*A. marmorata*), Rhop. Exot., 19 (*Acraea*), p. 9, pl. 3, f. 7, 8 (1892); Aurivillius, Voeltzkow Exp., p. 315 (1909).

Madagascar (Morondava, Tulear, Mahobo).

♂. Expanse about 60 mm. Wings creamy white with sepia black spots and markings. F.-w. base suffused with sepia extending to two-thirds the length of cell, slightly into area 2, in upper part of 1b nearly to middle, and slightly less in 1a. Costa dusted with sepia. An apical and hind-marginal border about 5 mm. wide at apex narrowing to about 2 mm. along margin to hind angle and bearing ochreous internervular spots. A small spot in cell rather before middle followed by a larger obliquely transverse spot, and usually a black mark on discocellulars. Beyond the cell a discal band of spots, wide at costa, becoming narrower posteriorly, and ending (in area 3) in a large rounded spot. A large spot in 2 close to median. A submarginal and a subbasal spot in 1b. H.-w. with a slight basal suffusion and a hind-marginal border about 4 mm. wide, the inner edge of which is rather indistinctly defined but with a marked indentation of the ground-colour in area 4. On this border and close to margin is a row of seven minute internervular white spots. Margin slightly serrated and fringes spotted with white. A discal row of eight spots, the first four (in 7, 6, 5, 4) lie almost in a straight line from middle of costa to middle of hind margin (sometimes this line of spots has a slight outward curve). The fifth spot is in 3 and further from margin, the sixth in 2 near median, the seventh and eighth (in 1c and 1b) nearer margin. The basal and subbasal spots are more easily seen on underside, but those in cell and 1c are well developed above.

Underside. F.-w. along costa to end of cell, for two-thirds of length of cell, and slightly in 1b and 1a, suffused with dull pink, otherwise much as on upperside but paler and markings less well defined. A whitish powdering round yellow apical submarginal spots. A minute black dot on costa about 3 mm. from base, a linear black mark in area 11 near middle, and a black dot in same area above end of cell.

H.-w. as on upperside but whiter and without basal suffusion; the hind-marginal border much paler, and the white dots are followed inwardly by elongated ochreous spots. The discal spots are as on upperside. A basal spot in 8 near precostal, a crescentic spot in 7, a small round spot followed by a second of crescentic shape in cell, one in 1c, 1b, and 1a. Sometimes a dot near end of area 1a. Area 9, base of 1a, and a small mark in 7, and 1c pink. Head black with a few pale spots, thorax black above with whitish lateral spots, and whitish below, abdomen black above, whitish below, with pale rings and lateral spots. Claws unequal.

♀. Mabille describes the ♀ as resembling the ♂ but more heavily marked. A ♀ example before me is rather less heavily marked than the male and the ground-colour is pure white. The f.-w. is much more rounded than that of the ♂.

A. turna f. *marmorata*.

In this form the ground-colour is bright ochreous, the dark markings are heavy and in the f.-w. partly confluent. In one example before me the two cell spots in h.-w. coalesce to form a black ring. The example figured by Grose-Smith is stated to be a ♀ and has the h.-w. rather paler than the primaries.

The difference in colour from that of the typical form is not seasonal and both the latter and f. *marmorata* occur together.

A. turna is rare in collections. It appears to be allied to *A. pseudolycia*.

GROUP VI.

36. Acraea egina. Pl. VIII, f. 1. Pl. XVI, f. 17.

Acraea egina, Cramer, Pap. Exot., (*Pap.*) 1, p. 64, pl. 39, f. F, G (1775); Staudinger, Exot. Schmett, (*A.*) 1, p. 83, pl. 33, ♂ and ♀ (1885); Haase, Bibl. Zool., 8, 2, pl. 4, f. 26 (1891); Karsch, Berl. Ent. Zeit., 38, p. 195, 198 (1893); Aurivillius, Rhop. Aeth., p. 92 (1898); (metam.), Arkiv. för Zool., Bd. 3, No. 1, figs. (1905); Neave, Proc. Zool. Soc., p. 13

(1910); Eltringham, Af. Mim. Butt., p. 66, pl. 6, f. 1, 2 (1910); Grünberg, Sitzb. Ges. Nat. Fr., p. 148 (1910).

= *rudolphina*, Herbst, Naturs. Schmett, (*Pap.*) 5, p. 7, pl. 81, f. 1, 2 (1792).

♀ = *persephone*, Fabricius, (*Pap.*) Syst. Ent., 3, 1, p. 174 (1793); Godart, Enc. Méth., (*A.*) 9, p. 234 (1819).

= *zidora*, Godart, Enc. Méth., 9, p. 237 (1819); Lucas, Lep. Exot., pl. 52, f. 1 (1835); Blanchard, Cuvier, Reg. Animal, ed. 3 (*Insecta*), pl. 134, f. 2 (1836); Lucas, in Chenu, Enc. Hist. Nat. Pap., p. 11, f. 33 (1853).

Senegal; S. Leone; Gold Coast; Lagos; Liberia; Ashanti; Togo; Cameroon; Gaboon; Bangala; Angola; Congo (Lokolele, Stanley Pool); N.E. Rhodesia; Uganda (Entebbe, Unyoro, Pt. Alice, Kampala, Sesse I.); British E. Africa (Nandi); German E. Africa (Kwidgwi I., Ukerewe I., Bukoba); Nyassaland (Bandawe); Pemba I.

A. egina, f. *harrisoni*, Em. M. B. Sharpe, Entomologist, p. 132 (1904).

Rhodesia (L. Bangweolo, Kalungwisi Valley, Lofu Valley); Uganda (Sesse I.); British E. Africa (Tiriki Hills); Nyassaland (Bandawe).

A. egina areca, subsp.

Mabille, Ann. Ent. Fr. (6), 8 Bull., p. 169 (1888); Mabille & Vuillot, Nov. Lep., 10, p. 100, pl. 14, f. 5 (1893); Butler (♀), Proc. Zool. Soc., 1893, p. 658 (1894); Aurivillius, Rhop. Aeth., p. 93 (1908); Eltringham, Af. Mim. Butt., p. 66 (1910).

= *khara*, Gr.-Smith, Ann. Nat. Hist. (6), 3, p. 128 (1889); Smith & Kirby, Rhop. Exot. (*Acraea*), pl. 2, f. 1, 2 (1889); Rogenhofer, Ann. Mus. Wien, 6, p. 457 (1891).

Nyassaland (Zomba); German E. Africa; British E. Africa; Pemba I.; S.E. Rhodesia.

A. egina medea, subsp.

Cramer, Pap. Exot., (*Pap.*) 1, p. 128, pl. 81, f. C, D (1775); Herbst, Naturs. Schmett, 4, p. 200, pl. 80, f. 3, 4 (1790); Kirby, Handb. Lep., (*A.*) 1, p. 38, pl. 7, f. 4 (1894); Aurivillius, Rhop. Aeth., p. 92 (1898); Ann. del Mus. Civ. Genov., 3, vol. 4 (1910).

= *pasiphaë*, Fabricius, Spec. Ins., (*Pap.*) 2, p. 33 (1781); Godart, Enc. Méth., (*A.*) 9, p. 235 (1819); Duncan, For. Butt., p. 143, pl. 12, f. 4 (1837).

= *medoa*, Palisot de Beauvois, (*Pap.*) Ins. Af. Amer., p. 220, pl. 6, f. 2a, 2b (1805).

= *saronis*, Hübner, (*Telch.*) Verz. bek. Schmett, p. 27 (1816).
PRINCES I., W. AFRICA ; ? SENEGAL.

A. egina egina. Pl. VI, f. 15 (larva).

♂. Expanse 70–80 mm. F.-w. sepia black, the discal area from about middle of cell to the subapical region rather more thinly scaled, nervures and rays black. In areas 1a, and 1b a bright red patch commencing beyond middle and terminating just before hind margin. Black spots of rather suffused outline as follows. One in cell just above origin of nervule 2, and one on end of cell ; just beyond cell a row of five more or less confluent spots in 10, 6, 5, 4, and 3, one spot in area 2 adjacent to median, and beneath this but nearer margin a spot in 1b ; in the same area a small subbasal spot nearly touching the median. H.-w. bright red, paler at costa and inner margin, with black basal area extending to end of cell, and a black hind-marginal border about 2 mm. wide, rather deeply edentate at the nervules and sometimes showing traces of pale internervular spots. Black discal and basal spots as on underside, but more or less hidden by basal suffusion.

Underside. F.-w. pale sepia, with dark internervular rays and spots as on upperside. Above costal a basal and a subbasal black spot. Base of area 1b faintly pink, and red in areas in 1a and 1b replaced by dull pink. H.-w. Base red, followed by greenish grey with internervular patches of ochreous. Median discal band dull pink, edged with dark ochreous at junction with black hind-marginal border, the latter bearing seven quadrate dull green internervular spots. Inner margin pale yellowish green. Black discal and basal spots as follows :—A discal band of nine, those in 7 to 4 roughly parallel to margin (that in 5 small or wanting), the fifth (in 3) adjacent to end of cell, the sixth touching median and 2, the seventh rather nearer margin, the eighth nearer base, the ninth still nearer base. Two coalescent spots on discocellulars, one subbasal and one median in cell ; one in 8 near precostal, one basal and one subbasal in 1c, and one in 1b and 1a, the latter nearer base than the former. Head and thorax black, a white line between the eyes and two on thorax, with lateral crimson tufts on collar. Basal part of abdomen black with ochreous lateral spots. Remainder orange ochreous. Claws unequal.

♀. Expanse 80–90 mm. F.-w. thinly scaled, dull sepia grey, sometimes with a median pinkish suffusion. A more or less developed whitish subapical bar. Spots as in ♂ but dull grey. H.-w. slightly darker, sometimes reddish grey, spots and marginal border as in ♂ but paler. Underside. F.-w. dull greenish grey, sometimes pinkish from subbasal to subapical area. Nervules and rays well marked, blackish. Spots as on upperside. H.-w. pale greenish grey, spots and markings as in ♂ but usually paler. In some examples the spots and hind-marginal border are as in the ♂ but the basal red is absent and the other colours only faintly represented. Abdomen black above, ochreous beneath, and with ochreous lateral spots.

Examples of *A. egina* from British E. Africa frequently have the red colour of a more brilliant and rosy tinge than in W. African examples, and the colouring of the underside is very brilliant. In the f.-w. the apical inter-nervular spaces are deep orange, and areas 1a and 1b bright pink. In the h.-w. the base is rose pink, the sub-basal spots and nervures are surrounded with green, the discal area is deep orange with a median pink suffusion, and the hind-marginal border is green with a black inner edge and black on the ends of the nervules.

Many examples from N.E. Rhodesia are of this brilliant colouring with the apical red streaks of the *harrisoni* form. Some of the examples taken by Neave on Chirui and Chishi Is., L. Bangweolo, are of the *harrisoni* form.

A. egina, f. *harrisoni.*

In this form there are in the ♂ (and less obviously in the ♀) streaks of the red colour in the internervular spaces of the apical portion of the f.-w. The underside colouring is much more brilliant than in ordinary examples. In the ♀ the f.-w. is much suffused with reddish and the h.-w. is red as in the ♂ but rather paler and the black spots smaller.

A. egina areca, subsp.

♂. Expanse 70–80 mm. F.-w. orange red with a trace of an oblique whitish subapical bar; costa, apex, and hind margin brownish black and a suffusion of same colour at base and on nervures. Black spots as in *egina* but larger and the subapical discal row sometimes confluent with that on end of cell. H.-w. orange red with black suffusion at base, but of much less extent than in *egina egina*, and a black hind-marginal border about 2 mm. wide rarely slightly paler between the nervules. Spots as in *egina egina* but often smaller, less clearly defined, or obsolescent.

Underside. F.-w. as above but much paler. H.-w. base dull red followed by orange, inner margin pale yellowish green, and a greenish dusting round spots and nervules. Discal area yellowish pink, orange at outer edge. Spots on hind marginal band pale green.

♀. Expanse 80–90 mm. F.-w. pinkish ochreous, a well-marked white, semitransparent oblique subapical bar. Apex, hind margin, and spots dull sepia black. H.-w. pale to darker ochreous with a dusky basal suffusion on a reddish ground, and a black hind-marginal border, inwardly edged with orange ochreous. Underside a pale replica of the upper but the ground-colour of h.-w. is greenish with a few red markings at base.

A. egina medea, subsp. Pl. II, f. 1 (♂).

♂. Expanse 70 mm. F.-w. black at base; costa, apex, and hind margin broadly black. Discal area red with large confluent black spots, of which there are one in cell above origin of 2, one on end of cell, a broad band of spots beyond cell from costa to nervule 3, one at base of area 2, beneath and touching the latter a spot in 1b, and a second in the same area between base and origin of 2.

H.-w. black at base with a broad black hind-marginal border. Central area red, broken up by large and confluent black spots corresponding to those on underside.

Underside. F.-w. Base, costa, and hind margin sage green. From nervule 6 to 1 this colour is broken into spots by heavy black marginal arches between which, and the discal spots the wing is deep ochreous. The spots beyond cell both distally and proximally are edged with pink. Black spots as on upper side with two small ones near base of costa.

H.-w. orange at base, followed by sage green as far as end of cell. Beyond this pink, outwardly edged with orange and enclosed by a broad black marginal border bearing quadrate internervular sage green spots. Large confluent black spots as follows:—One in 8, two in 7, the second followed by a series of three lying in a curved band in 6, 5, and 4. A long patch on discocellulars, and a spot at base of 3 and of 2 the latter followed by large contiguous spots in 1c and 1b and a small spot in 1a. Two spots in cell the second followed by contiguous spots in 1c and 1b. A spot at base of 1c and a subbasal in 1a.

Head and thorax black with a few pale dots, proximal half of abdomen black, remainder orange.

♀. Expanse 80 mm. Spotted and marked as in ♂ but all the red areas replaced by dusky white and the dark areas rather brown black. Underside like that of ♂ but generally paler and duller, and all the pink areas replaced by white.

Abdomen black above with large yellowish white lateral spots.

This remarkable form occurs on Princes I., W. Africa. Some old examples bear labels indicating that they were taken on the mainland, but if the form ever did occur there it does not appear to do so now. Aurivillius (Ann. Mus. Genov., *l. c.*) records sixteen ♂♂ and eight ♀♀ taken on Princes I., Jan. to Aug. 1901. The Oxford collection possesses a ♀ kindly presented by Prof. Aurivillius. The ♂ I have figured is in the general collection in the Berlin Museum, and is labelled Senegal.

The larva and pupa of *A. egina* have been described by Aurivillius *l. c.*, and his short description agrees with the specimen figured on Plate VI. From an example before me the larva may be thus more fully described.

Length about 34 mm. Dorsal area pale yellow the junctions of the segments marked by fine black lines, in front of each of which the yellow is deepened to an orange tint. The rows of spines arise from rather broad black transverse lines. The yellow area is bordered by a rather broad dark brown line beneath which is a lateral line of pale yellow broken up into spots followed by a brown sublateral line. Head black with a bifurcated pale line. True legs black. Prolegs dark brown segmented with yellowish. Spines rather stout, black, with fine black bristles. The bases of spines slaty blue.

The typical *A. egina* extends from Senegal across Africa to Rhodesia, Nyassaland, and Uganda, whilst the subspecies *areca* occurs in Nyassaland, German E. Africa, and British E. Africa. It is a well-defined species easily distinguished from the forms to which it bears a superficial resemblance. A series in the Oxford collection, taken at Chirinda includes examples somewhat intermediate between *egina* and *areca.* The ♂ armature is quite distinct, and shows no close affinity with that of any other species.

GROUP VII.

37. Acraea cepheus. Pl. VIII, f. 12.

Acraea cepheus, Linnaeus, Syst. Nat., (*Pap.*) ed. 10, p. 487 (1758) ; Mus. Lud. Ulr., p. 252 (1764) ; Clerck, Icones. Ins., 2, pl. 43, f. 4 (1764) ; Mabille, Hist. Nat. Mad., Lep. (*A.*) 1, p. 98, pl. 12, f. 1, 2 (1885–7) ; Butler, Proc. Zool. Soc., p. 66 (1888) ; Aurivillius, Rhop. Aeth., p. 93 (1898) ; Butler, Proc. Zool. Soc., p. 26 (1901).

♀ = *baumanni*, Rogenhofer, Ann. Mus. Wien., 4, p. 551, pl. 23, f. 2 (1889).

CONGO (Kassai, Bumba, Aruwimi, Bopoto, Stanley Pool, Lokolele); GOLD COAST; ANGOLA (Loanda, Cugho R.); GABOON (Chinchoxo, Fernan Vaz., Lake Azingo); SUDÂN (Giraffe R., Bahr el Ghazal).

f. *abdera*, Hewitson, Exot. Butt. (*Acraea*), pl. 1, f. 1, 2 (1852); Aurivillius (♀), Ent. Tidskr., 12, p. 200 (1891).
= *cepheus*, Staudinger, Exot. Schmett, 1, p. 85 (1885).
♀ = *pheusaca*, Suffert, Iris, p. 25 (1904).

NIGERIA; FERNANDO PO; CAMEROON; GABOON; CONGO STATE (Sassa).

f. *eginopsis*, Aurivillius, Rhop. Aeth., p. 93 (1898).
TOGOLAND.

♀ f. *sucepha*, Suffert, Iris., p. 25 (1904).
Loc. as typical form.

♀ f. *nigrescens*, f. n.
Loc. as typical forms.

A. cepheus cepheus.

♂. Expanse 52–60 mm. Wings vermilion red. Costa, apex, and hind margin black. Black spots as follows:—One in area 11, about middle of length of cell. In cell a subbasal spot adjacent to subcostal, a large transverse median spot the whole width of cell, and a spot on upper and middle discocellulars. Just beyond end of cell a confluent band of quadrate spots, the lowest (in 3) with its long axis transverse. A submarginal spot in 2 and 1b, the former often confluent with marginal black. A large spot in 2 touching median and nervule 2. Below this in 1b and rather nearer margin a large spot. In 1b midway between base and origin of 2, a comma-shaped spot. A black linear basal mark in cell and 1b. Hind margin narrowly black. H.-w. with black basal suffusion in cell, 1c, 1b, and 1a. Black hind-marginal border 2 mm. wide, edentate on the nervules. Black spots as follows:—A zigzag discal row of nine, one in each internervular space. In area 7 a subbasal and a median spot. A small spot on the upper discocellular, two in the cell, and one in 1c, 1b, and 1a, these obscured by the basal suffusion.

Underside. F.-w. Rose pink, yellowish on the costa and immediately beyond the discal spots. Apex and hind margin dark ochreous with narrow brown internervular rays and broadly black nervules. Usually a minute black subbasal spot on costa. H.-w. pinkish ochreous, basal portion of areas 7, 6, 5, distal end of cell, and median part of 1c, 1b, and 1a rose pink. Black hind margin deeply edentate on nervules, edged inwardly with deep orange, and bearing seven ochreous internervular spots. Black spots as on upperside and three additional basal spots visible in 8, at base of cell, and in 1c. Head black with orange tufts on collar. Thorax black with two whitish dorsal lines, orange lateral spots, and ochreous spots beneath, basal half of abdomen black with lateral orange spots, remainder orange. Claws unequal.

♀. Expanse 56–60 mm. Sepia black. F.-w. spots as in ♂ (spots sometimes smaller). An oblique white subapical band in 6, 5, 4, and 3. H.-w. usually without basal suffusion. Black hind-marginal border with internervular quadrate spots of the somewhat paler ground-colour.

Underside f.-w. greyish mauve; costa, apex, and hind margin sage green with black nervules and rays. Spots often smaller, those near base may be very minute. H.-w. sage green spotted as in ♂. Head and thorax black with dorsal and lateral greenish white spots. Abdomen black above, pale ochreous beneath, with lateral white and sublateral pale ochreous spots.

A. cepheus f. *abdera*, Hew.

Differs from the typical form in the absence of the red colour from the space between the end of cell and discal row of spots, and there is sometimes a trace of a whitish subapical bar.

A. cepheus f. *eginopsis*, Auriv.

The red in f.-w. forms a median hind-marginal patch, giving an appearance similar to that in *A. egina.*

A. cepheus ♀ f. *pheusaca*, Suffert (= *abdera* ♀, Auriv.).

The ground-colour of the wings is brownish red, the spots are obsolescent, the costa, apex, and hind margin reddish brown, and the subapical bar dark ochreous. The h.-w. spots small and often obsolescent. The marginal border bears slightly paler internervular spots. Underside f.-w. as above but paler; costa, apex, and hind margin brownish ochreous. H.-w. pinkish brown, spots as in typical examples.

Aurivillius associates this form of ♀ more particularly with the *abdera* form of the ♂, but I do not think it is the only ♀ form occurring with the *abdera* ♂.

A. cepheus ♀ f. *sucepha*, Suffert.

In this form the ground-colour is nearly as bright a red as in the ♂, the subapical band of the f.-w. is white, slightly suffused proximally, with pale ochre yellow. The underside is typical.

A. cepheus ♀ f. *nigrescens*, f. nov.

This form represented in the Tring Museum has all the wings sepia, without the white subapical bar. In the h.-w. the external portion of the discal area is paler and is deeply invaded on the nervules by the black of the marginal border, and between them by the dark ground-colour. The spots are as in the typical ♂. On the underside the f.-w. is deep mauve, the costa, apex, and hind margin sage green. H.-w. pale sage green. Spots and markings as in typical examples. (Described from a Sierra Leone specimen.)

A series of ♀ examples shows various intermediates between these different forms, often from the same locality. Thus specimens from Fernan Vas R. (French Congo) show all gradations from the typical ♀ to the *pheusaca* form, a ♂ from the same locality being of the usual coloration. I do not feel justified therefore in assigning any particular ♀ to a distinctive form of ♂. One is tempted to regard these different forms of ♀ as to some extent seasonal, but the series here mentioned were all taken at the same time, viz. in the month of January, which seems to preclude this possibility.

38. Acraea petraea. Pl. VIII, f. 13. Pl. XVI, f. 4.

Acraea petraea, Boisduval, Voy. Deleg., 2, p. 589 (1847); Wallengren, Rhop. Caffr., p. 21 (1857); Hoppfer, Peters Reise. Ins., p. 373, pl. 34, f. 1-4 (1862); Trimen, Rhop. Af., Austr. p. 100 (1862); Oberthür, Etud. d'Ent., 3, p. 26, pl. 2, f. 4 (1878); Staudinger, Exot. Schmett, 1, p. 85, pl. 33 (1885); Trimen, S. Af. Butt., 1, p. 144 (1887); (metam.), *l. c.*, p. 145; Butler, Proc. Zool. Soc., p. 192 (1898); Aurivillius, Rhop. Aeth., p. 95 (1898); Fawcett (metam.), Trans. Zool. Soc., p. 294, pl. 46, f. 1, 2, 3 (1901); Marshall, Trans. Ent. Soc., p. 325 (1902); Dixey & Longstaff, Trans. Ent. Soc., p. 318, 328 (1907).

♀ (dry season) = *petrina*, Suffert, Iris, p. 25 (1904).

Natal; Transvaal; E. Griqualand; German E. Africa (Dar-es-Salaam, Kilimandjaro, Tanganyika, Mikandani).

f. *taborana*, Suffert, Iris, p. 26 (1904).

Localities as above.

A. petraea petraea.

♂. Expanse 50–60 mm. Wings bright rosy red, rather darker at apex of f.-w. and in submarginal part of h.-w. F.-w. base suffused with black, slightly in cell and more widely in 1a and 1b. Costa and hind margin narrowly black. Nervures and nervules strongly marked and broadly black where joining hind margin. Black spots as follows :—In area 11 near middle of cell an oblique spot joining costal and subcostal. In cell a subbasal spot adjacent to subcostal, followed by a second larger subtriangular spot touching subcostal and median, a double spot on upper and middle discocellulars. Just beyond cell a band of confluent spots from nervule 11 to 3, narrow at first, widening suddenly in area 6 so as to join discocellular spot, narrower in 5 and 4, but occupying the entire basal half of area 3, and sometimes curving round on nervule 3 so as almost to join hind margin. In areas 2 and 1b two submarginal spots, and in 2 a large spot touching median and nervule 2 ; beneath this in 1b and nearer margin a large reniform spot. Inner margin narrowly black.

H.-w. Base suffused with black, rather broadly so in 1b, 1c, and lower half of cell. Hind margin with black border 1·5 mm. wide. Nervules strongly marked. Black spots as follows :—In area 7 a small submarginal spot. A sinuate discal row of eight internervular spots (no spot in 3), a subbasal spot in 7, two spots in cell, one on m.d.c., a basal and a subbasal in 1c, a subbasal in 1b, and 1a.

Underside. F.-w. dark salmon pink, apex greyish pink with deep orange internervular rays. A small black spot on costa near base. Spots near base are wanting and the remainder are of different shape and smaller size, the outline of the upperside spots showing through. H.-w. pale salmon pink with some reddish internervular marks at base, and reddish internervular rays. Hind margin bearing seven yellowish white spots. Black spots as above with an additional spot visible in 8, near precostal. Head black with a white central line, and two small lateral spots, red lateral tufts on collar. Thorax black with two faint dorsal white lines. Basal half of abdomen black with orange lateral spots, remainder orange. Claws unequal.

The foregoing description applies to an average wet season ♂. The black markings of this species are very variable in shape and extent, and it is almost impossible to make a description which will satisfactorily cover the range of individual variation. Trimen describes a ♂ aberration (*l. c.*, p. 146) with f.-w. entirely dull black.

♀. Expanse 60–64 mm. Wet season form. F.-w. sepia rather darker at costa, apex, and hind margin, with black spots as in ♂ but somewhat less distinctly outlined. A broad white subapical patch from costa to nervule 3. H.-w. pale sepia marked and spotted as in ♂.

Underside. F.-w. Basal and discal area brownish grey; costa, apex, and hind margin greenish grey with black nervules and dark ochreous rays. Subapical patch greenish white, spots as in ♂. H.-w. greenish grey with black spots as in ♂. Near inner edge of marginal border a row of small greyish ochreous streaks. Abdomen black above with large white lateral spots. Yellowish beneath.

Dry season form. Closely resembles ♂ but ground-colour duller red, white subapical patch as in wet season form, and apex black with reddish internervular rays. Underside of h.-w. pale dull ochreous with orange ochreous spots at inner edge of hind-marginal border. Discal spot in area 3 may be present though small.

A. petraea f. *taborana*, Suff.

The ♂ described under this name by Suffert has the median cell spot joined to the basal black, and the discal black band of spots is of less extent than usual. In so variable a species the name is hardly worth preserving.

In the ♀ ascribed to this particular variation of the ♂, but with which it has no special connection, the ground-colour is the same as that of the ♂ and the subapical patch is dull orange ochreous. The varietal name *taborana* may perhaps be preserved for this form. Both the above occur in a series taken by Marshall in Natal, and now in the Hope Department.

Fawcett's description (*l. c.*) of the larva and pupa is as follows:—

Larva.—"Ground-colour pale golden brown, with dorsal and lateral black lines, and a black transverse line on each segment bearing two largish white spots and six long branched black spines, those on 3rd, 4th, and 5th segments being longer than the remainder. Head large proportionately to body, black with a white bifid mark on front. Thoracic legs and claspers yellowish. The young larvae reared were all blackish in colour and fed in companies on *Oncoba kraussiana* (Planch).

"Pupa appears to be dichromatic, some being pale brown and others ferruginous; in both forms the fine black lines and spots peculiar to *Acraea* pupae are much reduced. The pupal stage lasted fifteen days in January."

Trimen says the young larvae feed in companies and drop to the ground on a silken thread when alarmed.

The species is undoubtedly closely allied to *A. cepheus* of the west.

39. Acraea guillemei. Pl. IX, f. 2.

Acraea guillemei, Oberthür, Etud. d'Ent., 17, p. 19, pl. 1, f. 1 (1893); Aurivillius, Rhop. Aeth., p. 97 (1898).

♂ = *A. acutipennis*, Lathy, Trans. Ent. Soc., p. 3, pl. 1, f. 3 (1906).

"Lake Tanganyika"; Congo State (Upper Lufupa R.); Angola (Bailundu).

♂. Expanse 46–50 mm. F.-w. somewhat elongated. Bright red with a blackish apical patch 4–6 mm. wide, more or less continued as a narrow blackish marginal border. A little black at base and black spots as follows:—One in cell at or beyond origin of nervule 2, one on end of cell, a discal band of five spots, the first small in 10, the second larger in 6 and rather more distal, the third below it in 5, the fourth in 4, more distal and with its long axis pointing downwards and outwards, the fifth below it in 3 but with its long axis pointing downwards and inwards. A large spot near base of 2 and beneath it but nearer margin a spot in 1b. Sometimes a subbasal spot in same area.

H.-w. bright red with some black at base especially in 1c. A narrow black hind-marginal border with a somewhat undulating inner edge and bearing more or less developed internervular spots of the ground-colour. Blacks spots as on underside.

Underside. F.-w. as above but duller, apical patch merely dusky. Sometimes two black spots on costa near base though one or both may be absent.

H.-w. much as above but duller and inclined to greenish grey at base and along nervules. Internervular marginal spots paler and better developed. Black spots as follows:—A little irregular black at base, a spot in 8 near precostal. An outer band of large black spots, the first in 7 well beyond origin of nervule 7, second in 6 more distal, and beneath it but still more distal a spot in 5; one near base of area 4 and beneath it but much nearer margin a spot in 3, one near base of area 2 and immediately beneath it a spot in 1c, followed by one in 1b slightly nearer base. A subbasal in 7, two in cell, and one on discocellular at base of 5, a subbasal in 1c, beneath it a spot in 1b and a dot in 1a, also a subbasal in the latter area.

Head black with a reddish tuft between eyes and two on collar. Thorax black above. Basal half of abdomen black above with yellowish lateral spots, remainder orange. Claws unequal.

♀. Like ♂ but with much more rounded f.-w. and somewhat less apical black.

One ♂ of this species from Angola in the collection of Herr J. N. Ertl has very little black at apex of f.-w., but the nervule ends are heavily scaled with black. The discal spot in h.-w. area 5 is represented by a mere dot, and is absent in one wing on the upperside.

I have seen only very few examples of this rare species, though in many collections a form of *A. nohara* is labelled *guillemei*. I was much struck with the rather peculiar arrangement of the h.-w. spots in Oberthür's *guillemei*, and observed that this arrangement corresponded to that in Lathy's *acutipennis*. When examining the Staudinger collection I found a single example agreeing with Oberthür's figure, but it was a ♀, and Oberthür's specimen is described as a ♂. I therefore wrote to that author requesting him to again examine the type, and he informs me that he thinks it is a ♀. If this be so I cannot doubt that *acutipennis* is its male, and I feel sure that the acquisition of further material will confirm this conclusion.

Whether the substitution, in the Angola example, of black nervules for the f.-w. apical patch as described above be peculiar to that region I have not sufficient material to decide. Staudinger's specimen is merely labelled W. Africa, and so affords no assistance.

The ♂ armature is quite distinctive.

40. Acraea büttneri. Pl. IX, f. 1.

Acraea büttneri, Rogenhofer, Ann. Mus. Wien., 4, p. 553, pl. 23, f. 8 (1889); Verh. z. b. Ges. Wien, 42, p. 575, f. 3 (1892); Aurivillius, Rhop. Aeth., p. 95 (1898); Neave, Proc. Zool. Soc., p. 14 (1910).

= *felina*, Trimen, Proc. Zool. Soc., p. 65, pl. 8, f. 5, 6 (1891).

Congo State (Abumonbasi, Bopoto, Stanley Falls, Luebo R., Kassai R., Popokabaka, Uboto, Lufupa R., Lubudi R.); N.W. Rhodesia (Kansanshi); Angola (Mkweta, Muene, Indali); Damaraland (Humbe, Cunene R., Omrora, Otiembora, Okavango R.).

♂. Expanse about 50 mm. Wings bright scarlet. (In some examples deep orange, but whether this difference is due to fading or to seasonal dimorphism I am unable to decide, the examples before me not being dated.) F.-w. Costa yellowish. Apex moderately suffused with black and the nervules heavily marked with the same colour. Hind margin narrowly black. Black spots as follows :—In area 11 near middle of length of cell a small spot. Below this in cell an oblique transverse spot and one on upper and middle discocellulars. Just beyond end of cell an oblique transverse band of spots from costa to nervule 4. In area 3 a broadly crescentic spot near middle of its length and sometimes a small submarginal. In area 2 a submarginal subtriangular spot and a reniform spot at basal end touching median and nervule 2. In area 1b a submarginal, close behind it a discal, and touching the median a subbasal spot; also a small black basal streak. In area 1a near middle a small black streak, also a slight black basal suffusion. H.-w. with a slight black basal suffusion and a narrow (about 1·2 mm.) hind-marginal band. Inner margin yellowish. Black spots as follows :—A discal sinuous row of eight the fourth (in 4) usually confluent with a minute spot on the discocellular (this latter not always present). The spot in 2 touching median and nervule 2. In area 7 a subbasal spot. Two spots in cell the distal one large and transverse. A subbasal and a basal spot in 1c, and one or two confluent and rather obscurely defined spots in 1b and 1a.

Underside. F.-w. rosy red, costa, apex, and hind margin ochreous. Hind margin and nervules narrowly black, reddish internervular marks, black spots as on upperside. H.-w. warm ochreous, darker in the internervular spaces and with some reddish marks near base. Hind margin with a narrow greenish grey border about 1·2 mm. wide, outwardly and inwardly defined by a very narrow black edge, and divided by the black nervules. Spots as above, an additional one being visible in area 8 near precostal, and a basal spot in 9, and 1c. The discal spots in 1a and 1b sometimes confluent.

Head and thorax black with a few yellowish spots, and red or orange lateral tufts on collar. Basal half of abdomen black with orange lateral spots. Remainder orange. Claws unequal.

♀. About same size as ♂ (one dwarfed example before me only 36 mm.). Ground-colour rather less brilliant. Spots similar. H.-w. margin with pale internervular spots of ground-colour. Abdomen all black above with large whitish lateral spots.

A. büttneri shows considerable variability in the size of the spots, their position also is not quite constant. In some specimens the margin of the h.-w. bears pale internervular spots of the ground-colour. On the underside, the h.-w. may be uniformly ochreous, the marginal border being only a little paler than the rest. In other examples the h.-w. hind-marginal border is pale greyish white, the narrow black outer edge being very indistinct.

The species is rare in collections, and I have been unable to gain access to sufficient numbers to decide whether it exhibits seasonal dimorphism. Though probably allied to *A. petraea* and *A. cepheus* the male armature is quite distinct.

41. ACRAEA VIOLARUM. Pl. IX, f. 3. Pl. XV, f. 20.

Acraea violarum, Boisduval, Voy. Deleg., 2, p. 591 (1847); Wallengren, Rhop. Caffr., p. 21 (1857); Trimen, Rhop. Af. Austr., p. 95 (1862); Staudinger, Exot Schmett, 1, p. 84 (1885); Trimen, S. Af. Butt., 1, p. 141, pl. 3, f. 4 (1887); Butler, Proc. Zool. Soc., p. 191 (1898); Aurivillius, Rhop. Aeth., p. 95 (1898).

= *nataliensis*, Angas, Kaff. Ill., pl. 30, f. 6 (1849).

ANGOLA (Bihé, Calweha R., Caconda, Cubal R., Cambo, Caquenje, Benguella); CAPE COLONY; NATAL; TRANSVAAL; MASHONALAND.

♂. Expanse 50–56 mm. Wings dull brick red (probably brighter in fresh specimens) spotted with black. F.-w. with a narrow apical black tip extending very narrowly for a short distance along costa and along whole length of hind margin to hind angle. Spots as follows:—On costa near middle of length of cell a linear spot. In area 11 near end of cell a small oblique quadrate spot, and immediately below this an elongate transverse spot extending right across cell. A small spot on the upper, middle and partly on lower discocellulars. Beyond cell a discal outwardly convex (in some species nearly straight) bar of confluent spots extending from costa to nervule 4. Beneath this in 3 and slightly nearer margin a crescentic outwardly convex spot. Three rounded subapical spots in 6, 5, and 4 lying almost in a straight line (occasionally a small additional spot in 8), followed by a submarginal spot in 3, 2, and 1b, the last being doubled. In area 2 a reniform spot touching median and nervule 2. Below this and nearer margin a large, often gemminate spot in area 1b, and in the same area a large transverse spot nearer base and touching median and nervule 1. In area 1a slightly beyond middle a small transverse spot. Small black linear marks in cell, 1b, and 1a.

H.-w. with black basal suffusion, slight in 7, widening in cell towards median, extending to middle of wing in 1c, and tapering off to base of 1a. Hind-marginal black border 2 mm. wide rather strongly arched on inner edge between nervules and bearing seven pale spots varying from red to yellowish. Black spots as on underside, except in 1a and 1b where they merely show through from beneath.

Underside. Wings as on upperside but rather paler and duller, f.-w. with apical region slightly yellower than the remainder. Spots as on upperside. The black at apex bears three small greyish white spots.

H.-w. On the marginal border the internervular spots are large, rounded, and violet grey, centred with yellow, the black portion being reduced to a series of rings. Black spots as follows:—A very irregular discal row of eight, first in 7 slightly beyond middle, second and third, in 6 and 5, midway between the latter and marginal border, contiguous, and lying at right angles to costa; fourth, in 4, touching nervule 5 and l.d.c.; fifth, in 3, crescentic nearly midway between end of cell and marginal border; sixth in 2 touching median and 2, seventh in 1c rather nearer margin than the sixth; eighth in 1b at same level. In addition to these the following basal and subbasal spots. In area 7 a subbasal spot, its long axis pointing towards inner margin; two in cell, the second elongate and transverse; a basal and a transverse subbasal in 1c, 1a, and 1b, the latter also extending into 1a. A basal spot in 9, and a small spot in 8 a short distance beyond precostal. Fringes of both wings white.

Head dark red brown, two reddish lateral tufts on collar, thorax black brown with lateral tufts of red. Abdomen black above, yellowish beneath with lateral orange spots. Claws unequal.

♀. About the same size as ♂, and resembling it in markings, but ground-colour duller, and f.-w. more rounded. Abdomen black with white lateral spots. Underside of h.-w. sometimes ochreous with reddish internervular patches. The ground-colour varies from slightly paler than the ♂ through dull ochreous, smoky ochreous, to violaceous sepia. An example of the latter coloration in the National Collection has a median white suffusion in the h.-w. The h.-w. margin if spotted at all is marked with white.

Unfortunately very few of the examples which I have been able to examine are dated, but the sepia coloured ♀♀ are probably wet season examples.

The species is not common in collections, and Trimen describes it as nowhere abundant.

42. ACRAEA ASEMA. Pl. IX, f. 4. Pl. XV, f. 19.

Acraea asema, Hewitson, Ent. Mo. Mag., xiv, p. 52 (1877); Trimen, Proc. Zool. Soc., p. 24, pl. 4, f. 3, 3a (1894); Marshall, Trans. Ent. Soc., p. 555 (1896); Aurivillius, Rhop. Aeth., p. 95 (1898); Neave, Proc. Zool. Soc., p. 14 (1910).

= *empusa*, Butler, Proc. Zool. Soc., p. 656 (1893).

f. *gracilis*, Wichgraf (*violarum g.*), Berl. Ent. Zeit., p. 243, pl. 6, f. 7, 8 (1908).

ANGOLA (Bihé, Bailundu); MANICALAND; MASHONALAND; NYASSALAND (Blantyre).

A. asema asema.

♂. Expanse 36–50 mm. Wings brick red with a rosy tinge, to ochreous or greyish ochreous, with black spots. F.-w. distal portion of costa very narrowly black, apex with a small black patch, continued along hind margin as a very narrow black marginal border. Black spots extremely variable. When all present arranged as follows:—In area 11 near end of cell one spot and beneath this an elongate transverse spot in cell. A small linear mark on upper portion of discocellulars. Shortly beyond end of cell an oblique transverse band of spots from close to costa to nervule 4, this band may be straight, irregular, or outwardly convex; beneath it and slightly more distally placed a spot in 3. Beyond these, in the subapical area, a row of three spots in 6, 5, and 4. These may be in a straight line, or outwardly convex, or absent altogether. Beneath them a submarginal row of three spots in 3, 2, and 1b. A spot near base of area 2 close to median, and two additional spots in 1b, one near submarginal spot, the other near base. Black basal linear marks in cell, 1b and 1a, absent in typical dry season examples. H.-w. with a narrow black border arched on inner edge as in *violarum*. This border is extremely variable and may be almost entirely black, or set with internervular white spots, or the internervular portions may be nearly all of the ground-colour leaving only a series of black arches. Black spots as on underside, but usually smaller and some of them frequently only showing through from beneath; basal suffusion of black in wet season specimens, often replaced by reddish in dry season examples.

Underside. F.-w. Wet season specimens usually show the black apex with three small yellowish white spots. Dry season examples have the apex pale ochreous, and the ends of the nervules black. Ground-colour as above but duller, spots as above. H.-w. Ground-colour as above, often with paler discal markings and the basal and inner marginal areas suffused with pink. The hind-marginal border is pale ochreous, and divided into spots by a series of narrow black arches. Black spots rather variable but usually more distinct than on upperside and arranged as follows. An irregular discal row of eight, the first in area 7 near middle, the second and third in 6 and 5, more distally placed, contiguous, and in a line perpendicular to costa, the fourth in 4 close to cell, the fifth in 3 some distance beyond cell, the sixth in 2 touching median and nervule 2, seventh and eighth rather more distal, contiguous, and lying at right angles to hind margin. A basal mark in 9, a small spot in 8 some distance beyond precostal, a transverse subbasal spot in 7, two spots in cell, a basal and subbasal in 1c, close to latter a spot in 1b, and nearer base a small spot in 1a. In dry season specimens several of these spots may be absent and generally all are smaller. Head black brown with reddish tufts on collar. Thorax black with lateral reddish spots and sometimes two anterior dorsal spots. Basal part of abdomen black with orange lateral spots, remainder orange. Fringes white. Claws unequal.

♀. Expanse 44–52 mm. F.-w. more rounded. Usually duller than ♂, some examples being greyish ochreous. One specimen before me, taken by Neave in Angoniland is dull ochreous and the apical and hind-marginal black is unusually broad and inwardly suffused. The h.-w. marginal border is about 3 mm. broad and bears ochreous internervular spots of medium size.

A. asema, f. *gracilis*, Wichgr.

I have examined the type of this form and find that the ♂ has the h.-w. margin very narrow and all black, the same feature in the ♀ being a little broader and spotted with white. Beneath, both sexes have the spots on this border white instead of ochreous. (Mashonaland.)

With regard to the seasonal forms of this species Marshall states (Trans. Ent. Soc., p. 555, 1896) that "the bright-coloured strongly spotted summer" (= wet season) "form is replaced in winter by a duller form in which the black markings are reduced, the two upper spots in subapical row usually being obsolete."

There is undoubtedly a certain amount of seasonal dimorphism, but from an examination of a large number of examples I am of opinion that the description bright-coloured for the wet season forms is apt to be a little misleading. The dry season forms are certainly less spotted than the wet, also the actual tone of colour is usually paler, but many of them have a rather bright pink suffusion, whilst the wet season forms though more *heavily* coloured are generally of a less rosy tint. A fine series taken by Neave in Nyassaland, mostly at an elevation of about 4,000 ft., contains examples taken in March, and also in June and July. Nearly all the former are of a rather dusky ground-colour whilst the latter have a rosy pink suffusion.

Though closely allied to *A. violarum* I consider *asema* to be a distinct species, both ♂ and ♀ genital armatures showing marked differences. Moreover I have seen no obvious intermediates.

43. Acraea omrora. Pl. IX, f. 5. Pl. XV, f. 21.

Acraea omrora, Trimen, Proc. Zool. Soc., p. 24, note (1894).
= *asema*, Trimen, Proc. Zool. Soc., p. 68, pl. 8, f. 9, 10, 10a (1891); Aurivillius, Rhop. Aeth., p. 95 (1898).
S. Angola; Damaraland (Ovampo R.).

A. omrora umbrata, subsp.
= *violarum umbrata*, Wichgraf, Berl. Ent. Zeit., p. 242, pl. 6, f. 5, 6 (1908).
= *violarum omrora*, Neave, Proc. Zool. Soc., p. 14 (1910).
N.E. Rhodesia; Katanga.

A. omrora omrora.

♂. Expanse 40–60 mm. F.-w. dark ochreous with a slight basal black suffusion and a very little black at apex continued as a fine marginal line to hind angle. Black spots as follows:—One large transverse spot in cell, and a spot on disco-cellulars. Beyond cell a transverse row of three spots in 6, 5, and 4, of which the second is slightly more distally placed. Beneath them and still more distal a spot in 3. A submarginal series of five small spots, the first in 5, the second in 4 rather more distal, and the third in 3 still nearer margin, the fourth and fifth in 2 and 1b are at the same distance from margin as the third, and that in 1b is doubled. A spot near base of area 2, beneath it but rather nearer margin a spot in 1b, and a double spot near base of same area.

H.-w. with ground-colour as in f.-w. and having a black hind-marginal border about 3 mm. wide which tapers to a point at anal angle. A slight black basal suffusion and some of the black spots of underside reproduced though most are obsolete.

Underside. F.-w. resembles upperside but paler and duller. H.-w. pale dull ochreous, the marginal border formed of somewhat pointed black internervular arches enclosing grey spots. Along the inner edge of this border a greyish suffusion. Black spots very small, as follows :—One in 7 about middle, one in 6 much nearer margin, beneath it a dot in 5, a spot near base of 4, and one about middle of area 2. At about the same level a double spot in 1c and one in 1b. A little black at bases of nervures, a dot in 8, two in cell, and a subbasal in 1c, and 1a.

Head and thorax black with yellowish marks, abdomen black at base, remainder whitish. Claws unequal.

♀. Expanse 50–56 mm. Resembles ♂ but ground-colour rather more dusky. The inner edge of h.-w. marginal black markedly sinuous. On underside the grey suffusion is wanting from inner edge of marginal border, and the abdomen is whiter than in the ♂.

A. omrora umbrata.

♂. Expanse 46–60 mm. Extreme wet season form. Wings brick red. Costa and hind margin narrowly black. An apical black patch 3 mm. wide at broadest part. A basal black suffusion which may be evenly distributed over basal area as far as middle of cell or may be radiate from base. Black spots as follows :—A small costal spot in area 11 at a point opposite origin of nervule 2. Just beyond this in cell a large transverse spot; a small spot on upper and middle discocellulars. Beyond end of cell in 10, 6, 5, 4, an oblique transverse row of four spots which may be straight, or irregular. Three submarginal spots in 5, 4, and 3, the last preceded by a subtriangular spot. In area 2 a submarginal and a basal spot; in area 1b a submarginal spot with another immediately preceding it (both these may be doubled). A subbasal spot in 1b more or less coalescent with basal suffusion. In area 1a a small spot about 4 mm. from hind angle.

H.-w. A black basal suffusion extending to about middle of cell. A black hind-marginal border about 3·5 mm. wide the inner outline of which may be smoothly rounded, or the border may be somewhat widened at nervules 2 and 3. In some examples this border is much wider beneath and shows through to the upperside as a grey submarginal band. In most examples a submarginal row of slightly paler internervular spots. Black spots less distinct than on underside, some only showing through.

Underside. F.-w. paler and duller than on upperside and the spots for the most part smaller, and, owing to the upperside spots showing through, appearing to be ringed with grey. At apex a small black patch containing three greenish ochreous spots in 8, 7, and 6. H.-w. the same colour as f.-w. The basal black much reduced, the marginal border sometimes wider than on upperside, and bearing seven usually well-rounded greenish ochreous internervular spots, that in 1c doubled. Black spots as follows:—A discal row of eight, the first in 7 beyond middle, the second rather nearer margin, and the third either immediately beneath it or very slightly nearer base, the fourth in 4 close to end of cell, the fifth in 3 about midway between end of cell and hind-marginal border, the sixth in 2 near median, the seventh in 1c rather nearer margin and doubled, the eighth in 1b nearer base. A minute dot in 8 a short distance beyond precostal, a subbasal spot in 7, one subbasal and one median in cell, a double subbasal spot in 1c, and a small subbasal in 1b and 1a. These are but slightly separated from the narrow black basal suffusion. Fringes black. Head and thorax black, a white spot on each eye, and one between. Two pairs of dorsal thoracic spots. Basal half of abdomen black with reddish lateral spots, remainder orange.

♀. Expanse 46–64 mm. Dull ochreous, with slight subapical reddish suffusion, spots and markings as in ♂ but less sharply defined. H.-w. hind marginal band rather broader and with a more suffused inner edge. Underside paler than above, spots and markings as above but many of those in f.-w. obsolescent, or only showing through from above. F.-w. apical, and h.-w. hind-marginal spots whitish, and the latter larger than in ♂. Abdomen black above with white lateral spots and yellowish beneath. The example here described was taken in the upper Luangwa Valley in the height of the rains.

Extreme dry season form ♂. Ground-colour pinkish ochreous. Basal black suffusion smaller and h.-w. marginal black narrower than in wet season form. The spots are all much smaller. Many of those in h.-w. are distinctly visible only on underside. The pale f.-w. apical and h.-w. hind marginal spots are smaller and whitish, distal end of abdomen dull ochreous.

♀ varies much in colour, some being smoky ochreous and others almost rosy pink especially in h.-w. Spots and markings much as in wet season ♀. H.-w. marginal black often narrower, and spots sometimes only showing through from underside. Black basal suffusion in both wings broad.

The forms above described occur in any long series of this species. I have called them wet and dry season forms since the extremes are mostly taken at those periods, but the variation in depth of colour and size of spots is very considerable and corresponds only approximately to the seasons.

In some cases the heavier black markings associated with the wet season may be well developed in the dry. A ♂ now before me, taken by Neave near Mporokoso in N.E. Rhodesia in July, is of a bright brick red, and though the h.-w. spots are smaller than in typical wet season forms, the black basal suffusion and h.-w. margin are unusually broad and heavy.

Trimen's figures of *omrora omrora* (*l. c.* as *asema*) correspond to dry season examples. The female is shown as having a white abdomen, but I do not observe this feature in any of the examples of *omrora umbrata*, though the lateral spots are usually white.

I have examined the specimens of Herr Wichgraf's *violarum umbrata* presented by him to the S. Kensington collection, and they do not differ from several of those taken by Neave in N.E. Rhodesia.

44. Acraea lofua. Pl. I, f. 8 (♂), f. 9 (♀). Pl. IX, ff. 12, 13.
Acraea lofua, Eltringham, Novit. Zool., xviii, p. 150 (1911).
N.E. Rhodesia (Lofu R.).

♂. Expanse 46 mm. F.-w. dull pinkish ochreous with a very slight black basal suffusion. Apex black for a depth of 3 mm. Hind margin very narrowly black. Small black spots as follows :—One in cell over origin of nervule 2, one on discocellulars. Beyond cell a transverse row of four, that in 5 vertically beneath that in 6, the third linear, its lower end pointing outwards, the fourth beneath the outer end of the third. A spot close to base of area 2, and one in 1b nearer margin. H.-w. more decidedly pink than f.-w., a black basal suffusion and a heavy black hind-marginal border, 5 mm. wide between nervules 2 and 3, and tapering off at hind angle. Some black basal and discal spots more easily observed beneath.

Underside paler than above. F.-w. as on upperside but spots less distinct; no basal, and very little apical black. H.-w. with faint pinkish basal internervular marks; very slight black basal suffusion. Hind margin black, narrower in middle than on upperside, its inner edge sharply dentate between the nervules, and having a submarginal row of seven triangular greyish white spots, their bases towards the margin. Black spots as follows:—One in 8, two in 7, beyond the latter a spot in 6 followed by spots in 4, 2, 1c, and 1b, all of which lie in an almost straight line at right angles to inner margin. Two spots in cell, the second at origin of nervule 2. A basal and a subbasal in 1c and 1b, and a basal, a subbasal and a distal spot in 1a.

Head brown, thorax black, abdomen black above with yellowish lateral spots. Claws unequal.

♀. Slightly smaller. Pale dull ochreous. F.-w. with a brownish basal suffusion, apical black rather broader than in ♂, but all the spots absent except that on end of cell, and the second of the discal row (this very minute). H.-w. with faint dusky basal suffusion; spots absent or very faint. Hind-marginal black narrower (in middle) than in male.

Underside. F.-w. paler than on upperside, the two spots just visible but the apical black only faintly represented. H.-w. with only a faint trace of the discal spots; basal spots small and indistinct; hind-marginal black 2·5 mm. wide, not dentate, bearing greyish white submarginal spots, smaller and less distinct than in ♂. Abdomen black with whitish spots.

Of this interesting little species I have seen only the ♂ and ♀ above described. They were taken on the Lofu River in N.E. Rhodesia (4,000 ft.) by Neave. The species is closely allied to *A. omrora*, Trim., and indeed I should have regarded it as a form of that species, but for the peculiar structure of the male armature which bears a supplementary pair of processes between the harpes.

45. Acraea nohara. Pl. IX, f. 8. Pl. XVI, f. 19.

Acraea nohara, Boisduval, Voy. Deleg., 2, p. 590 (1847); Wallengren, Rhop. Caffr., p. 21 (1857); Trimen, Rhop. Af. Austr., p. 96, pl. 3, f. 1 (1862); Staudinger, Exot. Schmett, 1, p. 84, pl. 33 (1885); Trimen, S. Af. Butt., 1, p. 142 (1887); Proc. Zool. Soc., p. 24 (1894); Aurivillius, Rhop. Aeth., p. 97 (1898); Fountaine (metam.), Trans. Ent. Soc., p. 60, pl. x, f. 14a, 14b (1911).

= *A. actiaca*, Hewitson, Exot. Butt. (*Acraea*) pl. 1, f. 3 (1852).

Natal; Transvaal; Zululand; Portuguese E. Africa (Delagoa Bay, Beira).

A. nohara halali, subsp.

Marshall (*A. halali*), Trans. Ent. Soc., p. 555 (1896); Aurivillius (var. *halali*), Rhop. Aeth., p. 97 (1898).

Mashonaland.

A. nohara pseudatolmis, subsp. n.
S.E. RHODESIA; MAHAKATA R.

A. nohara punctellata, subsp. n.
NYASSALAND (Zomba); ANGONILAND; [? DELAGOA BAY].

A. nohara nohara.

♂. Expanse 50–60 mm. Wings bright red (in fresh examples) varying to pale dusky ochreous with black spots. The ground-colour varies in intensity, and the spots somewhat in size. F.-w. Costa very narrowly black continued as an apical and hind-marginal border about 1·5 mm. wide at apex and tapering to hind angle. Ends of nervules black, and a black suffusion at base, widest in 1a. Spots as follows:—A large rounded spot in cell just above origin of 2 and a still larger spot on discocellulars. Beyond cell an oblique row of four and sometimes five subquadrate spots, the first in 9 sometimes absent, the next three in 6, 5, and 4 quadrate and separated only by the nervules. The fifth in 3 somewhat elongated, with its long axis parallel to hind margin. The appearance of this band of spots varies considerably. Most commonly the second, third, and fourth, lie in a perfectly straight line at right angles to costa, but in some specimens they lie on an irregular outwardly convex curve. A rounded spot in 2 close to median, and a submarginal and a subbasal spot in 1b.

H.-w. with a black basal suffusion, and a black marginal border 1·5–2 mm. wide usually with a slight indication of paler internervular markings. Black spots as on underside but those near base obscured by basal black, and those in 1a and 1b often only faintly indicated.

Underside paler than above. F.-w. with a conspicuous spot at base of costa, apical area sometimes with orange internervular markings, the two spots in 1b often faintly indicated, otherwise spots and markings as on upperside.

H.-w. paler than above, area 8, 9, end of cell, and median portion of 1c, 1b, and 1a often pinkish. Space between basal spots in cell, 1c, 1b, and 1a ochreous. Hind margin ochreous divided into spots by the black ends of nervules and black internervular arches. A narrow black marginal line from apex to anal angle. Black spots as follows:—A discal row of nine. The first in 7 near middle, the second and third much nearer margin and placed one above the other (occasionally the third spot is small or absent), the fourth almost touches end of cell, the fifth may lie immediately beneath it, or may be in a line pointing to apex, the sixth touches median and 2, the seventh rather nearer margin, the eighth nearer base, and the ninth which is very small (in 1a) rather nearer base. A spot in 8 near precostal. A subbasal spot in 7, two spots in cell and one on discocellulars, a subbasal spot in 1c, 1b, and 1a, the middle one nearer to margin. Some irregular basal black where wing joins thorax. Fringes whitish and prominent. Head and thorax with reddish brown hairs. Abdomen black above for about two-thirds of length, with orange lateral spots. Remainder orange. Claws unequal.

♀. Expanse 50–60 mm. Ground-colour varies from slightly paler than the ♂ to ochreous or ochreous grey. Markings as in ♂. The variation in colour of the ♀ is probably seasonal, but I have not before me a sufficiently long series of dated specimens to be certain on this point.

A. nohara halali, subsp.

This subspecies may be distinguished from the typical form by its smaller size, by the marked reduction in the size of the spots, the invariable absence of the submarginal spot in f.-w. 1b, the extremely narrow black margin in h.-w., and the almost invariable absence of the third and fifth discal spots.

Marshall describes the wet season ♂ as bright brick red and the dry season ♂ as dull ochreous, a difference not easily observed in cabinet specimens owing to the rapidity with which the more brilliant colour fades. The ♀ is dull pale grey in wet season forms, and dull ochreous in the dry season.

The species is peculiar in having larger black spots in the dry than in the wet season.

When Marshall wrote of this form in 1896 (*l. c.*) he was of opinion that it was a distinct species. I cannot however find in the genitalia any difference from those of *nohara*. Colour and pattern are most untrustworthy evidences of specific distinction. From such considerations it might reasonably be argued that if *halali* be the same species as *nohara* then the "*nohara chambezi*" of Neave must also be the same, but the latter is certainly a distinct species though some examples so closely resemble *nohara halali*.

A. nohara pseudatolmis, subsp. n. Pl. I, f. 6 (♂).

There are three ♂ examples of this curious form in the Oxford collection. They were taken on the Mahakata R. in 1905 by Marshall. They are smaller than the *halali* form (about 41 mm. expanse). The submarginal spot in 1b of f.-w. is well developed. The *fourth* discal spot is linear and lies nearly at right angles to the hind margin and makes a right angle with the fifth spot which extends right across area 3. In the h.-w. the black margin is extremely narrow as in *halali* but the discal row of spots are all present though small, and the second, third, fourth, and fifth are all run together in such a manner as to give the insect at first sight a marked resemblance to *A. atolmis*. This resemblance is even greater on the underside, the h.-w. having much pink suffusion, orange submarginal internervular marks, and the hind-marginal ochreous band is only very indistinctly divided into spots by the nervules.

I have not seen a female of this form.

A. nohara punctellata, subsp. n. Pl. V, f. 9 (♂).

In the British Museum there are several examples of a form of *nohara* labelled *guillemei*, Oberthür. The ♂ ♂ differ from typical *nohara* in being usually larger, and of a rosy red tint. The f.-w. is more rounded. than in typical *nohara* and the discal spots lie in an irregular line much as in *A. chambezi*. The nervules are less markedly black in the apical area. On the underside of the h.-w. the marginal border is formed of large yellowish spots only faintly outlined in black. All the black spots are smaller than in typical *nohara*. Three ♀ ♀ now before me are dusky ochreous brown, and in one the inner edge of the h.-w. marginal black is much suffused.

Two ♂ ♂ and two ♀ ♀ from the Tring collection present much the same features, but the ♀ ♀ are only a little less rosy than the ♂ ♂.

Whilst many of the above examples present a certain amount of individual variation they all agree fairly closely with Oberthür's figure of *guillemei*, and I should have been inclined to assign them to that form but for one feature. The figure of *guillemei* shows the spot in area 3 of h.-w. midway between end of cell and inner edge of marginal border, whereas in the forms above described this spot is close to the end of the cell. Since we have two totally distinct species, *A. chambezi* and *A. mansya* existing side by side in the same district and differing outwardly only in the position of this particular spot, I do not think that the present form can be identical with *guillemei*.

The latter seems almost certainly the ♀ of the species since described by Lathy as *A. acutipennis*, with which it agrees very closely in the peculiar arrangement of the h.-w. spots, and I have assigned *acutipennis* to Oberthür's species. The form of *nohara* here described appears in several collections over the label *guillemei*, but no specimen I have seen agrees with Oberthür's figure. The ♂ armature is identical with that of *nohara nohara*, but the ♀ plate is of a more rudimentary structure. In the Staudinger collection there are two ♂♂ and three ♀♀ of this form labelled *onerata*, and the locality is given as Delagoa Bay. Whether they came from Delagoa Bay or not they are certainly not *A. onerata*, which is a somewhat obscure western species of which only about three examples are known.

The early stages of *nohara nohara* are thus described by Miss Fountaine (*l. c.*).

"This larva feeds like several others of this same genus on *Wormskioldia longepedunculata*, a small, wayside flower, salmon-pink in colour, which grew abundantly in and about Macequece, a village in Portuguese E. Africa. The larva is most difficult to describe, longitudinally streaked with pale and dark ochreous-yellow, finely outlined with thin black lines, the spines are also black; they feed by preference on the flower itself of their food-plant, the salmon-pink colour of which is almost identical in tone with the salmon-pink colour of the freshly emerged butterflies. The pupa which is suspended, is very long and thin in shape, wing cases pale slaty grey, veined with black, and the abdomen cream colour with rows of ochreous-yellow dots, encircled in black."

According to Miss Fountaine's figure the ground-colour of the larva is deep yellow.

46. Acraea chambezi. Pl. IX, f. 10.

Acraea chambezi.

= *A. nohara chambezi*, Neave, Proc. Zool. Soc., p. 21, pl. 1, f. 5 (1910); Eltringham, Novit. Zool., xviii, p. 153 (1911).

N.E. Rhodesia (Chambezi Valley, near L. Young).

♂. Expanse 52–58 mm. Wings rosy red inclined to orange at apex. Costa very narrowly black from a short distance beyond base to apex. An apical and hind-marginal black border about 1 mm. wide at apex and gradually tapering to hind angle. A very slight black basal suffusion widest in 1b. Black spots as follows:—A linear transverse spot in cell above origin of nervule 2. A spot on discocellulars. Beyond cell a row of four (sometimes five) spots. The first in 11 (often absent). The next two in a straight line at right angles to costa. The fourth obliquely placed and pointing towards margin. The fifth slightly elongated, its long axis making an obtuse angle with that of the fourth. A subreniform spot in 2 near median. The ends of nervures though finely marked in black are *distinctly less black* than in *nohara halali.* A submarginal and usually a subbasal spot in 1b.

H.w. with a black basal suffusion widest in 1c. A hind-marginal black border about 1·5 mm. wide, with faint indications of paler internervular spots. Black spots as on underside, those near base obscured by the black suffusion, and those in 1b and 1c often faintly indicated.

Underside rose pink but more sparsely scaled than above. F.-w. as above but with a spot at base of costa, and an indication of pale spots on apical black in 6 and 7.

H.-w. with a black marginal border as above bearing distinct sublinear pale yellowish internervular spots. Discal row of seven spots. No spot in area 5. The spot in 3 is always much nearer to end of cell than to inner edge of marginal black. This spot seems to be *always a little further from end of cell* than in *nohara.* In one example it is absent. The three spots in 2, 1c, 1b, are usually in a straight line whereas the middle spot is generally nearer margin in *nohara.* This feature cannot be relied upon as a constant distinction since some specimens of *nohara* also have these spots similarly placed. There is a spot in 8 close to precostal, a subbasal in 7, two spots in cell, one in 1c, 1b, and 1a and some black about the base of the nervures.

Head black with red tufts between eyes and on collar. Thorax black with some reddish hairs. Abdomen, basal half black with orange lateral spots, remainder and beneath, orange. Claws unequal.

♀. Resembles the ♂ but the f.-w. are more orange coloured and the abdomen is dorsally black over whole length, and has dorso-lateral whitish spots.

When Neave described this form he was of the opinion that it was a subspecies of *A. nohara*, and in the absence of preparations of the male armature, such a conclusion would seem to be justified. The differences between the genitalia of *chambezi* and *nohara* are however of so marked a kind that the two must certainly be regarded as distinct species.

From typical *nohara*, *chambezi* differs in the smaller size of the spots; from *nohara halali* in the greater width of the hind-marginal black, and from both these forms in the very faint development of black on the nervules of the f.-w. apical area.

47. Acraea mansya. Pl. I, ff. 13 (♂), 12 (♀). Pl. IX, f. 11.

Acraea mansya, Eltringham, Novit. Zool., xviii, p. 153 (1911).

= *A. nohara chambezi* (part), Neave, Proc. Zool. Soc., p. 21 (1910).

N.E. Rhodesia (Chambezi Valley, near L. Young).

♂. Expanse 40–50 mm. Wings rosy red with black spots and markings. To give a full description of this species would be merely to repeat that of *A. chambezi* with the exception that the spot in area 3 of h.-w. is nearly midway between end of cell and the inner edge of marginal black and thus lies either immediately below the spot in 4, or is more distally placed. This is the only constant difference I have been able to discover. The tarsal claws are unequal. A careful comparison of the six examples before me with five of *chambezi* also shows that the pale spots on the marginal black on h.-w. underside are, though variable in size, more rounded in *mansya* than in *chambezi*.

The specimens show a great variation in size. One ♂ is 50 mm. in expanse and differs from the rest in having broader black margins, a small discal spot in area 5 of h.-w., and two small spots on h.-w. discocellulars. One ♂ has a whitish suffusion at base of 1b in f.-w. In only one specimen is there a subbasal spot in 1b in f.-w. and that only on one side. The type specimen has no spot in area 2 in f.-w. though this spot is present in varying degrees of intensity in the other examples. Two small ♂♂ are dull orange ochreous instead of rosy red.

♀. The single female in the series is small (40 mm.). The wings are dull smoky ochreous, with a tendency to orange in the apical area. All the spots in f.-w. except that on discocellulars are but faintly indicated on the upperside. The abdomen is black above with lateral white spots, and yellowish white beneath, and the "seal" is somewhat similar to that described by Trimen in the ♀ *onerata*. In this ♀ and in three of the ♂♂ the f.-w. discal row of spots forms a nearly straight line across the wing, in the others the line is angulated though not so sharply as in *A. chambezi*.

In examining the eleven examples of Neave's "*nohara chambezi*" in the Oxford Museum, my attention was attracted to the small ochreous ♀ above described and from that to the small males which appeared to correspond with it, and on making a preparation of the male armature I was surprised to find the very remarkable differences which may be seen on reference to my figures on Plate IX. A careful examination of the genitalia of all the other examples resulted in the sorting out of six specimens of the new form. They were all taken by Mr. Neave in the neighbourhood of the Mansya River and Lake Young at the end of October and beginning of November 1908.

48. ACRAEA ONERATA.

Acraea onerata, Trimen, Proc. Zool. Soc., p. 61, pl. 8, f. 7, 8, 8a (1891) ; Aurivillius, Rhop. Aeth., p. 97 (1898).

DAMARALAND (Okavango R.).

♂. Expanse 44 mm. F.-w. Ground-colour bright brick red much like that of a not too fresh example of *A. atolmis*. Costa very narrowly black. Apex and hind margin narrowly black. Nervule ends black nearly as far as end of cell. A little black at base of wing. Black spots as follows:—One in cell above origin of nervule 2, two on upper part of discocellulars. Beyond these, two together in 5 and 6, one beneath the other, followed by one in 4 more distally placed and pointing outwards. This followed by a fourth just beneath it but pointing inwards. A large spot at base of area 2. In 1b a minute spot near base close to median, and a submarginal beneath spot in 2 but more distal.

H.-w. with a little black basal suffusion and a black hind-marginal border about 2 mm. wide with only a faint trace of paler internervular markings. Black spots as on underside.

Underside. F.-w. as above but paler, and inclined to pinkish Spots as above with an additional brownish mark between the cell spot and end of cell, and another between end of cell and spot in 3.

H.-w. pinkish red with black spots as follows:—One in 9, one in 8 against precostal, two in 7, the outer one forming the first of a discal band of eight, the second in 6 nearer margin, third in 5, still more distal, fourth in 4, more proximal (immediately under first), fifth in 3 (under fourth), sixth in 2, seventh in 1c more distal, eighth in 1a, more proximal. Two in cell, the second transverse, and a basal and subbasal in 1c, a spot in 1b, and a subbasal in 1a. Marginal border black enclosing small white internervular spots.

Head black with an orange spot between eyes and two on collar. Thorax and basal part of abdomen black, terminal portion orange. Claws unequal.

♀. Resembles the ♂ but the ground-colour is more dusky especially in the f.-w. The terminal portion of abdomen is whitish.

I have described the ♂ from a single example in the collection of Mr. Roland Trimen. This specimen differs slightly from the type in being of a brighter red, in not having a yellowish basal patch on h.-w. beneath, and having the spots slightly different on the h.-w.

The ♀ I know only from the figure (*l. c.*), both it and the type ♂ being in the S. African Museum at Capetown. My search through large collections here and on the Continent has failed to reveal another example, although I have seen many specimens labelled with the name *oncrata*. The reputed specimens in the Staudinger collection are a form of *A. nohara*, and in another large collection I found an alleged example which proved to be *periphanes*.

A. oncrata is not a very distinctive form and is difficult to identify satisfactorily without further material. The country whence the type was received has not been much worked so that we may hope to see further examples in the future.

49. Acraea rohlfsi. Pl. I, f. 7 (♂).

Acraea rohlfsi, Suffert, Deut. Ent. Zeit. Iris, p. 124, pl. 3, f. 5 (1904).

Ukerewe I. (in south of Lake Victoria Nyanza).

♂. Expanse 46 mm. F.-w. bright brick red. A narrow black border round costa, apex, and hind margin, continued as a black line along inner margin. A little black suffusion at base especially in 1b and 1a. Nervures black. The nervule ends rather broadly black widening somewhat where they reach the hind margin so that the red ground-colour is divided up into broad clavate streaks. Black spots as follows:—A large spot in cell over origin of nervule 2, a spot on the discocellulars, and beyond cell a band of large spots extending from costal black into area 3, the spot in this area being nearly separated from those above it. In 2 and 1b two small submarginal spots lying parallel to hind margin. In 2 also a large spot touching median, 3, and 2, and beneath it but nearer margin a spot placed in a line with that in 3 parallel to hind margin. A small spot in 1b nearly midway between base and origin of nervule 2.

H.-w. bright brick red with a little black at base in 1c, 1b, and 1a. A narrow black marginal border the inner edge of which, between the nervules is straight, and narrowly edentate on the nervules. Black spots as on underside.

Underside. F.-w. dull brick red with black spots as above. Costa and hind margin only slightly darkened. Nervules grey black, and internervular rays at apex inclining to orange.

H.-w. yellowish pink the basal half inclined to reddish. A very narrow grey hind-marginal border, inwardly edged with orange red internervular marks about twice the width of the border. Nervule ends black. Black spots as follows:—One at base in area 9, three equidistant spots in 7 the second just beyond origin of nervule 7. Between and beneath the two more distal of these, a small spot in 6, and beneath it but slightly nearer margin a small spot in 5. One at base of areas 4, 3, and 2, all touching cell. Beneath that in 2 but nearer margin a large spot in 1c, and a second at the same level in 1b. Also two spots in cell, the second rather oblique, its lower end touching median just beyond origin of nervule 3. A basal and a subbasal in 1c and 1a, and a subbasal in 1b.

Head and thorax black with two or three reddish dots. Abdomen black above with small reddish lateral dots towards the extremity. Claws unequal.

It is through the kindness of Herr Ertl of Munich that I am able to give a figure and full description of this butterfly, he having sent me the type for that purpose. The specimen has the appearance of being dwarfed or not fully expanded, but is otherwise in good condition. It is not quite like anything else I have seen, and further examples will be awaited with interest. It was taken on the Island of Ukerewe in the southern part of Lake Victoria Nyanza.

50. Acraea atolmis. Pl. IX, f. 9. Pl. XV, f. 27.

Acraea atolmis, Westwood, Oates, Matabeleland, p. 343, pl. F, f. 3, 4 (1882); *l. c.*, ed. 2, p. 351, pl. 6, f. 3, 4 (1889); Trimen, Proc. Zool. Soc., p. 63, pl. 8, f. 1–3 (1891); Aurivillius, Rhop. Aeth., p. 97 (1898); Neave, Proc. Zool. Soc., p. 21 (1910).

= *acontias* (f. aestiv.), Westwood, *l. c.*, p. 345, pl. F, f. 7, 8 (1882); *l. c.*, ed. 2, p. 353, pl. 6, f. 7, 8 (1889); Trimen, *l. c.*, p. 64, pl. 8, f. 4 (1891).

= *luxi*, Rogenhofer, Ann. Mus. Wien., 4, p. 550, pl. 23, f. 5 (1889).

f. *decora.*

= *acontias* ab. *decora*, Weymer, Ent. Zeit. v. Guben, 16, p. 62 (1901); Iris., p. 225, pl. 2, f. 5 (1903).

ANGOLA (Longa R., Don Carlos, Bihé, Makweta, Luacinga R., Benguella, Guimbungo); DAMARALAND (Ovambo); CONGO (Stanley Pool, Lualaba Valley); RHODESIA (Victoria Falls, Chambezi Valley, Buluwayo, Barotseland).

♂. Expanse 42–58 mm. Dry season form. Wings bright brick red, with black markings. Costa, apex, and hind margin narrowly black. Nervules rather heavily marked with black for a length of some 7 mm. at apex and to a gradually decreasing extent towards hind angle. Very slight basal black suffusion, sometimes absent. A basal black streak in 1b. A transverse spot in cell over point of origin of nervule 2. A mark on upper part of end of cell. Beyond end of cell a row of five small spots, usually almost in a straight line at right angles to costa, but occasionally irregularly placed. The fifth spot (in 3) separated from the rest. A spot in area 2 close to median, and a submarginal spot in 1b.

H.-w. with a slight black basal suffusion and some minute black spots more easily observed on underside. An extremely narrow black marginal line from apex to anal angle.

Underside. F.-w. dull pink as far as discal row of spots, remainder pinkish ochreous striated by the black nervules and by orange internervular streaks. A black spot at base of costa. Other spots as on upperside, and sometimes a subbasal spot in 1b.

H.-w. dull pinkish ochreous to ochreous and striated by the fine black nervules and by orange internervular streaks. An extremely narrow black hind-marginal line. Black spots all very small as follows:—A discal row of eight, one in each internervular space except 3. That in 7 somewhat before middle of the area, and the next three closely beneath it arranged in a nearly straight line at right angles to costa. The fifth in the angle between 2 and the median, the sixth linear and obliquely transverse, the seventh linear and transverse, the eighth minute and more proximal. A dot on end of cell at origin of 6. A spot in 8 against precostal, a subbasal in 7, two in cell (the second linear and transverse) a basal and a subbasal in 1c, a subbasal in 1b, and 1a (that in 1b more distally placed).

Head and collar with brownish tufts, thorax black with some brownish hairs. Base of abdomen black, remainder pale orange ochreous. Claws unequal.

♀. Resembles ♂ but ground-colour rather less brilliant, and a trace of a pale subapical bar just beyond f.-w. discal spots. In one example before me the ground-colour is pale brownish ochreous and there is a distinct whitish subapical bar. Abdomen black above with large yellowish lateral spots. Pale yellowish beneath.

Wet season form ♂. Ground-colour as in dry form but all the black markings larger. A black marginal border about 1 mm. wide round both wings, narrower at angle of f.-w. and from angle to base of h.-w. All spots much larger than in dry form. In f.-w. an extra spot near base of 1b and a hind-marginal spot in 1a immediately below the spot in 2. In h.-w. a well-developed spot in 3, close to end of cell.

Underside much as in dry form, but spots larger in f.-w. and in h.-w. 3 the extra spot is present. In f.-w. there is a narrow submarginal line of ochreous along hind margin, and in h.-w. a similar line rather broader and bounded on its inner edge by a fine black line.

♀. Ground-colour dull brownish ochreous to sepia black, spotted as in ♂. The blackest forms show a small white subapical bar in f.-w. the development of which becomes less the more nearly the ground-colour approaches that of the ♂.

Weymer's ab. *decora* is a ♂ with much of the f.-w. ground-colour replaced by black. It is merely a melanic aberration.

The "seasonal" forms appear quite irregularly and seem all to occur together at least in Angola.

51. Acraea periphanes. Pl. IX, ff. 6, 7.

Acraea periphanes, Oberthür, Etud. d'Ent., 17, p. 20, pl. 2, f. 23 (1893); Butler, Proc. Zool. Soc., p. 657 (1894); *l.c.* p. 116 (1896); Trans. Ent. Soc., p. 107 (1897); Aurivillius, Rhop. Aeth., p. 97 (1908); Neave, Proc. Zool. Soc., p. 19 (1910).

L. Meru; Nyassaland (Zomba); Congo (Lualaba, Katanga); Rhodesia (Kasama, Lower Chambezi R., L. Bangweolo).

f. *beni*.

= *A. beni*, Bethune-Baker, Proc. Zool. Soc., p. 110 (1908); Eltringham, Novit. Zool., xviii, p. 152 (1911).

Angola; Rhodesia (Lower Chambezi Valley; L. Bangweolo).

f. *melaina*, Eltringham, Novit. Zool., xviii, p. 152 (1911).

= *periphanes*, (part,) Neave, Proc. Zool. Soc., p. 19 (1910).
RHODESIA (Lower Chambezi Valley ; L. Bangweolo).

f. *umida.*
= *onerata*, f. *umida*, Wichgraf, Berl. Ent. Zeit., 53, p. 246, pl. vi, f. 10 (1908).
= *periphanes*, f. *marginata*, Eltringham, Novit. Zool., xviii, p. 153 (1911).
RHODESIA (Chinsali ; Lower Chambezi Valley ; L. Bangweolo).

f. *acritoides*, Eltringham, Novit. Zool., xviii, p. 153 (1911).
= *periphanes*, (part,) Neave, Proc. Zool. Soc., p. 20 (1910).
RHODESIA (Chinsali; Lower Chambezi Valley ; L. Bangweolo).

A. periphanes periphanes.

♂. Expanse about 56 mm. Wings bright red with a rosy tinge. Costa very narrowly black from near end of cell. Apex black (6 mm. wide) the inner edge of the patch somewhat suffused. Hind margin narrowly black widened somewhat at the nervules. A basal black streak in 1b. Black spots as follows :—One in cell above origin of nervule 2. A double spot on upper part of discocellulars. Beyond the cell a discal row of five spots, the first (in 10) very minute, the second and third (in 5 and 6). These three usually lie in a straight line nearly at right angles to costa. The fourth (in 4) is nearer margin, and is obliquely placed, its long axis being nearly at right angles to the hind margin. Beneath this (in 3) the fifth spot, rounded, and lying in a straight line with the first three. In area 2 a rounded spot close to median, and in area 1b a submarginal and a subbasal spot (this often absent or minute). H.-w. often a little darker in colour than the f.-w. A black basal suffusion, widest in 1c, and a narrow black hind-marginal border, more or less broken up by internervular spots of the ground-colour. The black spots are as on underside but those in 1a and 1b sometimes faintly indicated.

Underside. F.-w. dull pinkish, the apical black of upperside represented by a greyish ochreous patch on which the nervules are strongly marked in black, and there are fairly distinct orange internervular rays. A fine black marginal line from apex to hind angle. Spots as above and a black dot at base of costa. H.-w. ground-colour orange ochreous, areas 8, part of 7, end of cell, middle of 1c, 1b, and 1a pink. Base of cell, 1c, 1b, and 1a lemon-ochreous. Hind margin lemon-ochreous divided into spots by the black ends of the nervules, and narrow black internervular arches. A thin black marginal line from apex to anal angle. Black spots as follows:—A median row of eight, the first in 7 near middle, second in 6 nearer margin, third in 4 in a line with second nearly at right angles to costa (very rarely a faint trace of a spot in 5), fourth in 3 close to end of cell, fifth in 2 touching median and nervule 2, sixth in 1c nearer margin, seventh in 1b slightly nearer base, eighth in 1a still nearer base. A spot in 8 rather beyond the precostal, a transverse subbasal spot in 7, one round and one transverse spot in cell, and one on upper discocellulars. A subbasal spot in 1c, 1b, and 1a, the second of these nearer margin than the other two. A basal spot in 1c. Fringes yellowish white. Head and thorax covered with reddish brown hair, abdomen black above, orange beneath, and with whitish lateral spots. Claws unequal.

♀. Expanse about 62 mm. Ground-colour extremely variable, rosy pink, warm sepia, or creamy white with a brownish basal suffusion. Markings as in ♂. The red form closely resembles ♂ on both surfaces, the sepia form has whitish spots on the hind margin of h.-w. and on the underside the f.-w. apex, and the ground-colour of the h.-w. are greenish ochreous. The whitish form is almost without the brown basal suffusion on the underside and the ground-colour is like that of the upperside.

A periphanes, f. *beni*.

This form was described by Bethune-Baker as a new species (*l. c.*). It is characterised by the absence of the subapical black in the f.-w. The ♀ may be of the sepia form, or dull red.

A. periphanes, f. *melaina*. Pl. III, f. 10 (♂).

Differs from typical examples in having a heavy black basal suffusion in both wings. The h.-w. margin is broad with only a trace of pale spots, in the ♂ it radiates into the discal area, and in the ♀ has a more regular though suffused inner edge and is widest (about 4·5 mm.) at 1c and 2. The ♀♀ present the same variations of ground-colour as the ♂♂.

A. periphanes, f. *umida*. Pl. V, f. 7 (♂).

In this form the basal suffusion and h.-w. margin are as heavy as in the *melaina* form but the apices of f.-w. are not at all or only slightly blackened, though the ends of the nervules are distinctly black. The discal spots are usually larger than in the type form. The ♀♀ present the same variations of ground-colour as do those of the typical form.

A. periphanes, f. *acritoides*. Pl. III, f. 11 (♂).

Differs from typical examples in having more elongated wings, and in the absence of the apical black patch and the discal spots of the f.-w. These differences have the effect of giving the insect a very close resemblance to *A. acrita* as already noted by Neave (Proc. Zool. Soc., p. 20, 1910). Of this form I have only seen male examples.

Examples of *A. periphanes* from the Alala plateau, N.W. Rhodesia, present much the same series of forms, but the specimens are generally of smaller size.

The extraordinary formation of the male genital armature in *periphanes* separates it very definitely from allied species.

The different forms above described are neither seasonal nor geographical unless Angola produces only the form *beni*. Even then the latter could not be regarded as a subspecies since it also occurs in other localities. It is a curious fact that dead and dried examples of this species usually have the last three or four segments of the abdomen sharply bent downwards and forwards.

GROUP VIII.

52. Acraea aureola. Pl. II, f. 8 (♂). Pl. IX., ff. 14, 15.

Acraea aureola, Eltringham, Novit. Zool. xviii, p. 149 (1911).

Angola (Bihé).

♂. Expanse 60 mm. Rich golden yellow with black spots and markings. F.-w. narrow and pointed, base very slightly suffused with black ; ground-colour of basal portion of a somewhat richer tint than the remainder: costa very narrowly black except at base ; subcostal, nervule 6, and distal ends of remaining nervules black. Hind margin narrowly black, expanded into small triangular marks at ends of nervules. A large ovate transverse spot in cell above origin of 2. A subquadrate spot on upper part of end of cell. A little beyond cell an outwardly convex row of five rather small rounded spots ; beneath these nearer to base, and between nervules 2 and 3, a rounded spot ; below this and slightly nearer margin a small, rather crescentic spot, and a very small subbasal spot in area 1b close to median.

H.-w. rather paler than f.-w. ; a moderately heavy black basal suffusion ; in area 7 a subbasal spot followed by a larger transverse spot near middle of costal margin ; beneath this but nearer margin a spot in area 6. In middle of cell a transverse V-shaped spot, the angle pointing outwards; remaining spots obscured by basal suffusion. Hind margin with a very narrow black line, and a series of well-marked black internervular arches.

Underside. F.-w. resembling upperside but paler and duller; apical portion pinkish ochreous; nervules not black and without triangular marginal marks. No basal suffusion. H.-w. pinkish ochreous; the basal portion brown ochreous, except above the subcostal; a round black spot near base of cell, followed by a V-shaped mark as on upperside. In area 1c a basal spot followed by another V-shaped mark, and a spot in 1b and 1a; other marks as on upperside.

Head and thorax brown; basal part of abdomen black, remainder orange; tarsal claws unequal.

Only a single example of this beautiful species is known to me. It appears to be very distinct. The structure of the genital armature is quite characteristic, and the dorsal abdominal plate is folded in a very peculiar manner, as I have endeavoured to show on Pl. IX, f. 15. I have placed the species in a separate group, as it does not appear to have any near allies.

GROUP IX.

53. ACRAEA ACRITA. Pl. X, ff. 1, 4. Pl. XVI, f. 10.

Acraea acrita, Hewitson, Exot. Butt. (*Acraea*), pl. 3, f. 18 (1865); Trimen, S. Af. Butt., 3, p. 381 (1889) (part); Proc. Zool. Soc., p. 28, pl. 4, f. 4 (1894); Aurivillius, Rhop. Aeth., p. 96 (1898); Neave, Proc. Zool. Soc., p. 16 (1910) (part).

f. *msamwiae*, Strand, Mitt. Zool. Mus. Berlin, v. 2, p. 282 (1911).

f. *aquilina*, Strand, *l. c.*, p. 281 (1911).

f. *nyassicola*, Strand, *l. c.*, p. 282 (1911).

PORTUGUESE E. AFRICA (Mt. Pakolwe); MASHONALAND; ZAMBESI; MANICALAND; RHODESIA (Chambezi, Luangwa, Alala Plateau, Kafue R., Mt. Kapsuku, Ft. Jameson); NYASSALAND.

A. acrita ambigua, subsp. Pl. X, ff. 9, 12.

Trimen, Proc. Zool. Soc., p. 70, pl. 9, f. 11 (1891); Aurivillius, Rhop. Aeth., p. 96 (1898); Neave, Proc. Zool. Soc., p. 17 (1910); Strand, Mitt. Zool. Mus. Berlin, p. 280 (1911).

f. *bella*. Pl. X, ff. 13, 14.

Weymer, Ent. Zeit. Ver. von Guben, p. 61 (1901); Iris, p. 225, pl. 2, f. 4 (1903); Strand, *l. c.*, p. 281 (1911).

L. Bangweolo; Luwingu; Tanganyika Plateau; Manicaland; Barotse Country; E. Damaraland (Okavango).

Acraea acrita pudorina, subsp. Pl. X, ff. 3, 6.

Staudinger, Exot. Schmett, i, p. 84, pl. 33 (1885); Pagenstecker, Jahrb. Hamb. Naturw. Anst., 10, 2, No. 6, p. 19 (1893); Butler, Proc. Zool. Soc., p. 566 (1894); Trans. Ent. Soc., p. 520 (1895); Aurivillius, Rhop. Aeth., p. 96 (1898); Strand, Mitt. Zool. Mus. Berl., 5, 2, p. 281 (1911).

f. *utengulensis*, Thurau, Berl. Ent. Zeit., 48, p. 130, pl. 2, f. 9 (1903); Strand, *l. c.*, p. 281 (1911).

British E. Africa (Mori R., Kibwezi, L. Baringo, Ngomeni, Nandi, Kikuyu Escarpment, Taita, Fort Hall, Machakos, Taveta, Rabai); German E. Africa (Mt. Kilimandjaro); Zanzibar Coast.

A. acrita littoralis, subsp. nov. Pl. X, ff. 7, 10.

= *acrita*, Trimen, S. Afr. Butt., 3, p. 381 (1889) (part).

f. *aquilia*, Thurau, Berl. Ent. Zeit., 48, p. 129, pl. 2, f. 8 (1903); Strand, Mitt. Zool. Mus. Berl., 5, 2, p. 280 (1911).

f. *chaeribulula*, Strand, *l. c.*, p. 281 (1911).

f. *usaramensis*, Strand, *l. c.*, p. 282 (1911).

German E. Africa (Tabora, Mandera, Dar-es-Salaam, Usaramo, Lindi).

A. acrita manca, subsp. nov. Pl. X, ff. 2, 5. Pl. XVI, f. 12.

= *A. guillemei manca*, Thurau, Berl. Ent. Zeit., 48, p. 305 (1903).

f. *lindica*.

= *acrita*, f. *lindica*, Strand, *l. c.*, p. 282 (1911).

German E. Africa (Irangi, Iraku, Itumba, Usagara, Usukumu, Tabora).

A. acrita bellona, subsp. Pl. X, ff. 8, 11. Pl. XVI, f. 11.

Weymer, Deut. Ent. Zeit., p. 728 (1908); Strand, Mitt. Zool. Mus. Berl., p. 280 (1911).

Angola (Benguella, Chissamba, Caconda, Calwelia, Ceramba, Guiballa).

A. acrita, f. *pauperata*.

Thurau, Berl. Ent. Zeit., p. 129 (1903); Strand, *l. c.*, p. 281 (1911).

(A form liable to be found in any locality, and differing only in absence of subbasal spot in f.-w. 1b.)

Acraea acrita appears to be a very unstable species of wide distribution, and on the verge of becoming divided into several different species. Its extreme variability combined with an excessive development of seasonal dimorphism has led to the description of a confusing multiplicity of forms. The highly complicated structure of the male armature, extending as it does to remarkable modifications in the structure of the dorsal abdominal plate, serves rather to enhance than to mitigate the difficulty. For a time I was of opinion that the forms could be resolved into several distinct species, but having now examined some hundreds of examples, including specimens from practically every known locality and taken at different seasons, and having also examined the structure of the male and female armatures in examples occurring throughout the range of the species, I can find no satisfactory means of dividing the forms into anything more definite than subspecies. Several geographical races or subspecies appear to be recognisable. At the northern limit of its range the subspecies *pudorina* occurs, characterised by its more than usually elongated wings, and the paucity or absence, according to the season, of spots in the f.-w. Further south, along the East Coast and extending as far as Delagoa Bay, is the subspecies which I have called *littoralis.* I should have been glad to have avoided the addition of another name to the already over-extended list, were it not for the fact that most of the existing names of forms which appear to belong to this subspecies indicate definite localities, and thus are apt to be misleading. Following this are the typical *acrita* and *acrita ambigua* which may be regarded as the central races, whilst in Angola the subspecies *bellona* appears to be perhaps the most distinctly separated of all, and is characterised by the exceptionally large size of the black spots in the f.-w.

These races include all the described forms except f. *pauperata*, Thurau, and the subspecies *manca.*

Pauperata may occur in any subspecies, being merely distinguished by the absence of the basal spot in area 1b of the f.-w. It is unfortunate that this feature should have been utilised as a key character by Strand in his list of the forms (*l. c. sup.*), since it is one of the most variable and unstable features of the species. It is not consistently absent even in *pudorina*, whilst several examples before me have the spot in one wing and not in the other. The subspecies *manca* is described later.

It is scarcely possible from the wing pattern alone to distinguish with certainty between all the races of *acrita*. They can, however, be to some extent distinguished (save in the case of transitional forms) by the central process of the dorsal abdominal plate which covers the male armature. In *pudorina* this is very short and cup-like, in *littoralis* it is of medium length and blunt, in *acrita acrita* it is long and somewhat spatulate, but in *bellona* it is usually (though not invariably) pointed, whilst there is always a prominent tooth, sometimes of bifid structure, at the base on the ventral side. These features can usually be observed in the dried specimen merely by the aid of a lens, especially after the characteristic appearance has been studied from the plates accompanying the present work.

To give a minute description of all the named forms of *A. acrita* would scarcely, I think, owing to the great variability of the species, serve a useful purpose. I shall therefore endeavour to give such typical descriptions, together with an account of the principal directions in which variation takes place, as should enable the collector to identify as nearly as possible, examples of the species.

With the exception of extreme wet-season forms of the female, *acrita* may generally be recognised by the peculiar flame orange-colour of the wings, usually with a paler or even whitish discal bar in the f.-w., by the absence of spots beyond the end of f.-w. cell (except in *manca*) by the presence of three, usually well marked (except in *pudorina*), often very prominent, black spots in f.-w., one on the end of cell, one in area 2, and one in 1b, the latter close to margin, and all three in a straight line at right angles to the costa.

The following typical examples may be thus further described :—

A. acrita acrita.

♂. Expanse 60–72 mm. Dry season. Ground-colour of all the wings flame orange, tending basally to scarlet. Outer half of f.-w. rich orange. A narrow black line along costa. A black apical tip about 2 mm. wide, and a narrow black line round margin. A large black spot in cell above, and usually slightly beyond origin of 2. On upper half of end of cell a double spot. In basal part of area 2 a spot, and a submarginal spot in 1b. These three lie in a straight line across the wing at right angles to costa. There may also be a subbasal spot in 1b. This spot varies considerably. It may be present in one wing and not in the other, or it may even be double in one wing and single in the other.

H.-w. with a slight black basal suffusion, and a hind-marginal border formed of well-marked black arches on a marginal black line, the latter continued as a narrow line right round the inner margin. Black spots variable and more easily observed on the underside.

Underside, f.-w. resembles the upper, but paler. The apical area ochreous with orange internervular rays, and ends of nervules black. A black spot at base of costa, but no apical black. Spots as above. H.-w. creamy ochreous with red splashes between the nervules. Black spots as follows :—A discal row beginning with one in 7 beyond the middle, second in 6 about 2 mm. nearer to margin, very rarely a spot in 5, when present small and just below the second, a spot in 4 close to end of cell, a spot (sometimes absent) in 3, touching end of cell, another in 2 touching median and 2, one in 1c nearer to margin, one in 1b further from margin and on a level with that in 2, and usually a minute spot still nearer to base in 1a.

A spot in area 9 on base of cell, one in 8 some distance beyond precostal, a subbasal in 7, two spots in cell, one in 5 on middle discocellular, a basal and a subbasal in 1c, ditto in 1b, and a basal in 1a.

Head black with an orange tuft between the eyes, collar orange, thorax black with red hairs, base of abdomen black with orange lateral spots, remainder orange. Fringes of all wings conspicuously white. Claws unequal.

♂. Wet season. Ground-colour rather darker. F.-w. with a black basal suffusion reaching the subbasal spot in 1b. Spots as in dry form but larger. Apical black 3 to 4 mm. wide. H.-w. with more black basal suffusion, especially in 1c. Discal row of spots all present and nearly all confluent. Marginal black border about 3 mm. wide to nervule 2, where it widens out to 4 mm. There is only a trace of internervular spots of the ground-colour. In extreme examples the black may join the basal suffusion, or even overrun almost the whole of the h.-w.

Underside much as in dry season form, but black spots larger, and h.-w. marginal arches heavier.

♀. Dry season. Expanse 60 to 66 mm. F.-w. much more rounded than in ♂. Ground-colour similar but duller. F.-w.

apical black, rather broader. H.-w. marginal black, broader and heavier. Dorsal part of abdomen black, with yellowish lateral spots.

♀. Intermediate between wet and dry. F.-w. coffee brown at base, outer half ochreous. H.-w. almost entirely suffused with black. Spots as in ♂. Underside proportionately duller.

♀. Wet season. Smoky black, spots especially in h.-w. only just distinguishable. Subapical part of f.-w. smoky ochreous. Underside f.-w. smoky ochreous at base, outer half dull ochreous. H.-w. dull red. Base of cell and 1c pale sage green, marginal black arches enclosing pale sage green spots. Abdomen black above with white lateral spots.

A. acrita ambigua, subsp.

♂. Dry season. Distinguished from *acrita acrita* principally by the increased width of the apical black in the f.-w. which is about 6 mm. wide. Extreme examples may have only the cell spot and the discocellular spots in f.-w., and the black arches of h.-w. margin are often obsolescent towards the anal angle. On the underside the h.-w. is without the internervular red splashes in the discal area. The f.-w. subapical area is usually paler than in *acrita acrita*.

♂. Wet season. Differs from the dry form in the same way as the corresponding forms of *acrita acrita*.

♀. Dry season. Resembles the ♂ but is duller coloured and has more rounded wings.

♀. Wet season. Similarly marked to the ♂ but the ground-colour dusky grey and the f.-w. subapical area white.

The figure of the ♀ of this form accompanying Trimen's original description is a somewhat abnormal example combining some of the dry-season red with the white sub-apical bar of the wet season.

A. acrita bellona, subsp. Pl. V, f. 4.

♂. Dry season. Easily distinguished from all the other forms by the very large size of the spots in cell, on discocellulars, and in area 2. These spots, especially in wet season ♀♀ may be so large as to become confluent. In addition to this distinction the f.-w. is more pointed and the apical black is 7 to 8 mm. broad. Occasional very dry ♂♂ may be rather difficult to distinguish from wet ♂♂ of *ambigua*, though the spots referred to seem never to be reduced quite to the size of those in the latter subspecies. There is the same absence of red splashes on the underside.

♂. Wet season. Differs little in ground-colour from the dry form but the spots are larger, especially those of the f.-w. The area between end of cell and apical black is very pale ochreous, and the h.-w. marginal black is better developed though not to the extent found in *acrita acrita*.

♀. Dry season. Resembles the dry season ♂. Very slightly duller in colour, and with more rounded wings.

♀. Intermediate. Resembles the ♂ but wings more rounded and red colour replaced by dusky brown. Spots large and f.-w. apical black about 9 mm. wide. A white discal patch extending from end of cell to apical black. Underside correspondingly dull in colour.

♀. Wet season. Resembles the foregoing intermediate form but the ground-colour dark smoky grey. Underside with base of cell and area 2, also internervular portions of hind-marginal border pale sage green.

♀♀ of *acrita bellona* are distinguished by the character of the genital plate which is very much narrower structure than in other forms (except *pudorina*). It is in fact in a condition intermediate between that in *pudorina* and the other forms.

A. acrita littoralis.

♂. Dry season. Ground-colour somewhat less brilliant than in *acrita acrita*. F.-w. apical black 3 mm. wide. H.-w. hind-marginal black arches rather faint towards anal angle. Many of h.-w. spots rather faintly indicated on upper side.

♂. Wet season. F.-w. spots larger than in dry form, and apical black broader than in *acrita acrita* (4–5 mm.). H.-w. discal spots very variable. Rarely a trace of a spot in area 5, sometimes no spot in 3, often all the spots very close together. Hind-marginal border with well-marked black arches varying to an almost entirely black border 3 mm. wide. H.-w. underside with or without red splashes in the discal area.

♀. Dry season. Resembling dry ♂ but with more rounded wings and duller in ground-colour. H.-w. hind-marginal border heavier, often leaving only a trace of internervular spots. The inner edge of this border may be either sharply defined or suffused.

♀. Wet season. Marked as in dry ♀ but ground-colour smoky grey and f.-w. apical black 6–7 mm. wide. A discal white band between apical black and end of cell. Underside correspondingly dull in colour. H.-w. marginal spots white or greenish.

This form is distinguished from *acrita acrita* principally by the broader apical black of the f.-w. and the shorter process of the terminal dorsal abdominal plate. In spite of its geographical position it is somewhat intermediate in pattern between *acrita acrita* and *acrita ambigua*.

A. acrita pudorina.

♂. Dry season. F.-w. rather more pointed than *acrita acrita*. Ground-colour rather duller flame colour varying to rosy. F.-w. almost devoid of spots, though curiously enough there is often a faint trace of a discal row of spots beyond the cell. No basal black suffusion and very little apical black, often a mere marginal line. Though the ground-colour is rather richer near base, there is no distinct paler outer area of the ground-colour. The spot in 2 when present is nearly always nearer the median than in the other forms of *acrita*, thus destroying the straight line effect already referred to. The spots on h.-w. are faintly indicated on the upperside, as also are the hind-marginal black arches. There is a slight black basal suffusion. Discal area of the h.-w. underside is not splashed with red.

♂. Wet season. Differs only in the somewhat more distinct black markings. A black suffusion at base of h.-w. Apical black about 1 mm. wide and h.-w. marginal black 3 mm. wide, sometimes leaving only a trace of internervular markings.

♀. Dry season. Resembles ♂ but the wings are more rounded.

♀. Intermediate. Duller than ♂ with a brown basal suffusion in f.-w. and rather rosy-pink h.-w., the marginal border of which is rather heavily marked with black.

♀. Wet season. Resembles the intermediate form in markings but ground-colour dusky ochreous grey. No subapical white. Black basal suffusion in both wings. H.-w. marginal border black 3 mm. wide with a faint indication of pale internervular spots. Abdomen black with white lateral spots. Underside correspondingly dull in colour and h.-w. hind-marginal spots white.

A. acrita. f. *manca.* Pl. III, f. 8 (♂).

This peculiar form is comparatively rare in collections. The ♂ has an expanse of 52 mm. and the ♀ 56. The ♂ resembles in shape a small but uniformly coloured example of *acrita pudorina*. The f.-w. has a narrow black apical border. A spot in cell just beyond origin of 2 and one on upper part of end of cell. The spot in 2 touches the median so that it does not make a straight line with those on end of cell and in 1a. There is a well-marked subbasal spot in 1a, and a *fully developed discal band of four spots beyond the cell*, the first of which is very minute. The h.-w. has a slight basal black suffusion and a clearly defined marginal border of black arches. The discal and basal spots are as in other forms of *acrita* but there is no spot in 3 and 5. The underside is paler and duller. The discal area of h.-w. is devoid of red splashes and the internervular spots of the margin are ochreous.

The ♀ resembles the ♂ but the ground-colour of the f.-w. has a brownish tinge and the spots are larger, especially the first of the f.-w. discal row. But for this discal row of spots, and the marginal spots of h.-w. underside which are ochreous instead of whitish, this ♀ closely resembles certain intermediate ♀♀ of *acrita pudorina*.

A. acrita manca. f. *lindica.*

♂. Expanse 58–64 mm. The apical black about 5 mm. wide. From middle of wing to the inner edge of the apical black the ground-colour is rich ochreous the basal area being of the usual flame orange colour. The usual spots are present but small, but there are *no subapical spots* as in the typical *manca* form. In the h.-w. the spots are as usual but I have seen no example of either sex having a spot in area 3. The marginal border is formed of a series of confluent black rings enclosing spots of the ground-colour.

♀. Dry season. Resembles ♂ but rather duller, the ground-colour having a tendency to rose colour.

♀. Wet season. Sepia grey with a white subapical patch, f.-w. apical black, all spots, and h.-w. marginal border rather more heavily marked than in dry season form.

The occurrence of this apparent subspecies of *acrita* with its two very different forms adds greatly to the complication and difficulty of the subject. My reason for separating them from the other forms is based on the structure of the dorsal abdominal plate in the ♂ and that of the genital plate of the ♀. In the former the central process is very long and lingulate, and the latter is a thick cylindrical chitinous structure very different from the corresponding organ in other forms. These structures are constant and similar both in the *manca* form with its subapical spots, and in the *lindica* form in which these spots are absent. I have used the name *lindica* because the male described agrees with that so named by Strand (*l. c.*). That author's example was taken near Lindi, but all the other examples I have seen have been found in the more central parts of German E. Africa.

There are before me ♀ examples of an intermediate form of the *pudorina* subspecies which show traces of the f.-w. subapical spots as developed in the *manca* form, but the structure of the ♀ genital plate is quite different and conforms to that of other ♀♀ of *acrita.*

But for the above facts I should be inclined to regard the *manca* form as a distinct species, such a view being strongly supported by the difference in the structure of the abdominal plate. I do not however feel justified in assigning specific rank to the present form so long as we possess so few examples.

It will be understood that the various subspecies of *acrita* above described overlap in their geographical distribution and that intermediate forms are liable to occur, which fact combined with the general tendency to melanic development in the wet season, furnishes material for a very wide range of individual variation.

As a result many form names have been published in connection with this species, these being enumerated in the synonymy already given. Though many of these are of little systematic importance it is necessary for the completion of the present work that these form names should as far as possible be identified. A key has recently been published by Dr. Strand of Berlin (*l. c. sup.*), who also made several additions to the list. I give below those to which allusion has not already been made in the foregoing descriptions, together with notes as to the apparent systematic position of each form.

f. *aquilia*, Thurau, is a wet season ♀ of *acrita littoralis.*

f. *utengulensis*, Thurau, appears to be a wet season ♂ of *acrita pudorina.*

f. *bella*, Weymer, is a dry season ♂ of *acrita bellona.*

f. *chaeribula*, Strand, is apparently an intermediate ♀ of *acrita littoralis.*

f. *aquilina*, Strand, appears to be a wet season ♀ somewhat intermediate between *acrita acrita* and *acrita littoralis.*

f. *msamwiae*, Strand, is a wet season ♂ of *acrita acrita.*

f. *usaramensis*, Strand, is a wet season ♂ of *acrita littoralis.*

f. *nyassicola*, Strand, is an intermediate ♂ of *acrita acrita.*

There is in the general collection of the Berlin Museum a remarkable form of *A. acrita* bearing the label "Uganda." The ground-colour is very brilliant. Beyond the cell in f.-w. there is a very small spot in area 6, below this a large spot in 5, and beneath that, but nearer margin a dot, more distinctly visible on the underside. The h.-w. has a very broad black border, narrow at the apex but immediately expanding to about 4 mm. and at nervule 3 to some 6 mm. wide. The border on underside is of the usual pattern. The specimen is labelled *guillemei*, but has nothing to do with that species. The process of the terminal abdominal plate is short, a little longer than in the *pudorina* form. No conclusion can be drawn from a single, apparently aberrant specimen of this kind, bearing a vague locality label. I have seen no other example of any form of *acrita* purporting to have been taken in Uganda.

Reference to the drawings of the ♂ armatures of forms of *acrita* shown on Plate X will suggest that marked differences of structure are to be found in these organs. Differences do certainly exist, but from a series of preparations carefully examined I cannot find satisfactory *constant* differences. The peculiar short blunt hooks vary in thickness and in the shape of their extremities, and the size and contour of the massive penis sheath is also inconstant. Moreover with a structure of such complication it is a matter of the greatest difficulty to make accurate comparison of the dimensions of the various parts. Such difficulty would not be insuperable given an unlimited number of specimens from every locality. Each part, uncus, claspers, sheath, etc., could then be carefully measured and tabulated. The magnificent material generously placed at my disposal by the Hon. W. Rothschild almost warranted such an investigation, but numerous though the specimens are, there appear to be some localities still insufficiently represented, so that for the present the problem of the true relationships of the forms of *acrita* must await a future solution. The species does not appear to be rare, so that we may look forward to having the assistance of much needed breeding experiments in the near future.

54. Acraea chaeribula. Pl. IX, ff. 17, 18. Pl. XVI, f. 8.

Acraea chaeribula, Oberthür, Etud. d'Ent. 17, p. 19, pl. 2, f. 16 (1893); Aurivillius (*acrita* var.), Rhop. Aeth., p. 96 (1898);

Neave, Proc. Zool. Soc., p. 19 (1910); Strand (*acrita* f.) Mitt. Zool. Mus. Berlin, v. Band, 2 Heft, p. 282 (1911).

Nyassaland (Zomba); N. Rhodesia; Congo (Katanga); German E. Africa.

♂. Expanse 50–58 mm. Wings deep orange-red shading to yellow in f.-w. subapical area, without the tinge of scarlet common in forms of *A. acrita*. F.-w. with some black at base which may be absent in very dry season specimens. Costa very faintly lined with black. Apex with a black tip 8–10 mm. wide usually with a fairly sharply defined proximal edge at right angles to costa. The remainder of hind margin bounded by a faint black line. A spot in cell slightly beyond origin of 2, one on upper part of discocellulars, one at base of area 2 close to median, a submarginal and a subbasal in 1a.

H.-w with a black basal suffusion usually extending into area 7 and widest in 1c. A hind-marginal border formed by a marginal line and black internervular arches. Spots as on underside, those near base obscured by the black suffusion.

Underside. F.-w. ground-colour as above but paler, apical black replaced by greyish ochreous divided by the black nervules and orange ochreous rays. A black spot at base of costa. Other spots as on upperside.

H.-w. dull orange ochreous, base of 7, end of cell, and median portions of 1c, 1b, and 1a splashed with red. Base of cell, 2, 1c, 1b and 1a pale greenish. Marginal border as on upperside but enclosing greenish or greenish-yellow spots. Black spots as follows:—Discal row, one in 7 about middle, one in 6 nearer margin, very rarely a minute spot in 5 beneath the second. Beneath this a spot in 4; in 3 a small spot touching end of cell (often absent), a spot in 2 touching median and 2, a spot in 1c, 1b and 1a, each nearer to base than the spot preceding it. A spot in 8 near precostal, a subbasal in 7, two in cell and one at base of 5 on m.d.c., a basal and a subbasal in 1c and a subbasal in 1b and 1a.

Head black, usually with a pale mark between the eyes, thorax black with red hairs, abdomen black tipped with orange, and with orange lateral spots. Claws unequal.

The above description is that applying to average examples. Very dry forms may have no spots at all in f.-w. and a very pale median area. Very wet forms may have an excess of black suffusion in the h.-w. The most constant feature is the very broad black apex in the primaries. The ground-colour is also constantly yellower than in *A. acrita.*

♀. Expanse 50–58 mm. Dry season. Ground-colour but little duller than that of ♂. Abdomen black above with white lateral spots. Wing spots often very small, and faint on upperside, otherwise spots and markings as in ♂.

Wet season. Ground-colour tending to dusky ochreous.

There would seem to be much less seasonal dimorphism in *A. chaeribula,* than in *acrita.*

Professor Aurivillius when compiling his catalogue of African Rhopalocera regarded the species as a form of *acrita.* Neave, however, pointed out (*l. c.*) that it was quite a distinct species, a fact which he established on his experience of the insect in life, and also from an examination of the male armature. In spite of this, however, Strand includes it in his list of forms of *acrita,* merely remarking in a footnote that according to Neave *chaeribula* is a good species.

55. Acraea lualabae. Pl. IX, f. 16.

Acraea lualabae, Neave, Proc. Zool. Soc., p. 18, pl. 1, f. 4 (1910).

Congo (Lualaba R.).

♂. Expanse about 50 mm. Wings rather dull orange somewhat paler on f.-w. median area: f.-w. with a very slight black suffusion at base and a conspicuous black tip about 7 mm. wide. A black spot in cell very slightly beyond origin of 2, and one on upper part of end of cell. Two discal spots beyond cell, one in 5 and a larger one in 3. In 2 a large spot touching the median, and in 1b a submarginal and a subbasal spot.

H.-w. dull orange with a black basal suffusion, and a marginal border formed of black arches on a narrow marginal line. Spots as on underside but smaller. In the cotype at Oxford there is a spot in area 5 on upperside, which is reduced to a minute dot on underside. The type has no spot in this area.

Underside. F.-w. as on upperside but paler, the apical black replaced by dark ochreous. A black spot at base of costa. H.-w. pale orange ochreous, lemon ochreous at base of cell to inner margin, reddish at base of area 7, and in median portion of 1c, 1b and 1a. Marginal border with black arches enclosing rounded spots of pale dull ochreous. Black spots as follows:— A median spot in 7, a spot in 6 much nearer margin, under this a minute dot in 5 representing the spot on upperside which is present in the cotype and not in the type ; in 4 a spot near margin immediately beneath that in 6, a spot in 3 not quite touching end of cell, one in 2 touching median and nervule 2, a large transverse spot in 1c, nearer to margin, and one in 1b and 1a nearer to base. In addition to these, a spot in 8 slightly removed from precostal, a subbasal in 7, two in cell, one at base of 5 touching m.d.c., a transverse subbasal spot in 1c and 1a, and between these, but more distally placed, a small spot in 1b.

Head and thorax black, latter with a few brown hairs, abdomen black with the last two or three segments orange. Claws unequal.

♀ unknown.

There are at present only two examples of this *Acraea*, the type in the National Collection and the cotype at Oxford. Both were taken by Neave on the Lualaba River, Belgian Congo. It is distinguishable from small examples of *A. acrita* by the f.-w. discal spots, and from *acrita manca* by the broad black apical patch.

The genital armature is very distinct. The claspers are entirely different from those of *acrita*, or indeed of any other species I have examined. The true uncus is reduced to a mere bristle, whilst the chitinous sheath of the penis is developed into what appears to be a false uncus.

GROUP X.

56. ACRAEA DIOGENES. Pl. XVI, f. 13.

Acraea diogenes, Suffert, Deut. Ent. Zeit. "Iris," xvii, p. 14 (1904.)

"LOWER GUINEA."

= *lactea*, Neave, Proc. Zool. Soc., p. 20, pl. 1, f. 7 (1910).

BELGIAN CONGO (Upper and Lower Lufupa R.).

♀. Expanse 48–56 mm. F.-w. translucent and having a milky appearance, being sparsely covered with greyish white scales, and for a depth of about 6 mm. the apex is somewhat dusky, the nervules and rays being a little darker. There is a trace of a dark spot in the middle of cell, and another in 2 just under median. In 1b a third much nearer margin. H.-w rather more thickly scaled dusky white, with a blackish marginal line and internervular arches, the latter inwardly suffused. The spots of the underside show through.

Underside, f.-w. almost scaleless, h.-w. dusky greyish with rather thick well-marked black marginal arches enclosing spots of ground-colour. End of cell, end of area 2, and all of 1a, 1b, and 1c, except extreme base, scaled with rusty red. Black spots as follows:—One in 9, one in 8, two in 7, the second followed by a spot in 6, and 5 all parallel to the apical margin, one in 4 close to cell, beneath it and nearer margin one in 3, one in 2 touching median and nervule 2, beneath it one in 1c, and one in 1b level with that in 2. Also two in cell, a dot on the middle discocellular, a basal and a subbasal in 1c, 1b, and 1a.

Head, thorax, and abdomen black with a few whitish marks.

In spite of the difference in locality Neave's *lactea* appears to be the same species as Suffert's *diogenes*, the type of which I have carefully examined. The cotype of *lactea* in the Oxford collection differs only in its larger size, its fresher condition, and in the greater extent of red on the underside of h.-w. So far as I am aware there are only three examples known, all ♀♀, and until more material is available it is difficult to decide the true affinity of this form. The genital plate is, as will be seen from a reference to the figure on Plate XVI, of a most curious formation, unlike that of any other species which I have had the opportunity of examining. The portion surrounding the opening of the bursa copulatrix consists of a heavily ridged mass of chitin, thickly set with minute spines or teeth, and resembles in this respect the membrane surrounding the male organs in *periphanes*. It bears no resemblance, however, to the ♀ plate in *periphanes*, which is of comparatively simple structure.*

GROUP XI.

57. Acraea leucopyga. Pl. XII, f. 3. Pl. XVI, f. 7.

Acraea leucopyga, Aurivillius, Ent. Tidskr. 25, p. 92, f. 32 (1904); Neave, Proc. Zool. Soc., p. 22 (1910).

= *liszti*, Suffert, Iris, 16, p. 17 (1904).

N.E. Rhodesia (Luangwa Val.); Nyassaland (Kota Kota, Kigonsera).

♂. Expanse 54–62 mm. Dry season. Wings deep rose pink, tending to deep orange at base, costa, subapical area, and hind

* The suggestion may seem somewhat speculative, but I am inclined to think that *A. diogenes* will ultimately prove to be a ♀ of *A. guillemei*, or, if that form be really distinct from *A. acutipennis*, then a ♀ of the latter.

margin in f.-w., and at base and along inner edge of marginal border in h.-w. F.-w. with a narrow black line along costa and hind margin, and a black apical tip about 5 mm. broad. Black spots as follows:—A spot in cell just beyond origin of 2, and in some examples another smaller spot about 2 mm. nearer base and touching the subcostal. A spot on upper part of discocellulars. Beyond end of cell a discal row of five, the first minute or absent (in 10), the second, third, and fourth (in 6, 5, and 4) in a straight line nearly at right angles to hind margin. The fifth in 3 about the middle. A spot in 2 close to median. Beneath this but nearer margin a spot in 1b, and in the same area a subbasal spot just behind origin of 2. H.-w. with a very little black at bases of nervures, and a black hind-marginal border about 2 mm. wide. Spots as on underside, but those near base and inner margin often faintly indicated.

Underside. F.-w. rose pink, the apex pale ochreous divided by black ends of nervules and orange internervular marks. A narrow black apical and hind-marginal line. H.-w. pinkish ochreous, base and middle part of 1c, 1b, and 1a rose pink, a good deal of orange powdering between the nervules, and a row of orange internervular spots just before the hind-marginal border. The latter formed of narrow clearly defined black arches on a black marginal line, enclosing pale lemon ochreous spots. Black spots as follows:—Discal spots. One in 7 about the middle, one in 6 nearer margin, one in 5 still nearer margin, one in 4 touching end of cell, one in 3 half-way between end of cell and marginal border, one in 2 close to median, one in 1c immediately beneath the last, and one in 1b and 1a further from margin. A spot in 8 close to precostal, a subbasal in 7, two in cell and one in 5 on m.d.c., a basal and a subbasal in 1c; a subbasal in 1b, and a basal in 1a. Fringes whitish, dotted with black at ends of nervules.

Head black with an orange tuft between eyes, and two on the collar. Thorax black with red hairs, and two white dorsal lines and two posterior spots. Abdomen, base black with white lateral spots and transverse lines, remainder white with orange scales at the extremity. Claws unequal.

♂. Wet season. Ground-colour much duller, a black basal suffusion in both wings. H.-w. hind-marginal black broader and often inwardly suffused.

♀. Dry season. Resembles the ♂ but dorsal part of abdomen blacker.

♀. Wet season. Wings dull ochreous, the spots accentuated, the basal black suffusion extended and the h.-w. hind-marginal black broad and inwardly suffused. Underside correspondingly duller. In extreme forms both wings may be sepia black with a pale ochreous discal bar in f.-w. Abdomen black with small white lateral spots.

The brilliant rose-colour of fresh examples of *leucopyga* is very striking. Neave describes the species as rather rare in the Luangwa Valley, and having the same low flight as *A. oncaea,* which it somewhat resembles on the wing.

58. Acraea intermedia. Pl. XI, f. 3.

Acraea intermedia, Wichgraf, Berl. Ent. Zeit., p. 241 ; pl. vi, f. 3, 4 (1908) ; Neave, Proc. Zool. Soc., p. 22 (1910).

Rhodesia (Kalungwisi Valley) ; Congo State (Lualaba Valley).

It is with some hesitation that I maintain this form separate from *A. caldarena*, as, although there are differences in the arrangements of the spots I can find no satisfactory difference in the structure of the respective male armatures. The figures of these would appear to show some differences, but comparison of the preparation of *intermedia* with a series of *caldarena* shows such differences to be very doubtful. Unfortunately I have only been able to secure a single example for dissection, but since series of preparations of the armature of *caldarena* and its near allies show constant and recognisable differences, it is at least remarkable that there should in this case be no marked distinction. The following description is taken from that by Wichgraf.

♂. Expanse 64 mm. Ground-colour uniform dull yellowish brown. F.-w. apical black 7 mm. broad. A very narrow hind-marginal line. The discal spots are three in number (in 3, 4, 5), the middle one being the largest and near to end of cell. These spots lie in a straight line not quite parallel to the edge of the apical black. The spots in 4 and 5 on middle and upper discocellulars rounded and confluent. An ovate spot in cell, and at about one-third of the distance from it to the base a smaller linear spot. The spot in 2 lies nearer to the cell than in *rhodesiana* and *caldarena*, and almost equidistant from nervules 2 and 3, and the spot beneath it in 1a, lies nearer to margin. Midway between this and the base a smaller spot. Nervules blackish towards the margin. Base only slightly suffused

H.-w. with a stronger suffusion not reaching beyond the middle of cell. The spots well rounded and fairly large, arranged as in *caldarena*, but larger and extended commensurately with the form of the wings.

Underside. Spots as above. The very large bluish white spots of the h.-w. margin enclosed by quite similar arched lines, but these arches are not thicker in the middle as in *caldarena*, *aglaonice*, etc. Basal part of h.-w. marked with brick red. A whitish mark extending from costa through the middle of the cell to 1b, and surrounding the four large subbasal spots. The spot in 1c is also surrounded with white. Abdomen not so black as in *rhodesiana* and the pale marks yellowish. Claws unequal.

♀. Ground-colour dark smoky grey. The space between the apical black and the discal spots white, trapezoidal, the posterior rather suffused portion reaching nervule 3. The yellowish grey-green ground-colour of the underside passes into light chocolate brown at a point two-thirds of the length of the wing from the base. In areas 6 and 10 there are two small extra spots of the discal row.

The locality given for Wichgraf's types is Rhodesia. A male example in the Oxford collection was taken by Neave in the Lualaba Valley (Congo State). What appears to be a dry-season female of the same species was taken by the same collector in N.E. Rhodesia in the Kalungwisi Valley. This specimen is the same colour as the ♂. The spots are nearly all very indistinct, most of them only showing through from beneath. On the underside the f.-w. spots are very small, but those on the h.-w. are of normal size.

One feature which appears to distinguish this form from *caldarena* is not insisted upon by Wichgraf. The first three h.-w. discal spots in 7, 6, and 5 are large, and lie in a nearly straight line which if produced would meet the hind margin at end of nervule 5. In *caldarena* the third of these spots is either directly underneath the second, or only very slightly more distally placed. Moreover the discal spots in f.-w. appear to be nearer the end of cell than in *caldarena*. In spite of these differences the similarity of structure of the male armature in this form and in *caldarena* makes me incline to the belief that it is only a form of the latter species, but a final conclusion can scarcely be attained with the present paucity of material.

59. Acraea caldarena. Pl. XI, f. 1.

Acraea caldarena, Hewitson, Ent. Mo. Mag., 14, p. 52 (1877); Trimen, S. Af. Butt., i, p. 149 (1887); Westwood, Oates, Matabeleland, Ed. 2, p. 355, pl. v, f. 1, 2 (1889); Butler, Proc. Zool. Soc., p. 657 (1893); Trimen, Proc. Zool. Soc., p. 27 (1894); Marshall, Trans. Ent. Soc., p. 553 (1896); Aurivillius, Rhop. Aeth., p. 99 (1898); Butler, Proc. Zool. Soc., p. 191 (1898); Butler, Proc. Zool. Soc., p. 906 (1898); Dixey, Proc. Ent. Soc., p. iii (1906); Dixey and Longstaff, Trans. Ent. Soc., p. 344 (1907); Neave, Proc. Zool. Soc., p. 25 (1910); Fountaine (metam.), Trans. Ent. Soc., p. 60, pl. x, f. 15*a*, 15*b* (1911).

= *amphimalla*, Westwood, Oates, Matabeleland, p. 347, pl. E, f. 1, 2 (1881).

= *dircea*, Westwood, *l. c.*, p. 348 (1881).

= *recaldana*, Suffert, Iris, p. 27 (1904).

Damaraland; Khama's Co.; N.E. Rhodesia (Luangwa Valley); Transvaal; Natal; Mashonaland; Matabeleland; Manicaland; Nyassaland; Portuguese E. Africa; German E. Africa; British E. Africa.

f. *neluska*, Oberthür (*oncaea* var. *neluska*), Etud. d'Ent., 3, p. 25, pl. ii, f. 2, 3 (1878).

= *ombria*, Weymer, Stett. Ent. Zeit., p. 82 (1892).

Zanzibar; Dar-es-Salaam.

♀ f. *nero*, Butler, Ann. Nat. Hist. (5), 12, p. 102 (1883); Aurivillius, Rhop. Aeth., p. 99, pl. i, f. 3 (1898).

V. Nyanza.

A. caldarena caldarena.

♂. Expanse 38–62 mm. Ground-colour varies from pinkish ochreous to a beautiful pale rose colour (= *recaldana*, Suff.). F.-w. Costa very narrowly black. Apex with a black patch about 7 mm. wide continued as a very narrow black line along margin. A slight dusky basal suffusion. Black spots as follows:—One in cell near origin of 2. One at end of cell on upper discocellulars. Beyond cell close to edge of apical black a transverse oblique row of four spots usually almost in a straight line, the first (in 6) sometimes absent. H.-w. with a slight dusky basal suffusion. A very narrow black line round margin, with internervular black arches. Occasionally these are developed to the extent of making an almost continuously black border about 2 mm. wide. Black spots rather variable on upperside, those in 1c, 1b, and 1a often only showing through from beneath. Fringe whitish and rather conspicuous.

Underside f.-w. rather paler than upper side. No dusky suffusion. Apical area ochreous with orange internervular rays. One basal and one subbasal spot on costa. Spots as above. H.-w. pale ochreous. A narrow black line round hind margin and narrow internervular black arches. Discal area with an orange ochreous band parallel to hind margin, its inner edge much suffused. Internervular patches of reddish in median and basal areas. Black spots as follows :—An irregular discal row of nine. The first in 7 rather beyond middle, second in 6 nearer margin, third in 5 immediately beneath, or slightly more discal than the second, fourth in 4 nearer base, fifth in 3 nearly midway between end of cell and the marginal black arch. The sixth and seventh in 2 and 1c and lying in a straight line with the fourth. The eighth in 1b rather nearer base, the ninth in 1a still nearer base. A spot in 8 a little distance from precostal and close to costa, a subbasal in 7, two in cell (the second just before origin of 2). A large spot at base of area 5 touching 6 and middle discocellular. A basal and a large subbasal in 1c, a small spot in 1b, and a subbasal in 1a.

Head reddish brown with tufts of same colour on collar. Thorax black with reddish hair. Base of abdomen black with pale lateral spots and narrow transverse segmental bands. The remainder pale pinkish ochreous. Claws unequal.

♀. Expanse 48–60 mm. Dry season examples may be very similar to ♂, but with a larger extent of dusky basal suffusion, and the hind-marginal border almost entirely black. A somewhat intermediate example before me has the ground-colour of a delicate pale salmon pink (= *recaldana*). From this condition every gradation may be found to an extreme wet season form in which all the wings are sepia, with a milk white patch in the f.-w. extending from costa to hind angle, and from origin of nervule 2 to inner edge of dark apical patch. Spots as in ♂. Abdomen black above with white or yellowish lateral spots.

A. caldarena ♀ f. *nero*, Butl.

In this form the ground-colour is greyish ochreous. F.-w. with heavy dusky suffusion extending over nearly the whole wing. H.-w. with a black marginal border and dusky suffusion over the whole wing. The distal ends of areas 4, 3, 2, and 1c are white, bounded distally by the marginal border, and proximally sharply cut off from the ground-colour. Only two examples are known to me, one in the British Museum, and one in the collection of Mr. H. Druce.

A. caldarena f. *neluska.*

The ♂ of this form differs from typical examples in having the f.-w. black apical patch much reduced in width. In three ♂ examples in the Tring Museum the patch does not exceed 4 mm. and in one it is reduced to 3 mm. The ground-colour is somewhat redder than in *caldarena caldarena.* In one example all the f.-w. spots except the discocellular, and most of the h.-w. spots, are obsolescent or wanting. In colouring and general appearance the form resembles *A. pudorella.* The ♀ is like an ordinary wet season specimen of *caldarena.*

The early stages of *caldarena caldarena* are thus described by Miss Fountaine, *l. c.*:—

"The larva of this butterfly also feeds on the flowers and leaves of *Wormskioldia longepedunculata*; it is of a soft pink rose colour, shading into yellow at the extremities, underneath it has a longitudinal white stripe between the legs, extending from head to tail; the spines are black. The pupa is not quite so elongated in shape as that of *A. nohara*, the wing cases are pale, dull drab veined and outlined with black, the abdomen is deep cream-colour with the rows of orange spots so heavily outlined with black as to be almost coalescent. I found this larva, but not at all commonly, at Macequece."

A. caldarena is described by Marshall as one of the commonest butterflies in Mashonaland. Dixey notes (Proc. Ent. Soc., p. iii, 1906) a strong smell of musty straw in the ♀. The relation of the pink ground-colour to the seasons seems to vary in different localities. Thus Marshall states (T. E. S., p. 553, 1906) that the ground-colour of the wet-season males is of a richer pink, whilst Neave states (Proc. Zool. Soc., p. 25, 1910) that examples taken in the "hot dry Luangwa Valley" are of a brighter colour, being of a peculiar shade of salmon pink.

60. Acraea pudorella. Pl. XI, f. 5. Pl. XV, f. 24.

Acraea pudorella.

= *A. caldarena*, var. *pudorella*, Aurivillius, Rhop. Aeth., p 99 (1898).

= *braesia*, Em. M. B. Sharpe, Proc. Zool. Soc., p. 337 (1894).

British E. Africa (Taita, Taveta, Kibwezi, Campi ya Simba, Sokoke Forest, Zanzibar); German E. Africa (Irangi); Abyssinia (Kotscha).

A. pudorella detecta, subsp.

=*A. detecta*, Neave, Proc. Zool. Soc., p. 24, pl. i, f. 6, 6a (1910).

N.E. RHODESIA (Luangwa Valley); NYASSALAND (Chikala Boma); GERMAN E. AFRICA (Lindi).

A. pudorella pudorella. Pl. III, f. 7 (♂).

♂. Expanse 52–62 mm. F.-w. thinly scaled, salmon pink with a yellowish tinge. Costa from about middle to apex narrowly black. Apical and hind-marginal border narrowly black. At apex and to some extent along hind margin the internervular spaces are suffused with orange. Base slightly darkened. Black spots as follows:—One in cell at, or slightly beyond origin of nervule 2. A spot (sometimes double) on discocellulars. A discal row of 2 to 4 spots beyond cell in 6, 5, 4, and 3, lying nearly in a straight line at right angles to costa. Sometimes a dot near base of area 2. In area 1b a central and a subbasal spot, the latter sometimes wanting. H.-w. ground-colour as in f.-w. but more densely scaled. Somewhat blackened at base and having a narrow black hind-marginal border bearing indications of paler internervular marks. Black spots as on underside but often only faintly indicated.

Underside f.-w. as on upperside but almost devoid of scales. Two black spots on costa near base.

H.-w. pinkish ochreous, internervular spaces reddened at base. Hind-marginal border formed of moderately thick black arches on a fine black marginal line and enclosing internervular spots of pale greenish ochreous. Patches of slightly darker ground-colour between the nervules at inner edge of marginal border. Black spots as follows:—An outer row of nine, the first in 7 a little beyond origin of nervule 7, the second in 6 more distally placed, third in 5 still nearer margin, fourth near base of area 4, fifth in 3 nearer margin, sixth near base of 2, seventh in 1c nearer margin, eighth in 1b nearer base, ninth in 1a still nearer base. Some basal black in 9, cell, 1c, 1b, and 1a. A subbasal spot in 7, two spots in cell, the second over origin of nervule 2, one on discocellular at base of 5, a subbasal in 1c and beneath it a spot in 1b, and a subbasal in 1a.

Head black with a deep pink tuft between eyes, and two on collar. Thorax black with pink hairs. Basal half of abdomen black with pink lateral spots and transverse lines, remainder yellowish pink. Claws unequal.

♀. Expanse about 56 mm. Resembles ♂ but f.-w. suffused with brown at base, and h.-w. orange brown becoming paler towards margin. F.-w. apical black and h.-w. hind-marginal border a little broader than in ♂.

Thorax and abdomen black above with white markings.

A. pudorella detecta, subsp.

♂. Expanse 48–54 mm. Closely resembles *A. caldarena*. Wings rather thinly scaled. F.-w. reddish ochreous to rusty red at base becoming distinctly paler beyond end of cell. A slight dusky suffusion at base and along costa, and a black apical tip 5 to 7 mm. broad, the inner edge of which is usually less well defined than in *caldarena*. The spots are rather variable and usually much reduced. One in cell above origin of 2, a black mark on upper part of discocellulars. Beyond cell a discal row of five (some often absent) in a straight line at right angles to costa. One in 2 near median, one beneath this in 1b, but nearer margin, and occasionally a subbasal spot in the same area, near median. In some examples traces of submarginal spots in 1b and 2.

H.-w. with a slight black basal suffusion and a narrow black hind-marginal border formed of a series of arches on a marginal line enclosing more or less distinct spots of the ground-colour. The inner edge of this border is often rather suffused. The spots of the h.-w. upperside correspond to those beneath, but those near base and inner margin are frequently only faintly indicated.

Underside f.-w. ground-colour as on upperside but thinly scaled and shiny. Apical black replaced by greyish ochreous. A black spot at base of costa, other spots as on upperside. H.-w. pinkish ochreous with a few reddish marks near base. Marginal border formed of black arches on a thin marginal line, enclosing whitish internervular spots. Black spots as follows:—Discal series, one in 7 about middle, one in 6 nearer margin, one in 5 still nearer margin, and *more distally placed than in caldarena*. One in 4 slightly removed from end of cell. One in 3 about midway between end of cell and marginal border, one in 2 touching median and 2, and *distinctly more proximally placed than in caldarena*. A spot in 1c nearer margin than that in 2. One in 1b on a level with that in 2. A spot in 8 near precostal, a subbasal in 7, two in cell, one at base of 5 on m.d.c., a basal and a subbasal in 1c, the latter contiguous with a spot in 1b, close to which is a spot in 1a. Also a subbasal spot in 1a, and some irregular black about the bases of the nervules.

Head black with a pale line between the eyes, and two tufts on collar. Thorax black with red hairs, base of abdomen black with yellowish lateral spots, remainder pinkish ochreous.

♀. Dry season. Very like the ♂ but rather duller in colour. Spots and markings as in ♂. Abdomen black above with white lateral spots.

Wet season. Dusky ochreous to sepia, often with a translucent whitish discal area in the f.-w. Spots and markings as in dry season form.

As the form to which Aurivillius gave the name *pudorella* proves to be specifically identical with Neave's *detecta*, the latter must become a subspecies of the former. Probably *pudorella* is the ancestral form and *detecta* has become modified in its pattern in association with *A. caldarena*, which it so closely resembles. The ♂ and ♀ armatures of *detecta* and *caldarena* are very distinct.

61. Acraea rhodesiana. Pl. II, f. 6 (♂).

Acraea rhodesiana, Wichgraf, Berlin Ent. Zeit., p. 240, pl. vi, f. 1, 2 (1909).

Rhodesia (Lofu R.).

♂. Expanse 54 mm. Wings apricot yellow. F.-w. with a slight dusky suffusion, distal half of costa black, apex black (4 mm. wide) hind margin narrowly black. Subapical area paler than ground-colour. Black spots as follows :—One in cell just beyond origin of 2, on end of cell a spot the greater part of which is beyond the discocellulars. A *very short distance beyond cell* a row of spots of which the first in 10 is markedly elongate, the second, third and fourth shorter but gradually increasing in length, the fifth in 3 separate and rather nearer margin. A spot in 2 near median, beneath it and slightly nearer margin a spot in 1b, and in the same area a very small spot close to median and just before origin of 2. H.-w. with a slight black suffusion and a black hind-marginal band 2 mm. wide with faint indications of paler internervular markings. Black spots corresponding with those beneath but those near inner margin faintly indicated.

Fringes rather conspicuously whitish.

Underside f.-w. pale pinkish ochreous with a still paler subapical patch. Apex pale sage green divided by black ends of nervules and internervular orange marks. Two black spots at base of costa, other spots as above. H.-w. pale pinkish ochreous. Base rose pink with some pale grey markings in cell and 1c. Hind margin bordered by a black line on which are black internervular arches enclosing pale sage green spots. Black spots as follows :—Discal spots. One in 7 about middle, one in 6 nearer margin, and immediately beneath it or very slightly nearer margin, a spot in 5 ; a spot in 4 close to end of cell, one in 3 about 2 mm. from end of cell, one in 2 near median, one in 1c nearer margin, one in 1b on a level with that in 2.

A spot in 8 near precostal, two in cell, one in 5 on m.d.c. and a dot on l.d.c., a subbasal in 1c, and one in 1b rather more distally placed, and a small spot slightly beyond the middle of 1a. Some irregular black at base of wing and a basal black line on inner margin. Head and thorax black with some reddish hairs, base of abdomen black with white lateral spots, and segmental lines, remainder white with some yellow hairs at tip. Claws unequal.

The above description is from the cotype in the National Collection. It appears to resemble the figure accompanying Wichgraf's description, but all the figures on this plate are so poor that they are of little value.

The ♀ is described (*l. c.*) as having a smoky chocolate brown ground-colour, the pale subapical area being represented by a sharply defined white patch, somewhat suffused in area 3. The spot in f.-w. cell distinctly larger.

A specimen in the Oxford collection taken by Neave on the Lofu River, N.E. Rhodesia, agrees with the fig. and description of *rhodesiana* ♀ with the exception that the f.-w. subapical area is ochreous instead of white.

The locality given in the original description is merely "Rhodesia." The types are in Herr Wichgraf's collection, and there is a ♂ co-type in the London and Stockholm Collections.

62. Acraea mima. Pl. XII, f. 8.

Acraea mima, Neave, Proc. Zool. Soc., p. 22, pl. i, f. 8, 9 (1910) ; Eltringham, Af. Mim. Butt. p. 39, pl. iii, f. 5 (1910).

N.E. Rhodesia (Serenje) ; Congo (Katanga).

♂. Expanse 56–60 mm. F.-w. greyish-black with black costa and black apex. Base of costa and median powdered with orange brown. Area 1a, 1b, and sometimes 2 and lower half of cell, suffused with salmon orange. A conspicuous white discal bar about 3 mm. wide at costa in 10, 9, 6, 5, 4, and upper part of 3. In one example this white area is dusted with reddish scales. Black spots as follows :—One in cell slightly beyond origin of nervule 2. At end of cell an irregular spot the greater part of which is beyond the discocellulars. *A very short distance* *beyond the cell*, a discal row of spots, of which the first in 10 is markedly elongated and extends further towards base than the rest; the second, third, and fourth in 6, 5, and 4 are contiguous and of gradually increasing length, the fifth in 3 separated and rather distinctly nearer margin. In 2 a large spot near median, two in 1b, of which one is beneath that in 2 and very slightly nearer margin, the other close to median just before origin of 2. H.-w. salmon-orange with a slight black basal suffusion, and a black marginal border 2 mm. wide bearing faint indications of paler internervular markings. Black spots corresponding to those on underside, those near inner margin faintly indicated. Fringes conspicuously whitish.

Underside f.-w. pale orange ochreous, rather dusky along costa and in median area. Costa, apex, and hind margin narrowly lined with black. Apical area greyish ochreous divided by the black ends of nervules and by broad orange internervular marks. Two spots near base of costa. Other spots and markings as above.

H.-w. pale orange ochreous, rose pink at base and central area rather paler. Hind margin bounded by a black line on which are rather flat, moderately heavy black arches enclosing pale yellowish-white spots. Black spots as follows. Discal spots. One in 7 about middle, one in 6 nearer margin, one in 5 still nearer margin, in 4 a spot touching l.d.c. and 5, a spot in 3 about 2 mm. from end of cell, one in 2 close to median, one in 1c rather more distally placed, one in 1b on a level with that in 2.

A spot in 8 a short distance from precostal, two in cell, one at base of 5 on m.d.c., a large spot in 1c near origin of 2, close to this but more distally placed a spot in 1b, and 1a, a basal spot in 1a, and some irregular black at base of wing.

Head black with pale orange marks between and behind the eyes, collar with two red tufts, thorax black with red hairs and lateral tufts. Base of abdomen black with lateral white spots, remainder yellowish white. Claws unequal.

♀. Expanse 44–58 mm. Resembles the ♂ but ground-colour duller. Abdomen black above with white lateral spots.

In the arrangement of the spots *A. mima* is almost the same as *A. rhodesiana* of Wichgraf, but the latter lacks the heavy black suffusion in the f.-w. and the subapical area is only slightly paler than the ground-colour instead of white as in *mima*. Also the reddish yellow colour of *rhodesiana* is of a paler tint.

In Mr. H. Druce's collection there is a beautiful ♂ example of this species which differs somewhat from Neave's specimens. The greyish black colour in f.-w. begins only at about 6 mm. from base and from thence as far as the discal spots it is quite narrow, extending only into upper part of end of cell. The subapical white bar is rather narrow and very sharply defined. The apical black extends barely as far as nervule 3, with a central marginal streak in area 2. The dark marginal border of h.-w. is very narrow and somewhat obsolescent towards anal angle. The terminal half of abdomen is white. The specimen was taken in August 1903, and is labelled Lowombwa River. As Neave's specimens were taken in December the difference in colouring may be seasonal.

As Neave has indicated, *A. mima* is nearly allied to Wichgraf's *rhodesiana*, and I consider it possible that they may ultimately prove to be forms of the same species. Unfortunately I have not had an opportunity of examining the genitalia of the latter species. The armature of *A. mima* is, as the figure shows, quite distinctive.

63. Acraea braesia. Pl. XI, f. 7.

Acraea braesia, Godman, Proc. Zool. Soc., p. 538 (Oct. 1885); Smith and Kirby, Rhop. Exot., 9. (*Acraea*), p. 3, pl. i, f. 7 (1889); Butler, Proc. Zool. Soc., p. 401 (1898); Aurivillius, Rhop., Aeth. p. 99 (1898).

= *leucosoma*, Staudinger, Exot. Schmett., i, p. 84 (Nov. 1885).

German E. Africa (Kilimandjaro, Dar-es-Salaam, Witu, Massaland, Usambara); British E. Africa (Mori River, Ukamba, L. Baringo, Voi River, Melindi, Kikuyu, Kaya Kauma, Taveta); Somaliland (Berbera); Abyssinia (Gurgura-Gololota.

f. *regalis*.

Oberthür (*A. regalis*), Etud. d'Ent., 17, p. 20, pl. ii, f. 20 (1893); Holland, Ann. Nat. Hist., 6, 12, p. 249 (1893); Aurivillius, Rhop. Aeth., p. 99 (1898).

German E. Africa (Kilimandjaro, Dar-es-Salaam); British E. Africa (Mombasa, Taita).

A. braesia braesia.

♂. Expanse 56–64 mm. F.-w. narrow and elongated. Translucent, the base flushed with rose brown shading to pink, the outer half transparent grey. Costa, apex, and hind margin narrowly black. At inner edge of apical and marginal black a series of orange spots large at apex and becoming smaller towards hind angle. Neuration black. Black spots as follows:—One in cell over origin of nervule 2. A double spot on discocellulars. Beyond end of cell an oblique band of spots the first (sometimes wanting in 10), the second, third, and fourth in 6, 5, and 4, in a straight line at right angles to costa, the fifth in 3 slightly nearer margin. A spot near base of area 2 and beneath it a spot in 1b. In the latter area a dot midway between base and origin of nervule 2. H.-w. rosy pink slightly blackened at base, and having a black hind-marginal border bearing indications of slightly paler internervular marks, its inner edge slightly sinuate. Black spots corresponding to those beneath but often only faintly indicated.

Underside f.-w. almost devoid of scales except at base, on spots, and on apex and hind margin. Otherwise as above.

H.-w. dull pinkish ochreous with a few reddish marks at base. Marginal border formed of rather heavy black arches on a fine black marginal line enclosing pale dull ochreous spots. Black spots as follows:—An outer series of nine. The first in 7 just beyond origin of nervule 7, second in 6 nearer margin, third in 5 still more distal, fourth in 4 touching cell, fifth in 3 a short distance from its base, sixth in 2 near its base, seventh in 1c nearer margin, eighth in 1b nearer base, ninth small, in 1a, still nearer base. One in 9, one in 8, a subbasal in 7, two in cell (the second just before origin of nervule 2), a basal and a subbasal in 1c and 1b, and a subbasal in 1a. A spot at base of area 5 on discocellular.

Head black with a whitish tuft between eyes and two on collar. Thorax black with a few whitish marks, basal half of abdomen black above with yellowish lateral spots, remainder whitish with a yellow terminal tuft. Claws unequal.

♀. Expanse 60–64 mm. F.-w. slightly more rounded at apex than in ♂. Colouring varies from a condition resembling the ♂ but slightly duller, to one in which the pink areas are replaced by grey, the outer half of h.-w. being white. Spots as in ♂. Abdomen entirely black above with large white lateral spots.

I have seen but few examples from Somaliland, but these differ in the following points:—

♂. F.-w. almost entirely transparent except for the spots and marginal and apical black and orange. The spot in area 3 is absent. The h.-w. is rose pink, sometimes with a slight tendency to white suffusion.

♀. F.-w. entirely transparent as in male. Submarginal orange spots only indicated. Spots in 3 and 2 absent or very faint. H.-w. white with black basal suffusion. Marginal border rather broader than in other forms. Spots as in typical examples.

Whether Somaliland specimens constantly differ as above described I am unable at present to say.

A. braesia f. *regalis*.

♂. Differs from typical examples in having the f.-w. fully scaled on the upperside. Deep brick red as far as the discal spots. Just beyond these a pink subapical band followed by a band of grey broad at nervule 6 and tapering to nervule 3. Orange submarginal spots large and confluent. H.-w. brick red with the spots only faintly indicated.

♀. The few ♀♀ I have seen resemble the ♂ though rather duller and paler.

A. braesia is a distinct and easily recognisable species. There is a little variation in the shape of the ♂ claspers, and at one time I thought the differences were sufficiently constant to warrant the separation of the *regalis* form as a species, but a series of preparations shows that whilst there is a general tendency for the armature of *regalis* to differ slightly from that of *braesia* such differences are not constant. The ♀ plates are the same. The *regalis* form may be regarded as being on the verge of separating off as a species though at present it occurs in company with the type form and is probably syngamic therewith.

64. Acraea doubledayi. Pl. XI, f. 6.

Acraea doubledayi, Guérin, Lefebre, Voy. Abyss., 6, p. 378 (1849); Reiche, Ferret and Galinier, Voy. Abyss., pl. 33, f. 1, 2 (1849); Aurivillius, Rhop. Aeth., p. 99 (1898).

= *gaekwari*, Em. M. B. Sharpe, Entomologist, 34, Suppl., p. 2 (1901).

Abyssinia; Somaliland.

♀ f. *candida*, f. nov.

Nyam Nyam.

A. doubledayi sykesi, subsp.

Em. M. B. Sharpe (*A. sykesi*), Entomologist, p. 279 (1902).

= *mystica*, Neave, Novit. Zool. xi, p. 327 (1904).

Uganda (Entebbe, Wadelai); British E. Africa (Kumi, L. Salisbury); German E. Africa (Bukoba).

A. doubledayi arabica, subsp. nov.
S. Arabia (Azvaki Ravine).

A. doubledayi doubledayi. Pl. II, f. 3 (♂).

♂. Expanse about 64 mm. F.-w. thinly scaled and rather translucent, brick red with black spots. Costa and base somewhat suffused with blackish. A black marginal band 6 mm. wide at apex becoming narrower towards hind angle, having its inner edge thinly scaled, and bearing a submarginal row of deep orange spots, the last of these (in 1b) often merged into the ground-colour. From each of these spots is given off inwardly a short black internervular ray (doubled in 1b). In areas 3, 4, 5, 6, 9 and 10 between the marginal border and the discal row of spots a white translucent band very sparsely scaled. Black spots as follows :—A large spot in cell above origin of 2 and rarely a trace of a second spot nearer base. A spot on the upper part of the discocellulars. A discal row of five confluent spots (the fifth sometimes separate), the first in 10 rather nearer base than the others and the next three almost in a straight line. A large spot in 2 its upper edge close to origin of nervule 3. Immediately beneath this a large spot in 1b, and in the same area a smaller round spot below median just before origin of 2. H.-w. brick red with some black basal suffusion. A black hind-marginal border about 2 mm. wide having a very distinct but *markedly undulating* inner edge, and very slightly paler internervular marks. Black spots as on underside but those near inner margin often only faintly indicated.

Underside f.-w. The greater part of median area very sparsely scaled and shining. Spots as on upperside with a basal and a subbasal spot on costa. Costa pale ochreous. Apex and hind margin pale ochreous with orange internervular spots each of the latter with a short black internervular ray. A narrow black line round apex and hind margin.

H.-w. pinkish ochreous with a greenish ochreous marginal band bounded by a narrow black marginal line, and broken by narrow black internervular arches. Just inside the latter a row of orange ochreous internervular marks. Basal and median area with some rose-pink internervular marks. Black spots of medium size as follows :—A discal row of nine, the first three in 7, 6 and 5, each nearer the margin than the last, the fourth in 4 nearer base, fifth in 3 midway between end of cell and marginal border, the sixth in 2 just below origin of 3, the seventh and eighth in 1c and 1b, nearly in a straight line with the sixth, the ninth in 1a nearer base. A spot in 8 near precostal, a subbasal in 7, two in cell and one on middle discocellular, a subbasal in 1c, 1b, and 1a, that in 1b nearer margin than the other two. Some irregular black at base of nervures.

Head black with brown hairs, and tufts on collar, thorax and base of abdomen black, the latter with small pinkish lateral spots, remainder pinkish ochreous. Claws unequal.

♀ resembles the ♂ in size and markings but the ground-colour varies from dull pink to dull smoky ochreous. The underside of f.-w. almost devoid of scales. The abdomen black above with white lateral spots, and sometimes the last three or four segments entirely white above.

A. doubledayi ♀ f. *candida*, f. nov.

Represented by an example in the Staudinger collection from Nyam Nyam. The ground-colour is white, the form bearing the same kind of relation to the type as does *A. encedon* f. *lycia* to *A. encedon encedon*.

A. doubledayi sykesi, subsp.

Differs from typical *doubledayi* in having the f.-w. of a yellower colour. The apical and marginal black is confined to the ends of the nervules and a thin marginal line, and the translucent patch is almost or entirely absent. The ground-colour of the h.-w. margin on the underside is white.

The ♀ is a more tawny brown and the f.-w. spots somewhat larger.

The type of *mystica*, Neave, has rather redder h.-w. than the other examples I have seen. It is a somewhat worn example, and its identity with the *sykesi* form is only evident on careful comparison with a series of the latter.

A. doubledayi arabica, subsp. Pl. II, f. 2 (♂).

Differs from the typical form in having the wings much more heavily scaled, but with hardly any basal suffusion. The translucent patch is often thickly scaled with dusky white (white in ♀). The ground-colour is usually a deeper brick red. In some examples there is a small black streak in f.-w. cell just before the large spot, and sometimes one in 1b just before the subbasal spot. The spots tend to be larger and the terminal half of the abdomen is white with some yellow scales at the tip. The underside is more richly coloured than in the typical form and in some examples the basal costal spots are wanting. The ♀ resembles the ♂ but the ground-colour is dull chocolate brown, and the abdomen is black with large white lateral spots and white segmental rings.

Much confusion has arisen over this species, doubtless owing to its rarity and the comparative inaccessibility of the original figure. I have therefore prepared a figure of the ♂ from an example in the Tring Museum which agrees with the figure given by Reiche (*l. c.*), and have also illustrated the Arabian subspecies which I found in the same collection. Four ♂♂ and one ♀ of this form were taken in the Azvaki Ravine in Southern Arabia. The *A. doubledayi* described in Trimen's S. African Butterflies is *A. oncaea*, and hence many examples of the latter species are labelled *doubledayi* in collections.

65. Acraea oncaea. Pl. XII, f. 5. Pl. XV, f. 25.

Acraea oncaea, Hoppfer, Monatsb. Ak. Wiss. Berlin, p. 640 (1855); Peters Reise Ins., p. 375, pl. 24, f. 5–8 (1862); Staudinger, Exot. Schmett., i, p. 84 (1885); Aurivillius, Rhop. Aeth., p. 100 (1898); Voeltzkow Reise Lep., p. 315 (1909); Neave, Proc. Zool. Soc., p. 25 (1910).

= *doubledayi*, Trimen, S. Af. Butt., i, p. 147 (1887); Butler, Proc. Zool. Soc., pp. 53, 191 (1898); Dixey, Proc. Zool. Soc., p. 11 (1900).

Congo (Kassai); Nyassaland (Zomba); Manicaland; Portuguese E. Africa; Natal; Transvaal; Cape Colony; Rhodesia; German E. Africa (Mafia I., Lindi, Dar-es-Salaam); British E. Africa; Abyssinia; Somaliland.

♀ f. *alboradiata*, Suffert, Iris, p. 28 (1904).
♀ f. *modesta*, Suffert, *l. c.*
♀ f. *obscura*, Suffert, *l. c.*
♀ f. *defasciata*, Suffert, *l. c.*, p. 29.
♂ f. *caoncius*, Suffert, *l. c.*, p. 27.
These forms are not confined to any particular locality.

A. oncaea liacea, subsp., nov.

= *caecilia liacea*, Suffert, Iris, p. 29 (1904).

German E. Africa (Usandawi).

A. oncaea oncaea.

♂. Expanse 50–60 mm. Wings dull orange red to dull ochreous. F.-w. costa from middle to apex narrowly black. At apex there is a narrow black tip, sometimes as much as 3 mm. wide but always quite recognisable. At about nervule 4 or 5 the black tapers to a narrow marginal line extending to the hind angle. The median area is often rather thinly scaled but does not become translucent. A slight dusky suffusion at base. The apical and hind-marginal area shows a tendency to orange between the nervules, and in the internervular spaces are black rays sometimes as far as area 2. Ends of nervules black. There is a submarginal row of black spots parallel to the hind margin. These vary in number. In very "dry" examples there may only be a minute spot in 1b and 2, while wet season specimens may have a well-developed row of four spots in 1b, 2, 3, and 4. Other spots as follows :—One in cell above origin of 2, sometimes preceded by a faint longitudinal streak. A double spot on upper part of discocellulars. A discal row, when all present five in number, in 10, 6, 5, 4, and 3, but that in 6 often minute or absent. These spots lie roughly in a straight line nearly at right angles to the costa; the spot in 3 well separated from the others. In area 2 a spot near the meridian. In area 1b a subbasal and a median spot.

H.-w. A slight black suffusion at base and a hind-marginal border varying in appearance from continuous black about 2 mm. wide to a row of faintly indicated dark internervular arches standing on a thin marginal line. The inner edge of this border is always regularly arched between the nervules. Black spots as on underside, those near inner margin often very faint, and the discal spots often smaller than those below.

Underside. F.-w. a pale replica of the upperside but without the apical black. Two small black spots near base of costa.

H.-w. Pinkish ochreous with internervular marks of a rather deeper pink in median and basal areas. Hind-marginal border bright ochreous with a thin marginal line and narrow black internervular arches. Black spots as follows :—A discal row of eight. The first three in 7, 6, and 5, approximately parallel to margin, the fourth in 4 close to end of cell, the fifth in 3 some distance from end of cell, but not in the middle of the area, the sixth in 2 close to median, the seventh in 1c nearer margin, and the eighth in 1b nearer base. A spot in 8 near precostal, a subbasal in 7, two in cell close together near middle, one at base of area 5 touching m.d.c. and 6. A large subbasal spot in 1c, and close to it a spot in 1b, and 1a, all three in a straight line, a subbasal spot in 1a and some irregular black about bases of nervures.

Head black with brown hairs, and tufts on collar. Thorax black with brown hairs. Base of abdomen black with orange lateral spots, remainder orange. Claws unequal.

Some fine examples of the ♂ *oncaea* taken by Neave on Chirui I., L. Bangweolo, have the f.-w. dull rosy red, and the space between the discal spots and the apical black is grey. The inner edge of the apical black is much suffused and broken up by submarginal orange spots each of which is divided by a black ray. The h.-w. is bright red with a rosy tinge, and bears the usual black spots. The h.-w. underside at base and inner margin is deep rose pink.

Suffert describes under the name *caoncius* (*l. c.*) a form in which the f.-w. apical black is no wider than the marginal black.

♀. Expanse 48–64 mm. Extremely variable. Whilst in a long series all kinds of intermediates may be found, the following may be specially noted :—

(1) Dry season. F.-w. base to discal row of spots reddish chocolate. Beyond the spots a white band in 10, 9, 6, 5, 4, and 3, about 4 mm. wide. Between the outer edge of this and the apical black, dusky orange. H.-w. reddish chocolate with a pink patch beyond cell in 4, 3, 2, and 1c. Spots, etc., as in ♂.

Underside. F.-w. paler and duller. White area replaced by creamy yellow, apex pale ochreous with orange internervular marks.

H.-w. whitish with rose pink marks beyond discal spots and at base and inner margin . . . = f. *obscura*, Suffert.

(2) Dry season. Similar to (1) but without the white patch in f.-w. . . . . . . = f. *defasciata*, Suffert.

(3) Wet season. Resembles ♂ but the wings are greyish black, and f.-w. has a white patch as in (1). H.-w. marginal black, broader than in ♂ and inner edge suffused. Little or no basal black suffusion. Underside similar but paler. This form agrees with figure of Hoppfer's type.

(4) Wet season. Resembles (3) but the nervures of h.-w. dusted with white . . . . = f. *alboradiata*, Suffert.

(5) Wet season. Resembles (3) but h.-w. with a large white median patch . . . . . . = f. *modesta*, Suffert.

(6) Resembles ♂ but wings are dull ochreous grey. No white markings. Underside similar but h.-w. dark ochreous.

In all the ♀ forms the abdomen is black above with whitish or yellowish lateral spots.

f. *liacea*.

This form was described by Suffert as a subspecies of *caecilia*, but having examined the types I find it belongs to the present species. In the ♂ the h.-w. black margin is rather ill-defined inwardly and beneath has heavy black arches enclosing whitish spots. The ♀ is like the ♂ but has the h.-w. margin broader, and more suffused, and is without a white subapical bar in f.-w. Examples taken by Neave in the Iringa District, German E. Africa, in December (wet season) show that the ♀ of this subspecies does not become black in the wet season, the ground-colour being much the same as in the ♂.

A curious aberration of the ♀ was taken by Neave in the Luangwa Valley in Aug. 1910. The ground-colouring resembles that of the first form above described, except that the apical black and the subapical white are contiguous. The spots are reduced to one (large) in middle of f.-w. cell, and a black mark on discocellulars. In h.-w. there is a spot in cell and one at base of 6 and 5. On underside the h.-w. marginal border consists merely of a thin double black line broken by a black mark on end of each nervule.

A. oncaea is an abundant species and Neave records it as common at all seasons in the Luangwa Valley. The male armature is quite distinct in form. The species has been much confused with *A. doubledayi*, Guér., from which, however, it is quite distinct.

66. ACRAEA EQUATORIALIS. Pl. XII, f. 6. Pl. XV, f. 28.

Acraea equatorialis.

= *A. doubledayi equatorialis*, Neave, Novit. Zool., 11. p. 327 (1904); Eltringham, Novit. Zool., 18, p. 151, note (1911).

BRITISH E. AFRICA (Kisumu).

A. equatorialis anaemia, subsp. nov.

= *A. doubledayi equatorialis*, Aurivillius, Sjöstedt's Exped., p. 4 (1910).

BRITISH E. AFRICA (Kikuyu Escarpment, Campi-ya-Simba, Rabai, Zanzibar, Pemba I.); GERMAN E. AFRICA (Kilimandjaro).

A. equatorialis equatorialis. Pl. II, f. 10 (♂), f. 11 (♀).

♂. Expanse 46–48 mm. Wings rather lightly scaled, delicate pinkish ochreous. Costa, apex, and hind margin very narrowly black, slightly broader at apex. Just inside this black border, a narrow band of orange divided by the black ends of nervules, and followed inwardly by a grey area bearing black internervular rays. Black spots as follows:—One in cell at or just before origin of 2, one on upper part of discocellulars, a row of five beyond cell, the first in 10, often very small or obsolescent, the second, third, and fourth in 6, 5, and 4 further from end of cell and in a straight line at right angles to costa, fifth in 3, separate and rather nearer margin. A spot in 2 just under origin of 3, beneath this and slightly nearer base, a spot in 1b, and in same area a subbasal spot just beyond middle of first section of median. Sometimes a slight black basal suffusion in 1b.

H.-w. with a slight black basal suffusion, and a narrow black hind-marginal line on which are rather ill-defined flat internervular arches enclosing small marks of the ground-colour. Black spots corresponding to those beneath but often rather faintly indicated near inner margin.

Underside. F.-w. very thinly scaled and shiny. Usually two black spots at base of costa. Otherwise as above. H.-w. pale pinkish ochreous with a few pink marks at base. Hind-marginal border as above but very clearly traced, and enclosed spots rather yellower than ground-colour. Black spots as follows:—Two in 7 near middle and rather close together, one in 6 nearer margin and one in 5 still nearer margin, in 4 a spot about 1 mm. from end of cell, and beneath it but nearer margin, a spot in 3. One in 2 close to median, beneath it and nearer margin a spot in 1c, and a spot in 1b on a level with that in 2. A minute spot in 8 near precostal, two in cell, a basal and a subbasal in 1c, close to the latter a spot in 1b followed by a spot in 1a, another larger spot in same area nearer base. A small black mark in area 9. *Very rarely* a minute black dot at base of 5 on m.d.c. Fringes pale ochreous.

Head and thorax black with ochreous tufts. Base of abdomen black with pale lateral spots, remainder creamy white. Claws unequal.

♀. Expanse 42–48 mm.

f. 1. Like the ♂ but wings more rounded, and ground-colour duller. H.-w. marginal black with little indication of pale internervular marks, and on the underside enclosing whitish spots. Abdomen black above with white segmental lines and lateral spots.

f. 2. Like f. 1, but f.-w. ground-colour pale grey with indications of a white subapical bar beyond the discal spots. H.-w. white with a dusky suffusion at base, costa, and along inner edge of marginal border. Inner margin yellowish.

Intermediates between these two ♀ forms occur, and the difference does not appear to be seasonal, as all the 38 examples in the Oxford collection were taken in November to January by Mr. Wiggins.

The species is quite distinct and is not a form of *doubledayi*, though some of the grey ♀♀ are not unlike the ♀ of that species.

A. equatorialis anaemia, subsp. Pl. V, f. 5 (♂).

♂. Expanse 50–60 mm. Differs from typical *equatorialis* in having the wings more sparsely scaled and the ground-colour paler and more delicate. Both wings have a brownish basal flush and submarginal spots are frequently present in f.-w. 1b, and 2.

♀ resembles ♂ but wings are more rounded and abdomen is black with white lateral spots.

67. Acraea ella. Pl. II, f. 7 (♂). Pl. XI, f. 8.

Acraea ella, Eltringham, Novit. Zool., xviii, p. 151 (1911).

Angola (Bihé).

♂. Expanse 50–60 mm. Wings dull to golden or pinkish ochreous. F.-w. with a slight dusky basal suffusion, costa, apex, and hind margin very narrowly black, rather broader at apex. Apical area usually rather richer yellow than remainder of wing. A submarginal row of internervular black rays which rarely reach the margin. Nervule ends black. Black spots as follows :—In cell a spot very slightly beyond origin of 2. A double spot on upper part of discocellulars. Beyond cell a discal row of spots of which the first in 10 is rather nearer base than the others, and usually elongate, the second, third and fourth in 6, 5, and 4 nearly in a straight line at right angles to costa, the fifth separate and nearly in the middle of area 3. A spot in 2 just below origin of 3, and beneath this but slightly nearer margin a spot in 1b, and in same area a spot (sometimes doubled) about 2 mm. before origin of 2.

H.-w. with some black basal suffusion, and a hind-marginal border formed by a narrow black marginal line on which are rather flat, not always clearly defined, internervular arches enclosing spots of the ground-colour. Black spots corresponding to those on underside but usually only faintly indicated near inner margin.

Underside f.-w. like the upperside but without basal suffusion, paler, and with two spots at base of costa. H.-w. paler than on upperside, base, inner margin, and area 1c splashed with pink. Marginal border as above but much more clearly defined. Black spots as follows :—Discal spots, one in 7 about middle, one in 6 about 3 mm. nearer to margin. Beneath this and slightly nearer margin a spot in 5 (absent in three examples). In 4 a spot about 1 mm. from end of cell, a spot in 3, 2 mm. from end of cell, and one in 2 not very close to median. A spot in 1c, 3 mm. from margin, and one in 1b rather nearer base. A spot in 8 near precostal, a subbasal in 7, two in cell, one at base of 5 on m.d.c., a basal and a subbasal in 1c, and immediately below the latter a spot in 1b and 1a, also a subbasal in 1a. Some irregular black at base of wing.

Head and thorax black, with reddish tufts and hairs, base of abdomen black with whitish lateral spots, remainder white to yellowish. Claws unequal.

♀ resembles ♂ but ground-colour rather more dusky ochreous.

This species is apparently very closely allied to *equatorialis.* It may be distinguished from the latter by its larger average size, and by the fact that the discal spot in f.-w. 1b is usually slightly more distally placed than that in 2, whereas in *equatorialis* this spot is slightly more proximally placed. Also the spot in h.-w. at base of area 5 is well developed, and is rarely indicated in *equatorialis.* Further the structure of the claspers in the male armature is slightly different and the penis is longer and much more slender. The chitinous plate in the female of *A. ella* is of quite different structure, having a bifid process on its anterior edge, and the aperture is much smaller.

68. Acraea axina. Pl. XII, f. 7.

Acraea axina, Westwood, Oates, Matabeleland, p. 344, pl. F, f. 5, 6 (1881); *l.c.*, Ed. 2, p. 352, pl. 6, f. 5, 6 (1889); Trimen, Proc. Zool. Soc., p. 66 (1891); *l.c.*, p. 26 (1894); Aurivillius, Rhop. Aeth., p. 99 (1898); Butler, Proc. Zool. Soc., p. 905 (1898); Neave, Proc. Zool. Soc., p. 25 (1910).

= *doubledayi*, var., Trimen, S. Af. Butt., 1, p. 147 (1887).

Angola (Bihé, Benguella); Damaraland; Manicaland; Mashonaland; Transvaal; Portuguese E. Africa (Delagoa B., Tete); Nyassaland (Blantyre); Rhodesia (Ft. Jameson, Alala Plateau).

♂. Expanse 36–48 mm. Dry season form. Wings rosy ochreous with a brownish basal and costal suffusion. Costa from middle to apex narrowly black. Hind margin black, 1 mm. broad, slightly narrowing towards hind angle. Apical area orange ochreous, the ends of nervules black, and with black or brownish internervular rays. Black spots as follows:—A large spot in cell above origin of 2, a spot on upper part of discocellulars. A discal row of five, the first four (in 10, 6, 5, and 4) nearly in a straight line and confluent, the fifth smaller and separate. A spot in 2 near median, beneath it and rather nearer margin a spot in 1b, and a second in the same area near the base. H.-w. with a slight blackish brown suffusion, and a black sharply defined marginal border with faint indications of paler internervular markings. Spots small and as on underside. Fringes rather conspicuously whitish.

Underside, f.-w. with one or two subbasal costal spots. Ground-colour paler than above. Apical area ochreous with orange internervular marks. Other markings as on upperside but marginal black narrower. H.-w. pale ochreous with rose pink internervular marks. Hind margin border formed by moderately heavy black arches and a very narrow black marginal line enclosing greenish ochreous internervular spots. Black spots as follows :—A discal row of eight, the first three in 7, 6, and 5 each nearer margin than the last (the third often absent in dry season specimens), the fourth in a line with the second at right angles to the costa, the fifth in 3, about midway between end of cell and marginal border, the sixth in 2 near median, the seventh and eighth in 1c and 1b. Of the last three that in 1c is rather nearer margin than the others. A spot in 8 near precostal, a subbasal in 7, one spot (very rarely two) in cell, one on middle discocellular, one in 1c, 1b, and 1a all in a straight line, and a basal spot in 1a.

Head black with brown tufts between eyes and on collar, thorax black with a few brown hairs, basal half of abdomen black with orange lateral spots, remainder orange.

Wet season form. Ground-colour more yellowish, spots larger, basal suffusion broader, apical and marginal black broader in both wings. F.-w. internervular rays blacker.

♀. Expanse 48–52 mm. Dry season form very like ♂ but ground-colour of f.-w. more dusky. Abdomen black above with yellowish lateral spots. Wet season form, also like ♂ but ground-colour dull ochreous to pale sepia. Just beyond f.-w. discal spots is an indication of a whitish subapical patch.

Though quite a distinct species, *A. axina* closely resembles a small specimen of *A. oncaea*. It may be distinguished from the latter by the absence of submarginal spots in 1b and 2 in f.-w., by its consistently much smaller size, and by the usually sharply defined black border in the h.-w.

There is in the Joicey collection a curious aberration of this species. It is a ♂ from Ft. Chicquaqua, Mashonaland. There is a spot in the f.-w. cell followed by one in the discocellulars, and three subapical spots. The h.-w. has one spot only, that on the discocellulars. The h.-w. hind-marginal border is black and rather deeply edentate between the nervules, and bears indications of paler internervular marginal spots.

69. Acraea caecilia. Pl. XI, f. 2.

Acraea caecilia, Fabricius, (*Pap.*) Spec. Ins., 2, p. 34 (1781); Godart, (*A*) Enc. Méth., 9, p. 235 (1819); Godman, Proc. Zool. Soc., p. 221 (1884); Karsch, Berl. Ent. Zeit., 38, p. 194 (1893); Carpenter, Proc. R. S. Dub. (2), 8, p. 305 (1895); Aurivillius, Rhop. Aeth., p. 100 (1898); Ann. Mus. Genov., p. 10 (1910).

= *bendis*; Hübner, Verz., p. 27 (1816).

Senegal; S. Leone; Gold Coast; Lagos; Ashanti; Togoland; Nigeria; Nubia; Uganda (Unyoro, Pt. Alice, Entebbe, Bulamwezi); British E. Africa (L. Baringo, Kikuyu, Mori R., Kiboko R., Kibaoni); German E. Africa (Ukerewe I., Tabora); Somaliland (Sheik Hussein, Abulcassim); Abyssinia (Mole R.); French Sudân (Bammako to Wagaduga).

♀. f. *hypatia*, Drury, (*Pap.*) Ill. Exot. Ins., 3, p. 16, pl. 13, f. 1, 2 (1782); Fabricius, Ent. Syst., 3, p. 163 (1793); Godart, (*A*) Enc. Méth., 9, p. 232 (1819).

S. Leone.

♀. f. *artemisa*, Stoll, (*Pap.*) Cramer Suppl., p. 123, pl, 25, f. 4, 4 d. (1790).

? loc.

A. caecilia pudora, subsp.

Aurivillius, Sjöstedt's Exp. n. Kilimandjaro, p. 4 (1910).

German E. Africa (Usandowi, Kilimandjaro); British E. Africa (Machakos, Kikuyu).

f. *umbrina*, Aurivillius *l. c.* (1910).

Kilimandjaro.

A. caecilia caecilia.

♂. Expanse 56–70 mm. Ground-colour pale ochreous pink to pale salmon pink. F.-w. with a black or brown basal suffusion and a brown dusting of scales along the costa. Apex black about 4 mm. wide, the inner edge much suffused in outline, the black continued as a narrow tapering line along the margin to the hind angle. Subapical and submarginal area inclining to orange ochreous between the nervules, and in areas 6, 5, 4, 3, and 2 sometimes a grey ground-colour with submarginal orange spots and black internervular rays. Black spots as follows:—One in cell above origin of 2, and a double spot on upper part of end of cell. A discal row of five in 10, 6, 5, 4, and 3, the first often much elongated, and rather nearer base, the next three in an almost straight line and contiguous, the fifth subcrescentic and in the middle of area 3. A spot in 2 near median, and immediately beneath it a spot in 1b, also a subbasal spot in 1b near median. A submarginal row of spots parallel to hind margin, the first in 4 (sometimes absent), the second in 3 very close to the fifth discal spot (also sometimes absent in ♀).

H.-w. with a black or brownish black basal suffusion and a well-defined hind-marginal black border usually with traces of paler internervular marks. The discal and basal black spots are rather variable, often faintly indicated, and most easily observed on the underside.

Underside a paler replica of the upper, but without basal suffusion. F.-w., two basal black spots on the costa, and apical black of much less extent. H.-w., black marginal border bearing seven rounded whitish spots. Black spots as follows:—An irregular discal row of nine, the first about middle of area 7, the second about middle of 6, the third (often minute or absent) slightly nearer margin, the fourth touching end of cell, the fifth just before middle of area 3, the sixth in 2 close to median, the seventh in 1c nearer margin, the eighth in 1b crescentic and nearer base, the ninth in 1a and still nearer base. A spot in 8 near precostal, usually two in cell close together, one at base of 5 touching m.d.c. A large subbasal in 1c, a small ditto in 1b, nearer margin, and a medium-sized subbasal in 1a close to that in 1c. Some black at base of nervures enclosing two white dots.

Head black with a yellow tuft between the eyes and two on the collar. Thorax black with reddish hairs, and two anterior, two dorsal, and two posterior pale marks. Abdomen black at base with pale lateral spots, remainder whitish. Claws unequal.

♀. Expanse 56–64 mm. Varies from pale salmon pink to white. F.-w. with black basal suffusion, dusted with brownish along costa, apex black inwardly suffused with yellow and nearly reaching the discal spots. Black spots as in ♂. H.-w. with a black basal suffusion and a broad (about 4 mm. wide) black hind-marginal border, its inner edge suffused with brownish.

Underside paler, marked as in ♂, much less apical black than above, and area between this and discal spots grey with orange internervular marks. H.-w. pinkish at base and with seven large rounded pinkish or yellowish white spots on the marginal black. Thorax and abdomen black with white spots, the abdomen also segmented with narrow white lines.

A. caecilia ♀ f. *artemisa*.

This form appears to be a rare aberration in which the black markings, especially those of f.-w. apex and both hind margins, are exceptionally heavy. I know it only from Stoll's figure; though occasional Western examples show an unusual breadth of the h.-w. border.

A. caecilia ♀ f. *hypatia*.

For some time I was of opinion that Drury's figure of *hypatia* was too highly coloured, but I have now seen examples of *caecilia* ♀ which are quite as deeply tinted. The f.-w. is tawny ochreous and the h.-w. deep pink. The f.-w. apical and marginal black is narrow and well defined, resembling that in Eastern examples. We may therefore preserve Drury's name for this form. A specimen is in the Tring collection and bears the label Mohoroni.

A. caecilia pudora.

To the Eastern subspecies of *caecilia* must be assigned the name given by Aurivillius (*l. c.*) to what he regarded as the dry season form of Suffert's "*caecilia liacea*." The latter is however not *caecilia* at all, but a form of *oncaea*. *A. caecilia pudora* differs from more Western examples in having the f.-w. apical black much narrower and more sharply defined. The spot in h.-w. area 5 is usually well developed.

A. caecilia f. *umbrina*, Auriv.

On the f.-w. a dull grey semitransparent submarginal band between nervules 2 and 5–6.

A. caecilia exhibits little seasonal dimorphism. The wet season ♂♂ are pinker and more heavily spotted, and the ♀♀ have a whiter ground-colour and heavier black markings. One Abyssinian example I have seen is of the typical form and another is intermediate to *pudora*. The species is nearly allied to *A. caldarena* and there is little difference in the respective ♂ armatures.

70. Acraea marnois. Pl. XI, f. 4.

Acraea marnois, Rogenhofer, Ann. Mus. Wien, 4, p. 552, pl. 23, f. 7 (1889); Aurivillius (*oncaea* var.), Rhop. Aeth., p. 100 (1898).

Sudân (Bahr-el-Seraf), "V. Nyanza."

♂ Expanse 50–56 mm. Wings rich ochre yellow and somewhat more rounded than in other males of the *caldarena* group. F.-w. slightly darkened at base. Apex narrowly black continued as a narrow hind-marginal line. Black spots as follows :—One in cell over origin of nervule 2. A double spot on discocellulars. Beyond cell an oblique band of four black spots in a straight line at right angles to costa followed by a spot in 3 rather more distal and beneath this a submarginal spot in 2 and in 1b. A spot in 2 beneath origin of nervule 3 and beneath it a spot in 1b. A subbasal spot in the same area. H.-w. slightly blackened at base and having a black hind-marginal border about 2 mm. wide bearing indications of paler internervular marks ; its inner edge slightly arched between the nervules. Black spots corresponding to those on underside but rather faintly indicated towards inner margin. Fringes white.

Underside. F.-w. as on upperside but rather paler and having two spots on costa near base.

H.-w. as on upperside but without basal black and the hind-marginal border bearing white internervular spots. Black spots as follows :—One in 7 just beyond origin of nervule 7. One in 6 much nearer margin. One near base of area 4. Beneath it but nearer margin a spot in 3. One near base of 2. Beneath it a spot in 1c, followed by one in 1b rather nearer base, and a dot in 1a. A spot in 9, one in 8, a subbasal in 7, two in cell, one in discocellulars, a basal and a subbasal in 1c, 1b, and 1a.

Head black with a pale mark between the eyes, and two yellowish tufts on collar. Thorax black with reddish hairs. Abdomen black above with yellowish lateral spots, except last three or four segments, which are yellowish. Claws unequal.

♀ unknown.

An example in the National Collection agrees very closely with the type, differing only in the following points :—F.-w. The submarginal spots are absent in 2 and 1b, the first or costal spot of the discal row is very minute, and there is hardly any basal black. H.-w. There is a small discal spot in area 5. Underside. H.-w. the marginal border is formed of much narrower black arches on a fine marginal line, thus enclosing larger whitish spots.

For the present I must keep *A. marnois* separate. Aurivillius regards it as a form of *A. oncaea*. If, however, Rogenhofer's type is specifically identical with the specimen in the National Collection above described, this must be an error, as the latter example bears a much closer relationship to *caldarena* and *caecilia*. The genital armature is only very slightly different from that of the two species mentioned, that of *A. oncaea* being of an entirely different form. On the whole I regard it as nearest to *A. caecilia*, and the acquisition of further material may decide whether it is really separate from that species.

The type was taken at Bahr-el-Seraf in the Sudân. The British Museum specimen is merely labelled Victoria Nyanza.

71. Acraea aglaonice. Pl. X, f. 16.

Acraea aglaonice, Westwood, Oates, Matabeleland, p. 346, pl. F, f. 9, 10 (1881); Ed. 2, p. 353, pl. 6, f. 9, 10 (1889); Trimen, S. Af. Butt., 1, p. 151, pl. 3, f. 3 (1887); *l.c.* 3, p. 398 (1889); Proc. Zool. Soc., p. 27 (1894); Marshall, Trans. Ent. Soc., p. 555 (1896); Aurivillius, Rhop. Aeth., p. 99 (1898); Trimen (ab. melan.), Trans Ent. Soc., p. 64, pl. 4, f. 4 (1906).

= *A. fenestrata*, Trimen, Trans. Ent. Soc., p. 435 (1881).

Mashonaland, Delagoa Bay, Transvaal, Natal, Manicaland.

♂. Expanse 50–62 mm. Wings orange red to rosy red. F.-w. A narrow black line along costa (rather wider at apex) and continued along hind margin to angle. Costa, apical and hind-marginal portion of wing inclining to orange. A slight dusky suffusion at base. Ends of nervules rather distinctly black. In the subapical region in areas 4 and 5 (and sometimes slightly in 6), a transparent mark caused by a paucity of scales. This transparent marking may be almost absent in dry season examples. Black spots as follows:—A large, transverse, irregularly shaped spot in cell above origin of 2, and a black mark on discocellulars, usually on upper part but sometimes over whole width of end of cell. Beyond cell and just before the transparent marks a discal row of fine spots in 10, 6, 5, 4, and 3, the first sometimes absent, and the last sometimes very small. The three middle spots almost in a straight line, the first rather more distally placed, the fifth with its long axis pointing towards apex. In 2 a spot close to median (absent in one example). In 1b a discal spot below that in 2 and slightly nearer margin, and a second spot near median at about two-thirds of the distance from base to origin of 2.

H.-w. with a slight dusky basal suffusion and a black hind-marginal border varying from 1 to 2 mm. in breadth and very rarely showing traces of paler internervular markings. Black spots very small and more easily observed on underside. Those near inner margin sometimes only faintly indicated.

Underside. F.-w. paler and duller than above and rather glossy. A small basal and subbasal spot on costa. Apical and hind-marginal areas ochreous with orange internervular rays. Spots as on upperside. H.-w. pinkish ochreous. A very narrow black line round hind margin, followed by a band of greenish ochreous corresponding in width to the black border of the upperside and divided by narrow internervular black arches. This marginal border is followed by internervular splashes of orange, and the basal and median portions of wing bear internervular rose pink marks. Black spots very small and slightly variable. A discal row beginning with one in 7, 6, 5, and 4, the fourth much further from margin than the third. Very rarely a minute dot in 3. I have never seen a ♂ with a spot in 2, though there is sometimes a very small one in the ♀. In 1c a spot at base, a second just before origin of 2, and a third half way between the second and the margin. In 1b two spots near middle, in 1a one near base and one near middle. In 8 a spot near precostal, beyond this in 7 a transverse spot. A spot at base of 7, two in cell and one on middle discocellular.

Wet season examples have a general tendency to a richer colour and more dusky suffusion especially of the f.-w.

Head black with a brown tuft between the eyes and two on the collar. Thorax black with lateral brown hairs and two dorsal whitish streaks. Base of abdomen black with orange lateral spots. Remainder orange. Claws unequal.

♀. Expanse 60–66 mm. Dry season form :—F.-w. Costa, base, and inner margin more or less heavily suffused with umber brown, median area rosy red, apex and hind margin brownish ochreous. A black tip at apex narrowing suddenly below nervule 7 but continued along hind margin as a line broader than in ♂. Ends of nervules heavily marked with black. The whitish transparent patch conspicuous. Black spots as in ♂ and usually an additional spot in cell at about the middle. H.-w. rosy red suffused with brownish black at base. Hind margin black about 3 mm. broad and bordered inwardly by a band of brownish ochreous on which the nervules are heavily dusted with black. Underside much as in ♂. Abdomen black above with white lateral spots.

Wet season form. F.-w. basal, costal, and apical suffusion black, median area dull pinkish ochreous, apical and hind-marginal areas ochreous. H.-w. ochreous along costa, remainder black with a white median patch. Spots in both wings as in ♂. Underside much as in ♂ but f.-w. very dull coloured, and h.-w. with much less orange and pink, median area whitish, and the black arches of marginal border very heavy. Abdomen black above with white lateral and yellowish dorsal spots. Intermediates between the extreme seasonal forms are found in any good series.

A. aglaonice is readily distinguished by the transparent mark in the f.-w. and the very small spots in the h.-w. It is a very distinct species, the peculiar projection on the middle of the inner side of the claspers distinguishes the male armature at a glance from that of any other species.

In 1906 (*l. c.*) Trimen described a melanic ♀ aberration of this species from Melville, Johannesburg, and at the same time gave an interesting note from Mr. Feltham, who states that this butterfly made its appearance in the depth of the winter season in 1904 at Johannesburg, and that other members of the genus also seem to choose the coldest season for their appearance there.

[The range of the species is described by Trimen as from S. Matabeleland to E. Mashonaland and Delagoa Bay, through the Transvaal as far as Johannesburg and extending to Zululand, Delagoa Bay, and very rarely to Natal.]

72. Acraea atergatis. Pl. XII, f. 2.

Acraea atergatis, Westwood, Oates, Matabeleland, p. 342, pl. F, f. 1, 2 (1881); *l. c.*, Ed. 2, p. 350, pl. 6, f. 1, 2 (1889); Trimen, Proc. Zool. Soc., p. 65 (1891); Aurivillius, Rhop. Aeth., p. 100 (1898); Neave, Proc. Zool. Soc., p. 25 (1910).

Congo (Katanga, Lualaba R., Maringa R.); Rhodesia (Victoria Falls, Barotse, Mashonaland); Angola (Cugho R., Luacinga R., Guimbungo).

♂. Expanse 50–60 mm. Dry season. Wings dull orange-ochreous. F.-w. rather pointed. H.-w. rather distinctly angulated at nervule 4. F.-w. costa very slightly blackened and a faint black line round hind margin. Ends of nervules along hind margin black, and some indication of black internervular rays. Black spots as follows:—One in cell above origin of 2. A double spot on upper part of discocellulars. A discal row of seven, the first sometimes very faint and usually further from base than the remainder. The next four (in 6, 5, 4, and 3) in a straight line at right angles to costa. The sixth and seventh in 2 and 1b lie almost in a straight line with the fifth and at right angles to the inner margin. A small subbasal spot in 1b.

H.-w. with a slight black suffusion about base of median, and a narrow black line round margin. Black spots as on underside, but some may be only faintly indicated, whilst others may be larger above than below.

Underside a pale dull replica of the upper. F.-w. with two spots at base of costa. H.-w. spots as follows:—A discal row of nine. The first in 7, the second in 6 nearer margin, the third in 5 almost immediately below the second, the fourth close to end of cell, the fifth in 3 a short distance from end of cell, the sixth, seventh and eighth in 2, 1c, and 1b almost in a straight line at level of end of cell, the ninth in 1a rather nearer base. A spot in 8 near precostal, a subbasal in 7, two in cell, and one at base of area 5 against m.d.c. A subbasal in 1c, 1b, and 1a, the middle one further from base. Some black marks about base of nervures. Head black with a red tuft between eyes and two on collar, thorax black with red hairs, base of abdomen black with yellow lateral spots, remainder whitish. Claws unequal.

Wet season form. Differs from the dry season form in having the ground-colour redder, the costa blacker, all the spots larger, a trace of submarginal spots in 1b and 2, well-defined black internervular rays on apical area, h.-w. spots large and sometimes partly confluent, the hind margin with a black border about 1·5 mm. wide.

Underside like the upper but duller, and in h.-w. a well-marked whitish marginal border divided by the black ends of nervules, and bounded outwardly by a narrow black line, and inwardly by black internervular curved marks.

End of abdomen orange.

♀. Expanse about 60 mm. Resembles wet season ♂, but in some cases the underside is distinctly darker than the upper, especially on the h.-w., the spots ringed with grey, the fringes conspicuously white, and the black marks at inner edge of marginal border may be produced into points between the nervules. I have not seen melanic forms of the ♀ such as exist in allied species.

A. atergatis appears to be generally somewhat rare. Neave describes it as not common in the north of N.E. Rhodesia, but plentiful in Katanga. It is described as on the wing all the year except in June and July. Dr. Dixey has recorded (Proc. Ent. Soc., p. iii, 1906) that he noticed in this insect a musty odour with a strong ammoniacal scent like that of stable litter.

73. ACRAEA STENOBEA. Pl. X, f. 15.

Acraea stenobea, Wallengren, Wien. Ent. Mon., 4, p. 35 (1860); Öfvers. Vet. Akad. Förh., 29 (3), p. 49 (1872); Trimen, S. Af. Butt., 1, p. 153, pl. 3, f. 2 (1887); Proc. Zool. Soc., p. 71 (1891); Westwood, Oates, Matabeleland, Ed. 2, p. 354, pl. 6, f. 11, 12 (1889); Aurivillius, Rhop. Aeth., p. 98 (1898); Butler, (*caecilia*, var.) Proc. Zool. Soc., p. 401 (1898).

= *acronycta*, Westwood, Oates, Matabeleland, Ed. 1. p. 346, pl. F. f. 11, 12 (1881).

♀ = *natalica* (var.), Trimen, Trans. Ent. Soc., p. 346 (1870).

= *lygus*, Druce, Proc. Zool. Soc., p. 408 (1875).

= *albomaculata*, Weymer, Stettin. Ent. Zeit, p. 83 (1892).

ANGOLA (Bihé, Benguella); DAMARALAND; CAPE COLONY; BECHUANALAND; KHAMA'S CO.; TRANSVAAL; MASHONALAND; BAROTSELAND; GERMAN E. AFRICA (Saadani).

♂. Expanse 50–60 mm. F.-w. milky ochreous inclining to orange at apex between nervules, often with a pale pink median suffusion. Base widely suffused with sepia which extends about two-thirds the length of cell, nearly half the length of 1a and 1b, but rarely into 2. Costa very narrowly black. Apex and hind margin narrowly black. Nervures and nervules more or less distinctly black. Black spots rather variable, but the following usually present:—One in cell above origin of 2, one on upper part of discocellulars. A discal row of four, in 6, 5, 4, and 3. The first three in a straight line, the fourth rather more distally placed. In 2 a spot near median, and generally a submarginal spot; in 1b, a spot near median, a second rather beyond middle, and often a third (submarginal) spot.

H.-w. more pinkish than f.-w. and sometimes of a delicate pale rose tint. A black basal suffusion extending about half the length of cell and a black hind-marginal border about 2 mm. wide, usually showing a faint indication of paler internervular markings. Black spots variable. In the examples before me the largest number is eleven, two in 7, two in cell, one in 4 near end of cell, and two in 1c, 1b, and 1a, all these faint and only showing through from beneath.

Underside. F.-w. as above but duller and without the dark suffusion. Two black spots on costa, one at base, and one just beyond. Sometimes a spot beyond end of cell in 10. Remaining spots as above.

H.-w. pale pinkish, the distal portion yellow, and the basal portion faintly reddish between the nervules. Black spots rather variable. One in 8 near precostal, a very minute spot in 2, a short distance below median, and some irregular black at base of nervures enclosing two white spots which lie close against thorax. Remaining spots as above. Marginal border as above but with seven large white internervular spots, that in 1c doubled.

Head black with two white marks between the eyes, one behind each eye, and two spots on the collar. Thorax black with two white dorsal anterior streaks. Base of abdomen black with whitish lateral spots and transverse lines. Remainder creamy white. Claws unequal.

♀. Expanse 50-60 mm. F.-w. orange ochreous with a rich sepia basal suffusion, extending in some cases nearly all over the wing, but in the latter case leaving a trace of a paler subapical band just beyond discal black spots. Apical and marginal black broader than in ♂. Black spots equally unstable, the discal row varying from a confluent band to two small separate spots in 4 and 5.

H.-w. milky ochreous to salmon-pink with a black basal suffusion and a broad black hind-marginal border, in some examples 4 mm. wide at area 2. A white discal suffusion of very variable extent.

Underside f.-w. orange ochreous sometimes with a trace of the black basal suffusion especially along nervure 1, and the base of median. The apical region with orange internervular rays on a paler ground. Spots as on upperside with the two basal costal spots as in ♂. H.-w. rose-pink at base, distal portion orange, some pale ochreous suffusion about nervules in median area. Black marginal border with large rounded white spots; in one example the margin spots are pale ochreous and there is a line of same colour along inner edge of marginal black. The fringes of both wings are pale lemon ochreous and very conspicuous. Abdomen black above with white lateral spots.

A. stenobea is rare in collections. The variation in the ground-colour and extent of black suffusion may be more or less seasonal, but I have not seen a sufficiently long series to be able to form an opinion on this point.

Butler has suggested that *stenobea* is a seasonal form of *caldarena*, and later (P.Z.S., 1898, p. 401) refers to it as a variety of *caecilia*. The structure of the male armature shows, however, that it is quite a distinct species. Trimen states (*l. c. sup.*) that the white suffusion on the ♀ h.-w., though variable in extent, seems always to be present.

74. Acraea natalica. Pl. XII, f. 1.

Acraea natalica, Boisduval, Voy. Deleg, 2, p. 590 (1847); Staudinger, Exot. Schmett, 1, p. 83 (1885); Trimen, S. Af. Butt., 1, p. 155 (1887); Butler, Proc. Zool. Soc., p. 66 (1888); Aurivillius, Rhop. Aeth., p. 101 (1898); Butler, Proc. Zool. Soc., p. 53 (1898); *l. c.*, p. 26 (1901); Dixey and Longstaff, Trans. Ent. Soc., p. 318 (1907): Rogers, Trans. Ent. Soc., p. 525 (1908); Neave, Proc. Zool. Soc., p. 26 (1910); Aurivillius, Sjöstedt's Exp., p. 4 (1910).

? = *cephaea*, Bertolini, Mem. Accad. Bologna, 2, p. 176 (1851).

= *bellua*, Wallengren, Rhop. Caffr., p. 22 (1857).

= *hypatia*, var., Trimen, Rhop. Afr., Austr., p. 98 (1862).

Angola (Canhoca); Congo (Kassai; Lualaba); Barotseland; Natal; Transvaal; Cape Colony; Griqualand; Mashonaland; Portuguese E. Africa (Mozambique); Nyassaland; German E. Africa; British E. Africa (Taita, Taveta, Kibwezi); Pemba I.; Zanzibar.

f. *umbrata*, Suffert, Iris, p. 30 (1904).

= *natalica* Hoppfer, Peters Reise, Ins. p. 371, pl. 23, f. 12, 13 (1862).

Portuguese E. Africa; German E. Africa; British E. Africa; Pemba I.; Congo (Lualaba).

A. natalica pseudegina, subsp.

Westwood (*A. pseudegina*), Gen. Di. Lep., p. 531 (1852); Aurivillius, Ent. Tidskr., 14, p. 276 (1893); Karsch., Berl. Ent. Zeit., 38, p. 195 (1893); Aurivillius, Rhop. Aeth, p. 100 (1898); Lathy, Trans. Ent. Soc., p. 186 (1903); Aurivillius, Ann. Mus. Genov, p. 11 (504), (1910).

= *egina*, Stoll., (*Pap.*) Cramer Suppl., p. 122, pl. 25, f. 3, 3c (1790).

Portuguese Guinea; S. Leone; Gold Coast; Nigeria; Angola.

A. natalica abadima, subsp.

Ribbe (*A. abadima*), Iris, 2, p. 182, pl. 4, f. 2 (1889); Aurivillius, Ent. Tidskr., 12, p. 201 (1891); Butler (*pseudegina*, var.), Proc. Zool. Soc., p. 731 (1895); Aurivillius (*pseudegina* var. *abadima*), Rhop. Aeth., p. 101 (1898).

= *clarei*, Neave, Novit. Zool., 11, p. 327, pl. 1, f. 4 (1904).

Congo (Stanleyville); German E. Africa (Ukerewe I., Muansa); British E. Africa and Uganda (Entebbe, Kikuyu, Kampala, Unyoro, Mori R., Pt. Alice); Uganda (Bulamwezi); Abyssinia (Alesa, Kotscha).

A. natalica natalica. It is a matter of some difficulty adequately to describe this species owing to its extreme variability. It is however abundant and widely distributed, and familiarity with its general appearance is easily attained by reference to the long series to be found in most collections. Average examples may be described as follows:—

♂. Expanse 50–80 mm. F.-w. rosy red to pinkish ochreous, subapical area deep ochreous. A basal black suffusion extending nearly to middle of cell. Costa very narrowly black. Apex black (3–4 mm. wide), becoming very narrow at 4 and continued as a fine marginal line to hind angle. Black spots variable. When all present arranged as follows:—One in cell at or just before origin of 2, a double spot on upper part of discocellulars. Just beyond cell a discal row of confluent spots widest near costa and extending to nervule 4, and forming together a *characteristic wedge-shaped mark.* A submarginal row of three spots in 3, 2 and 1a. A spot near base of 3 in line with, but separated from, the wedge-shaped row. A similar spot near base of 2 well separated from the neighbouring nervules. Immediately beneath this a spot in 1a, and in the same area another spot at the edge of the black basal suffusion.

H.-w. with a black basal suffusion extending nearly to middle of cell, and a black hind-marginal band with a very faint indication of paler internervular marks. This band varies in width from about 2–4 mm. The discal and basal spots are always small, and while corresponding to those on the underside, are in many cases only faintly indicated.

Underside. F.-w. ground-colour as on upperside but paler and duller. The black basal suffusion only shows through from the upperside and the apex is greenish-ochreous with orange internervular marks, the margin being narrowly black. Two black spots at base of costa, remaining spots as above but those just beyond cell more distinctly separated.

H.-w. ground-colour pinkish ochreous. No basal suffusion. A hind-marginal band formed of large pale sage-green spots surrounded by heavy black arches and a black marginal line. In area 1b there is a marginal line of the same colour as the spots. About the base, inner margin, and along inner edge of hind-marginal border are reddish internervular markings. Black spots as follows :—A discal row, the first in 7 about middle, second in 6 nearer margin, third in 5 beneath second but slightly more distal, fourth in 4 just above outer point of cell, fifth in 3 directly below fourth and some distance from end of cell, sixth in 2 further from margin, seventh in 1c at about same level, eighth in 1b slightly nearer base. A spot in 8 near precostal, a subbasal in 7, two spots in cell, one at base of 5 on m.d.c. a large subbasal in 1c, beneath it a spot in 1b, and two equidistant spots in 1a. Head and thorax black with white spots, base of abdomen black above with yellowish lateral spots, remainder orange or whitish. Claws unequal.

The male exhibits a certain amount of seasonal dimorphism, wet season forms being often more heavily spotted and especially having a broader h.w. marginal band. Very dry males often have the ground-colour ochreous.

♀. Expanse 46–80 mm. Dry season. Very like ♂ but with more rounded f.-w. Spots of h.-w. margin on underside whitish. Abdomen black above with white spots.

♀ Intermediate. F.-w. smoky ochreous much paler in subapical area. H.-w. dusky pink. Marginal border broad and inwardly much suffused, the black sometimes extending over the whole wing.

♀ Wet season. Sepia black. F.-w. with a whitish subapical bar and a central whitish band. H.-w. sometimes with a white median patch.

In all these ♀ forms the spots and markings are as in the ♂.

A. natalica f. *umbrata* resembles the ordinary form but has a greyish median band across the f.-w. Hoppfer's figures in "Peters' Reise nach Mossambique" agree closely with this form.

A. natalica pseudegina, subsp. Pl. VI, f. 9 (larva).

This is the western subspecies. Typical examples of the ♂ have the f.-w. smoky black, the spots being thereby much obscured. Near the apex are two or three internervular markings, orange ochreous to white. The h.-w. is, in fresh specimens, rich rose colour without, or with only a faint black marginal band, though the black arches of the underside are just visible. The spots are represented only by dull brownish marks.

Some examples have a reddish suffusion in the median area of f.-w. and the apical ochreous marks may be continued as a marginal border. The usual black spots are well marked on the underside, and the h.-w. marginal spots are ochreous like the ground-colour, instead of green. The ♀ is like the ♂ but the f.-w. red suffusion is more frequently developed.

In a beautiful series of very perfect examples bred by Mr W. A. Lamborn near Lagos, the colours of both surfaces are extremely brilliant, and there is in nearly every case an additional submarginal spot in f.-w. in area 4, and one or two submarginal spots on the h.-w. underside in 7, and 6.

Acraea natalica abadima, subsp.

This may be regarded as the central race of the species. It has a wide range extending from Angola, across the Upper Congo region to British E. Africa and into Abyssinia. In the f.-w. the spots and markings are as in typical *natalica*, though there are often four submarginal spots. The whole f.-w. is rather thinly scaled and has a delicate translucent appearance. The subapical area is grey, and at the inner edge of the apical black there are orange-ochreous internervular markings continued along the margin as more or less rounded marginal spots. There is very little black basal suffusion in either wing. The h.-w. is red, probably rosy red in very fresh specimens. The spots are indistinct. There is no black marginal border, but a narrow black line on which are faintly indicated the black arches of the underside. On the underside the f.-w. is very thinly scaled and glossy, and the marginal spots of the h.-w. are rich ochreous.

The ♀ has the same semitransparent f.-w. but the ground-colour is dusky grey sometimes with a slight reddish tinge and the orange subapical marks are replaced by white. H.-w. reddish grey or dull grey often with a slight median white suffusion.

Between the above forms nearly every grade of intermediate pattern may be observed in a long series, though the *pseudegina* form is perhaps more clearly separated from the type pattern than is *abadima*. Perhaps the most characteristic features are the wedge-shaped f.-w. discal mark, and the black basal suffusion in both wings. *A. anemosa* has the same features but the black suffusion extends to both surfaces, and is spotted with white on the h.-w. underside.

The larva of *A. natalica* is described by Trimen (*l. c.*) as light buff-yellow with a white, black-edged dorsal stripe, and a white lateral stripe. A black stripe on each side just above the lateral row of spines, and a broad, black vertical stripe interrupted by the bases of the prolegs. The pupa is also noted by the same author as "creamy white, with the limbs and position of wing nervures outlined in black ; a triple black streak from top of head along middle of back of thorax, and a broad lateral streak varied with white spots; the abdomen bearing two dorsal, two lateral, and one median ventral, chains of black rings enclosing orange yellow spots."

The larva of *natalica pseudegina* I have figured on Plate VI, from examples sent home by Mr. W. A. Lamborn. The black stripes would appear to be less marked than in the southern form, but the white marks on the head are characteristic.

A ♀ of *natalica natalica* taken by Rogers near Rabai bears a note to the effect that it "emitted a strong odour like that of rotten cabbages."

75. Acraea asboloplintha. Pl. XII, f. 4. Pl. XV, f. 23.

Acraea asboloplintha, Karsch., Ent. Nachr. 20, p. 223 (1894); Aurivillius, Rhop. Aeth., p. 90 (1898); Heron, Trans. Zool. Soc., xix, p. 148 (1909).

= *dissociata*, Gr.-Smith, Novit. Zool. 5, p. 350 (1898); Rhop. Exot., p. 19, pl. 6, f. 4, 5, 6 (1901).

= *natalica* var. *dissociata*, Butler, Proc. Zool. Soc., p. 46 (1902).

Congo (Ruwenzori Region, 7,000 ft.; Mt. Mikeno); Uganda; British E. Africa (Tiriki Hills).

A. asboloplintha rubescens, subsp.

Trimen, Trans. Ent. Soc., p. 547 (1908).

♀ = *asboloplintha* ♀, Suffert, Iris, p. 19, pl. 2, f. 6 (1904).

British E. Africa (E. and S. of Kikuyu, Nairobi, Weithaga, Ft. Hall).

♂. Expanse 54–60 mm. F.-w. warm sepia, a brick red median patch on inner margin rarely extending slightly into area 1b. Small black spots rather faintly discernible on the dark ground corresponding to those on the underside.

H.-w. brick red with a slight black basal suffusion and a narrow black line round hind margin. Black discal and basal spots, very small, and corresponding with those on underside.

Underside. F.-w. pale umber brown, apex with orange brown internervular marks. One black spot (rarely two) at base of costa and a black line round apex and hind margin. A black spot in cell just before origin of 2, one on upper part of l.d.c. Beyond cell four spots in 6, 5, 4, and 3 and all in a straight line nearly at right angles to costa. A spot in 2 near median, beneath it but slightly nearer to base a spot in 1b, and in same area a subbasal spot near median.

H.-w. deep ochreous with red patches at base and in 1b and 1a, A faint black line round hind margin bordered inwardly by a paler ochreous band about 1·5 mm. wide. The internervular spaces of the discal area orange ochreous. Black spots as follows :—A discal row of eight, first in 7 near middle, second in 6 nearer margin, third in 5 immediately beneath second (or very slightly more distally placed), fourth in 4 close to end of cell, fifth in 3 a short distance from end of cell ; sixth, seventh, and eighth, in 2, 1c, and 1b, all in a straight line at right angles to inner margin. A spot in 8 close to precostal, two in basal half of cell, a basal and a subbasal in 1c, and 1a, and a subbasal in 1b.

Head and thorax black with a few small white marks. Abdomen black at base with lateral orange spots, remainder orange ochreous. Claws unequal.

♀ resembles ♂ but the brick red is entirely replaced by ochreous brown. On the h.-w. underside the basal and marginal portions are whitish. Some red marks at base of cell, 1c, and in 1b and 1a. Spots all as in ♂. Abdomen black with small white lateral spots.

A. asboloplintha rubescens, subsp.

♂. Expanse 58–62 mm. Differs from the type form in having the ground-colour of the h.-w. rosy red. In the f.-w. the greater part of area 1a, the middle of 1b, base of 2, and a part of cell are also flushed with rosy red. Dark areas sepia black. The black border of h.-w. is about 1 mm. broad. All the black spots are decidedly larger. The underside is as in the typical form but the colours are more brilliant.

♀. Like the ♂ but with the rosy red areas replaced by white. Dark areas paler than in ♂ and h.-w. broader and inwardly suffused.

Suffert's description of the ♀ *asboloplintha* applies to this form, but he states that it is "coloured as in the ♂." The figure accompanying the description is an uncoloured photograph and appears to represent the black and white ♀ described above. The figure thus appears to be correct and the description wrong, but up to the present I have been unable to find an explanation of the discrepancy. When Trimen described the *rubescens* form he had only one example of each sex, and suggested that possibly the black and white ♀ might be exceptional and that there might also be a ♀ coloured like the ♂. Since that time the Oxford Museum has acquired further examples, but they furnish no evidence that the ♀♀ are ever other than black and white.

GROUP XII.

76. Acraea anacreon. Pl. XIII, f. 3. Pl. XV, f. 22. Pl. XVI, f. 14.

Acraea anacreon, Trimen, Trans. Ent. Soc., p. 77, pl. 6, f. 3–5 (1868): *l. c.*, p. 347 (1870); S. Af. Butt., 1, p. 168 (1887); Marshall, Trans. Ent. Soc., p. 552 (1896); Butler, Proc. Zool. Soc., p. 841 (1897); Trans. Ent. Soc., p. 107 (1897); Aurivillius, Rhop. Aeth., p. 96 (1898).

Basutoland; Natal; Transvaal; Kaffirland; Nyassaland (Kigonsera); German E. Africa (Unyika); Cape Colony.

A. anacreon bomba, subsp.

Grose-Smith, Ann. Nat. Hist. (6), 3, p. 128 (1889); Smith and Kirby, Rhop. Exot., 19 (*Acraea*), p. 8, pl. 3, f. 5, 6 (1892); Aurivillius, Rhop. Aeth., p. 96 (1898).

= *induna* (f. aestiv.), Trimen, Trans. Ent. Soc., p. 184, pl. 5, f. 3, 3a (1895); Butler, Proc. Zool. Soc., p. 905 (1898); Neave, Proc. Zool. Soc., p. 16 (1910).

Angola (Bailundu); N.E. Rhodesia (Chambezi Valley, L. Bangweolo); Mashonaland; Nyassaland; German E. Africa; British E. Africa (Mombasa).

A. anacreon anacreontica, subsp.

Grose-Smith, Novit. Zool., 5, p. 352 (1898); Aurivillius, Rhop. Aeth., p. 96 (1898).

British E. Africa (Nandi, W. Slopes of Mt. Kenia 6,500 ft.).

A. anacreon speciosa, subsp.

Wichgraf, Berl. Ent. Zeit., p. 245, pl. 6, f. 9 (1908).

Angola (Ceramba, Bihé).

A. anacreon anacreon.

♂. Expanse 50–52 mm. Deep golden orange with black, spots and markings. F.-w. somewhat narrow and angulated, narrowly black along costa. A black hind-marginal band 5 mm. wide at apex and tapering off towards hind angle. On this border a marginal row of spots of the ground-colour narrow and elongated at apex but becoming shorter and rounder towards hind angle. Above subcostal in the subapical region the ground-colour is distinctly paler (sometimes whitish) and beneath this is sometimes an indication of a pale subapical patch. A slight powdering of black at base. Spots rather variable. One large spot in cell just beyond origin of nervule 2 and a mark on the discocellulars. Beyond end of cell a row of two to three discal spots in 6, 5, and 4, and lying in a straight line nearly at right angles to the costa. Beneath these a spot in 3 and one in 2 near the base of these areas, and lying in a line almost at right angles to that of the first three spots. In 1b a spot, usually immediately beneath that in 2, and in the same area a subbasal spot (sometimes absent).

H.-w. with a black suffusion having its maximum extent in area 1c. A large spot in cell beyond middle, and a subbasal spot (sometimes faintly indicated) in area 7. The remaining subbasal spots obscured by the black suffusion. A row of eight discal spots arranged in a peculiarly characteristic manner. The first four (7–4) lie in a regular curve approximately parallel to the margin, the next two are so placed that the line takes a sharp bend inwards. The seventh spot is slightly nearer the margin than the sixth and eighth, these three lying in a kind of secondary curve. The hind-marginal border is black about 2 mm. wide and bears seven yellow internervular spots (that in 1c doubled). The fringes of both wings are whitish and rather well developed.

Underside. F.-w. a black spot at base of costa. Costal margin ochreous, subapical area pale ochreous, apex and hind margin greyish ochreous with a dusting of orange between the strongly marked black nervules. Remainder dull orange ochreous with spots as on upperside.

H.-w. rather pale ochreous, area 9, base and median portion of 1c, base of 2, and extremity of cell, pink. A spot in 8 against the precostal. All the spots large and more distinct, a subbasal spot in 1c, one in 1b, and two spots in 1a, the outermost making a continuation of the discal curved row. Beyond the median area the nervules are black and in 1c there is a marked black internervular ray. The hind margin is sulphur yellow divided into spots by the nervules, bounded externally by a fine black marginal line, and internally by very narrow black arches tinged with pink on their inner edge. Head and thorax dark brown, reddish tufts on the collar, abdomen black above, yellowish beneath with pale lateral spots. Claws unequal.

♀. Expanse 54–58 mm. Upperside f.-w. violaceous to pinkish grey. Spots and markings as in ♂ but there is a more or less developed subapical creamy ochreous patch, and the submarginal spots are paler at the apex and fading to cream colour hind angle.

H.-w. ochreous grey to orange ochreous, much paler at inner margin. Spots as in ♂. Hind-marginal border with pale lemon ochreous spots.

Underside f.w. Costa and hind margin greyish ochreous, a pale lemon ochreous subapical patch, internervular spaces light ochreous along margin. Remainder of wing as on upperside but paler.

H.-w. lemon ochreous with spots and markings as in ♂.

A. anacreon exhibits a certain amount of seasonal dimorphism, dry-season specimens having a tendency to more elongate wings and less pronounced spotting.

A. anacreon bomba, subsp.

In this form the wings are usually more rounded, the f.-w. black apical patch is in wet season examples well developed, its inner edge lying more transversely across the wing (width about 5 mm.), the marginal internervular spots are either faintly discernible or obsolete. The discal spot in f.-w. 1b is generally nearer margin than in *anacreon anacreon*. The most noticeable difference in the h.-w. is the decreased width of the hind-marginal border. The colouring of the underside is much richer than in *anacreon anacreon*. The f.-w. has the apex greenish ochreous with orange internervular rays. In the h.-w. the space between the discal and subbasal spots is almost entirely rose pink, and between the discal spots and the marginal border the internervular spaces are flushed with orange. There is much more marked seasonal dimorphism in this form, and though the wet season forms (= *induna*) are extremely variable there is a general tendency in both sexes to a paler ground-colour and heavily marked black apices in the f.-w. In some wet season forms from near Ft. Jameson all the spots are large and there is a heavy black basal suffusion in h.-w.

There is on the whole less difference of colour between the sexes, but the ♀♀ are generally paler and greyer.

In Proc. Zool. Soc., p. 16, 1910, Neave expresses the opinion that Gr.-Smith's *bomba* should be kept separate from *induna*. Two dry-season examples, however, taken in N.-W. Rhodesia, agree so nearly with *bomba* that I am convinced that the synonymy here adopted is the correct one.

A. anacreon anacreontica, subsp.

This form presents the following features:—

F.-w. pale ochreous with a basal suffusion of orange ochreous of rather variable extent. Pale apical and hind marginal spots well developed and sharply defined. H.-w. orange ochreous with a narrow black border bearing very distinct pale ochreous spots. Inner margin inclining to pale ochreous. Discal spots for the most part faint and obsolescent. On h.-w. underside the spots are much smaller and closer together and enclose an irregular but well-defined band of rose-pink. In many examples the two central spots in 1c are joined together and form a peculiar semicircular line enclosing a rose-pink mark. The ♀ may resemble the ♂ or may be more heavily spotted and of a generally richer ground-colour.

A. anacreon speciosa, subsp.

This is the Angola subspecies of *anacreon*. I am indebted to Herr Wichgraf for the opportunity of examining the type. The following are the principal differences from typical *anacreon* :—

Wings brighter red, with little indication of the black apical area in f.-w. The spot in area 2 lies further from the margin. The underside is very brightly coloured, with orange patches between the h.-w. nervules.

In the type the spot in cell lies before origin of nervule 2, but this may be an aberration as I have before me examples in which this feature is normal. The f.-w. spots are larger and except for the absence of the apical black the specimen has the appearance of a heavily spotted example of the *induna* form.

I cannot regard the distinction between the above forms as more than subspecific. The genitalia appear to be all of the same structure and, though simple, possess certain features which are remarkable and common to all. The claspers bear on their outer side peculiarly dense tufts of hairs or scales, which, however, are easily removed if due care be not exercised in dissection. Also the dorsal abdominal plate is large, deeply bifid, and its inner membrane is densely clothed with a mass of special scales, so numerous and so easily detached as to obscure the preliminary operations of dissection.

I have before me a series of some eighty examples from various localities, and it is possible to arrange them so as to show a perfect gradation of wing pattern.

Marshall found the larva at Ulundi, and records that out of seventy-five individuals, twenty were killed by a dipterous parasite. I cannot find any description of the early stages.

Butler records both *bomba* and *induna* forms taken together by Crawshay on the Chuona River, Unyika.

A remarkable feature of the species is the variability in the relative positions of the spots in f.-w. 1b and 2. In *anacreon anacreon* that in 1b is usually beneath that in 2, whereas in *anacreontica* sometimes, and generally in *bomba* and *speciosa* it is nearer margin.

77. Acraea rahira. Pl. XIII, f. 1.

Acraea rahira, Boisduval, Faune. Madg., p. 33, pl. 5, f. 4, 5 (1833); Voy. Deleg., 2, p. 590 (1847); Wallengren, Rhop. Caffr., p. 21 (1857); Trimen, Rhop. Af. Austr., p. 103 (1862); Mabille, Hist. Nat. Mad. Lep., 1, p. 110, pl. 11, f. 9, 10 (1885–7); Trimen, S. Af. Butt., 1, p. 166 (1887); Proc. Zool. Soc., p. 73 (1891); Aurivillius, Rhop. Aeth., p. 103 (1898); Fawcett (metam.), Trans. Zool. Soc., p. 294, pl. 46, f. 7, 8, 9 (1901); Trimen, Trans. Ent. Soc., p. 231, pl. 19, f. 1, 1a, 1b (1904); Neave, Proc. Zool. Soc., p. 26 (1910).

Angola (Cugho R., Mikenge); Damaraland (Ovambo); Cape Colony; Natal; Transvaal; Mashonaland; N.E. and N.W. Rhodesia (Alala Plateau, Chambezi Valley); Portuguese E. Africa; [Madagascar (?)].

♂. Expanse 38–45 mm. Wings rich to paler orange ochreous. F.-w. costa broadly black. Ends of nervules broadly black at margin and narrowing inwardly. A black basal spur in 1b. Black spots as follows:—One in cell above origin of 2. A mark on upper part of discocellulars. Beyond cell a discal band of four spots, the first three (in 6, 5, and 4) contiguous, their outer edges forming a somewhat convex curve, the fourth (in 3) slightly separated, its long axis pointing towards the apex. A spot in 2 below origin of 3, and immediately beneath it a spot in 1b.

H.-w. slightly black at base and having a narrow black margin deeply indented between nervules by the ground-colour; ends of nervules powdered with black. Spots corresponding to those on underside. Central area rather paler and bounded by a faint dusky line indicating the pattern of the underside.

Underside f.-w. much paler than above. Costa pale greyish ochreous. Ends of nervules in apical area very distinctly black. Spots as on underside, with an extra dot at base of costa. Beyond discal spots the apical area is pale ochreous, and between the nervules are orange lines, that in 6 reaching inwardly to the spots.

H.-w. pale creamy ochreous. Some irregular reddish ochreous marks at base and across the central area of wing, just before the discal spots. Beyond the discal spots a central band of the ground-colour traversing the wing as far as area 4 nearly at right angles to the inner margin and then curving sharply upwards towards costa. As far as area 4 this band is distally outlined with sepia scales, beyond which the nervules are black, and the internervular spaces bear reddish ochreous rays. From apex to anal angle a fine black marginal line. Black spots as follows:—A discal series of nine, the first three (in 7, 6, and 5) nearly parallel to the apical curve, the line then bends sharply inwards and the remaining spots lie approximately at right angles to the inner margin. In addition to these there is a spot in 8 against the precostal, near it one in 7, two in cell, two on the discocellulars, one in 1c, 1b, and 1a and some irregular black at bases of nervures.

Head black with a pale mark between the eyes and orange hairs on collar. Thorax black with a few reddish hairs, abdomen black above, with lateral yellowish and dorsal whitish spots. Claws unequal.

♀. Expanse 44–52 mm. Resembles ♂ but the ground-colour is usually creamy ochreous, the spots are larger, and the black powdering of the nervules along the f.-w. apex and hind margin is so wide as to form a band broken only by narrow orange ochreous rays. In rare cases the ground-colour is nearly as dark as that of the ♂.

The larva is thus described by Fawcett (*l. c.*):—

"Larva, back and sides blackish; thoracic legs, claspers, and a line above them chrome yellow. A dorsal white stripe, and on each segment four yellow spots from which spring four branched yellow spines, the lower pair springing from the yellow spiracular line. These spines are shorter than in the majority of *Acraea* larvae. Head yellow.

"Feeds on a species of groundsel, *Erigeron canadense.*"

Two figures of the pupa are given: one pupa is waxy white and similar to the pupae of other *Acraeae*, the other ferruginous. The ferruginous pupae had nearly always been attacked by ichneumons, with which the larvae were much infested.

Trimen figures (*l.c.*) two aberrations of the ♂ from Johannesburg, the first having the black markings on both sides much enlarged, the second having no black spots except that in f.-w. cell (much reduced), those on f.- and h.-w. discocellulars, and a streak at base of h.-w. cell. On a previous occasion (*l.c.* 1891) the same author described a ♀ from Matabeleland corresponding to the first aberration mentioned above. The occurrence of the species in Madagascar is extremely doubtful. Boisduval states (*l. c.*) that M. Goudot says he found it at Tamatave, but as he (M. Boisduval) has examples from the "pays des Hottentots" he fears that Goudot collected it at the Cape on his way out and afterwards it got mixed with those he took in Madagascar. Mabille includes it in his work on the Madagascar Lepidoptera, but apparently only on the same doubtful authority.

Neave describes the species as being fond of swamps and marshy ground and having a very feeble flight.

78. ACRAEA ZITJA. Pl. XIII, f. 2.

Acraea zitja, Boisduval, Faune. Mad., p. 32, pl. 4, f. 4, 5 (1833); Guenée, Vinson Voy. Mad. Annexe. F., p. 35 (1864); Mabille, Hist. Mad. Lep., 1, p. 108, pl. 11, f. 1, 2 (1885–7); Aurivillius, Rhop. Aeth., p. 103 (1898); Voeltzkow Exp., p. 316 (1909).

♀ f. *radiata*, Guenée, Vinson Voy. Mad. Annexe. F., p. 35, note 8 (1864); Mabille, Nat. Hist Mad. Lep., 1, p. 109, pl. 11, f. 5, 6 (1885–7).

♀ f. *calida* (♀), Butler, Ann. Nat. Hist. (5), 2, p. 288 (1878); Mabille, Nat. Hist. Mad. Lep., 1, p. 109 (1887).

♀ f. *rakeli*, Boisduval, Faune. Mad., p. 32, pl. 5, f. 1, 2 (1833).
= *zitja* ♀
Mabille, Nat. Hist. Mad. Lep., 1, p. 108, pl. 11, f. 3, 4 (1885–7).

♀ f. *fumida*, Mabille, Ann. Ent. Belge, 23, Bull., p. 106 (1880); Nat. Hist. Mad. Lep., 1, p. 109, pl. 9a, f. 9 (1885–7).

MADAGASCAR (Fenerive, Kinkuni, Tulear, Fianarantsoa, Menabe, Morondava, Camp d'Ambre, Antanosy, Diego Suarez); ? NATAL.

Acraea zitja is exceedingly variable both in ground-colour and in extent of markings. Typical examples may be thus described:—

♂. Expanse 36–50 mm. Ground-colour rather dull brick red. F.-w. costa narrowly black; apex and hind margin black (about 2–3 mm. wide, tapering to a point at angle) and deeply indented between the nervules by the ground-colour. Black spots as follows:—One in cell above origin of 2, one on upper part of discocellulars; a discal row of four, the first three in 6, 5, and 4 either separated or contiguous and on a line outwardly more or less convex. The fourth in 3 separated and rather nearer base than the third. A spot in 2 about 2 mm. from the base of that area, and either immediately beneath it or slightly nearer margin a spot in 1b.

H.-w. with a little black at base and a hind-marginal black border about 1·5 mm. wide the inner edge of which may be fairly regular or may be indented between the nervules by the ground-colour. Black spots corresponding to those on the underside.

Underside. F.-w. ground-colour paler than above. Costa greyish white, the apical and hind-marginal areas striated by the black ends of nervules which are laterally dusted with white, a fine black line round margin.

H.-w. brick red, all the spots more or less surrounded with white, the black ends of nervules laterally dusted with white. A fine black marginal line on which at the end of each nervule stands a black V-shaped mark with its apex on the margin, the spaces between these markings being white. The costa is also narrowly white. The proportion between red and white varies, and some examples might be described as having the ground-colour whitish with broad internervular red marks. Small black spots as follows :—A discal row of nine, the first four, in 7, 6, 5, and 4 forming a line parallel to the apical margin of the wing, the line then curving round so that the next four lie on a line at right angles to the inner margin ; the last in 1a is rather nearer base. Some irregular black marks at base of wing. A spot in 8 against the precostal, near it one in 7, two in cell and one at base of 5 and 4 on discocellulars, one in 1c and 1b close together, and a basal spot in 1a.

Head and thorax black, brown tufts on collar. Abdomen black above with reddish yellow lateral spots. Claws unequal.

♀. Like the ♂ but somewhat larger.

Up to the present I have not seen a ♀ of this species resembling the ♂ in colour, but Aurivillius states (*l. c.*) that such ♀♀ exist, and these must therefore be associated with the ♂ type.

A. zitja f. *radiata*.

♀♀ of this form have a brownish ground-colour and the spots are more prominent. In the f.-w. the space between the discal spots and the hind margin is somewhat paler than the rest, whilst there is a pale curved discal band just beyond the discal spots in the h.-w. Mabille (*l. c.*) figures the underside of a ♂ which he assigns to this form, and in this there is a pale area in f.-w. beyond the discal spots 6, 5, and 4, and in the h.-w. there is much less internervular red than usual beyond the discal spots, also rather less marginal white. He states that intermediates are numerous.

A. zitja ♀ f. *calida.*

This would appear to be merely an aberration. Some of the black spots are absent. The marginal black is reduced to a series of triangular spots prolonged on the nervules. The cell spot is absent, while that at the end of cell is large and rounded. The underside resembles that of f. *radiata* but is paler.

A. zitja f. *rakeli.*

♀♀ of this form are rather pale dusky ochreous. In the f.-w. the apical black is 3–4 mm. broad, and the subapical area pale ochreous. The spots are more than usually prominent. In the h.-w. the area just beyond the discal spots is pale ochreous and the inner margin whitish.

A. zitja ♀ f. *fumida.*

This is merely a grey and white form, corresponding to the *lycia* form of *A. encedon.* The greater part of the ground-colour is grey and the spots are much enlarged. In the f.-w. there is a whitish suffusion round the cell spot, and a good deal of white between the nervules in the discal area. The same applies to the h.-w. in which the inner margin is also white.

It may be that these various forms of female are to some extent seasonal, though I have not been able to examine a sufficiently long series of dated examples to form an opinion on this point. If names were given to all the forms presenting slight differences the list would be a long one. In spite of its variability the species is not difficult to recognise owing to the peculiar arrangement of the discal spots and the small triangular white marginal spots in the h.-w.

Mabille describes it as common in Madagascar, frequenting woods, gardens, and cultivated places. It is on the wing during the greater part of the year and appears to have several broods. There are in the Staudinger Collection two examples labelled Verulam, Natal, but this is the only record I have found of the occurrence of the species on the mainland, and failing further evidence should be received with caution.

79. Acraea wigginsi. Pl. XIII, f. 4. Pl. XVI, f. 16.

Acraea wigginsi, Neave, Novit. Zool., xi, p. 326, pl. 1, f. 3 (1904); Eltringham, Af. Mim. Butt., p. 40, pl. 3, f. 4 (1910).

Uganda and British E. Africa (Kisumu, Unyoro, Kirembwe, Bulamwezi).

♂. Expanse 46 mm. F.-w. Upper half of costa (from a little beyond base) to just beyond cell, apex, and hind margin, black. Beyond cell a broad white subapical bar in 10, 9, 6, 5, 4, and part of 3. Below the black area deep golden yellow inclining to red towards base and invading the black outer margin in 1b and 2, so as to leave only a marginal line and black nervule ends and rays. Black spots as follows:—One large spot in cell over origin of 2, one at end of cell on discocellulars, two beyond cell at inner edge of white band in 5 and 4, one near base of area 3, and below it but nearer cell a spot in 2. Below this but more distally placed a spot in 1b, and in the same area a dot (sometimes absent) nearly midway between base and origin of nervule 2. A black linear mark at base of 1b, and a black basal streak in 1a. In some examples a series of internervular yellow spots along hind margin.

H.-w. golden yellow inclined to darker towards base, with a little black powdering in cell and 1c. Black spots as on underside but only faintly indicated towards inner margin. A narrow black marginal border somewhat edentate on the nervules and bearing pale internervular spots.

Underside f.-w. as above but paler, and the apical portion beyond white patch is pearl grey, striated by the black nervule ends which join in a black marginal line, and bearing golden yellow internervular streaks, that in area 6 being much longer than the rest. Costa ochreous with a black dot at base. H.-w. pale creamy ochreous with a narrow black border broken up by white internervular spots, and bordered on its inner edge by a series of golden yellow quadrate internervular spots. An outer series of black spots the first long and transverse in 7 just beyond origin of nervule 7; this followed by a curved series of four small spots in 6–3, and three larger spots more basally placed in 2, 1c, and 1b, and lying in a straight line at right angles to inner margin. Above the last of these a small dot in 1a. In addition there is an inner spot in 7, also transverse, a spot near end of cell, just before origin of 3, and a spot in 1c, 1b, and 1a. Between these two rows of spots and sharply enclosed by them is an irregularly curved band of deep pink, and there is a basal patch of the same colour in 9 and 1c. A black dot in 8 near precostal. Head black with reddish brown collar, thorax black, abdomen ochreous with a blackish dorsal line and indications of dark segmental lines. Claws unequal.

♀. Expanse 48–56 mm.

Resembles the ♂ but area 2 in f.-w. is powdered with black.

This interesting little species was first taken near Kisumu by Mr. C. A. Wiggins, the examples received from him being all females. I found both males and females in the Tring collection taken at Kibwezi and Kaligire in Unyoro. Another ♂ bears the label Kirembwe, Bulamwezi. All these specimens are smaller than the Kisumu specimens. I have not found it in the very large collections received from Entebbe.

80. Acraea mirifica. Pl. XIII, f. 5. Pl. XVI, f. 15.

Acraea mirifica, Lathy, Trans. Ent. Soc., p. 2, pl. 1, f. 2 ♂ (1906); Neave, Proc. Zool. Soc., p. 14, pl. 1, f. 3 ♀ (1910).

Angola (Bihé); N.E. Rhodesia (Serenji to L. Bangweolo).

♂. Expanse 41 mm. F.-w. velvety brown black. A band of pale dull ochreous with a slightly metallic lustre crosses the wing beginning at costa just beyond cell about 3 mm. wide and rapidly widening to 5 or 6 mm. as far as nervule 4. Beneath this the colour inclines to pearl grey and the inner edge recedes towards margin, the band being continued about 3 mm. wide, tapering slightly to the hind angle. A row of orange dots along the hind margin. H.-w. velvety brown black with pale ochreous fringe conspicuous on inner margin.

Underside f.-w. cell, base of 3, and whole of wing beneath nervule 3 black. Costa and apical portion pale dull metallic gold. Just before margin the nervules bear diamond shaped black spots which enclose an apical series of crimson spots on the margin.

H.-w. pale dull metallic gold, the nervule ends bearing spindle-shaped black marks which meet in a fine marginal black line and enclose a marginal series of semiovate spots of the ground-colour and a submarginal row of crimson spots. Area 9 is also crimson, and a crimson spot at base of 1c. Black spots as follows:—Two in 7, the second beyond origin of nervule 7. Following these three spots in 6, 5, and 4, nearly in a straight line pointing to middle of hind margin. A spot near base of 3, and of 2. Beneath the latter and nearer margin a spot in 1c, followed by one in 1b, rather nearer base. A transverse spot in cell and one on middle discocellular. A subbasal spot in 1c, 1b, and 1a, the last nearer to base.

Head and collar red. Thorax and abdomen, above, black. Claws unequal.

♀. Expanse 48 mm. F.-w. ochreous grey. Costa orange red. Apex black, this colour being continued as a tapering hind-marginal border. Red marginal spots as in ♂. Sometimes the inner edge of this marginal border is dusted with pale ochreous.

Black spots as follows :—One in cell before origin of nervule 2, and one on discocellulars, one in 3 about 3 mm. from end of cell, one in 2 near its base, and beneath it but nearer margin a spot in 1b. In the same area a spot nearer base beneath that in cell.

H.-w. Ground-colour same as in f.-w. but slightly darker in shade, spotted with black as on the ♂ underside. A black hind-marginal border narrower in the middle than at apex and anal angle, its inner edge sometimes dusted with pale ochreous scales.

Underside f.-w. dull ochre-yellow, costa orange, subapical area pale yellow. Black spots as on upperside but smaller, and sometimes a trace of a discal spot in area 5. Black nervule ends and crimson marginal spots as in ♂.

H.-w. as in ♂.

The type ♂ of this species is slightly aberrant, having three white dots in the h.-w. and no red marginal spots in f.-w. It differs in these respects from other Angola specimens, and from those obtained near L. Bangweolo by Neave. The species, as Neave has pointed out, bears a greater resemblance to members of the S. American genus *Actinote* than to any African *Acraea*, especially as it has a rudimentary nervule between 1a, and 1b in the h.-w. It is described as frequenting marshy places and having a very weak flight. The integuments are tough, and if squeezed it exudes a green juice. I have observed that the males are peculiarly liable to become "greasy." The underside of the h.-w. is exceedingly beautiful, having the appearance of being cut from a thin sheet of metal, whilst under the microscope every scale exhibits a beautiful iridescence recalling the appearance of the well-known diamond beetle.

GROUP XIII.

81. Acraea encedon. Pl. XIV. f. 4

Acraea encedon, Linnaeus, (*Pap.*) Syst. Nat., ed. 10, p. 488 (1758) ; Mus. Lud. Ulr., p. 244 (1764); Aurivillius,(*A.*) Sv.Vet. Akad. Handl., 19. 5, p. 56 (1882) ; Trimen, S. Af. Butt., 3, p. 163 (1889) ; Aurivillius, Rhop. Aeth., p. 110 (1898) ; Fawcett (metam.), Trans. Zool. Soc., 294, pl. 46, f. 4, 5, 6 (1901) ; Marshall and Poulton, Trans. Ent. Soc., pp. 479–484, etc. (1902) ; Dixey, Trans. Ent. Soc., p. 151 (1903) ; Proc. Ent. Soc., p. iii (1906) ; Heron, Trans. Zool. Soc., xix, p. 147

(1909); Neave, Proc. Zool. Soc., p. 27 (1910); Eltringham, Af. Mim. Butt., p. 35, pl. 3, f. 1, p. 36, pl. 8, f. 16 (1910).
= *encedonia*, Linnaeus, (*Pap.*) Syst. Nat., ed. 12, p. 762 (1767).
= *sganzini*, Boisduval, Voy. Deleg., 2, p. 590 (1847).
= *fulva*, Doubleday, Hew. and West., Gen. Di. Lep., p. 140, pl. 19, f. 2 (1848); Staudinger, Exot. Schmett., 1, p. 83 (1885).
= *lycia*, Wallengren, Rhop. Caffr., p. 22 (1857).
= *lycia*, var. A., Trimen, Rhop. Af. Austr., p. 103 (1862).

S. Leone to E. Coast; Cape to Upper Egypt; Madagascar; Pemba I.; Mafia I.

f. *infuscata*, Staudinger, Exot. Schmett., 1, p. 83 (1885); Aurivillius, Rhop. Aeth. (1898); Eltringham, Af. Mim. Butt., p. 36 (1910).

f. *alcippina*, Aurivillius, Rhop. Aeth., p. 111 (1898); Lathy, Trans. Ent. Soc., p. 186 (1903); Heron, Trans. Zool. Soc., xix, p. 147 (1909); Eltringham, Af. Mim. Butt., p. 36, pl. 3, f. 3 (1910).

f. *sganzini*, Boisduval, Faune. Madag., p. 34, pl. 6, f. 6, 7 (1833); Staudinger, Exot. Schmett., 1, p. 83 (1885); Butler, Proc. Zool. Soc., p. 65 (1888); Aurivillius, Rhop. Aeth., p. 111 (1898); Butler, Proc. Zool. Soc., p. 965 (1899); Eltringham, Af. Mim. Butt., p. 36 (1910).
= *lycia*, Mabille, Nat. Hist. Mad. Lep., 1, p. 113, pl. 11, f. 11, 12 (1885–7); Trimen, S. Af. Butt., 1, p. 164 (1887).

f. *lycia*, Fabricius, (*Pap.*) Syst. Ent., p. 464 (1775); Godart, (*A.*) Enc. Méth., 9, p. 239 (1819); Staudinger, Exot. Schmett., 1, p. 83 (1885); Butler, Proc. Zool. Soc., p. 65 (1888); Aurivillius, Rhop. Aeth., p. 111 (1898); Butler, Proc. Zool. Soc., pp. 53, 190, 400 (1898); p. 922 (1900); p. 46 (1902); Heron, Trans. Zool. Soc., xix, p. 147 (1909); Eltringham, Af. Mim. Butt., p. 36 (1910).
= *braunei*, Staudinger, Exot. Schmett., 1, pl. 33 (1885).

f. *necoda*, Hewitson, Exot. Butt. (*Acraea*), pl. 2, f. 9 (1861); Aurivillius, Rhop. Aeth., p. 111 (1898); Eltringham, Af. Mim. Butt., p. 36 (1910).

f. *daira*, Godman and Salvin, Proc. Zool. Soc., p. 221, pl. 17, f. 3 (1884); Butler, Proc. Zool. Soc. p. 115 (1896); Aurivillius, Rhop. Aeth., p. 111 (1898); Butler, Proc. Zool. Soc., pp. 420, 965 (1899); Eltringham, Af. Mim. Butt., p. 36, pl. 3, f. 2 (1910).
= *encedon*, ab. ♀, Trimen, S. Af. Butt., 1, p. 165 (1887).

= *lycia*, var., Butler, Proc. Zool. Soc., p. 66 (1888).
= *usagarae*, Vuillot, Ann. Ent. Fr., 60, Bull., p. 78 (1891).
= *caecilia*, Butler, Proc. Zool. Soc., p. 566 (1894).
= *encedon*, Lanz, Iris, 9, p. 131 (1896).

f. *radiata*, Aurivillius, Arkiv. Zool., ii, 12, p. 4 (1905).
(ANDAMANA, W. AFRICA.)

The above numerous forms of *Acraea encedon* do not appear to be peculiar to any one part of the species' range. The *lycia*, *alcippina*, and *infuscata* forms are more numerous in West African localities than elsewhere, though they seem liable to occur anywhere. The *daira* form does not appear to occur in the west and south. Though the f. *radiata* has not been recorded except from the locality given by Aurivillius, it is not peculiar to that locality, as it occurred with a *lycia* and an *alcippina* form.

A. encedon encedon.

♂. Expanse 48–70 mm. F.-w. orange tawny to golden brown. A little black at base. Apical half black with a rather suffused inner edge and a broad conspicuous white oblique subapical band in 10, 9, 6, 5 and 4 followed by a separate smaller spot in 3. An ovate transverse black spot in cell just beyond origin of 2. A large spot near base of 2 touching nervule 3. Beneath this, but nearer margin, a double spot in 1b, and a small spot in same area shortly before origin of 2 and close to median. Sometimes a spot or streak in 1a, ground-colour usually a little paler than f.-w. beyond the middle. H.-w. slightly black at base. and having a black hind-marginal border about 2 mm. wide narrowing to a point at apex and anal angle. Ends of nervules black. Internervular rays narrow and brown. Black spots as on underside but those near base and inner margin often only faintly indicated.

Underside f.-w. as above but basal half dull brownish and apex and hind margin dark ochreous with black nervule ends and orange ochreous internervular rays. A fine black hind-marginal line. A black spot at base of costa.

H.-w. dull ochreous, marginal border reduced to a narrow black line with just a faint indication of the broader black of upperside. Black spots as follows:—A discal row of eight regular round spots, the first four (in 7, 6, 5 and 4) in a slightly outwardly curved line, the fifth in 3 at the same distance from the margin as the fourth, the sixth in 2 nearer base than the fifth, and the seventh and eighth in 1c and 1b, lying in a straight line with the fifth at right angles to inner margin. Some black at base of nervures and usually a spot in 8 near precostal. A subbasal in 7, two before middle of cell, two on discocellulars, and a spot in 1c, 1b and 1a, that in 1b further from base than the other two.

Head black with white spots between and behind the eyes, two yellowish tufts on collar. Thorax black with pale dorsal and lateral marks. Abdomen black above with orange ochreous segmental lines and lateral spots, the latter becoming confluent towards the distal extremity. Claws unequal.

♀ resembles the ♂.

f. *infuscata.*

The tawny areas of the typical forms are replaced by smoky brown.

f. *alcippina.*

The h.-w. has a white central suffusion of varying extent.

f. *sganzini.*

The tawny areas of the typical form are replaced by a dusky yellowish colour.

f. *lycia.*

The ground-colour of both wings is white, the black markings being as in the typical form.

f. *necoda.*

The black markings especially in f.-w. are much reduced, the f.-w. apex is only a little darker than the rest of wing and the whole ground-colour is violet grey.

f. *daira.*

The black of apical half of f.-w. and the white subapical band are absent. In some cases the subapical band may be traced as a slightly paler area on the ground-colour. All the black markings much reduced.

f. *radiata.*

Described as allied to the *daira* form but having the nervules on the upperside terminating in broad black triangles, and the basal half of the h.-w. white as in *alcippina.* The apex of f.-w. is not darkened and has no pale subapical band.

The larva and pupa are thus described by Fawcett (*l. c.*) :—

"Larva.—Slaty black, with a yellow lateral line above prolegs and claspers. On each segment three deep fine transverse lines enclosing two white patches dorsally and two yellow patches laterally. On the centre black line of each segment are placed six black spines (branched). Head, thoracic legs and claspers black.

"Pupa waxy white with the usual fine black lines on the wing covers and black spots with orange centres on the abdominal segments.

"Feeds on *Commelina*."

Every kind of intermediate form may be observed in a long series. None of the forms seems to be specially characteristic of any particular locality, though the *alcippina* form seems to attain its maximum development in West Africa. Long series of examples have been bred by Mr. Lamborn near Lagos, and the majority of these broods consist of two forms, viz. *infuscata* and *lycia*. The latter are somewhat unusual in having broad suffused orange internervular markings on the hind margin of the secondaries on the underside, also some basal markings of the same colour.

Examples of the *lycia* form may have the ground-colour pale creamy yellow. Another now before me has the f.-w. sepia black except for the subapical white band.

An exceptionally fine ♀ example of the typical form from Chishi I., L. Bangweolo, measures rather over 70 mm. in expanse and has the ground-colour rich red brown.

In Proc. Zool. Soc. 1900, Butler quotes from Crawshay who writes that *encedon* "is a graceful insect . . . alternately flapping its wings and skimming along in its flight very differently to the other *Acraeinae*."

Dr. Longstaff has noted a disagreeable odour in the ♀ when crushed, and Marshall has noted that the insect has a bitter taste.

The species appears to have no very near allies.

GROUP XIV.

82. Acraea goetzi. Pl. XIII, f. 14.

Acraea goetzi, Thurau, Berl. Ent. Zeit. (48), p. 132, 1903.
= *byatti*, Neave, Novit. Zool., xi, p. 328, pl. 1, f. 17 (1904).
S. Nyassaland (Zomba); German East Africa (Langenberg, Unyika, Kondeland); S. Tanganyika (Fwambo).

♂. Expanse 42–44 mm. F.-w. with a little black at base of 1a, 1b, and cell. Costa and upper part of cell, apical portion beyond cell, and hind margin, black. A tawny orange subapical patch. Remainder of wing tawny red. The black band dividing the subapical patch from the red central area is broad at costa (about 3 mm.), and becomes rather suddenly narrower at nervule 4.

H.-w. with a blackish basal suffusion extending to nearly half the length of cell, and in this blackish area are long yellow hairs. Some of the spots of underside faintly indicated. Central area of wing tawny red with indications of spots in 7 and on upper discocellulars. A broad black hind-marginal border about 3 mm. wide at apex, its inner edge rather suddenly angulated at 5, thence traversing the wing nearly at right angles to inner margin making lower half of border about 4 mm. wide.

Underside. F.-w. costa greenish ochreous with a black spot at base. Basal half of wing reddish orange, the distal outline of this area corresponding to that on upper side. Subapical patch pale ochreous inclining to orange at its proximal side. Between this patch and end of cell a black mark extended downwards as a rather suffused line, which forms the inner edge of hind-marginal border. Apical and hind-marginal border greenish grey, the nervules black, and between them broad, tapering, dull orange internervular marks. A fine marginal black line.

H.-w. pale ochreous, areas 8 and 9 red. Base of area 7 pale sage green, followed by two transverse linear black spots enclosing a patch of red. Beneath the outer of these spots a black dot in 6, and a spot on upper discocellulars. Base of cell pale sage green with a round black spot. A spot at extreme base of area 2. Base of 1c red, with a basal, two subbasal, and a discal spot, the latter linear and extending right across the space. Base of 1b and 1a greenish yellow with two black spots in each area. Hind-marginal border, from 5 to the inner margin, broader than on upperside, otherwise of similar shape. Its inner edge marked by a fine brown line; a marginal row of subtriangular greenish white spots resting on a fine black marginal line. On the border the nervules are black edged with whitish, and between them from the marginal spots to the inner edge are broad red marks edged with black Head black with white marks between and behind the eyes. Reddish tufts on collar. Thorax black with whitish lateral marks. Abdomen black above with yellowish segmental lines and lateral spots. Claws unequal.

♀. Expanse 52 mm. F.-w. marked much as in ♂, but the reddish central area is replaced by tawny orange, darker at base, and the subapical patch pale yellow tinged with orange. A black spot in 1b at base of nervule 2, and a hind-marginal row of dull orange spots larger and more distinct near hind angle.

H.-w. with some blackish at base followed in 2, 1c, 1b, and 1a by pale yellow. Traces of the underside black spots especially on upper discocellulars. Central area pale tawny orange. Hind-marginal border much broader than in ♂, and having pale orange marginal internervular spots.

Underside a rather less brilliantly coloured replica of that of the ♂.

A. goetzi is nearly allied to *A. excelsior*, but there is a slight difference in the structure of the ♂ armature.

83. Acraea excelsior. Pl. XIII, f. 12.

Acraea excelsior, E. M. B. Sharpe, Proc. Zool. Soc., p. 192, pl. 17, f. 3 (1891); Karsch, Ent. Nachr., 23, p. 371 (1897); Aurivillius, Rhop. Aeth., p. 104 (1898).

Nyassaland (Zomba); German East Africa; British East Africa (Kikuyu, Kenya).

♂. Expanse 40–42 mm. F.-w. black, with a large central brick red patch, edged with lemon-ochreous, and covering the greater part of cell, a small portion of base of 3, more than half of 2, nearly the whole of 1b, and the central part of 1a. A sub-marginal band of lemon ochreous spots divided only by the nervules in 9, 6, 5, and part of 4.

H.-w. with a rather clearly defined black basal suffusion, its outer edge bounded by a straight line at right angles to inner margin and traversing cell just beyond the middle. A conspicuous black linear spot on upper part of discocellulars, above which in 7 is a deep crimson mark marginally powdered with black. Central portion of wing lemon-ochreous, darker from costa to nervule 3, followed by a black hind-marginal border, the inner edge of which runs parallel to apical margin as far as 3, where it becomes suddenly wider and runs straight to the inner margin.

Underside. F.-w. The red area corresponding to that above, costa ochreous dusted with black, remainder black as on upperside with a similar but slightly larger lemon-yellow subapical patch. Reddish orange marginal internervular marks.

H.-w. lemon-yellow with a black hind-marginal border as on upperside. On this border is a series of broad deep crimson internervular rays each edged with sooty black and tipped with white at the outer extremity. Midway between base and inner edge of marginal border is a crimson black-bordered triangular mark, its base on the costa, and its apex nearly reaching end of cell. Area 9 crimson. Base of 7, cell, and 2 narrowly black, base of 1c broadly black with two crimson spots, base of 1b and 1a black, the latter with two lemon-yellow spots.

Head black, collar with two red tufts, thorax black, abdomen black above with pale yellowish lateral dots. Claws unequal.

♀ resembles the ♂ but is slightly larger, the colours generally are duller and the basal red is in some cases replaced by yellowish. Both wings have a submarginal border of reddish internervular spots.

By the peculiar and very beautiful pattern of the h.-w. underside *A. excelsior* is easily distinguished from any other species.

84. Acraea mirabilis. Pl. XIII, f. 13.

Acraea mirabilis, Butler, Proc. Zool. Soc., p. 760, pl. 47, f. 1 (1885); in James, Unknown Horn of Africa, p. 236, pl. f. 1 (1888); Aurivillius, Rhop. Aeth., p. 103 (1898); Dixey, Proc. Zool. Soc., p. 11, pl. 1, f. 4 (1900).

Central Somaliland (Bundu Maria, Aoho).

♂. Expanse 40–46 mm. Wings orange-ochreous. F.-w. narrowly black along costa, apex, and hind margin. Subcostal nervure narrowly black. A small black, more or less wedge-shaped mark on upper part of discocellulars. Ends of nervures at apex and hind margin black. Midway between end of cell and apex an ochreous spot extending from costa to middle of area 4, and outlined with black.

H.-w. with a very little black at base of 1c. A narrowly black hind margin, and ends of 3, 4, 5, 6, and 7 rather broadly black. A black spot in cell showing through from underside and the peculiar pattern of the underside faintly indicated.

Underside. F.-w. orange ochreous, costa, apical area and hind margin greyish ochreous, the nervules thereon narrowly black. In the internervular spaces at margin are patches of the ground-colour, that in 6 long and reaching inwardly to the pale discal spot which is as above but paler. A narrow black hind-marginal line, and in 4 and 5 a black internervular ray between pale discal spot and orange marginal marks.

H.-w. Base pale ochre-yellow with some irregular black about bases of nervures. A black spot in 8 some distance from precostal, one in cell near base, and one in 1a. A pink flush in 9, 7, 1c, and 1a. Across middle of wing a curved band of pale grey having on both sides a narrow broken black outline, and irregularly flushed with pink, notably in 7, 5, 4, cell, 1c, and 1b. A minute black spot at base of 5 and 4. Following this grey band a parallel immaculate band of pale ochre yellow.

From the distal edge of this band to the margin the ground-colour is pale greenish grey, forming a marginal band some 3·5 mm. wide, its inner edge indistinctly dotted with black between the nervules. The marginal edge narrowly outlined with black, and a submarginal row of narrow linear black marks. Between these and the inner edge of the grey border, a series of internervular deep orange marks.

Head black with an orange collar. Thorax black with orange hairs and two anterior dorsal pale streaks. Base of abdomen black, remainder whitish. Orange lateral spots edged with black. Claws unequal.

♀. Expanse 38–44 mm. Resembles ♂, but ground-colour and markings paler and duller.

The foregoing descriptions are taken from a small series of specimens in the Oxford collection. They differ from examples in the National Collection in having a somewhat richer ground-colour, the paler marks beneath are yellower, and the yellow band in h.-w. beneath is very definitely outlined, whereas in the British Museum specimens the submarginal grey gradually becomes paler proximally towards the dark median band. The Oxford specimens were taken in August, and the British Museum examples in April, so that as suggested by Dr. Dixey (*l. c.*) the differences may be seasonal.

The species is easily recognised by its characteristic underside, and the genitalia are quite distinct.

85. Acraea uvui. Pl. XIII, f. 16.

Acraea uvui, Gr.-Smith, Ann. Nat. Hist. (6), 5, p. 168 (1890); Aurivillius, Rhop. Aeth., p. 106 (1898); Neave, Novit. Zool., 11, p. 346 (1904); Heron, Trans. Zool. Soc., xix, p. 147 (1909); Aurivillius, Sjöstedt's Exp. Lep., p. 4 (1910).

= *minima*, Holland, Entomologist, 25, Suppl., p. 89 (1892); Ann. Nat. Hist. 6, 12, p. 249 (1893); Proc. U.S. Nat. Mus., 18, p. 232 (1895).

German E. Africa (Dar-es-Salaam, Kilimandjaro); British E. Africa (Mombasa, Tana R.); Uganda (Entebbe, Toro).

A. uvui balina, subsp.

Karsch, Ent. Nachr., 18, p. 170 (1892).

Cameroon (Baliburg, Bitje); Angola (Libollo).

♂. Expanse 30–34 mm. F.-w. black. A subapical patch of tawny red narrow in 10, 9, and 6, and widened to about double the width in 5 and 4. A central inner marginal patch of the same colour occupying the central part of 1a and 1b, rather more than the basal half of 2, extending slightly into 3 at its base, and into lower part of distal end of cell.

H.-w. with a black triangular basal patch, central area tawny red often inclining to yellow at inner margin, somewhat indenting the basal patch at upperside of cell. Hind margin with a black border about 2 mm. wide, its inner edge deeply indented by the red colour in 4 and 5, above this point somewhat convex, and below running horizontally across to inner margin.

Underside very like that of *bonasia alicia*. F.-w. Basal half pale reddish yellow with dusky indications of the basal black of upperside. The subapical patch ochre yellow, its proximal edge straight or even concave. Remainder of wing brownish black. H.-w. ochre yellow with a greenish tinge at base. Some irregular black at base of wing and a small basal spot in cell. At about the level of middle of cell a transverse band of irregular confluent black spots usually divisible into five rather large subquadrate marks in 7, cell, 1c, 1b, and 1a. Hind-marginal border as on upperside though occasionally slightly narrower. A marginal series of small white subtriangular spots.

Head and thorax black with two brownish tufts on collar. Abdomen black with very minute pale lateral spots and segmental lines. Claws unequal.

♀. Expanse 38 mm. The upperside resembles that of the ♂, but there is usually a marginal row of tawny red spots on the h.-w. Underside extremely variable. In some examples it resembles that of the ♂ though the hind-marginal border of h.-w. is always much broader. In a series of sixteen ♀♀ before me the following variations in the h.-w. may be observed.

(1) Base of 7 and middle of cell pale greenish yellow. In cell and 1c, a basal and a median spot of dull brown. A few indications of black dots. The hind-marginal border is composed of a series of broad internervular reddish marks, each laterally dusted with black, and these are divided by the black nervule ends, each laterally dusted with yellowish. A marginal series of yellowish subtriangular spots. In areas 7, 6, and 5 the reddish marks are followed inwardly by a narrow sharply defined area of dull brown which at nervule 5 suddenly widens out so as to reach as far as end of cell, its outline then being directed straight downwards to anal angle. Remainder of wing pale ochreous.

(2) The border is not followed by a definite brown area but the whole of the rest of wing is dusted with brown scales.

(3) The border is nearly all black except for the marginal spots which are greyish white; area 7 is nearly all black, and the base is black with some ochreous scales in 9, 8, 7, 1b, and 1a. Remainder of wing dark brown.

The series contains various intermediates between the above three forms. All were taken by Neave on Mt. Kokanjero, but a similar variability seems to occur in other localities.

A. uvui balina, subsp.

The type of Karsch's *balina* is either an aberration or its colour has been damaged by an excess of cyanide in the killing bottle. The pale marks are reddish yellow and the dark areas are pale brown. Had I seen only the type I should have been inclined to regard it as merely an aberration, but there are examples having a perfectly normal appearance in the Tring collection, so that, in view of the fact that the structure of the ♂ armature is identical with that in *uvui*, I regard *balina* as the western subspecies of the latter. In appearance it differs from *uvui* principally in the rather smaller extent of the tawny red area, and in the pattern of the hind-marginal border on the underside which is broader and has red internervular marks above the marginal white spots.

A. uvui may be distinguished from *bonasia* and *alicia* by the arrangement of the black at base of f.-w., the outer edge of which runs straight up, continuously with the triangular black of the h.-w., nearly to the upper distal part of cell. It is also much smaller than the other species referred to.

86. Acraea lumiri. Pl. IV, f. 16 (♂). Pl. XIII, f. 15.

Acraea lumiri, Bethune-Baker, Ann. Nat. Hist., 2, p. 471 (1908).

Congo (Kissegneis to Albert Nyanza); Cameroon (Asokko, Ja R.).

♂. Expanse 34 mm. Wings orange red. F.-w. with a black costal margin extending into upper half of cell with a slight projection over origin of nervules 2 and 3 and becoming very narrow beyond cell (where it is invaded by the subapical patch) and continued at apex into an apical and hind-marginal border about 2 mm. wide rather broader at apex and narrower at hind angle. From costal black at end of cell, to middle of marginal border an oblique bar of black, cutting off a large rounded subapical patch of the ground-colour. A little black at base and in basal half of 1a.

H.-w. with a very slight blackish basal suffusion, and a perfectly regular hind-marginal black band 2 mm. wide. Traces of underside spots on discocellulars and near base of 1c, 1b, and 1a.

Underside. F.-w. basal half pale orange red, costa and transverse bar blackish and shaped as above. Subapical patch dark ochreous. Hind margin black, the ends of nervules laterally lined with dark ochreous, and marginal internervular triangular spots of the same colour.

H.-w. greenish yellow at base, followed by some small very irregular black marks, which may be made out approximately as follows:—One in 9, one in 8, one in 7 before end of cell, one on discocellulars more or less confluent with a larger spot in cell. Another spot in cell nearer base, two in 1c, one in 1b with a minute streak at base, and one in 1a. Rest of wing dark ochreous as far as marginal border which is black, inwardly edged with a few brown scales, and bears triangular marginal internervular spots of greyish white.

Head black with grey tufts on collar. Thorax black, abdomen black above with small yellowish lateral spots. Claws unequal.

I have not seen a ♀ of this species. The ♂ differs from allied species in the reduction or absence of basal black in both wings. There are several examples in the Berlin Museum and also at Tring.

87. Acraea bonasia. Pl. XIII, f. 11.

Acraea bonasia, Fabricius, (*Pap.*) Syst. Ent., p. 464 (1775); Trimen, (*A.*) S. Af. Butt., 1, p. 174, note (1887); Aurivillius, Ent. Tidskr., 12, p. 202 (1891); Karsch, Berl. Ent. Zeit., 38, p. 195 (1893); Aurivillius (metamorph.), Ent. Tidskr., 14, p. 277, pl. 5, f. 1 (1893); Rhop. Aeth., p. 105 (1898); Neave, Proc. Zool. Soc., p. 26, 1910.

= *eponina* ♂, Cramer, (*Pap.*) Pap. Exot., 3, p. 138, pl. 268, f. A, B (1780); Staudinger, Exot. Schmett., 1, p. 84 (1885); ♀, Iris, 9, p. 202 (1896).

= *serena*, Herbst, (*Pap.*) Nat. Schmett., 4, pl. 82, f. 6, 7 ♂ (non ♀) (1790); Godart, (*A.*) Enc. Méth., 9, p. 232 (♂ non ♀) (1819).

♀ f. *cynthius*, Drury, (*Pap.*) Ill. Exot. Ins., 3, p. 52, pl. 37, f. 5, 6 (1782); Butler, (*A.*) Ann. Nat. Hist. (6), 16, p. 271 (1895).

= *cynthia*, Herbst., (*Pap.*) Naturs. Schmett., 4, p. 198, pl. 80, f. 1, 2 (1790); Godart, (*A.*) Enc. Méth., 9, p. 234 (1819).
= *eponina* ♀ (2nd f.), Staudinger, Iris, 9, p. 202 (1896).

Portuguese Guinea to Cameroon; French Congo; Fernando Po; Congo State to L. Tanganyika and Toro; German E. Africa (Ruaha R.).

♀ f. *praeponina*, Staudinger, Iris, 9, p. 202 (1896); Aurivillius, Rhop. Aeth., p. 105 (1898).
Congo (Kuilu).

♀ f. *siabona*, Suffert, Iris, p. 32 (1904).
Togo (Misahöhe Stn.).

A. bonasia alicia, subsp.
= *A. alicia*, Em. M. B. Sharpe, Ann. Nat. Hist. (6), 5, p. 442 (1890); Aurivillius, Rhop. Aeth., p. 105 (1898); Butler, Proc. Zool. Soc., p. 420 (1899); Heron, Trans. Zool. Soc., xix, p. 146 (1909); Grünberg, Sitzb. Ges. Nat. Fr., p. 150 (1910).

♀ = *cappadox*, Oberthür, Etud. d'Ent., 17, p. 23, pl. 1, f. 2 (1893).

♂ = *planesium*, Oberthür, *l. c.*, p. 24, pl. 1, f. 11 (1893).
Cameroon (Barombi); Congo (Ruwenzori); Uganda (Toro, Entebbe, Sesse I.); British E. Africa (Kisumu, Kenya).

♀ f. *cabiroides*, Poulton, Trans. Ent. Soc., p. 529 (1908).
British E. Africa (Ft. Hall, Kikuyu).

♀ f. *tenelloides*, Poulton, *l. c.*, p. 531 (1908).
British E. Africa (Ft. Hall, Kikuyu).

A. bonasia banka, subsp. nov.
Abyssinia (Banka, Malo).

A. bonasia bonasia. Pl. VI, ff. 11, 12 (larvae).

♂. Expanse 40–44 mm. F.-w. warm black. A tawny red oblique subapical patch about 2 mm. wide in 10, 9, 6, 5, and 4. Lower half of cell, base of 3, proximal half of 2 (except a small portion at base) and distal central part of 1b, and 1a tawny red. Usually also a red streak just beneath median which may extend from wing base to origin of 2, or may be reduced to a small mark.

H.-w. with a triangular basal patch of greyish black, the outer edge of which is roughly continuous in a straight line with the adjacent black of the f.-w. Central portion of wing tawny red. Hind margin black about 3 mm. wide slightly invaded by the discal red in areas 3 and 4.

Underside, f.-w. paler and duller than above, the costal black not reaching to base, and the basal inner marginal black only represented by a blackish mark at base of 2, and some irregular black beneath it in 1b. The subapical patch is ochre yellow, a slight ochreous powdering along the nervule ends, and a series of acutely triangular ochreous marginal internervular spots.

H.-w. Base pale sage green with a black basal spot in 9, 8, cell, and 1c. The green area is closely followed by a series of black spots roughly arranged in a double line and usually enclosing small red marks in 7, cell, and 1c. These spots are very variable and irregular, sometimes being coalescent and sometimes fairly well separated. Discal area ochre yellow. Marginal border rather variable. Usually about 2 mm. wide as far as nervule 3, then about 3 mm. wide tapering to inner margin. This border may be quite black with pale ochreous triangular internervular marginal spots, or the nervures may be laterally powdered with ochreous producing a striated appearance. One example from Ruaha Valley, German E. Africa, has red streaks between the nervules.

Head black with white lines behind the eyes and two brown tufts on collar. Thorax black with some whitish scales. Abdomen black above with yellowish segmental lines and lateral spots. Claws unequal.

♂. ab. The black replaced by brown, and all the reddish tawny areas replaced by dull ochreous. (1 example. Mus. Oxon., Lagos.)

♀. f. 1. Like the ♂ but rather larger (about 48 mm.). The h.-w. margin broader, especially beneath.

♀. f. 2. F.-w. dull smoky grey, subapical patch very pale ochreous. A whitish inner marginal patch suffused with grey, the greater part of which in 1a and 1b lies rather beyond the middle, extending upwards into base of 3. Indications of pale triangular spots on margin. H.-w. base dull grey, with black spots of underside showing through, central area pale ochreous, remainder dark grey with faint triangular marginal spots and indications of darker internervular rays.

Underside. F.-w. with a basal dull reddish grey area corresponding to the pale tawny red in f. 1. Subapical patch dusky white. Margin striated by blackish nervule ends laterally powdered with whitish, and elongated whitish triangular internervular marks laterally powdered with blackish. H.-w. base pale grey with the usual black spots, remainder dusky white, the marginal border striated similarly to that in f.-w.

Every gradation of intermediate between these two forms of ♀ may be found. An intermediate was figured by Drury (*l. c.*) and named *A. cynthius.* The larva is figured by Aurivillius (*l. c.*) and thus described :—

> Bluish white above with two narrow dark dorsal lines and a broad black longitudinal line on each side between the dorsal and upper lateral spines. The spines of segments 1–3 and 11–13 are quite black, the remainder only more or less blackish towards the point.

Large numbers of this species have lately been bred by Mr. W. A. Lamborn near Lagos, and the specimens together with examples of the larvae and pupae are now in the Oxford Museum.

The larvae are dimorphic. That corresponding to Aurivillius' description, is, at Lagos, comparatively rare, the commoner form being darker in colour and having darker markings. From notes supplied by Mr. Lamborn I am able to furnish the following description of the paler form of larva in its various stages.

> A company of larvae found on August 10, 1911, consisted of individuals of an average length of 1·4 cm. The ground-colour, legs, and underside were bluish white. The spines of the first segment black, those of the second sometimes only partly black. Spines of last two segments black, the remainder white. These larvae moulted about two days later, after which the average length was 2 cm. The ground-colour remained the same but longitudinal whitish stripes appeared, the legs and underside being of the same colour. The first and last two rows of spines were black, the third row whitish with black apices, the remainder whitish with black hairs. About the 17th, moulting again took place, after which the average length was 2·6 cm. The principal change from this stage to pupation was an increase in depth of the ground-colour, which became bluish green. When fully grown the larvae had an average length of 3·2 cm., and by the 21st many were suspended for pupation.
>
> The darker form of larva, Pl. VI, f. 12, has a bluish white ground-colour, two dorsal blackish bands, bordered on the lower side with yellowish, and a yellowish subspiracular band. The sublateral spines, and those of the six central segments are whitish with black hairs. The lower part of head is black and the upper part brownish. Legs yellowish.

I am of opinion that the imagines do not present any marked differences corresponding to the two forms of larvae.

A dipterous parasite of the family *Tachinidae* emerged from some of the larvae reared by Mr. Lamborn.

A. bonasia ♀. f. *praeponina*, Staud.

After a careful examination of Staudinger's type I cannot regard this as other than a form of *bonasia*. It has the blackish brown of f.-w. inner margin turned up to meet that from the costa just beyond origin of 2, whilst the h.-w. margin on underside is narrower than in ordinary *bonasia* ♀♀, and the brown colouring is so dark and complete that it appears hardly at all striated. There are triangular whitish marks on the border and the suppression of the striation gives it somewhat the appearance of *urui*. Staudinger's description refers to the black spots making an entirely different pattern to those in *bonasia* (*eponina*). They are however much the same, but a little more accentuated. There are three ♀♀ examples in the Staudinger collection, two from Kuilu and one only vaguely described as from the Congo Region.

A. bonasia ♀. f. *siabona*.

This form is described as having the f.-w. apical and marginal black broader than in typical examples. The subapical patch yellow, and the remaining reddish areas duller than usual. On the h.-w. underside the marginal band is twice as broad as in typical forms and the nervures heavily dusted with black. On the inner edge of the marginal band are triangular blackish spots in 1b, 2, 3, and 4, divided by the nervures, having their apices directed towards the base. These spots are produced into narrow rays reaching the cell in 3 and 4. In 5, 6, and 7 are long acute angled spots. Basal and discal spots very small. (1 ♀ from Misahöhe, Togo.)

A. bonasia alicia, subsp.

♂. Expanse 30–40 mm. F.-w. costa, outer half of wing, and hind margin black. An oblique subapical patch of tawny red in 10, 9, 6, 5, and 4. Inner margin black on both sides of submedian as far as the middle, but this black *does not*, as in *bonasia*, *extend upwards as far as nervure* 2. H.-w. with a triangular black mark at base extending rather beyond middle of cell much as in *bonasia*. Central area of wing tawny red varying to yellowish, especially towards inner margin. Hind margin with a black band about 3 mm. wide somewhat invaded by the red colour in areas 4 and 5.

Underside. F.-w. as above but reddish colour paler, and the subapical patch ochre-yellow. H.-w. greenish yellow at base, with one or two basal black spots, followed by a transverse row of irregular somewhat confluent spots, sometimes, though rarely, forming a double line enclosing small red marks. Central area dark ochreous (darker than in *bonasia*). Marginal border black corresponding in shape to that on upperside and having yellowish marginal internervular spots. This border is sometimes, though rarely, striated.

Head and thorax black, with reddish tufts on collar. Abdomen black above with small yellowish lateral stripes.

Some examples of the ♂ have the paler areas of both wings orange yellow. Specimens of this coloration have been received from Kilimandjaro and the Tiriki Hills. Occasional examples have the subapical patch continued to the costa where it is nearly as broad as elsewhere.

♀. Expanse 36–44 mm. Extremely variable. The following forms may be observed in a long series :—

f. 1. Closely resembles the ♂. Only slightly paler and duller. On the h.-w. there is a marginal row of triangular spots of the ground-colour. Underside paler and duller. The h.-w. margin very little broader than that of the ♂, its inner edge curved, nearly parallel to apical margin as far as nervule 4 where the border becomes suddenly wider, and its edge runs nearly straight, and at right angles to the inner margin. Large triangular whitish spots.

f. 2. *tenelloides.*

Pale central area of f.-w. light orange ochreous, subapical patch yellow. H.-w. pale yellow, rather darker towards costa. A mere trace of basal black. Marginal border very narrow, its inner edge slightly suffused with orange and its outer edge bearing pale yellow triangular spots.

Underside very pale. F.-w. basal half pinkish ochreous. A trace of a discocellular spot. Costal, apical, and hind-marginal area pale dusky ochreous very faintly striated by the nervule ends. Subapical patch pale yellow.

H.-w. pale creamy ochreous. Traces of a few small black spots near base. Marginal border pale dusky ochreous with traces of the usual triangular spots and their internervular rays.

♀. f. 3. *cabiroides.*

Upperside almost exactly like that of the ♂ but with traces of reddish marginal spots on h.-w. Underside. F.-w. paler than above. Subapical patch pale ochreous. Hind margin from costa to angle striated in the following manner :—The nervule ends blackish and with a line of greyish ochreous on each side.

Between the nervules are elongated triangular orange ochreous markings, their bases occupying the whole internervular space at margin and their sides outlined with black. H.-w. like that of ♂ except for the marginal border. This is rather broader as far as nervule 5, where it becomes still wider nearly reaching end of cell. From 5 to the inner margin its inner edge is not straight but convex. The nervules on the border are blackish. The triangular marginal spots are large, whitish, and edged with black. This black edging is produced inwardly in a double internervular ray, and all the internervular spaces beyond the marginal spots are dusted with brown.

♀. f. 4. Ground-colour much duller than in ♂ and apical patch yellowish. The h.-w. marginal border on the upperside is almost double the width of that in the ♂, and there is rather more basal black. A broad yellowish suffusion about the inner margin, and yellowish marginal spots. Underside of h.-w. like that in *cabiroides* but marginal border still wider, reaching the cell and only very little narrower towards apex.

In addition to the above forms many intermediates occur. An interesting example now before me is perfectly intermediate between *tenelloides* and *cabiroides*, having the pale areas of the upperside nearly as yellow as in the former, whilst the h.-w. underside exhibits a similar pattern, but somewhat less developed than in the latter.

A. bonasia banka, subsp.

This, the Abyssinian subspecies, is distinguished by having rather more black on the upperside, and the inner marginal basal black of the f.-w. is slightly produced upwards so as to touch nervule 2. The dark areas of the underside are quite black, and in the h.-w. the subbasal spots are large and coalescent, forming an almost continuous black band.

Forms intermediate between *bonasia* and *alicia* are rare, but a ♂ example from Toro now before me has the f.-w. inner marginal basal black slightly produced upwards though not quite reaching nervule 2.

♂♂ from the Kikuyu Escarpment generally have the h.-w. yellow on the upperside, with the usual black markings. In a note on the species (P. Z. S., p. 922, 1900), Butler states, quoting from a letter from Mr. Crawshay, that the insect "does not succumb to 90 per cent. cyanide in an hour—cyanide which suffocates every other Lepidopteron in twenty-five to thirty seconds." It is to be assumed that the "every" does not include all other Acraeas, as many have great tenacity of life. The above collector also reports that the species was found "simply in swarms, on the mud on the rocks in the bed of the stream."

88. ACRAEA SOTIKENSIS. Pl. XIII, f. 8.

Acraea sotikensis, Em. M. B. Sharpe, Proc. Zool. Soc., p. 634, pl. 48, f. 1 (1891); Oberthür, Etud. d'Ent., 17, p. 23 (1893); Aurivillius, Rhop. Aeth., p. 105 (1898); Neave, Novit. Zool., 11, p. 346 (1904); Proc. Zool. Soc., p. 26 (1910).

ANGOLA (Calweha, Bolombo, Bango, Bailundu); CONGO (Katanga); KONDELAND; N.E. RHODESIA (Chinsali); BUKOBA; RUTSCHURU (90 km. W. of Albert Nyanza); UGANDA (Unyoro, Toro, Mondo); BRITISH E. AFRICA (Nandi, Machakos); ABYSSINIA (Djala, Gardulla, Abassi).

f. *supponina*, Staudinger, Iris, 9, p. 204 (1896); Aurivillius, Rhop. Aeth., p. 105 (1898).

KATANGA; "W. AFRICA; CONGO" (Staud.).

f. *katana*, f. nov.

= *sotikensis*, Neave, Proc. Zool. Soc., p. 26 (1910) (part).

KATANGA.

A. sotikensis rowena, subsp. nov.

= *sotikensis*, Heron, Trans. Zool. Soc., xix, p. 146 (1909).

MT. RUWENZORI.

A. sotikensis sotikensis.

♂. Expanse 42–50 mm. F.-w. rich sepia black. Lower half of cell (sometimes only basal part), basal half of 2, and central half of 1b and 1a, orange red. A subapical patch of pale ochre yellow of somewhat variable shape and size in 11, 10, 9, 6, 5, and 4.

H.-w. with a triangular black patch at base with slight indications of the black spots of underside. Central area of wing orange-red invading more or less deeply the marginal border in 4 and 5. Marginal border dark sepia with faint indications of underside pattern. This border is about 3–4 mm. wide from costa to nervule 3, where it becomes suddenly wider, its inner edge being straight and at right angles to inner margin. This straight edge is often clouded with brownish red. In some examples there is a hind-marginal row of small reddish yellow spots.

Underside. F.-w. much as above but the red colour duller and occupying the whole basal half of the wing, except costa. A more or less curvilinear spot in 1b, just beyond origin of 2. In margin there are reddish brown internervular rays. The pale yellow subapical patch extends narrowly along both sides of nervule 5 to margin, and along the upperside of 4.

H.-w. Pale sage green at base with numerous black spots on an area corresponding to the triangular black of the upperside. The more distal of these spots are in some cases more or less confluent, but the following can usually be distinguished :— One in 9, 8, and 1c at base. Two in 7 close together, one at base of 6, one on discocellulars, three in cell (sometimes only two), two in 1c, 1b, and 1a. The more distal spots are arranged roughly in two parallel rows enclosing crimson marks in 7, cell, and 1c. Central portion of wing pale pink. A broad hindmarginal blackish border, its inner edge corresponding in shape to that on upperside. On this border the nervules are black, sometimes with a whitish lateral powdering. Between the nervules a series of marginal triangular whitish spots, produced into reddish rays, each spot and its rays outlined with black.

Head and thorax black. Red tufts on collar. Abdomen black above with pale ochreous segmental lines and lateral spots. Claws unequal.

♀. Expanse 50–58 mm. May be coloured very like the male or may be distinctly paler and duller. Occasionally the f.-w. subapical spot is whitish. There is usually a well-marked row of reddish triangular internervular spots in h.-w. Underside as above but paler and duller.

A. sotikensis f. *katana*.

This form is distinguished by having the orange red areas deeper in tint, whilst the f.-w. subapical spot is usually of the same red colour instead of pale ochreous. There seems nearly always to be a marginal row of reddish spots in h.-w.

♀ like ♂ but larger and duller. F.-w. subapical spot sometimes yellow or even whitish. Though scarcely quite constant, the form is specially characteristic of the Katanga region.

A. sotikensis f. *supponina*. Pl. IV, f. 15 (♂).

Amongst numerous examples of the *katana* form there are some which present a remarkable difference in the arrangement of the black spots in the h.-w. underside. Those in areas 4, 5, 6, and 7 projecting downwards in a straight line nearly at right angles to the costa, instead of lying almost parallel to the subbasal spots. On examining the type of Staudinger's *A. supponina* I found this arrangement of spots to be its most distinguishing feature, and in other respects it agrees with examples taken by Neave in the Katanga region. There are also intermediate examples before me from the same locality. I have no hesitation therefore in regarding *supponina* as merely another form of *sotikensis*.

A. sotikensis rowena, subsp.

Distinguished from typical form by having rather more black on f.-w. and the central area of h.-w. is pale ochreous tinted with orange on the upper half. H.-w. marginal spots rarely present. When visible they are pale ochreous and minute. The central pale area of h.-w. underside is very pale yellow without any trace of pink. I have not seen the ♀.

Four ♂♂ Mus. Tring. Similar forms in Mus. Brit., Mt. Ruwenzori.

Intermediate examples between the three forms described above may occasionally be found. Some examples from Toro, Unyoro, and Kondeland, in the Tring collection, have the red colouring very pale, and the red of f.-w. cell is a mere streak. The h.-w. hind margin has well-developed spots.

89. Acraea cabira. Pl. XIII, f. 9.

Acraea cabira, Hoppfer, Monatsb. Akad. Wiss. Berlin, p. 640 (1855); Peters. Reise. Ins., p. 378, pl. 23, f. 14, 15 (1862); Staudinger, Iris, 9, p. 205 (1896); Aurivillius, Rhop. Aeth., p. 106 (1898); Aurivillius, Sjöstedt's Exp., p. 4 (1910).

= *A. apecida* var. *flavomaculatus*, Lanz, Iris, 9, p. 130 (1896).*

Congo (Stanley Pool); Uganda (Unyoro); British E. Africa (Kibwezi, Kavirondo); German E. Africa (Ukerewe I., Muansa, Mamba); Rhodesia; Nyassaland (Kigonsera, Bandawe); Natal; Transvaal; Portuguese E. Africa (Delagoa B.); Cape Colony.

f. *apecida*, Oberthür, Etud. d'Ent., 17, p. 23, pl. 2, f. 15 (1893); Staudinger, Iris, p. 206 (1896); Aurivillius, Rhop. Aeth., p. 106 (1898); Butler, Proc. Zool. Soc., p. 53 (1898); Neave, Novit. Zool., 11, p. 346 (1904); Proc. Zool. Soc., p. 27 (1910).

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* Except that the yellow band in h.-w. upperside is broader in this form than in typical *cabira*, I cannot find any particular difference. The width of this band is so variable in a long series that there seems no advantage in retaining this form name.

= *cabira*, var., Trimen, S. Af. Butt., 1, p. 174 (1887); Rogenhofer in Baumann, Usambara, p. 326 (1891).

German E. Africa (Usambara); Congo (Luangwa Val., Katanga).

Also liable to occur with the typical form in other localities.

f. *abrupta*, Grünberg, Sitz. Gesell. Natur. Freunde, p. 163, f. 2 (1910).

Sesse I., V. Nyanza.

f. *natalensis*, Staudinger, Iris, p. 206 (1896); Gooch (metamorph.), Entomologist, 14, p. 1 (1881); and Trimen, S. Af. Butt., p. 174 (1887); Aurivillius, Rhop. Aeth., p. 106 (1898); Sjöstedt's Exp., p. 4 (1910).

= *cabira*, Wallengren, Rhop. Caffr., p. 21 (1857); Staudinger, Exot. Schmett, p. 84, pl. 33 (1885); Trimen, S. Af. Butt., 1, p. 173 (1887).

= *cynthia*, Trimen, Rhop. Afr. Austr., p. 108 (1862) (part).

Natal; Delagoa Bay; Manicaland; German E. Africa (Kilimandjaro).

f. *karschi*.

= *viviana* f. *karschi*, Aurivillius, Rhop. Aeth., p. 106, fig. 13 (1898).

Cameroon (Baliburg); British E. Africa (Mt. Kenya, Mori R.).

f. *biraca*, Suffert, Iris, p. 33 (1904).

German E. Africa (Langenberg); Rhodesia (Chirinda).

A. cabira cabira.

♂. Expanse 36–42 mm. F.-w. brownish black. The subcostal nervure reddish at its base. A subapical oblique patch of pale ochreous about 2 mm. wide in 11, 10, 6, 5, and 4. A central patch of pale ochreous occupying the lower half of cell, a small part of base of 3, the basal half of 2, the upper basal and entire central part of 1b, and the middle of 1a. In typical examples this patch is of such a shape that it projects along the median in a finely drawn out point to the base.

H.-w. with a small triangular greyish basal patch with indications of the black spots of the underside. Central area pale ochreous. A broad black hind-marginal band 2·5 mm. wide at apex, its inner edge running parallel to the apical margin as far as 4, where it turns inwards, traversing the wing nearly at right angles to the inner margin. On this border faint lighter and darker lines indicate the pattern of the underside.

Underside. Basal half reddish, darker at base of cell. Costa dusky ochreous. Subapical patch pale ochreous, and between it and cell some irregular black partly projecting into cell, wide at costa, narrow at base of 3 and turning downwards to inner margin to form a suffused inner edge to the hind-marginal border. The latter greyish ochreous with black nervule ends and dark ochreous elongate triangular internervular marks edged with black. A fine black line round margin. Some irregular blackish along basal half of nervure 1.

H.-w. greenish grey at base with a black spot in 8, and some black at base of nervures. Next to the basal grey two spots in 7 enclosing a red mark and a dot at base of 6. A spot on upper discocellular joined to two in cell, the three enclosing a red mark. A large spot in 1c, and a smaller one in 1b and 1a. (These spots are sometimes divided, and there may be an additional spot in cell so that the spots form roughly a double row; and there is sometimes a basal spot in cell.) Central area pale ochreous. Hind-marginal band shaped as above, its inner edge marked by a brown line, the nervule ends black, edged with pale ochreous, a fine black line round margin, on which are subtriangular pale ochreous spots, each produced into a brown ray and edged with black.

Head black, with pale marks behind and between the eyes. Brownish tufts on collar. Thorax black with a few pale marks. Abdomen black above with pale yellowish lateral spots and segmental lines. Claws unequal.

♀. Expanse 56-60 mm. Except for its much greater expanse of wing resembles the ♂. Often an elongate spot in middle of cell. The h.-w. marginal border is much broader, and bears pale ochreous marginal spots, together with more distinct indications of the underside pattern. The basal and subbasal spots of h.-w. underside are larger and separated so that the following may be distinctly observed:—One at base in 9, one in 8, two in 7 enclosing a red mark, one on upper part of discocellulars, two in cell enclosing a red mark, and a basal spot. A basal and two subbasals in 1c, the latter enclosing a red mark, one in 1b, and two in 1a.

A. cabira f. *apecida.*

This form differs in having the central areas of both wings, and to some extent the f.-w. subapical patch, reddish yellow. Nearly every intermediate shade of colour may be observed in a long series.

A. cabira f. *abrupta.*

This form is described by Grünberg from Sesse I. in the V. Nyanza. It differs principally in the absence of striations on the h.-w. marginal border on underside, the border being black with white or whitish marginal spots.

A. cabira f. *natalensis.*

This form differs from typical examples in that the f.-w. central pale area does not extend in an elongate spur to the base, but is merely sharply angulated near origin of nervule 2. The form is not confined to the Natal region, and the pale areas may be either pale ochreous, reddish yellow, or of an intermediate tint.

A cabira f. *karschi*

Differs from the typical form in having the f.-w. pale inner marginal patch with nearly parallel sides and not extending towards base.

A. cabira f. *biraca.*

Differs from typical examples in that the central pale area of the f.-w. occupies the lower half of the cell and the whole of area 1b to the base. The specimen described by Suffert is a ♂ taken at Langenburg, L. Nyassa. Some examples from Chirinda now in the Oxford collection show the same feature.

The following descriptions of the larva and pupa are taken from Trimen's work (*l. c.*).

"Larva.—Bluish green with yellow ochreous longitudinal lines and transverse bands. Head, and segments 2, 3, and 4 yellowish brown. A dorsal and two subdorsal longitudinal lines. From the transverse band on each segment arise the spines, which are rigid and of moderate length, black on the second, twelfth, and thirteenth segment, yellow ochreous on the rest. The band is marked on each side with a bluish green subdorsal spot and a black spiracular ring.

"Feeds on a woolly fleshy leaved weed like a *Lamium*, common in clearings.

"Pupa.—Whitish green, with the usual pattern of the markings slightly marked, the dorsal markings more pronounced than the others."

A. cabira is extremely variable in ground-colour and in the extent to which the f.-w. central pale area is produced towards the base. So far as I am able to judge no particular form is definitely associated with a particular locality. In a long series from Chirinda, now in the Oxford collection, the f.-w. pale central patch is very variably extended towards the base, and in some cases little is left of the basal black but a streak in the cell and some black powdering about the submedian nervule. Others have a mere trace of the triangular basal black in the h.-w. Generally speaking these Chirinda specimens have a tendency to a reduction of basal black, and in most cases the pale areas are of a pale reddish yellow intermediate between typical examples and the *apecida* form.

Several large ♀ examples from the Luangwa Valley have the pale areas of both wings orange-colour except the f.-w. subapical patch, which is very pale lemon-ochreous. One ♂ from Machakos has all the pale areas nearly white. All grades of intermediates are found, and the sole constant feature which distinguishes the species from *viviana* is the fact that the basal black of the f.-w. is more or less indented by the yellow or red central ground-colour at or near the origin of 2, and extends more or less along the inner margin, whereas in *viviana* the black is narrowest at the inner margin, its distal edge proceeding *upwards and outwards* to nervule 2, and forming a line continuous with the outer edge of the h.-w. basal black.

Aurivillius places the form *karschi* under *viviana*, but if the latter is really a separate species then *karschi* belongs rather to *cabira*, if one may judge from a series of preparations of the ♂ armatures. It may be distinguished from *viviana* by the smaller extent of the pale areas.

90. Acraea viviana. Pl. XIII, f. 10.

Acraea viviana, Staudinger, Iris, 9, p. 204 (1896); Aurivillius, Rhop. Aeth., p. 106, f. 12 (1898); Heron, Trans. Zool. Soc., xix, p. 147 (1909).

= *cabira*, Neave, Novit. Zool., xi, p. 346 (1904).

Cameroon (Ja River); Congo (Vivi, Zongo, Mokoange, Bangasso, Sassa); Uganda (Toro, Entebbe, Kampala, Pt. Alice); German E. Africa (Bukoba).

♂. Expanse 48–50 mm. F.-w. black. Subcostal and median nervures reddish. An oblique subapical patch of pale or dark ochreous in 11, 10, 9, 6, 5 and 4. An inner marginal patch of the same colour occupying nearly the whole of area 1a except a small part at base and margin, the middle part of 1b, the basal half of 2 and usually just extending into cell and base of 3. The basal black which remains in 1b has its outer edge straight and pointing slightly outwards, meeting the median at the origin of 2, and is not indented or divided along the median as in *cabira*.

H.-w. with a more or less triangular basal black area extending barely to middle of cell with indications of the spots of underside. Central area dark or pale ochreous. A hind-marginal border of black some 4 mm. wide at apex, its inner edge running straight downwards to nervule 4 where it makes a sharp curve thence becoming suddenly rather broader at 3, traversing the wing nearly at right angles to inner margin.

Underside. F.-w. slightly reddish at base (much less red than in *cabira*). The remainder of wing a pale replica of the upperside, the apex and hind margin striated by black nervules laterally powdered with pale grey, and internervular brownish marks laterally lined with black.

H.-w. grey at base. Area 9 dark red, a black spot in 8, two in 7 enclosing a red mark one on middle disco-cellular closely followed by two in cell, the three together enclosing a red mark, a third spot in cell nearer base. A basal and a subbasal spot in 1c sometimes enclosing a very little red, a spot in 1b (sometimes absent) and two in 1a. Some irregular black at base of nervures. Central area of wing pale ochreous to creamy white. Hind-marginal border similar in shape to that on upperside and marked exactly as in *cabira*, i. e. the nervules black, laterally lined with pale ochreous, and between the nervules pale triangular marginal spots produced inwardly into brownish marks each lined with black. Some brownish scales along inner edge in 3, 2, 1c, 1b and 1a.

Head black with a few whitish markings, two brown tufts on collar, thorax black with some pale lateral marks, abdomen black above with yellowish segmental lines and lateral spots. Claws unequal.

♀. Expanse about 56 mm. Resembles the ♂, but the h.-w. marginal border is somewhat broader, and has a mere trace of paler marginal spots, and of the striations of the underside pattern.

A. viviana is easily distinguished from *cabira* by the shape of the basal black in the f.-w., the outer edge of which in 1b passes nearly straight up, inclining slightly outwards from the submedian to the origin of 2. It is rarer in collections than is *cabira*, and I have not had an opportunity of examining very long series, but so far I have seen no intermediates between the two species. Also the genitalia though of a very simple structure appear to differ. The species occurs as far west as Cameroon. It has not been found in the large consignments lately received at Oxford from Mr. Lamborn from Lagos, and I think it may safely be assumed not to occur there. It is found in Angola and in the Congo State, and extends north and east to Ruwenzori, Toro, and Entebbe.

91. Acraea acerata. Pl. XIII, f. 7.

Acraea acerata, Hewitson, Ann. Nat. Hist. (4), 13, p. 381 (1874); Exot. Butt. (*Acraea*), pl. 7, f. 44 (1875); Butler, Proc. Zool. Soc., p. 730 (1895); Aurivillius, Rhop. Aeth., p. 104 (1898).

f. *vinidia*, Hewitson, Ent. Mo. Mag., 11, p. 130 (1874); Exot. Butt. (*Acraea*), pl. 7, f. 45, 46 (1875); Staudinger, Exot. Schmett, 1, p. 84 (1885); Karsch, Berl. Ent. Zeit., 38, p. 195 (1893); Aurivillius (metamorph.), Ent. Tidskr., 14, p. 277, pl. 4, f. 3, 3a, 3b (1893); Rhop. Aeth., p. 105 (1898); Heron, Trans. Zool. Soc., xix, p 147 (1909).

Abundant over the whole region from Ashanti to German E. Africa.

f. *brahmsi*, Suffert (*A. brahmsi*), Iris, p. 15, pl. 3, f. 4 (1904).
Cameroon; Nigeria.

f. *diavina*, Suffert, Iris, p. 31 (1904).
Cameroon.

f. *tenella*.

Rogenhofer, Ann. Mus. Wien., 6, p. 457, pl. 15, f. 1 (1891); Butler, Proc. Zool. Soc., p. 114 (1896).

= *abbotti*, Holland, Entomologist, 25, Suppl., p. 89 (1892); Proc. U.S. Nat. Mus., 18, p. 233, pl. 7, f. 1 (1895); Aurivillius, Rhop. Aeth., p. 105 (1898).

Nyassaland; German E. Africa; British E. Africa; Abyssinia.

Hewitson published the description of *acerata* in May and that of *vinidia* in November 1874. In the description accompanying the figures in Exot. Butt. he expresses the opinion that *acerata* is a form of *vinidia*, as no doubt it is, but as the name *acerata* was published first it would appear that it must stand as that of the species. As the *vinidia* f. is much the commoner I will describe it first, afterwards indicating the differences presented by the other forms.

A. acerata f. *vinidia*.

♂. Expanse 36–42 mm. Wings orange tawny to pale ochreous. F.-w. base of 1a, 1b, costa, and the greater part of cell brown black.

An apical and hind-marginal black border about 3 mm. wide. At and beyond end of cell there extends from costa a more or less wedge-shaped black mark, its narrower and lower portion being connected with the hind-marginal black, thus enclosing a subapical patch which may be of the ground-colour or paler. There is sometimes a rather large black spot in 2 close to median and a smaller one below it, and rather further from margin in 1b.

H.-w. may show traces of the spots of underside. Base slightly blackened, hind margin with a black border 2 to 3 mm. wide, the inner edge of which may be nearly parallel to hind margin or it may be somewhat angulated at 3, thus giving the central pale patch a slightly quadrate appearance.

Underside f.-w. like the upper but paler and with the black of base and cell reduced to a spot in cell. The subapical patch paler than the ground-colour. The apex and hind margin have a series of triangular reddish-yellow spots.

H.-w. pale ochreous with a black or very dark brown hind-marginal border bearing triangular reddish marginal spots, the apex of each being produced into a deep black ray, which does not however extend beyond the black border. Numerous small black spots usually as follows :—One in 8 against precostal, two in 7, sometimes one in 6, a streak on discocellulars, and a dot at base of 4 (there is apparently never a spot in 3), one at base of 2, two in cell, and two in 1c, 1b, and 1a. Some irregular black at base of nervures and sometimes a few basal red marks.

Head black with a pale mark behind each eye, and two reddish tufts on the collar. Thorax black. Abdomen black above with orange lateral and whitish dorsal spots. Claws unequal.

♀ resembles ♂, but ground-colour slightly duller, or in some cases much paler.

A. acerata acerata. Pl. VI, f. 13 (larva).

Differs from *acerata vinidia* in having a slightly paler ground-colour, and in the fact that the black wedge-shaped mark in f.-w. is not connected at its lower end with the hind-marginal black, so that the subapical patch is continuous with the ground-colour.

f. *tenella.*

This is an extreme eastern form of the species. It is characterised by having a much paler ground-colour. The black margins are slightly narrower than in the western forms, and marginal spots are usually visible on the upperside. Scarcely any spots are visible on the h.-w. upperside.

Beneath all the colours are much paler. There is a spot in cell, and the wedge-shaped black mark of the upperside may be resolved into a discocellular and a row of discal spots. The dark marginal borders of the upperside are represented only by light brown scales, though the h.-w. border may be somewhat darker than that of the primary. A ♀ example before me has the borders pale brownish grey, divided up by the dark brown ends of nervules, and by the triangular orange-coloured internervular marks, each of which is prolonged at the apex to a dark brown ray. The h.-w. spots are much reduced in both sexes, those in area 7 being most prominent. There are frequently some red internervular marks on the basal portion of the wing.

f. *brahmsi.*

This form like the others is rather variable in markings. It differs from them in having the orange tawny colour replaced by dull brick red, and in having the dark markings on the upperside of a more decidedly brown tone. The subapical patch, which is small, a very small distal part of cell, the basal half of area 2, and the central part of 1b and 1a are dull brick red. Remainder of wing dark brown. A brown spot near base of 2, and beneath it but rather further from margin a spot in 1b usually connected by a spur with the basal brown. H.-w. dull brick red, slightly blackened at base, and having a dark brown hind-marginal border 2·5 mm. wide as far as 3, where it widens to about 4 mm.

On the underside the basal half of f.-w. is dull red, paler than above. Costa greyish brown. A large black spot in cell, and one in 2 and 1b. The subapical patch is ochreous, and between it and end of cell is an irregular black mark joined on its lower side to a crescentic spot in 3. The apical and hind-marginal border presents a different appearance to that in *acerata* and *vinidia*. There is a series of subtriangular orange ochreous marginal spots, followed inwardly by a band of pale brown. The spots are separated only by the black ends of nervules; each spot is outlined with black and its apex produced into a black ray which bifurcates where it meets the pale subapical spot, or the ground-colour in 2 and 1b.

H.-w. pale ochreous with black spots as in *acerata*. Red internervular marks in basal half in 9, 7, 5, cell, 1c, 1b, and 1a. A broad pale brown hind-marginal border shaped as in *vinidia*, and inclining to tawny at its inner edge. Subtriangular orange ochreous marginal spots, each outlined with black and produced inwardly in a black internervular ray. Nervule ends also black.

I have not seen a ♀ of this form, but judging from those of the other forms it probably does not greatly differ from the ♂.

Suffert's *diavina* has in f.-w. a smaller subapical spot, and larger spots in 2 and 1b. It was taken at Victoria, Cameroon, but similar examples are before me from N. Rhodesia.

Aurivillius (*l. c.*) describes the larva and pupa as follows:—

Larva very like that of *bonasia*, but more marked with red brown above, and with paler and more interrupted longitudinal streaks. Only the spines of segments 1, 2 and 11–13 are black, the remainder being whitish. The head is blackish with a pale anterior bifurcate middle line.

Pupa pale with black markings, the five rows of spots of the abdomen formed of separated subquadrate spots with pale centres, the latter not raised.

Examples of the larva (Pl. VI, f. 13), taken by Mr. W. A. Lamborn near Lagos are pale green with a few brownish dorsal and dorsolateral marks on each segment. Lateral line pale yellowish. On the first and last four segments the spines are black. The remainder are yellowish. An anterior view of the head shows it to be brownish with a black triangular mark in the centre, on each side of which is a thick black line. The food plant at Lagos is *Lepistemon africanum*, Oliv. (*Convolvulaceae*).

Examples of *acerata* taken by Neave in the neighbourhood of L. Bangweolo vary very considerably and may be of the *acerata* or *vinidia* form, the latter predominating whilst there are intermediates to *tenella* and *brahmsi*.

The species has a wide distribution. The *vinidia* form is predominant, true *acerata* appearing rather occasionally. Both occur from Ashanti, through Togoland, Nigeria, Cameroon, French Congo, Angola, Congo State to North Rhodesia. In this region many intermediate forms are found. In Nyassaland, German East Africa and British East Africa, and extending into Abyssinia (Marmasa and Alaballa) the *tenella* f. is predominant and might perhaps be regarded as an eastern subspecies, though it is scarcely sufficiently constant to be thus separated. The local form *brahmsi* is found in Cameroon (Bipindi) and Nigeria (Kabba Town).

92. ACRAEA TERPSICHORE. Pl. XIII, f. 6.

Acraea terpsichore, Linnaeus, (*Pap.*) Syst. Nat., ed. 10, p. 466 (1758); Mus. Ulr., p. 222 (1764); Seba, Locuplet. Rerum. Nat., iv, pl. 27, f. 29, 30 (*cepheus* var.) (1765); Butler, (*A.*) Proc. Zool. Soc., p. 655 (1893); Aurivillius, Rhop. Aeth., p. 104 (1898); Ann. Mus. Genov., p. 11 (504) (1910).

= *serena*, Fabricius, (*Pap.*) Syst. Ent., p. 461 (1775); Herbst, Naturs. Schmett, 5, p. 19, pl. 82, f. 8, 9, ♀ (non ♂) (1792); Godart, (*A.*) Enc. Méth., 9, p. 232, ♀ (non ♂) (1819); Oberthür, Ann. Mus. Genov., 15, pp. 157, 184 (1879); Snellen, Tijdschr. v. Ent., 25, p. 216 (1882); Staudinger, Exot. Schmett, 1, p. 83 (1885); Karsch, Berl. Ent. Zeit., 38, p. 195 (1893); Butler, Proc. Zool. Soc., p. 115 (1896); Neave, Novit. Zool., 11, p. 346 (1904); Proc. Zool. Soc., p. 26 (1910); Grünberg, Sitzb. Ges. nat. Fr., p. 149 (1910).

= *eponina*, Cramer, (*Pap.*) Pap. Exot., 3, p. 138, pl. 268, f. C.D. (non A.B.) (1780).

= *liberia*, Butler, Trans. Ent. Soc., p. 525 (1870).

= *manjaca*, Snellen, Tijdschr. v. Ent., 15, p. 11 (1872).

♀ f. *janisca*, Godart, Enc. Méth., 9, p. 233 (1819).

f. *rougeti*, Guérin, Lefeb. Voy. Abyss., 6, p. 368, pl. 10, f. 6, 7 (1849); Grünberg, Sitzb. Ges. nat. Fr., p. 149 (1910).

= *manjaca*, Wallengren, Rhop. Caffr., p. 22 (1857).

= *serena*, Trimen, Rhop., Afr. Austr, p. 107 (1862); Hoppfer, Peters Reise. Ins., p. 377 (1862); Staudinger, Exot. Schmett, 1, p. 83, pl. 33 (1885).

= *manjaca*, Boisduval, Faun. Madag., p. 33, pl. 4, f. 6, pl. 5, f. 6, 7 (1833); Aurivillius, Voeltzkow Exp., p. 316 (1909).

= *serena*, Mabille, Hist. Nat. Mad. Lep., 1, p. 111, pl. 11, f. 7, 8 (1885-7).

= *buxtoni*, Butler, Ann. Nat. Hist. (4), 16, p. 395 (1875); Trimen, S. Afr. Butt. 1, p. 170 (1887); Proc. Zool. Soc., p. 74 (1891); Fawcett (metam.), Trans. Zool. Soc., p. 295, pl. 46, f. 10, 11, 12 (1901).

= *perrupta*, Butler, Ann. Nat. Hist. (5), 12, p. 102 (1883); Proc. Zool. Soc., p. 400 (1898).

f. *melas*, Oberthür, Etud. d'Ent., 17, p. 24, pl. 1, f. 13 (1893).

f. *subserena*, Gr.-Smith, Novit. Zool., 7, p. 544 (1900); Rhop. Exot. (*Acraea*), 8, p. 28, pl. 8, f. 5, 6 (1901).

[S. LEONE.]

f. *venturina*, Thurau, Berl. Ent. Zeit., 48, p. 303 (1903); Suffert, Iris, p. 31 (1904).
[UGANDA (Muanza).]

f. *connexa*, Thurau, Berl. Ent. Zeit., 48, p. 304 (1903).
[NGURUMAN.]

f. *intermediana*, Strand, Mitt. Zool. Mus. Berl., p. 283, fig. (1911).
[GERMAN E. AFRICA (Mahenge, Mkamba).]

The localities of the named forms are given under each. Generally *A. terpsichore* occurs from about lat. 10·3° N. to 30° S. and in Madagascar and the Islands.

f. *ventura*, Hewitson, Ent. Mo. Mag., 14, p. 51 (1887); Butler, Proc. Zool. Soc., p. 655 (1893); *l. c.*, p. 565 (1894); Aurivillius, Rhop. Aeth., p. 104 (1898); Neave, Proc. Zool. Soc., p. 26 (1910); Grünberg, Sitzb. Ges. nat. Fr., p. 149 (1910).
= *terpsichore*, var. *bukoba*, Weymer, Iris, p. 225, pl. 2, f. 6 (1903).
CONGO (Lualaba V.); N.E. RHODESIA (Serenje, Abercorn, Broken Hill to Tanganyka, Fwambo); GERMAN E. AFRICA (Mosozi, Madikia, Langenberg, Bukoba); BRITISH E. AFRICA (L. Baringo), UGANDA (Sesse I.).

f. *rangatana*, f. nov. ? subsp.
= *ventura*, Butler, Proc. Zool. Soc., p. 565 (1894).
BRITISH E. AFRICA (Rangatan, Laitsipia).

A. terpsichore ochrascens, subsp.
= *A. ochrascens*, Em. M. B. Sharpe, Entomologist, p. 40 (1902).
V. NYANZA (Buka Bay).

A. terpsichore is an extraordinarily variable species, especially in the ♀ sex. A careful examination of a long series of specimens, numbering many hundreds of examples, convinces me that nearly all the variations are liable to occur anywhere throughout the wide range of the species. It should however be stated that the *rougeti* form in which the f.-w. subapical patch is not separated from the ground-colour is very characteristic of the more southern part of the species' range, and in fact might be regarded as a southern subspecies. Both the typical and *rougeti* forms however occur together in many localities. The following is a general description of the male :—

A. terpsichore terpsichore.

♂. Expanse 40–50 mm. Ground-colour reddish orange to deep golden yellow. F.-w. black along costa, narrow at base and just before apex, and rather wider between. Apex with a fairly broad black tip (3–5 mm.) becoming narrower along hind margin. This marginal black is wider in areas 2 and 3 than elsewhere. In typical examples it is so extended inwardly that it joins a large wedge-shaped black mark emanating from the costal black at about the end of cell, and thus cuts off a subapical patch of the ground-colour. When this patch is not completely cut off, but is joined to the general ground-colour across area 3, the example may be said to belong to the form *rougeti.* Upon the marginal black is a series of internervular submarginal spots of the ground-colour varying much in size and sometimes disappearing towards the apex. There is usually a spot in the cell, close against the subcostal nervure and above origin of nervule 2. This spot may be a minute dot, an elongated streak, or a rounded mark some 2 mm. in diameter. There is sometimes a very slight black basal suffusion.

H.-w. slightly blackened at base and having a black hind-marginal border from 2 to 3 mm. wide and bearing internervular spots of the ground-colour, these being very variable in size and sometimes reaching the margin. The inner outline of this border may be perfectly regular and parallel to the outer margin, or it may be somewhat angulated, the border being rather wider at apex and anal angle. Black spots corresponding to those on underside but usually only faintly indicated, with the exception of the spot on discocellulars, which is almost always visible as a short black line in the middle of the wing, and forms a very characteristic feature.

Underside f.-w. from base to central portion like upperside but paler, darkest at base and along subcostal. Costa greyish ochreous. The subapical and apical areas may be black as on upperside, though duller, and enclosing the subapical patch, which on the underside is pale ochreous, or the upper distal portion of the wing may be ochre yellow from the discocellular mark to the margin, broken only by the black ends of the nervules. Along the hind margin in 3, 2, 1b, and 1a, either the black or the yellow may predominate. In the former case internervular yellow marks remain, in the latter the black powdering on the nervules may be either straight or may widen a short distance from the margin into arrow-head markings. There is a black dot at base of costa and a narrow black line round hind margin.

H.-w. pale ochreous with black spots and markings. Frequently there are splashes of red on the central area of the wing, and when this is well developed the example may be said to belong to f. *venturina*, Thur. The markings of the hind-marginal border are rather difficult to describe. The end of each nervule is black for a distance of 2 to 3 mm., and there is a narrow black line round the margin. Upon this line stand rather sharply pointed black internervular arches, their central points being produced inwardly as short internervular rays. Each of these rays touches inwardly the middle of a second internervular arch, the secondary arches having their apices pointing towards the margin. The rather complicated pattern so formed is distinctly wider in areas 2 and 3 than elsewhere. In the *venturina* form the internervular rays are red instead of black and may project outwardly into the primary arches. In some cases the secondary arches are flushed with red along their inner edge. The spots are sometimes large and confluent, but more usually small and separate. There is a discal row of nine, but those in 3 and 6 are sometimes absent. The first five (in 7 to 3) form a fairly regular curve nearly parallel to apical margin, the line then curves sharply round towards the inner margin. In addition to these spots there is some irregular black at base, a spot in 8 against precostal, one in 7, two in cell, one on discocellulars, and one in 1c, 1b, and 1a, that in 1b being further from base than the other two.

Head black, with a pale line between the eyes and two reddish tufts on the collar. Thorax and abdomen black above, with reddish yellow lateral spots. Claws unequal.

♀. Expanse 44–60 mm. The ♀ of this species is so excessively variable that it is scarcely possible to describe every form which it may assume. There are before me sixteen examples selected from a very long series. These sixteen examples are all different, and every grade of intermediate may be found. The only constant feature seems to be the spotting of the h.-w. underside and the black linear spot on the h.-w. upperside discocellulars. The forms selected may be thus shortly described :—

(*a*) Like the ♂, but with a brownish suffusion at base of wings, and two blackish marks near base of f.-w., 1b.

(*b*) Like ♂, but much paler. F.-w. apical black completely enclosing a pale ochreous patch. H.-w. marginal spots all touching the margin, and the black border about 5 mm. wide in 2 and 3.

(*c*) Like (*b*), but very pale dusky ochreous. F.-w. subapical patch white.

(*d*) F.-w. ground-colour violet grey. Subapical patch white. H.-w. ochreous grey. Submarginal spots of both wings pale ochreous.

(*e*) F.-w. grey, flushed with red at base, subapical patch creamy white. H.-w. ochreous, suffused with red at base. Submarginal spots of both wings orange.

(*f*) Like (*e*), but ground-colour of f.-w. white with a rust red basal flush.

(*g*) F.-w. violet grey with a white subapical patch. H.-w. bright ochreous.

(*h*) F.-w. violet grey. A faint trace of whitish subapical patch. H.-w. golden yellow with a broad black margin bearing golden yellow spots.

(*i*) F.-w. white. Apical patch not enclosed. H.-w. creamy white. Broad black marginal border. Submarginal spots pale ochreous.

In the following there is no wedge-shaped black central mark in f.-w., merely a black spot on the discocellulars, and the marginal black is not widened at 2 and 3 but tapers from apex to hind margin and is much suffused inwardly. There is only a trace of submarginal spots in f.-w.

(*j*) F.-w. pale dusky cream colour, h.-w. rather more ochreous.

(*k*) F.-w. ground-colour semitransparent sepia with a faint indication of whitish subapical patch. H.-w. dark sepia with a discal powdering of reddish scales.

(*l*) F.-w. white with orange basal flush. H.-w. upper half dull orange, lower half dark grey. Marginal border 4 mm. broad. Only a trace of submarginal spots.

(*m*) F.-w. white with ochreous flush at base. H.-w. dark cream colour.

n) F.-w. dull ochreous red, h.-w. rather brighter.

(*o*) F.-w. Basal half red, discal part white. Submarginal spots orange. H.-w. reddish yellow.

(*p*) F.-w. reddish grey suffused with dull red at base. A curved transverse creamy white band from costa to hind angle. H.-w. dull orange. A faint trace of marginal spots.

To Godart's f. *janisca* may be assigned those forms of the ♀ which are dusky grey. Boisduval's f. *manjaca* occurs in Madagascar. The ♂ may have the f.-w. apical patch completely enclosed or not, and the ♀ is like that described above under (*i*), but with the f.-w. apical patch practically enclosed. Madagascar forms seem no more constant than those from other localities. Of two ♀♀ before me one is like Mabille's figure (pl. 11, *l. c.*), and the other is similarly marked, but the f.-w. is flushed with yellow, and the h.-w. is ochreous.

Thurau's ab. *connexa* has the cell spots of the h.-w. beneath contiguous with those on the discocellulars. The same author's ab. *excentrica* has the spots in 3 and 6 of h.-w. drawn out to meet the black arches of the marginal border, whilst those in 4 and 5 are partially extended in the same manner.

Oberthür's ab. *melas* is a melanic aberration of the ♂. Grose-Smith's *subserena* is not separable from the present species. It is a ♂ in which the h.-w. spots are scarcely visible above, and represented beneath by one spot in 7, 1c, 1b, and 1a, and a basal spot in cell. On the upperside the hind margins of both wings are densely black with a few pale spots on h.-w. margin, and the f.-w. discal black bar is represented only by a spot at end of cell separated from the costa by the ground-colour.

Strand's *intermediana* is a curious form, the type of which has large marginal spots on the black borders of both wings. The subapical black bar is interrupted. The spots of h.-w. underside are as in typical *terpsichore*, but between them is a considerable amount of red scaling. There is also a curious dusting of brown scales on the nervures in the middle of the wing. With the type in the Berlin Museum are three co-types. These show very little of the brown scaling and much less of the red.

The form *ventura* has hitherto been regarded as a distinct species, and the remarkable difference in the pattern of extreme examples would, in the absence of intermediate forms, amply justify such a conclusion. The form may be thus described :—

A. terpsichore f. *ventura*.

♂. Expanse 42–58 mm. Wings deep orange tawny. F.-w. brownish black along costa. Apex black 4–5 mm. wide and a black hind-marginal band 2–3 mm. wide bearing elongated internervular spots of the ground-colour. This marginal border is widened at nervules 3 and 4 where it joins a transverse black bar proceeding from costa just beyond end of cell, thus enclosing a more or less ovate subapical patch of the ground-colour. This patch is not always completely enclosed. A very slight blackish suffusion at base of wing. Sometimes a spot in 1b near middle. H.-w. slightly blackened at base, and having a black hind-marginal border about 2 mm. wide upon which are ovate spots of the ground-colour which sometimes reach the margin. Just before middle of wing there is an indication of a double curved band of linear spots corresponding to those beneath. A linear spot on discocellulars more distinct than the others.

Underside, f.-w. Basal half orange tawny but paler than above, darkest along subcostal. The subapical patch indicated in ochreous yellow. Costa, apex, and hind margin greyish ochreous. Apical and hind-marginal areas striated by the black ends of nervules and internervular orange streaks. An irregular transverse black mark extending from costa just beyond end of cell partly into area 3. A narrow black marginal line.

H.-w. Pale ochreous, area 9 pinkish. Just before middle of wing a curved double row of linear transverse spots between the nervules enclosing in 7, cell, and 1c a red patch. There is also a spot in 8 against precostal, a basal spot in cell, and in 1c. The marginal border formed as follows:—The ends of nervules are black and there is a narrow black marginal line upon which stands a series of finely black triangles enclosing ochreous triangular spots. The apices of these triangles are produced inwardly into broad red internervular marks. This pattern is much narrower in 4 and 5 than elsewhere, so that the border is at that point deeply invaded by the ground-colour. The inner edge of the border may be clearly defined by a fine black line. Head black with a pale mark between the eyes, two reddish tufts on collar, thorax black with a few pale markings. Abdomen black above with pale ochreous lateral spots and segmental lines.

♀. Expanse 50–60 mm. Resembles the ♂ fairly closely but the ground-colour varies from rather duller to dusky ochreous. The black spot in f.-w. 1b more generally present and often in the form of an irregular streak. H.-w. has the marginal spots larger and the discal spots more distinct. The black nervule ends and the more clearly defined inner edge of the underside marginal pattern are distinctly visible on the upperside.

The underside is very like that of the ♂, but the h.-w. discal black spots are thicker and the inner edge of the marginal pattern is distinctly defined by a black line.

I can find nothing in Weymer's fig. of "*terpsichore* var. *bukoba*" to distinguish it from this form, the only difference being the absence of the spot on discocellulars in h.-w.

Such an example of the *ventura* form as is described above is really not quite typical, as Hewitson's type is in fact more like an intermediate between *terpsichore* and *ventura*, the red on the h.-w. underside being less developed than in the more extreme forms.

A. terpsichore ochrascens, subsp.

♂. Expanse about 42 mm. Wings pale creamy white. F.-w. with a slight dusky suffusion at base, a dusky powdering along costa, about 1 mm. wide to just beyond end of cell, where it becomes very narrow, finally joining an apical brownish black patch about 4 mm. wide. At area 5 this apical patch becomes suddenly narrower and continues along the hind margin as a border about 2 mm. wide bearing marginal or submarginal spots of the ground-colour. At end of cell a blackish, more or less wedge-shaped mark like that in *terpsichore*.

H.-w. blackish at base with a slight indication of the small discal and basal spots of the underside, those in 7, and on the discocellulars being most distinct. A blackish hind-marginal border about 2 mm. wide bearing large spots of the ground-colour.

Underside, f.-w. Like the upper but no apical and marginal black. The ends of nervules are however distinctly black. Margin with a fine black line.

H.-w. as on upperside but without black basal suffusion. A little irregular black at base and a spot in 8 close to precostal. Across the wing at the level of end of cell a double row of small linear black spots formed by two in 7, one in cell and one on discocellulars, two in 1c, 1b, and 1a. In 7, cell, and 1c these spots enclose reddish marks. Hind-marginal border of a complicated pattern somewhat resembling that in *terpsichore*. The ends of nervules are black, and from the extremity of each arises a pair of internervular streaks. Each of these streaks meets one from the next nervule at a point some distance from margin, and the triangle so formed encloses near its apex a reddish mark. This border is only about half as wide in 4 and 5 as elsewhere, so that in those areas the ground-colour extends outwards in a characteristic manner. Sometimes there is a spot at base of cell.

Head and thorax black, abdomen black above with whitish lateral spots and segmental lines.

♀ resembles the ♂.

This peculiar form is, so far as is at present known, extremely local. The type was described as from Entebbe, but it has not been received by the Oxford Museum, amongst the many thousand specimens from that locality. The habitat given, viz. Buka Bay, V. Nyanza, is the only quite authentic record I possess.

A. terpsichore f. *rangatana*. Pl. V, f. 2 (♂).

♂. Expanse 44 mm. F.-w. Cell, a small elongated spot at base of 3, basal half of 2, greater part of 1b, and central portion of 1a tawny yellow. Costa and apical half of wing sepia. The usual subapical patch of ground-colour is reduced to three elongated pale ochreous streaks in 6, 5, and 4, that in 6 being only about one-third the length of those in 5 and 4. Submarginal internervular spots of tawny yellow. A little black at base extending outwards along nervure 1 and there expanding into a small dusky spot about 5 mm. from base. A small crimson streak on subcostal near its base.

H.-w. with a little black at base, central area tawny yellow, hind margin broadly sepia, deeply indented by ground-colour in areas 4 and 5. A series of submarginal yellow spots inclined to tawny towards apex. Inner margin paler with two dusky spots in 1a and one in 1b, all more or less coalescent. The subbasal band of red edged with black, so conspicuous beneath, is here faintly indicated.

Underside, f.-w. as above, but paler and duller, and the dark apical portion blackened only at end of cell, and along outer edge of the tawny yellow in 3 to 1a. Orange internervular streaks along the margin. H.-w. pale dull ochreous with black nervule ends and bifurcated rays enclosing red marks, the latter inwardly limiting the subtriangular marginal spots of ground-colour. At about the level of end of cell a double row of elongated transverse black spots enclosing red, much as in *ventura*. A round subbasal black spot in cell. A black spot in 8 and some red in 9. Some irregular black at base.

♀. I have not seen a ♀ of this form.

The pattern of the upperside of this form is very distinctive and with the exception of the type and co-type in the South Kensington Museum, I have seen no examples at all like it. The genitalia are the same as in *terpsichore*.

The larva and pupa of *A. terpsichore* are thus described by Trimen :—

"Larva.—Dull green. A whitish stripe along each side of the back, interrupted on each segmental incision by a transverse line darker than the ground-colour. Spines of the dorsal and upper lateral rows black; of the lower lateral row on each side yellow. The two dorsal black spines on segment next head longer and more distinctly branched than the rest, and projecting forward beyond the head, which is ochreous."

The food plant is stated to be a species of *Hermannia.*

"Pupa.—Pale yellowish. Outline of wings and nervures very finely black; some thin and ill-defined dorsothoracic black marks; on each side of abdomen a subdorsal and a lateral row of yellow spots in black rings, the latter being thinner in the lateral than in the subdorsal row. Attached to a slender stalk."

Fawcett's description is as follows:—

"Larva.—Pale buff dorsally, deepening to pale green on the sides with a buff lateral spinacular line above thoracic legs and claspers, which are also buff. Two dorsal pale green stripes, interrupted on every segment by a pale yellow transverse stripe bearing four black branched spines; below these are two buff coloured spines springing from the buff spiracular line. Head yellowish. Feeds on a sp. of nettle locally called 'pink hibiscus' (although it is not a *hibiscus* at all). It is a common plant on the Berea, Durban, where I found the larva, and has been identified for me by Mr. Medley Wood as *Triumfetta rhomboidea*, Jacq.

"Pupa waxy white with the usual fine black lines and spots with orange centres, beautifully gilded; pupae formed in the dark, however, inside a box, are slaty black."

It is only after careful examination of many hundreds of examples that I have arrived at the conclusion that *ventura* is only a form of *terpsichore.* As stated, there is a great difference between extreme examples of the two forms, but latterly I have had the opportunity of inspecting so many intermediates, that I find it impossible to define the point at which *terpsichore* ends and *ventura* begins. A series of preparations of the genitalia shows a range of individual variation which entirely confirms the view that there exists at present no dividing line. The condition of the species is such as to make it conceivable that *ventura* may be syngamic with *terpsichore* in some localities and not in others, though breeding experiments are necessary before we can be certain of the actual relations obtaining between the forms.*

As regards the *rougeti* form in which the subapical patch of ground-colour is not isolated from that of the remainder of the wing, this form is certainly characteristic of the South and East, though the feature is scarcely, in my opinion, sufficiently constant to warrant the separation of *rougeti* as a subspecies.

GROUP XV.

93. ACRAEA OBERTHÜRI. Pl. XIII, f. 17.

Acraea oberthüri, Butler, Ann. Nat. Hist., 6, 16, p. 231 (1895); Aurivillius, Rhop. Aeth., p. 107 (1898); Eltringham, Af. Mim. Butt., p. 82, pl. 8, f. 14 (1910).

= *bonasia*, Staudinger, Exot. Schmett, 1, p. 84 (1885) (non Fabr.).

= *cynthius*, Oberthür, Etud. d'Ent., 17, p. 27, pl. 1, f. 5 (1893).

OLD CALABAR; NIGERIA (Lagos); CAMEROON; F. PO; GABOON (Abanza); CONGO (Bangala, Ft. Beni to Ituri R.).

f. *confluens*, Suffert, Iris, p. 23 (1904).

CAMEROON; NIGERIA (Lagos).

A. oberthüri oberthüri. Pl. VI, f. 14 (larva).

♂. Expanse 42–58 mm. F.-w. dark umber brown. Base of subcostal nervure usually reddish. An oblique subapical patch of ochreous varying to orange ochreous in 10, 9, 6, 5, and 4. An inner marginal patch of the same colour 3 to 4 mm. wide, its inner edge running from just before middle of area 1a to a point on median midway between origin of 2 and 3. In areas 1b and 2 this edge is concave, being slightly invaded

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* Since the above was written I have had the advantage of discussing the point with my friend Mr. S. A. Neave, whose extensive experience in the field is of the utmost value in cases of this kind. He considers the form which has a very complete central red band on the underside of h.-w. to be a distinct species. Should this ultimately prove to be the case it seems probable that a new name will have to be given to it, as Hewitson's type of *ventura* is apparently only an unusually red *terpsichore* and is scarcely of the pronounced red type of specimens which were captured by Mr. Neave, and on which his opinion is based. We may hope to succeed in breeding these forms at no distant date. Meanwhile we can do no more than recognise their very close affinity.

by the ground-colour. The outer edge of the patch runs from near the hind angle in 1a to the middle of nervule 3, and is slightly convex between the nervules. The apical and hind-marginal border shows distinct traces of the striated pattern of the underside.

H.-w. Base occupied by a brownish grey triangular patch, its outer edge reaching nearly to end of cell. On this patch are black spots corresponding to those on underside. Central area of wing with a curved pale band varying in colour from ochreous to orange. This band is continuous at the costa with the f.-w. inner marginal patch and of about the same width, and terminates on the inner margin where it is rather narrower. Beyond this central band is a broad hind-marginal border the inner edge of which is a perfectly regular curve and not angulated as in some of the rather similar species. This marginal border is sepia grey with elongated inwardly tapering brown internervular streaks each of which is bifurcated at the margin by a sepia grey triangular mark.

Underside. F.-w. from base to apical patch, along costa, middle of cell, and middle of area 1b, the dark colour corresponding to that of the upperside is invaded by an irregular radiating suffusion of dull ochreous, usually leaving a dark spot just beyond middle of cell, and sometimes a second smaller spot in 1b close to median. The light patches are as on upperside but paler, often with a tendency to coalesce in area 3. The apical and hind-marginal border is ochreous, striated by the black nervule ends and black internervular bifurcated rays, the latter meeting inwardly except in 3, 2, 1b, and 1a, where they coalesce with a blackish submarginal suffusion. A fine black line round hind margin.

H.-w. Base, over an area corresponding to the dark area of the upperside, pale greenish ochreous, spotted with black as follows:—One in 9, and one in 8, two in 7 about 3–4 mm. apart, one at base of 6, one at base of 5 coalescing with a double discocellular spot and a terminal spot in cell. Two in cell, one at base of 2, a basal spot in 1c, followed by two spots which are sometimes confluent and sometimes separated, in the latter case enclosing a faintly reddish mark. Beneath these, two in 1b and in 1a. Central band as above but paler. Marginal border of the colour of the central band, heavily striated by black nervule ends between which are internervular inwardly tapering rays, each of which is bifurcated at margin by a whitish triangular mark. A fine black line round hind margin.

Head black with pale marks between and behind eyes, thorax black with a few paler scales, abdomen black above with pale ochreous segmental lines and lateral spots. Claws unequal.

♀. Expanse 50–68 mm. Resembles ♂ but paler and duller, the ground-colour being sometimes brownish grey. The paler areas though varying in depth of tint do not appear ever to attain the orange colour seen in some ♂ ♂. The h.-w. marginal border often broader than in ♂, and always showing much more distinct traces of the underside pattern. Underside correspondingly paler, and the h.-w. central band with a faint pinkish tinge.

A. oberthüri f. *confluens*, Suff.

In this form the apical and inner marginal patches are confluent in area 3 on both surfaces. Suffert's examples were from Cameroon. Similar forms of both sexes are before me, from Kiva Iho R., Nigeria, and from Lagos. One of these (♂) was taken near Lagos by Mr. Lamborn. Besides having the paler areas (which are orange colour) confluent in the f.-w. the colour of the central band of h.-w. radiates along the nervules into the marginal border. Another example (♀) occurs in a series bred by the same collector from a company of larvae, the other specimens being normal though the paler areas show a varying depth of tint.

The larvae near Lagos are as follows:—

Slaty blue with a reddish yellow head, and traces of a paler lateral line on segments 10–13. The spines on segments 2–5 and the dorsal and lateral spines on 10–13 are black. The dorsal and lateral spines on 6–9 are yellowish and the sublaterals are yellowish, those on 6 and 10–13 tipped with black. Each black spine arises from a dark tubercle, and there appear to be a few irregular darker dorsal and lateral segmental markings not accurately discernible in a preserved specimen.

The food plant is *Ancistrocarpus densispinosus* (*Tiliaceae*).

The pupa is of the usual Acraeine appearance, white, with two dorsal and two lateral rows of black-ringed orange spots, and black lines on the wing-covers. Each of the dorsal black rings has a small blunt process on the side nearest the median dorsal line, and the whole pupa is covered with microscopic spines.

94. Acraea althoffi. Pl. XIV, f. 1.

Acraea althoffi, Dewitz, Ent. Nachr., 15, p. 102, pl. 1, f. 5 (1889); Aurivillius, Rhop. Aeth., p. 107 (1898); Grose-Smith, Novit. Zool., 7, p. 544 (1900); Smith and Kirby, Rhop.

Exot. (*Acraea*), p. 28, pl. 8, f. 3, 4 (1901); Neave, Novit. Zool., 11, p. 346 (1904); Eltringham, Af. Mim. Butt., p. 81 (1910); Grünberg, Sitzb. Ges. naturf. Fr., p. 150 (1910).
CONGO (Mukenge); UGANDA (Entebbe, Pt. Alice, Sesse I.).

f. *rubrofasciata*, Aurivillius, Ent. Tidskr., 16, p. 111 (1895); Rhop. Aeth., p. 107 (1898).
CONGO (Bangala, Nyam Nyam); CAMEROON (Bitjé).

♀ f. *telloides*, f. nov.
Eltringham (*althoffi*, ♀, f. 3), Af. Mim. Butt., p. 82, pl. 8, f. 12 (1910).
ENTEBBE.

♀ f. *drucei*, f. nov.
Eltringham (*althoffi*, ♀ form 1), *l. c.* p. 82 (1910).
ENTEBBE.

♀ f. *ochreata*, f. nov.
ENTEBBE.

A. althoffi pseudepaea, subsp. nov.
= *A. pseudepaea*, Dudgeon, Proc. Ent. Soc., p. liii (1909).
E. and W. ASHANTI; S. NIGERIA (Ila).

A. althoffi althoffi.

♂. Expanse 60–64 mm. F.-w. sepia black. From base along lower half of cell a scarlet streak which becomes gradually wider till it reaches a point about 2 mm. before end of cell when it becomes suddenly wider extending across cell to subcostal. Beyond end of cell a subapical scarlet patch consisting of three rectangular spots separated by nervules 5 and 6, the lowest spot being somewhat produced along the upperside of nervule 4. Beneath this in 3 and somewhat more distally placed a fourth subquadrate spot, yellow, powdered with scarlet. An inner marginal patch of scarlet in 2, 1b and 1a, the outer edge slightly convex between the nervules, the inner edge deeply on 2, and slightly between 2 and 1, indented by the ground-colour. On the hind margin a faint trace of the pattern of the underside. H.-w. with a sepia black triangular basal patch with indications of the black spots of the underside. A central band of pale lemon ochreous about 2 to 3 mm. wide (white in some examples) beginning just beyond middle of costa, bending inwards at 6 and thence traversing the wing nearly straight to the middle of the inner margin. Remainder of wing sepia black with indications of the underside pattern.

Underside. F.-w. Costa pale brown with a whitish speck and a small black streak at base. Cell pale dull scarlet, a rounded black spot near middle close to subcostal followed by a more or less V-shaped spot, its apex towards base. The subapical spots are cream colour dusted proximally with reddish yellow and the space between them and the cell is blackish. The apex and hind margin is brownish ochreous, striated by black nervule ends and black internervular rays, each of the latter being swollen out just before margin and enclosing a whitish streak. The base of 2, 1b and 1a is brownish ochreous, the central portion pale dull scarlet and there is a black spot between the brown and the red in 2 and 1b, and a second, subbasal spot in the latter area close against the median. The outer edge of the reddish portion is separated from the marginal border by a blackish suffusion.

H.-w. base greenish grey with black spots, of which there are one in 9 and 8, two in 7 about 3 mm. apart enclosing a brownish mark, one near base of area 6, one at base of 5 more or less confluent with a discocellular spot, and sometimes with a terminal spot in cell, though this may be absent. Two spots in cell, the outermost followed by a brownish mark, a dot at extreme base of 2. A basal and two other spots in 1c, the latter enclosing a brownish mark, two spots in 1b and 1a and some black at bases of nervures. Central band as above but paler. Marginal half of wing brownish ochreous striated by the black nervules and by internervular black rays, each of which is bifurcated a short distance from margin, and encloses a whitish somewhat shuttle-shaped streak.

Head black with a few whitish dots, thorax black, abdomen black above with yellowish segmental lines and lateral spots. Claws unequal.

♀. Expanse about 67 mm. F.-w. greyish black. The paler markings in f.-w. shaped as in male but white instead of scarlet and yellow, the streak in cell not reaching to base. Indications of black spots more readily seen on underside, in cell, 2, and 1a, as in ♂. H.-w. base with a slight blackish suffusion the edge of which is not well defined as in ♂. Some black basal spots corresponding to those on underside. A central white band, double the width of that in ♂, remainder of wing greyish black with some indication of the striation of the underside.

Underside f.-w. like the upperside but slightly brownish at base, the black V-shaped spot at end of cell very broad and the spot at base of 2 and those in 1b much larger than in ♂. Apex and marginal border pale grey striated as in ♂. H.-w., base greyish inclining to brown in 9, 8 and 1c. The black spots rather variable with a tendency to reduction in size and number. Central area greyish white, border pale grey striated as in ♂. Abdomen black above with white lateral spots.

A. althoffi f. *rubrofasciata*.

This form occurs in both sexes and is distinguished by having the central band of the upperside of the h.-w. much broader. This band and also all the paler marks on f.-w. are red. On the underside of h.-w. the basal and central areas are ochre yellow and not differentiated. The white submarginal streaks are visible on the apex of f.-w.

A. althoffi ♀ f. *telloides*.

Just as the typical form of *althoffi* ♀ appears to be modified in the direction of the black and white ♀ ♀ of *jodutta*, so this form seems to be a development in the direction of the pattern of *Planema tellus*.

In the f.-w. the whole basal half of the wing is dull orange ochreous, though the black spots in cell, 2, and 1b remain, that near end of cell usually confluent with the subapical patch. The spots of the latter are all confluent, forming an approach to the continuous patch in *Pl. tellus*. The h.-w. has very little black at base, but the basal black spots are fairly distinct. The whole of the rest of the h.-w. is dull orange ochreous, the margin slightly powdered with black, the nervule ends black, and the usual characteristic internervular striations, though these differ in that the bifurcations of the internervular rays are open and nearly at their widest on the margin. On the underside the pattern is the same as on the upper, and in fresh examples the ground-colour is quite as dark on the upperside.*

A. althoffi ♀ f. *ochreata*, f. nov.

Differs from other forms in having all the light areas pale dull ochreous, the same colour as in the ♂ *A. jodutta*.

A. althoffi ♀ f. *drucei*.

There is in Mr. Druce's collection a large ♀ which has much the same colouring as the ♂. The f.-w. is of a rather dull brown. There is an orange red streak in the cell, and the subapical spots are pale yellow, the upper ones being tinged with red. The spots in 2, 1b, and 1a are orange red. The h.-w. has a central white band and whitish submarginal spots.

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* Unfortunately my figure of this form in Af. Mim. Butt. shows the h.-w. hind-marginal black too heavy and distinct, the margin being usually merely dusted with black.

A. althoffi pseudepaea, subsp.

♂. Expanse about 65 mm. F.-w. rich black brown. An inner marginal patch of tawny orange occupying the central third of areas 1a and 1b, and not quite covering base of 2. Subapical patch small and of the same colour, consisting of three spots in areas 6, 5, and 4, the last having its outer half suddenly narrowed and extending distally, so that the entire spot is twice as long as those above it. Beneath the narrow portion of this spot is a fourth spot of the same colour in area 3 not quite reaching nervule 3.

H.-w. with a triangular black brown patch at base. Remainder of wing tawny orange rather darker on the distal third of wing, which is striated with rich black brown on and between the nervules, the striations and typically bifurcated rays becoming coalescent at margin into a border about 2 mm. wide.

Underside. F.-w. basal two-thirds of cell dull orange brown with a large rounded spot. End of cell black. The subapical spots much paler than above. A black spot at base of 2, and a basal and a subbasal in 1b. Apical and hind-marginal areas dusky ochreous with the usual fusiform spots on margin. H.-w. dusky orange ochreous with paler central band and the typical striations and bifurcated rays. Black spots at base, one in 9, one in 8, two in 7, two in cell, one small spot at base of 5, basal and two subbasal spots in 1c, two subbasal spots in 1b, and one in 1a.

A second example is rather smaller and has the dark areas more velvety and of rather greater extent.

♀. Expanse 75 mm. Like the ♂, but the tawny areas are paler, especially the f.-w. subapical spots. H.-w. with only narrowly blackened rays and nervules and a little dusting of black on margin.

There is no doubt whatever that this interesting form is specifically identical with *althoffi*. In the type specimen the claspers happen to be protruded, and they are quite as in typical examples. I have to thank Mr. N. M. Dudgeon for having taken a great deal of trouble to make arrangements for me to see the type, in the absence abroad of his brother, Mr. G. C. Dudgeon.

Compared with the other species received from Entebbe, *althoffi* may be said to be comparatively rare. For some reason not at present evident it is most difficult to obtain an example in good condition, the ♀♀ especially being almost invariably damaged or worn.

The species can be recognised quite easily in spite of its variability by the peculiar bifurcated formation of the internervular rays especially on the h.-w.. each with its enclosed streak. The general pattern also is not like that of any other species of the genus.

The type was received from Mukenge in the southern central part of the Congo State, and has the yellow h.-w. band rather narrower than in the Uganda specimens. The f. *rubrofasciata* has been received from Bangala in the Upper Congo and Nyam Nyam, and also from Bitjé in the Cameroons. Of the subspecies *pseudepaea* I have seen only the two ♂♂ and one ♀, in Mr. Dudgeon's collection.

Our knowledge of this peculiar species has increased greatly in recent years. It is chiefly remarkable for the number of its polymorphic forms which for the most part exhibit mimetic patterns. We have the typical ♂ and also the *rubrofasciata* and *pseudepaea* forms. Of the ♀♀ one is black and white resembling ♀ examples of *jodutta*, one more or less like its own ♂, one of the *rubrofasciata* form, one resembling the ♂ *jodutta*, and one resembling *Pl. tellus*. Both sexes of the *pseudepaea* form resemble *Pl. epaea*.

GROUP XVI.

95. Acraea pharsalus. Pl. XIV, f. 8.

Acraea pharsalus, Ward, Ent. Mo. Mag., 8, p. 81 (1871); Af. Lep., p. 8, pl. 6, f. 7, 8 (1873); Dewitz, Nov. Act. Nat. Cur., 41, 2, No. 2, p. 5 (177) (1879); Mabille, Nat. Hist. Mad. Lep., 1, p. 100, pl, 12, f. 3, 4 (1885–7); Karsch, Berl. Ent. Zeit., 38, p. 195 (1893); Aurivillius (metam.), Ent. Tidskr., 14, p. 275, pl. 4, f. 1a, 1b, 1c, 1d (1893); Rhop. Aeth., p. 110 (1898); Lathy, Trans. Ent. Soc., p. 186 (1903); Neave, Novit. Zool., 11, p. 346 (1904); Strand, Wien. Ent. Zeit., 29, 1, p. 29 (1910); Aurivillius, Ann. Mus. Gen., p. 19 (512), 25 (518), (1910); Grünberg, Sitzb. Ges. Nat. Fr., p. 150 (1910).

Senegal; S. Leone; Lagos; Gold Coast; Ashanti; Ivory Coast; Nigeria; Cameroon; Fernando Po; Prince's I.; Angola; Congo (Ituri Forest; Katanga); Nyassaland; German E. Africa; British E. Africa; Uganda.

f. *pharsaloides*, Holland, Entomologist, Suppl., p. 89 (1892): Proc. U.S. Nat. Mus., p. 232, pl. 7, f. 3 (1895); p. 747

(1896); Rogers, Trans. Ent. Soc., p. 525 (1908); Aurivillius, Sjöstedt's Exp. p. 4 (1910).
= *saluspha*, Suffert, Iris, p. 34 (1904).
ANGOLA; GERMAN E. AFRICA; BRITISH E. AFRICA.

f. *pallidepicta*, Strand, Int. Ent. Zeit. Guben., 41, p. 220 (1911).
GERMAN E. AFRICA (Amani).

f. *nia*, Strand, *l. c.* (1911).
GERMAN E. AFRICA (Amani).

A. pharsalus vuilloti, subsp.
= *A. vuilloti*, Mabille, Ann. Ent. Fr. (6), 8 Bull., p. 170 (1888); Mab. and Vuillot, Novit. Lep., 2, p. 10, pl. 2, f. 1 (1890); Aurivillius, Rhop. Aeth., p. 110 (1898).
GERMAN E. AFRICA (Ukami, Usagara, Kikoka Stn., Bagamoyo).

A. pharsalus rhodina, subsp.
Rothschild, Novit. Zool., 9, p. 595 (1902).
ABYSSINIA (Up. Gelo R., Bonga, Scheko, Anderatscha, Gamitscha, Banka Omo).

A. pharsalus pharsalus. Pl. VI, f. 7 (larva).

♂. Expanse 60–72 mm. F.-w. base, costa, apical area, hind margin and the greater part of area 1a, dark sepia. Discal half of cell, base of 6, 5, 4, 3, 2, and central half of 1b bright red. A few red scales towards distal end of area 1a. Black spots as follows:—In cell a small spot not far from base, followed by a larger spot beyond origin of 2. A large spot the whole width of cell on discocellulars. Beyond cell an oblique band of three contiguous quadrate spots in 6, 5, and 4 followed by a rounded spot in 3 just under the spot in 4. A large spot at base of 2, usually touching median and nervule 2, beneath it but nearer margin a spot in 1b, and another in the same area close to median just before origin of 2. At the outer edge of the oblique discal band of spots three pale spots varying from white to reddish orange.

H.-w. base suffused with dark sepia extending slightly beyond middle of cell, hind margin brownish black, about 2 mm. wide, its inner edge not very sharply defined, and interrupted by the black nervule ends, and short reddish brown, rather indistinct internervular rays. Central area of wing bright red. Numerous black spots corresponding with those on underside.

Underside f.-w. Those areas which are dark sepia above are here ochreous grey. The black spots are as on upperside, the red areas are dusky pink, and the apical and hind-marginal portions are striated by the black nervule ends and internervular rays. There is a whitish dot and a small black spot at base of costa, and there are white marks beyond the black discal spots as on the upperside. A fine black marginal line.

H.-w. Base and hind margin greenish grey, central area pale pink. On the hind margin the nervule ends are black, and there is a fine black marginal line. Between the nervules are large dark brown triangular marks (double in 1c) the bases of which do not rest quite on the margin, but leave a very narrow submarginal line of greenish-grey (this line is obliterated in some specimens). Black spots as follows :—One in 8 against precostal, two in 7, the outermost just beyond origin of 6 and 7. Beneath this, but much nearer margin a well-rounded spot in 6 and beneath it one in 5. A spot in 4, nearer base than that in 5, and immediately beneath it a spot in 3. In 2 a spot at the level of end of cell, followed by a spot in 1c and 1b, all three in a straight line at right angles to inner margin. Two spots in cell, the second just beyond middle, two on the discocellulars, a basal and a subbasal in 1c, below the latter a spot in 1b, and a basal, a subbasal, and a distal spot in 1a. Some irregular black at bases of nervules.

Head black with a white spot between the eyes, thorax black with a few whitish spots. Base of abdomen black above with orange ochreous lateral spots, remainder orange ochreous. Claws unequal.

♀. Expanse 70–80 mm. Like the ♂ but the red areas much duller, and in f.-w. of less extent. In h.-w. the internervular rays are longer and darker.

The above descriptions apply to typical examples of this species. The Oxford Museum has lately received large companies of *A. pharsalus* bred by Mr. W. A. Lamborn, near Lagos, and these show a fairly wide range of variation. Amongst them the following forms may be observed :—

(*a*) ♂. Expanse 56 mm. F.-w. rose pink, inclining to whitish beyond cell. Costa and basal suffusion brownish, apex and hind margin sooty black. Pale spots beyond the discal black, white to pinkish. H.-w. rose pink with a sooty black basal suffusion and marginal border. H.-w. underside bluish grey at base. Marginal internervular triangular marks sooty black and contiguous at margin.

♀. F.-w. sepia grey, whitish between the black spots in central area. Subbasal spot in 1b, usually wanting. H.-w. varying from dark sepia to dusky pink. These specimens are all in one brood, but two of the ♂♂ are normal.

(*b*) One ♂ specimen with the f.-w. pale discal spots, outer portions of 4, 2, and 1b, and the lower half of the h.-w. pale ochreous. Markings otherwise normal.

(*c*) Several ♂♂ with f.-w. red reduced to a few indistinct marks, dark areas almost black, central part of h.-w. crimson.

(*d*) Several ♀♀ with the basal half of f.-w. and the whole of h.-w. suffused with pink. No basal black in f.-w., and that in h.-w. much reduced in depth of colour.

(*e*) Several ♀♀ with the entire ground-colour of both wings sepia grey. No basal suffusion in either wing.

A. pharsalus f. *pharsaloides.*

Though characteristic of the more Eastern localities, and apparently quite replacing the type in German E. Africa, this form is scarcely constant enough to be regarded as a subspecies. It is distinguished by the much-reduced dark basal suffusion in both wings, and by the fact that the red colour extends in the f.-w. considerably beyond the discal black spots, especially in area 4, leaving only a comparatively narrow dark brown apical patch. The ♀ is much paler, the lighter markings inclining to whitish in the f.-w.

Prof. Aurivillius points out (Sjöstedt's Exp., p. 5, 1910) that the form which Suffert described as *saluspha* is really the typical form of *pharsaloides.* What Suffert regarded as typical *pharsaloides* was a variety of that form.

A. pharsalus f. *pallidepicta*, Strand.

Of the three ♀ examples in the Berlin Museum (all labelled *type*) two have the f.-w. subapical spots whitish. There are no other white markings and the internervular rays on underside are broad and triangular. Another example is whitish in f.-w. cell at base of 2, the costa of h.-w. being greyish.

A. pharsalus f. *nia*, Strand.

This form is more intermediate to *vuilloti.* The whole ground-colour is tawny orange. The spots are not more developed than in ordinary *pharsaloides.* There is a suggestion of a yellowish suffusion beyond spot in f.-w. 2, and at base of 1b. Also a little yellowish in h.-w. in 1c and 2. The triangular rays on h.-w. underside are somewhat reduced. (1 ♂, Amani, Berlin Mus.)

A. pharsalus vuilloti, subsp. Pl. I, f. 11 (♂).

♂. Expanse about 56 mm. F.-w. black. An irregular red mark across cell at origin of 2, narrow at subcostal and wide at median. Beneath this in 1b a subtriangular red mark, the apex of which just touches the lower outer corner of the red in cell. In the middle of this red mark a black dot. A second transverse red mark in cell about 2 mm. wide, its outer edge reaching median at origin of 3 and there becoming continuous with an elongated quadrate red patch in area 2, which, occupying the whole width of that area, begins just before origin of 3 and ends 3 mm. from margin. Beneath this patch and of about half its length, a quadrate red mark in 1b, its outer edge about 2 mm. from margin, and beneath this a slightly longer red mark in 1a reaching to the margin. Remainder of area 1a grey. On or just beyond end of cell, three very small internervular red spots which form a small transverse streak, and beyond this a subapical bar of red, 2·5 mm. wide, outwardly deeply concave, beginning just above nervule 6 and ending at nervule 3.

H.-w. rather pale sepia grey with a red patch occupying outer half of cell, basal half of 6, 5, 4, and upper basal half of 3. A white patch occupying middle third of 1b, 1c, basal half of 2, and lower basal half of 3. Black spots as follows :—Two in 7, two contiguous spots about middle of 6 and 5, and two ditto at base of 4 and of 3. Two in cell before the middle, and two on discocellulars. One at base of 2, a basal, a subbasal, and a central spot in 1c, two near middle of 1b, and a basal and a subbasal in 1a.

Head black with a whitish dot between the eyes, thorax black with pale marks, abdomen black above with deep yellow lateral spots.

Underside, as above but much duller and pattern less defined. Apical and marginal border powdered with pale sage green and having a fine black marginal line. H.-w. base greenish grey, central area whitish with a pale pinkish flush at end of cell, 6, 5, and 4. Margin greenish grey with a fine black marginal line, the nervule ends black and the internervular rays heavily powdered with black but scarcely exhibiting the characteristic triangular appearance of those in *pharsalus pharsalus*.

The ♀ resembles the ♂.

Of this form there are 2 ♂♂ and 2 ♀♀ in the Staudinger collection. One ♀ is from Usagara, the three remaining examples being from Ukami Mt. From the latter locality there are also examples of *pharsalus*, and these tend somewhat to the *pharsaloides* form, but all have the internervular rays of the h.-w. linear and not triangular, and they are narrower in *pharsalus* than in *vuilloti*. One ♀ is an intermediate, and there can I think be no doubt that Aurivillius is correct in his suggestion that *vuilloti* is a form of *pharsalus*.

The type of *vuilloti* was taken at Kikoka Station, Bagamoyo, German E. Africa.

The larva of *pharsalus* from Kitta, Cameroon, is described by Aurivillius as follows :—

> Reddish yellow above, paler below ; a narrow dorsal line, small streaks at fore and hind parts of each segment, and at the spiracles, black. The spines are not longer than the diameter of the body and are finely branched. The upper branches are black and the lower whitish.
>
> The pupa is also figured, and is shown as white with only very faint black lines on the wing cases, etc. It is smooth, and has two dorsal, two lateral, and a vertical row of black marks, most of which appear to be in the form of double streaks with a dot between.

The above description agrees with the larvae sent home by Mr. Lamborn (Pl. VI, f. 7), except that the ground-colour does not appear to be reddish above. I may add that the head is black with a rather conspicuous central, vertically bifurcated white line.

Mabille records the species from Madagascar, but it seems almost certain that this is an error.

GROUP XVII.

96. ACRAEA PERENNA. Pl. XV, f. 4.

Acraea perenna, Doubleday, Hew. and Westw., Gen. Di. Lep., pl. 19, f. 4 (1848) ; Butler, Proc. Zool. Soc., p. 66(1888) ; Aurivillius, Rhop. Aeth., p. 93 (1898) ; Neave, Novit. Zool., 11, p. 346 (1904) ; Strand, Wien. Ent. Zeit., (29) 1, p. 29 (1910) ; Neave, Proc. Zool. Soc., p. 14 (1910) ; Grünberg, Sitzb. Ges. nat. Fr., p. 149 (1910).

= *polydectes*, Ward, Ent. Mo. Mag., 8, p. 81 (1871) ; Af. Lep., p. 8, pl. 6, f. 5, 6 (1873).

S. LEONE ; LAGOS ; ASHANTI ; CAMEROON ; TOGO ; ANGOLA ; CONGO (Kassai, Quango, Mukenge, Ubangi, Lufupa R., Aruwimi R.) ; UGANDA (Semliki R., Entebbe, Kampala, Pt. Alice, Toro, Unyoro); British E. Africa (Nandi, Nairobi); German E. Africa (Bukoba, Ukerewe I.).

A. perenna thesprio, subsp.

Oberthür, Etud. d'Ent., 17, p. 21, pl. 3, f. 34 (1893); Aurivillius, Rhop. Aeth., p. 93 (1898); Sjöstedt's Exp., p. 3 (1910).

Katanga; Nyassaland; German E. Africa; British E. Africa.

A. perenna kaffana, subsp.

Rothschild, Novit. Zool., 9, p. 595.

Abyssinia (Dalba, Uma R., Anderatscha).

A. perenna perenna. Pl. VI, f. 6 (larva).

♂. Expanse 30–74 mm. F.-w. sepia black rather more thinly scaled in median and subapical area. Hind margin markedly concave. An obsolescent dark spot in cell above origin of 2. A double spot on end of cell, and just beyond this an oblique discal band of four spots in 6, 5, 4, and 3. A large spot in 2 touching median and nervule 2. Below this in 1b a subcrescentic spot. A black longitudinal streak in area 1b from base extending about half the length of this area. A red patch in 1a, 1b, and 2 extending from near hind angle nearly to nervule 3, widest in 1b. A faint reddish mark at discal end of cell. Two small submarginal red spots in area 1b. H.-w. bright red with sepia black basal suffusion extending nearly to end of cell. A black hind-marginal border about 2 mm. wide, having a sinuous inner outline and bearing seven internervular spots, that in 1c doubled. Black discal and basal spots as on underside.

Underside f.-w. Cell and base of 1b almost devoid of scales. Black spots as on upperside. Space between end of cell and discal spots, and for some distance beyond latter, whitish. Costa powdered with brownish scales. Apex and hind margin rusty brown with black nervules and rays. Red patches as on upperside but paler and duller. A small black basal spot on costa.

H.-w. pink, reddish at base, the cell and basal half of area 7 greenish grey. Marginal band dark brown with orange ochreous spots. Black basal and discal spots as follows:—A discal row of seven in 7, 6, 5, 4, 2, 1c and 1b (no spot in 3) a spot on the middle discocellular, a small spot in 8 near precostal, a subbasal spot in 7, one subbasal and one median in cell, and one in 1c, 1b, and 1a. These spots vary in size and may be small and well separated, or large and confluent. Head black, thorax black with a few pale spots. Basal half of abdomen black with orange ochreous spots, remainder orange ochreous. Claws equal.

♀. Expanse 70 to 80 mm. Differs but little from the ♂. Wings slightly rounder. The sepia black areas somewhat paler and the h.-w. margin rather broader.

A. perenna thesprio, subsp.

In this form the red colour extends over nearly the whole of the f.-w. leaving only the costa, apex, and hind margin sepia black. Oberthür states that he has three ♂♂ of this form from Zanzibar, and there is one in the Hope Department from Mombasa. Aurivillius gives Nyassaland as another locality. It appears to be the Eastern subspieces of *perenna*. Examples from Nairobi in the Harrison collection are however of the typical form.

A. perenna kaffana, subsp.

This Abyssinian subspecies resembles the *thesprio* form but differs in the larger size of the f.-w. discal spots, and in having a more extended black basal area, and broader marginal band in the h.-w.

The larva of *A. perenna perenna* (Pl. VI, f. 6) is black with long dorsal spines. There is an ochreous dot on each segment just behind the origin of the lateral spine. Beneath this a few irregular vertical yellowish marks and below the sublateral spines are longitudinal yellowish marks. The segments bearing the true legs have some additional transverse dorsal yellowish marks. The branched spines and the head are black. (Described from an example received from Mr. W. A. Lamborn, taken near Lagos.)

A. perenna bears outwardly a close resemblance to *A. egina*, but can always be distinguished by the marked concavity of the f.-w. hind margin.

97. ACRAEA ORINA.* Pl. XV, f. 3.

Acraea orina, Hewitson, Ent. Mo. Mag., 11, p. 130 (1874); Exot. Butt. (*Acraea*), pl. 7, f. 43, 48 (1875).

♀ = *oreta*, Hewitson, Ent. Mo. Mag., 11, p. 131 (1874); Exot. Butt. (*Acraea*), pl. 7, f. 42 (1875); Aurivillius, Rhop. Aeth. p. 113 (1898).

ASHANTI; GOLD COAST; S. LEONE; FERNANDO PO; GABOON; CONGO (to the Ituri R.)

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* Aurivillius (*l. c. sup.*) suggests that Hewitson's *A. derbela* is an aberration of *orina*. The type is in the British Museum, and is merely a melanic aberration the identity of which there is some difficulty in deciding. Except as a curiosity it is of little importance.

f. *nigroapicalis*, Aurivillius, Ent. Tidskr., 14, p. 275 (1893).
CAMEROON ; UGANDA (Entebbe).

f. *orinata*, Oberthür (*A. orinata*), Etud. d'Ent., 17, p. 22, pl. 2, f. 22 (1893).
CONGO (Ubangi).

A. orina orineta, subsp. nov.
♀ = *orinata* ♀, Butler, Proc. Zool. Soc., p. 44, pl. 1, f. 1 (1902).
BRITISH E. AFRICA (Kampala, Entebbe).

A. orina orina.

♂. Expanse about 54 mm. F.-w. dark umber brown. In 1b a rather broad streak of red from base nearly to hind margin. In 2 a patch of red from close to median to near hind margin. A streak of red in cell somewhat indented on upperside near subcostal almost at the level of origin of nervule 2. In 6, 5, 4, and 3 short broad discal red marks.

H.-w. brick red with a dark brown basal suffusion obscuring a number of black spots better observed on underside. Beyond this suffusion two black spots on the disc in 6 and 5. A dark brown hind-marginal border about 2 mm. wide, its inner edge somewhat edentate at each nervule and internervular ray.

Underside, f.-w. A dull replica of the upperside.

H.-w. Pinkish ochreous with a greenish tinge over base and hind margin. Nervule ends and internervular rays rather broadly powdered with dark brown. Black spots variable and often confluent. The following may be approximately discerned :—One in 8 near precostal, two in 7 (sometimes confluent). One in 6 and 5 just before the middle of these areas. Some irregular spots on discocellulars. Two in cell, the second rather beyond the middle. A spot at base of area 3 and 2. Two spots in 1c, 1b, and 1a ; each of these pairs may be confluent. Some irregular black at base of nervures.

Head and thorax black with a few pale spots. Abdomen black above with yellowish lateral spots. Claws equal.

♀. (= *oreta*, Hew.) Expanse about 70 mm. F.-w. black with reddish brown streaks in 1b, and 2. Costa at base and greater part of cell reddish brown. In cell a black spot near subcostal above origin of 2. Beyond cell in 6, 5, and 4 three rather obscure white marks. (All these markings are very irregular.)

H.-w. reddish brown with some black at base, and a black hind-marginal band about 2 mm. wide, edentate on inner edge at and between the nervules. Black spots corresponding to those on underside.

Underside, f.-w. rather thinly scaled, blackish only from end of cell to position of white subapical marks. The reddish areas visible as above but paler. Costa dusky ochreous with a black spot at base. Apical and hind-marginal area dusky ochreous striated by the black nervule ends and rays. Only a trace of the white subapical marks.

H.-w. Almost uniformly ochreous, a trace of a greenish tinge about base and on hind margin. Black spots as follows: —One in 9, one in 8, two in 7; the second well beyond end of cell, but not over spot in 6. One in 6 and 5 (one below the other and about 4 mm. from base of those areas). One at base of area 5 on discocellular, one (very small) at base of area 4, two in cell, the second (large) at the level of origin of nervule 2. One in area 4 just beyond its base, and a row of four large spots in a straight line from end of cell to inner margin in 3, 2, 1c and 1b. A basal and a subbasal in 1c, a subbasal in 1b, and two spots in 1a. The ends of nervules are laterally somewhat powdered with brown, but not the internervular rays.

A. orina f. *nigroapicalis.*

This form, described by Aurivillius, differs only by the absence of the discal red marks in the f.-w. An example from Fernando Po is in the Oxford Museum. Aurivillius' specimen is from Kitta, Cameroon. Many Entebbe specimens exhibit the same variation.

A. orina f. *orinata.*

The difference between this and the type form is thus described by Oberthür:—On the upperside the reddish brown spots beyond cell are nearer to the cell. Beneath the h.-w. has two spots outside the cell which are not present in *orina*. Oberthür further remarks that the h.-w. hind margin is yellowish instead of reddish as in *orina*, but he was probably judging of the latter by the colour of the original figure, which is, in fact, redder than the actual type specimen, which I have examined. The differences are so slight as to make the name scarcely worth preserving.

A. orina orineta, subsp.

♂. Expanse 50–64 mm. F.-w. dark sepia. Nearly the whole of the cell (in which there is a black indentation on subcostal near the middle), and 1b, and the basal half of 2 and 3 red, separated only by the rather widely black nervules. In 6, 5 and 4, just beyond cell, broad red streaks separated only by the nervules. On apex and hind margin black internervular rays rather conspicuous.

H.-w. red with a well-defined sepia black basal area on which basal and subbasal spots are just visible. This black area extends almost to end of cell, and has a well-rounded distal edge more or less parallel to the hind margin. Beyond it is a correspondingly curved red discal band some 5 mm. wide, and a sepia black hind-marginal border about 2 mm. wide, its inner edge regularly but not deeply edentate on and between the nervules.

Underside. F.-w. like the upper but duller, and the costal, apical, and hind-marginal areas dusky ochreous striated by the black nervule ends and internervular rays. Traces of a blackish mark just beyond middle of area 1b.

H.-w. base, costa, and hind margin greenish ochreous, central area dull pinkish. Nervules and internervular rays rather broadly dusted with brown. Black spots on the basal area as follows:—One in 9, one in 8, two in 7 about 2 mm. apart, one at base of 6 and 5, three in cell, the second beyond the middle and the third near end. One at base of 2, a basal, a subbasal, and a central in 1c, two confluent spots about middle of 1b, and the same in 1a.

Head and thorax black with a few pale dots, basal half of abdomen black above, with lateral yellowish spots, terminal segments orange ochreous.

♀. Expanse 64–72 mm. F.-w. sepia brown with red marks much as in ♂ but duller and rather more widely separated by black, and those in 6, 5, and 4 nearly always replaced by white forming a conspicuous discal bar. One example before me from Kampala has all red markings.

H.-w. as in ♂ but paler and duller.

Underside. F.-w. rather thinly scaled, a pale dull replica of upperside, but costa, and apical and hind-marginal areas dusted with dusky white between the nervules and rays.

H.-w. Pattern as in ♂ but dusted all over with whitish scales, or, in some cases, the whole underside is almost devoid of scales and vitreous.

The *orineta* form is distinguished principally by the more continuous and well-defined basal black of the h.-w., especially in the ♀. This peculiarity does occasionally occur in western examples, but it does not appear to be a characteristic feature until we reach the neighbourhood of Uganda.

A. orina is very closely allied to *parrhasia*. I am not quite satisfied that *orina* has not in the West a female form which is practically indistinguishable from that of *parrhasia*. If it has not, then the ♀ *orina* is strangely rare in collections. Apart from the examples of Hewitson's *oreta*, which is certainly one form of the ♀, I have seen no ♀ specimens from the West which could be certainly assigned to *orina*, and yet the ♂ is by no means rare. All the ♀♀ from the West, which might otherwise be associated with the species, resemble more or less closely the bred and therefore authenticated ♀♀ of *parrhasia* now at Oxford. A much more extensive material is necessary before we can come to any sound conclusions with regard to this species.

98. ACRAEA BAXTERI. Pl. XV, f. 5.

Acraea baxteri, E. M. B. Sharpe, Entomologist, p. 40 (1902).

f. *fulleborni*, Thurau, Berlin Ent. Zeit., p. 133, pl. 2, f. 7 (1903).

f. *subsquamia*, Thurau, Berlin Ent. Zeit., p. 135 (1903).

NYASSALAND; GERMAN E. AFRICA (Mpwapwa, Mamba, Kilimandjaro, Langenberg, Meru, Mlolo, N. Usambara); BRITISH E. AFRICA (Aberdare Hills).

A. baxteri baxteri. Pl. V, f. 10 (♂).

♂. Expanse about 60 mm. F.-w. not very densely scaled, black, with a rosy red flush at base extending nearly to end of cell, slightly beyond middle of area 2, and nearly to margin in 1b and 1a. Beyond cell a subapical series of three more or less transparent spots, separated only by nervules 5 and 6.

H.-w. with a large black patch at base obscuring more or less completely a number of black spots. Beyond this patch a dull rosy red area enclosed by a narrow black marginal border, the nervules well marked black.

Underside f.-w. almost scaleless, merely having a slight dusting of blackish brown at apex and greyish ochreous along costa.

H.-w. with a large chocolate brown basal patch followed by a broad pinkish band, the latter enclosed by a reddish brown border, broader than the black border of the upperside. Upon the chocolate basal patch are the following black markings:—A spot in 8, a broad black streak in 7, the ends of which curve downwards and touch the subcostal and nervule 7. At bases of areas 6, 5, and 4 two spots just separated by very small areas of the ground-colour. Along the edge of the chocolate basal patch are large spots in 3, 2, 1c and 1b. Area 1a is nearly all black, and a long black basal mark in 1b, 1c, and in cell, the latter also having a large spot in its distal half. Head, thorax, and abdomen intensely black, the abdomen with minute white lateral dots. Claws unequal.

♀. Expanse 60 mm. Resembles ♂ but duller and f.-w. more rounded. Subapical transparent spots larger. H.-w. with dark basal patch much reduced, especially from upper half of cell to costa. Underside as in ♂ but duller and rather paler.

A. baxteri, f. *fulleborni.*

This form differs in having the f.-w. rather more translucent, the transparent spot in area 4 is longer, and the black border of the h.-w. is broader than in the type form, also the red colour is of a less rosy tint. On the underside the h.-w. black spots are rather smaller and less confluent, and the pale band is narrower.

A. baxteri, f. *subsquamia.*

This form differs from the type in the following characters:—The f.-w. upperside has the red less extended in area 2, the subapical spots are more transparent, and the blackish border is broader at the hind angle. On the h.-w. the black border is produced inwardly on the nervules, and at the costa the red colour invades the black basal patch. On the underside the h.-w. nervule ends are broadly black, and the black spots are smaller and more separated. One example has greyish spots in the basal area.

At present I have not sufficient material to decide whether the differences between the above forms are of importance. Unfortunately I was unable to secure the type of *A. baxteri* before my visit to the Berlin Museum and was obliged therefore to send a drawing of it, which Dr. Strand very kindly compared with Thurau's types. My figure on Plate V is taken from Miss Sharpe's type now in the Joicey collection.

99. Acraea peneleos. Pl. XIII, f. 27.

Acraea peneleos, Ward, Ent. Mo. Mag., 8, p. 60 (1871); Af. Lep., p. 7, pl. 6, f. 3, 4 (1873); Dewitz, Nov. Act. Nat. Cur., 41, 2, No. 2, p. 19 (part), (1879); * Staudinger, Iris, 9, p. 196 (1896); Aurivillius, Rhop. Aeth., p. 113 (1898); Lathy, Trans. Ent. Soc., p. 186 (1903).

= *fenelos*, Aurivillius, Ent. Tidskr., 14, p. 273, f. 5 (1893).

S. Leone to Cameroon; Fernando Po; Gaboon; Congo (Kassai R.).

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* I give this reference under *peneleos*, but the description is so inadequate that it might refer either to *peneleos* or *penelope*. One of the examples included under *peneleos* in this paper is a red variety of *A. mairessei*. See p. 286.

♀ f. *helvimaculata*, f. n.

Lagos.

♀ f. *lactimaculata*, f. n.

Fernando Po.

♀ f. *sepia*, f. n.

Fernando Po.

A. peneleos pelasgius, subsp. n.

= *A pelasgius*, Grose-Smith, Novit. Zool., vii, p. 545 (1900), (♀ non ♂); Rhop. Exot., iii (*Acraea*), vii, p. 25, pl. 7, f. 9, 10 (1901); Neave, Novit. Zool., xi, p. 346 (1904); Grünberg (*peneleos*), Sitzb. Ges. nat. Fr., p. 150 (1910).

Gaboon; Cameroon (Ja R.); Fr. Congo (Loango); Congo (Kassai R., Bopoto); Angola (Quanza R.); Uganda (Semliki Valley, Unyoro, Entebbe, Kampala, Port Alice, Sesse I.).

A. peneleos gelonica, subsp.

Rothschild and Jordan, Novit. Zool., xii, p. 183 (1905).

Abyssinia (Upper Gelo R.).

A. peneleos peneleos. Pl. IV, f. 10 (♂), f. 12 (♀). Pl. VI, f. 4 (larva).

♂. Expanse 52–58 mm. F.-w. narrow and somewhat pointed, but less angulated than in *A. parrhasia*. Costa, apex, hind margin, and inner margin sepia black, nervures and nervules black, remainder semitransparent owing to reduction in number rather than in size of scales. The most distal part of the transparent area more sparsely scaled than the remainder. In 2 a patch, variable in size, of pink or reddish scales, beneath this, in area 1b a similar but larger and more persistent patch often extending as a linear mark to base of wing. A small elongated pink or reddish submarginal spot in 1a. Sometimes a trace of red in cell near base. A black spot at base of costa.

H.-w. rosy red in fresh examples but fading to yellowish red. A grey basal suffusion extending nearly or quite to end of cell, and a sepia black hind-marginal border about 2 mm. wide, its inner edge slightly edentate on nervules. Black spots as on underside but those near inner margin often faintly indicated.

Underside. F.-w. sparsely scaled and vitreous, the costa, apex, and hind margin scaled with grey to ochreous, the nervule ends and internervular rays dusted with umber brown.

H.-w. basal suffusion and marginal border greenish grey, the ends of nervules sometimes rather broadly dusted with brown. Between them short narrow internervular rays reaching the margin. Discal area ochreous. Black spots rather variable, as follows:—An outer row of three spots graduated in size lying nearly parallel to apical margin, in 7, 6, and 5, rarely a spot near base of 4 and of 3. A spot at base of area 2, followed by a spot in 1c slightly more proximally placed, and a third in 1b slightly more distal than that in 2. A spot in 9, one in 8 against pre-costal, a subbasal in 7, two (occasionally three) spots in cell, the second above origin of nervule 2. A medium sized spot followed by a linear mark (sometimes confluent) on upper part of discocellulars. A basal and a subbasal in 1c. A basal streak and a subbasal spot in 1b and two spots in 1a.

Head black with a whitish dot between the eyes, and two on the collar. Thorax black above with indications of paler markings. Abdomen black above with lateral yellowish spots. Claws unequal.

♀. Expanse 56-64 mm. F.-w. more rounded than in ♂. Costa sepia dusted with red, apex dusted with sepia (about 4 mm. deep) hind margin dusted with sepia, inner margin with red. Nearly the whole of remainder of wing more or less thinly scaled with red but showing a wide range of individual variation in extent and depth of colour. In some examples the red colour predominates, whilst in others it is much broken up by a broad dusky scaling of the nervules. There is usually a patch of blackish scaling in cell near middle, and another on end of cell. In areas 4, 5, and 6 there is often a tendency to the formation of whitish subapical streaks, whilst in one example before me the red scaling is divided in the discal area by an oblique transverse band of blackish thus leaving an outer submarginal row of rather indefinite red spots which become gradually paler in colour as they approach the apex.

H.-w. red, in fresh examples only a little duller than in ♂. Very little grey basal suffusion. The blackish hind-marginal border usually narrower than in ♂ but produced inwardly much further, on and between the nervules.

On the underside, in the f.-w. the dusky areas are replaced by ochreous, on which the nervules and rays are brown.

The h.-w. is slightly brownish ochreous, the basal area and marginal border only a little darker. The internervular rays often do not quite reach the margin. The black spots are as in ♂ but usually have an elongated appearance as though they had "run" in the direction of the nervules. They are also further apart than in the ♂, the three outer spots in 7, 6, and 5, being often very distally placed. The spots in areas 4 and 3 are almost invariably present. It is almost impossible to give a satisfactory description of so variable an insect, but perhaps the most characteristic *general* feature is the scattered and elongated appearance of the h.-w. spots, and the position of the three outer spots in areas 7, 6, and 5.

Perhaps the species most easily confused with it is the ♀ of *A. orina* (= *oreta*), but in this species the outer spot in 7 is nearer the base than those in 6 and 5, instead of being nearly above them as in *peneleos*, also the wings of *orina* ♀ are much more heavily scaled.

A. peneleos ♀ f. *helvimaculata.* Pl. IV, f. 11.

Expanse 50 mm. F.-w. transparent with a few dusky scales along costa, apex grey black to a depth of 6 mm., hind margin with an inwardly rather suffused grey black border 2 mm. wide. Cell, and areas 2, 1b, and 1a faintly tinged with reddish. A faint blackish linear mark in cell.

H.-w. salmon red with a very slight dusky basal suffusion and a grey black hind-marginal border edentate on the nervules and emitting short, fine, dark internervular rays. Black spots as in typical examples, and beyond the outer row a curved discal band of yellowish white some 3 mm. broad crossed by the nervules which are powdered with red.

Underside. F.-w. dusky areas replaced by ochreous grey and crossed by grey nervules and rays. H.-w. base and hind-marginal border pale brownish pink, outer edge of border having a greenish tint. Nervule ends powdered with umber brown, and between them are fine short brown internervular rays. Central band creamy ochreous. Black spots as in typical form but only one spot in area 1a and spots in 4 and 3 only just visible.

This form, of which two examples occur in the large number of bred specimens received at Oxford from Mr. Lamborn occurs near Lagos and appears to be an occasional aberration. Its appearance has proved of the greatest value as an indication of the identity of the form *lactimaculata* from Fernando Po.

A. peneleos ♀ f. *lactimaculata.* Pl. III, f. 3.

Expanse 58 mm. F.-w. as in *helvimaculata* but entirely devoid of red, the basal area being finely powdered with brownish black scales. H.-w. base as far as outer row of spots sepia grey, the nervures reddish. A hind-marginal border of sepia brown some 3 mm. wide, dusted with orange ochreous on its inner edge towards anal angle, the same colour extending as a fine line along the inner margin. Spots as in typical form, but none in areas 4 and 3. A central curved band of ivory white narrowest at costa.

Underside. F.-w. as on upperside, dark areas replaced by dusky ochreous, the nervule ends and rays darker. H.-w. basal area as far as central band, and hind-marginal border, dusky ochreous ; nervule ends and rays blackish. Central band as on upperside but rather narrower.

Up to the present I have only seen examples of this form from Fernando Po. There is a small series in the S. Kensington Museum and it also occurs in the Tring collection.

A. peneleos ♀ f. *sepia*.

Expanse 60 mm. F.-w. costa, apex, hind margin, and inner margin dark sepia brown. Remainder of wing semitransparent, powdered with dark scales. Traces of whitish scales in areas 2 and 1b. H.-w. sepia brown with a slight powdering of reddish scales especially just beyond end of cell, and at inner edge of hind-marginal border. The latter a still darker brown. Inner margin ochreous.

Underside. F.-w. as above but brown replaced by dusky ochreous, striated by dark nervule ends and rays. H.-w. basal portion dull greenish ochreous, followed by a curved central band of dusky white. Hind-marginal border about 5 mm. wide, dusky ochreous, inwardly edged with sepia brown, and striated by brown nervule ends and rays. Spots as in typical forms but none in 4 and 3.

This form also seems to be peculiar to Fernando Po. A fine series of specimens in the British Museum collection, received by the late Mr. Hewitson from the locality named, show a gradation from ordinary forms of ♀, through f. *lactimaculata* to f. *sepia*, with numerous intermediates.

A. peneleos pelasgius, subsp. Pl. IV, f. 2 (♂).

♂. Expanse 45–56 mm. F.-w. sepia black. Cell and base of area 2 and 1b rather thinly scaled and partially transparent. Beyond cell the basal portions of areas 6, 5, and 4 are still more transparent especially outwardly, and there is a small semi-transparent patch in 2 often with a few pinkish scales in the centre. In the middle of area 2 a large rounded spot rather thinly scaled with pale orange red, beneath this a similar but rather larger spot in 1b, and a linear mark of the same colour in 1a.

H.-w. with a sepia black basal portion, its outer edge rather straightly defined across the wing, and extending as far as the origin of nervule 2. Hind-marginal border sepia black, 2 to 3 mm. wide, its inner edge somewhat edentate on the nervules. Central area orange red. Black spots as on underside but largely obscured by the basal suffusion.

Underside. F.-w. as above, but costa, apical area, and hind margin ochreous brown, nervule ends and rays dark brown. Remainder nearly devoid of scales, and vitreous. The reddish spots of upperside reproduced in pink. A black spot at base of costa.

H.-w. Basal portion umber brown outwardly inclined to chestnut, followed by a dark ochre-yellow central band, and an umber brown hind-marginal border inwardly inclined to chestnut. Nervules and rays dark brown. Black spots as in typical *peneleos*. Usually only two in cell and none in 4 and 3. Head, thorax and abdomen as in typical *peneleos*.

♀. Expanse about 62 mm. F.-w. more rounded than in ♂. Sepia brown. A subapical series of three transparent spots in 6, 5 and 4 progressively increasing in size, and beneath these a small pink spot in area 3. A somewhat irregular pink spot in area 2 near middle, and beneath it a similar but broader spot in 1b.

H.-w. Basal brown suffusion outwardly less well defined than in ♂. Remainder of wing dull orange red with an ill-defined dark brown hind-marginal border consisting of an elongated triangular powdering of the nervules and rays all more or less coalescent at margin. Black spots as in *peneleos*.

Underside. F.-w. devoid of scales and vitreous, except costa, apical area and hind margin, which are rich umber brown with darker nervules and rays, the pink spots of upperside faintly showing through.

H.-w. Basal area deep reddish brown, followed by a dark ochreous central band narrower than on upperside, and a hind-marginal band of somewhat lighter brown, 7 mm. wide at nervules 3 and 4, and striated by dark brown nervules and rays.

A. peneleos gelonica, subsp.

♂. Expanse 54 mm. Differs from subsp. *pelasgius* in the following points:—The f.-w. is transparent except costa, apical area, and hind and inner margins, which are sooty black. Main nervures, middle and end of cell, and base of areas 2 and 1b powdered with black. No pink spots, but often a few whitish scales in area 1b. H.-w. basal black of rather less extent, hind-marginal border black and rather broader. Underside. H.-w. basal area more chestnut brown, marginal border darker and inclined to reddish at its inner edge.

The larva of *A. peneleos* (Pl. VI, f. 4) from Oni, near Lagos, may be described as follows:—

Ground-colour dark brown with transverse striae of a darker tint, bordered with yellow. Lateral line and legs yellow. Head bright chestnut. In the actual larva all the spines are black, but according to Mr. Lamborn's notes the sublateral spines are yellowish. There may possibly be some variation in this respect.

True *peneleos* seems to occur from S. Leone through Lagos and as far as Fernando Po, producing the aberrant forms of ♀ above described. From Fernan Vaz and right across the Congo State we find the development, at first somewhat irregular, of the dark-coloured underside of the h.-w. with its central ochreous band. On the Kassai R. forms are found which vary between *peneleos* and *pelasgius*, and thence the latter form is predominant. It is very common at Entebbe, whence its distribution extends north-eastwards into Abyssinia, where it is represented by the form *gelonica*.

100. Acraea pelopeia. Pl. XIII, f. 28.

Acraea pelopeia, Staudinger (*peneleos* var.), Iris, 9, p. 192 (1896), Aurivillius, Rhop. Aeth., p. 113 (1898).

Congo (Kassai R., Aruwimi R., Ft. Beni).

♂. Expanse 68 mm. F.-w. sepia black. Cell, basal portions of 6, 5, 4, 3, 2, and nearly all 1b, rather thinly scaled and partially transparent. A slight submarginal powdering of whitish scales in 1b. H.-w with a dark sepia grey basal suffusion extending slightly beyond origin of nervule 2, and outwardly approximately determined by a line drawn from middle of costa to middle of inner margin. Discal area deep orange red (probably rosy red when alive). A well-defined brown-black hind-marginal border about 2 mm. wide, its inner edge slightly edentate on the nervules. Black spots as beneath, but obscured by basal suffusion.

Underside. Costa, apical area and hind margin dusky ochreous, striated by the nervules and rays which are broadly powdered with dark brown. The ochreous marginal border gradually obscured towards the hind angle by a sepia-brown suffusion. A black spot at base of costa, and some black at base of area 1b.

H.-w. Basal area and hind margin greenish ochreous, central area ochreous. The brown nervules towards the margin heavily dusted with dark brown, the dusting being widest before it reaches the margin, thus giving the nervules a swollen appearance. Between them the internervular rays, though more slender, are similarly indicated. Unlike *peneleos* these rays extend to the bases of the internervular areas. A series of black spots, most of which are rather large. In area 7, two, much closer together than in *peneleos*. Beneath the outer spot a smaller one more distally placed in area 6, and beneath this a dot in 5. On the upper part of discocellulars a spot of variable size, sometimes confluent with another just beneath it. In cell two or three spots, the second over origin of nervule 2, and the third, when present, very small. Sometimes a spot at base of area 3. A spot in 2 near its base, followed by one in 1c and in 1b, nearly in a straight line. A basal and a subbasal in 1c. Beneath the latter a spot in 1b, and more proximally placed a spot in 1a. A spot in 9 and in 8.

Head black with a pale dot between eyes, two pale tufts on collar. Thorax black above with two pale spots. Abdomen black above with yellowish lateral spots. Claws unequal.

The ♀ is unknown to me.

The late Dr. Staudinger in his paper in Iris 1896, gave a description of this species. This description is somewhat involved, and consists largely of a comparison of *penelope*, *peneleos*, *parrhasia*, and the present form. He concludes by saying that, should it be found through the acquisition of further material to be a distinct species, he proposes for it the name *pelopeia*. After having seen the insect described, I found it agreed in all respects with two ♂♂ in the Tring collection. I cannot claim to have certainly established its specific distinction, but at present at least I propose to keep it separate from *peneleos* which it closely resembles. The peculiar appearance of the nervules on the h.-w. underside scarcely suffices to distinguish it from some examples of *peneleos* which exhibit a similar tendency. On the other hand, the internervular rays in all forms of *peneleos* are comparatively short, whilst in this species they extend to the bases of their respective areas. The whole insect is of a larger and stouter build. The two spots in area 7 of the h.-w. are closer together than in *peneleos*, whilst finally, though the male armature is, like that of several allied forms, simple in structure and but little distinctive, it appears to present certain constant differences. The acquisition of a ♀ specimen may help to decide its true affinity. In the meantime I prefer to keep the form separate from *peneleos*, under the name which the late Dr. Staudinger proposed. That author's example is described as from the Upper Congo, without precise locality. One of the Tring examples is labelled Aruwimi, and the other Luebo, Kassai River. These localities are rather far apart, the latter being apparently some 750 miles S.W. of the former. The two examples do not, however, appear to differ in any noticeable particular. In addition to these two specimens there are also in the Tring collection several examples taken near Ft. Beni in the northern part of the Congo region. These I must refer to the same species. They differ only in having a browner ground-colour, and in the h.-w. a duller shade of red.

101. Acraea grosvenori. Pl. II, f. 9 (♂). Pl. XIII, f. 24.

Acraea grosvenori, n. sp.

Congo (Rutschuru R., S. of Albert Nyanza).

♂. Expanse 64 mm. F.-w. sepia black with a tendency to thinner scaling and partial transparency in cell, in discal portions of areas 6, 5, and 4, basal half of 3 and 2, and the greater part of 1b. At the extremity of partially transparent area a slight dusting of pink scales in area 4, beneath this, in 3, a slightly more distinct mark, beneath this, in 2, an elongated ill-defined pink spot, and in 1b a larger ovate pink spot, the whole area traversed by a fine dark internervular ray which is laterally dusted with pink nearly to the base.

H.-w. brick red. A sepia basal patch outwardly ill defined, obscuring a few minute black spots. A very narrow marginal dusting of sepia black, most distinct on and between the nervules. On the red area the nervules and long internervular rays are distinctly perceptible in a slightly darker colour.

Underside. F.-w. Costa, apical area, and hind margin deep orange ochreous striated by the darker nervules and rays. A black spot at base of costa, and base of area 1b. Remainder of wing vitreous and almost devoid of scales. A fine dark line round hind margin.

H.-w. Deep orange ochreous without any basal suffusion or marginal border, though the dark basal portion of upperside gives the base a slightly shaded appearance. The nervures, nervules and rays are very narrowly but distinctly outlined in dark brown. The rays are long and reach almost to the bases of their respective areas. A fine dark marginal line. Black spots, very small, as follows :—One in 9, one in 8 against precostal, one in 7 near base, two, the second very minute, on upper part of discocellulars. Two in cell, the second before the origin of nervule 2. One in 2 near base, followed by a double spot in 1c, and a dot in 1b. Some black at base of nervures 1b and 1a. In 1c a subbasal spot, another in 1b more distally placed, and a third in 1a, level with that in 1c.

Head black, with a minute dot between, and two behind, the eyes. Thorax black. Abdomen black above with yellow lateral spots on the more distal segments. Claws unequal.

The ♀ is unknown to me.

The foregoing description is taken from the type in the Tring collection.

A second male differs only in having a rather more extensive dark basal patch in the h.-w., and a slightly broader and more continuous hind-marginal border.

Both examples were taken in February 1908, in the Gallery Forest, Rutschuru River, at a height of 1000 metres.

This species has the appearance of being very distinct, the h.-w. underside not resembling that of allied forms. The basal spots also are very small and scarcely observable on the upperside. In this latter respect it is distinguishable from *pelopeia*, and though it presents the long internervular rays of the latter the nervules are delicately outlined and not heavily dusted with brown. There appears to be a recognisable difference in the ♂ armature, but paucity of material has prevented my studying this feature to an adequate extent.

I have pleasure in dedicating the species to my friend Mr. G. H. Grosvenor, M.A., of New College, Oxford.

102. Acraea parrhasia. Pl. XV, f. 2.

Acraea parrhasia, Fabricius, (*Pap.*) Ent. Syst., 3, 1, p. 175 (1793); Aurivillius (metam.) (*peneleos*), Ent. Tidskr., 14, p. 274, pl. 4, f. 2, 2a, 2b (1893); Ent. Tidskr., 15, p. 273 (1894); Staudinger, Iris, 9, p. 200 (1896); Aurivillius, Rhop. Aeth., p. 113 (1898); Lathy, Trans. Ent. Soc., p. 186 (1903); (?) Grünberg, Sitzb. Ges. nat. Fr., p. 150 (1910).

= *peneleos*, Aurivillius, Ent. Tidskr., 14, p. 274 (1893).

S. Leone ; Lagos ; Cameroon ; Fernando Po ; ? Uganda (Sesse I.).

♀. f. *oppidia*, Hewitson, Ent. Mo. Mag., 11, p. 131 (1874) ; Exot. Butt. (*Acraea*), pl. 7, f. 49, 50 (1875).
Fernando Po.

♀. f. *parrhoppidia*, Staudinger, Iris, 9, p. 201 (1896).
Cameroon.

♀. f. *leona*, Staudinger (*A. leona*), Iris, 9, p. 199 (1896).
= *A. igola leonina*, Bethune-Baker, Ann. Nat. Hist., 12, p. 325 (1903).

A. parrhasia parrhasia. Pl. III, f. 1 (♀). Pl. IV, f. 3 (♂). Pl. VI, f. 3 (larva).

♂. Expanse 54–64 mm. F.-w. narrow, and pointed at apex. Costa, apex, hind, and inner margins black. Cell, areas 2 and 1b, semitransparent, rather thinly powdered with black. The cell at base and extremity tinged with red. Area 2 occupied by a large semitransparent spot dusted with red, sometimes fading outwardly to creamy white. Base of area 1b dusted with red and near margin a large fairly well-defined spot also dusted with red. Beyond cell a subapical bar of three elongated semitransparent patches between the nervules, dusted with black basally, and sometimes with creamy white distally. Beneath these a similar but shorter and rounder patch in area 3. Nervules 2, 3, and 4 heavily dusted with black especially towards margin.

H.-w. with a sepia black basal suffusion rather well defined outwardly, and obscuring numerous black spots which are more easily distinguished on the underside. A sepia black marginal border 2–3 mm. wide and inwardly somewhat edentate on and between the nervules. Central area of wing bright red (rosy red in fresh examples), yellowish at inner margin.

Underside. F.-w. sparsely scaled and rather vitreous, the red areas showing through from the upperside. Costa, apex, and hind margin ochreous traversed by brown black nervule ends and rays. Some brown black dusting at hind angle, and costa and area 1b black at base. A fine dark brown line round hind margin. Median nervure and basal portions of nervules 2 and 3 laterally dusted with large ochre-yellow scales.

H.-w. Ochre yellow with a greenish basal suffusion and hind-marginal border. A fine brown hind-marginal line. Beyond cell the nervules are narrowly powdered with dark brown, and between them are short, fine, brown internervular rays which reach the margin. Black spots as follows :—One at base in area

9, one in 8 against precostal, two in 7 not far apart, the outer one just over, or slightly beyond origin of nervule 7. (Sometimes a minute spot between these.) In areas 6, and 5, two small spots (sometimes absent), and that in 5 may be either more proximally or more distally placed than that in 6. On the upper part of discocellulars two spots which may be minute, or large and confluent. In cell, two, and sometimes three spots, the second of which is large, and the third varies from being totally absent, to being large, and confluent with the second. A spot at base of area 2. A basal, a subbasal, and a distal spot in 1c, two median spots in 1b, and two in 1a.

Head black with a white dot behind each eye, and a transverse white streak. Thorax black with whitish lateral marks. Abdomen brownish black above, with yellowish lateral spots and segmental streaks. Claws equal.

♀. Expanse about 70 mm. Wings much more rounded than in ♂. F.-w. Dull sepia brown. A central reddish streak in area 1b, and 2, and base and distal portions of cell dusted with dull red. The subapical streaks are much as in the ♂ and may be transparent or have a whitish appearance due to a sparse clothing of brownish white scales; the patch beneath them in area 3 is reddish.

H.-w. with a basal suffusion and hind-marginal border as in ♂ but browner, the central area dull brownish red.

Underside. F.-w. much as in ♂ but without the ochreous scaling on median nervure, etc. H.-w. as in ♂ but rather duller ochreous.

Head, thorax, and abdomen more distinctly spotted than in ♂.

parrhasia ♀ f. *oppidia.*

Whilst the few examples of ♀ *parrhasia* which I have seen from S. Leone are as already described, all those from near Lagos present a closer approach to the form named *A. oppidia* by Hewitson. This form which occurs at Fernando Po, is characterised by its somewhat richer colouring and by the greater development of white scales in the subapical area of the f.-w. which here form a definite white bar, and in the h.-w. there is much less dark basal suffusion.

parrhasia ♀ f. *parrhoppidia.*

In this form the red extends all over the cell, and over nearly the whole of areas 1b and 2. There is a blackish mark in cell. The whitish subapical streaks are replaced by clear areas.

parrhasia ♀ f. *leona*. Pl. III, f. 2.

Smaller than average ♀♀ of *parrhasia*. The f.-w. almost transparent but having a brownish tinge in reflected light. A faint trace of a blackish mark in middle of cell, costa apex, and hind margin finely dusted with brown scales.

H.-w. thinly scaled with reddish brown, no basal suffusion, but a narrow brownish hind-marginal border, the ends of nervules, and the internervular rays being slightly marked in darker brown. The underside resembles the upper but the f.-w. is still more devoid of scales, and the h.-w. is ochreous brown. There are black spots as in *parrhasia*, but those beyond the cell are usually wanting.

The determination of the identity of Staudinger's *A. leona* has been a matter of considerable difficulty. After having seen the type however I find that the form is by no means rare in collections. It is always ♀ and always from S. Leone, and though ordinary ♀♀ of *parrhasia* also come from S. Leone, still I think there can be little doubt that it is a form of that species. Moreover in the Staudinger collection in Berlin there is a ♀ example of *parrhasia* from the same locality which is quite intermediate between the typical ♀ and *leona*.

The true affinities of many of these black and red semitransparent forms are extremely difficult to establish, and some of them have entailed laborious, if interesting, research. I am by no means satisfied that I have even now quite unravelled the difficulties. My work has however been greatly assisted by the magnificent collections which the Oxford Museum owes to the generosity of Mr. W. A. Lamborn, who has bred large companies of *A. parrhasia* and of other species with which it has formerly been confused. *A. parrhasia* can at least be easily distinguished from *A. peneleos* and its forms, since the male tarsal claws of the former are symmetrical.

The larva and pupa of *A. parrhasia* have been figured by Aurivillius (*l. c.*) under the name of *peneleos*.

He describes the larva as brown, with very long dorsal spines. Head, dorsal, and dorsolateral spines blackish, and arising from dark transverse bands. The lower lateral spines short and brown at base.

Pupa. Pale with the usual black markings. Dorsal abdominal spots widely separated, quadrate, and with pale central spots. Well-developed short tubercles on segments 2–7.

I have figured (Pl. VI, f. 3) one of the larvae sent by Mr. Lamborn from Lagos. They agree with Aurivillius' description though his examples were taken in Cameroon. It may be added that there is a fairly conspicuous pale lateral line, and a whitish bifurcated mark on the head. The pupae also agree with Aurivillius' figure.

The ♂ *A. parrhasia* presents comparatively little variation though the ♀ is less stable. Generally speaking the latter tends to greater transparency in the extreme western part of its range, this feature reaching its maximum development at Sierra Leone in the ♀ f. *leona*. The latter however occurs in company with examples which differ but little from those bred further east, near Lagos, these forming a perfect transition to the *oppidia* form at Fernando Po. From thence eastward the transparency appears to increase again slightly since Cameroon examples are described as resembling the *oppidia* f., but having more transparent f.-w., more faded, yellowish-red h.-w., and an inwardly less sharply defined outline of the f.-w. white subapical spots.

103. Acraea penelope. Pl. XIII, f. 18.

Acraea penelope, Staudinger, Iris, 9, p. 195 (1896); Aurivillius, Rhop. Aeth., p. 113 (1898); Grünberg, Sitzb. Ges. nat. Fr., p. 150 (1910).

= *pomponia*, Grose-Smith, Novit. Zool., vii, p. 545 (1900); Rhop. Exot. (*Acraea*), 7, p. 25, pl. 7, f. 7, 8 (1901); Neave, Novit. Zool., 11, p. 346 (1904).

Congo (Kassai R., Benabendi, Kwilu, Aruwimi R., Ft. Beni); Uganda (Msarosaro, Toro, Port Alice, Mondo, Entebbe, Kampala, Sesse I.).

♀ f. *argentea*, f. nov.
Uganda (Entebbe).

♀ f. *exalbescens*, f. nov.
Uganda (Toro, Kampala).

♀ f. *penella*, f. nov.
Uganda (Kitanwa).

A. penelope vitrea, subsp. nov.
British E. Africa (Tiriki Hills, Kabras).

A. penelope derubescens, subsp. nov.
Togoland (Misahöhe Station).

A. penelope translucida, subsp. nov.
Lagos (Oni).

A. penelope penelope.

♂. Expanse 46–50 mm. F.-w. deep brown black. Beyond cell, a subapical row of three elongate transparent spots separated only by nervules 5 and 6 which are black. Beneath these in area 3 a smaller partially transparent spot. Near base of area 2 a large ovate orange red spot, and beneath it in 1b a rather larger similar spot. Often a small red mark beneath these in 1a. In many examples all these spots are enlarged, forming a nearly continuous band across the wing in which case the spots in 2 and 1b are thinly scaled with red and there may be a few red scales on that in 3.

H.-w. brown black at base, the outer edge of this colour varying somewhat in regularity of definition but usually extending as far as origin of nervule 2. A central band of orange red, its outer edge slightly convex, but indented on the nervules by the brown black marginal border which varies in width from 3 to 5 mm. Black spots of underside show faintly on the dark basal colour.

Underside. F.-w. costa, apical area, and hind margin pale to rich ochre yellow. Remainder of wing may be almost scaleless or may be thinly scaled with dusky orange ochreous, except on the subapical transparent spots. A thin black line round apex and hind margin, the nervule ends rather broadly black and joining a fine black marginal line, and the short internervular rays narrowly black reduced to a fine point at margin. The black powdering of nervules and rays becomes coalescent at the inner edge of the apical and marginal ochreous, which latter colour it tends to obliterate in areas 2 and 1b. A blackish streak at base of cell and 1b.

H.-w. clear ochre yellow, often with a greenish tint in the basal half. In some examples a slight reddish tint in cell and 1c. The hind margin over an area corresponding to the border above, has a slightly darker shade varying in tint from greenish to orange ochreous. On this area the nervule ends are rather broadly black, their outer extremities joining a fine black marginal line. Between them are short black internervular rays broadest at their inner end and tapering outwardly to a fine point which does not reach the margin. In many examples the inner ends of these rays are confluent with the black nervules and so form a continuous dark inner edge to the hind-marginal border. On the basal half of the wing are black spots so variable in size and number as to be little value for purposes of identification. An examination of a series of examples shows that there is rarely a spot in 8 near precostal and when present it is very small. The two usual spots in area 7 are apparently always present, though sometimes extremely small. The maximum number in cell is three, only the second of which is invariably present, and placed at or before the origin of nervule 2. There seem never to be spots in areas 3 and 4, and very rarely in 5. Sometimes that at base of area 2 is missing. The most constant are those in 1c, 1b, and 1a in which areas there appear always to be two spots.

Head black with a white dot between the eyes and two on collar, thorax black above with pale lateral spots, abdomen black above with yellowish lateral dots. Claws equal.

♀. Expanse 46–50 mm. F.-w. more rounded than in ♂. Transparent and red spots usually rather larger and all the colours of both wings a trifle duller.

H.-w. as in ♂, but the inner edge of hind-marginal border rather more regularly curved.

Underside much as in ♂ with similarly variable black spots.

A. penelope ♀ f. *argentea*. Pl. IV, f. 8.

General colouring paler, and the h.-w. hind-marginal border broader than in typical form, and on it the short darker nervule ends and rays can be distinctly seen.

Underside. F.-w. ochreous areas replaced by silvery grey. H.-w. basal portion and hind-marginal border silvery grey, central area faintly pink.

A. penelope ♀ f. *exalbescens*.

Resembles typical ♀ in pattern, but all reddish areas replaced by yellowish white, and the h.-w. hind-marginal border as broad as in f. *argentea*.

Underside. Ochreous areas replaced by yellowish white rather dusky on f.-w. costa, apex, and hind margin and on h.-w. basal area and hind-marginal border.

A. penelope ♀ f. *penella*, f. nov. Pl. V, f. 3.

F.-w. Basal half reddish brown slightly blackened at base, and about end of cell. Apex and hind margin brownish black tending to reddish towards hind angle. From subcostal to inner margin a broad transparent discal band divided into large spots by the nervules which are slightly dusted with brownish.

H.-w. tawny red, somewhat blackened at base, the spots of underside irregularly indicated. Hind margin border of medium width thickly dusted with sepia, its inner edge ill defined and edentate on and between the nervules.

Underside. F.-w. much as above but costa, apex, and hind margin tawny ochreous with blackish nervules and internervular rays. H.-w. base nearly to end of cell reddish tawny, followed by a discal band of pale pinkish ochreous and having a broad, well-defined marginal border of tawny ochreous striated by the black nervule ends and short internervular rays. The reddish basal portion more heavily spotted than is usual in *penelope*. Two spots in 7, the second just beyond origin of nervule 7, and beneath it but slightly nearer margin a spot in 6, and in 5. A dot at base of area 5 on discocellular; a basal, a central, and a distal spot in cell (the latter may be an aggregation of dots) a spot at base of area 2. Three spots in 1c, the third just beneath origin of nervule 2, and beneath it two spots in 1b. A subbasal and a distal in 1a.

This interesting form is at once distinguished by the tawny red basal area of h.-w. underside which brings into prominence the central pale band, thus producing a close resemblance to *peneleos pelasgius*. The pattern is doubtless modified in mimetic association with that species.

A. penelope vitrea, subsp. nov. Pl. IV, f. 7.

♂. F.-w. Costa, apical area, and hind margin sepia black. Cell and basal portions of 6, 5, 4, 3, 2, 1b, and 1a dusted with the same colour. Remainder perfectly transparent with a dusting of orange red in areas 2 and 1b, and an orange red linear mark in 1a. H.-w. orange red, usually with a less extensive basal suffusion, and having a narrower hind-marginal border.

Underside resembles that of typical *penelope*.

The ♀ is unknown to me.

A. penelope derubescens, subsp. n. Pl. IV, f. 5.

♂. Resembles subsp. *vitrea*, but in the h.-w. the central area is crimson, much reduced in width, and does not reach the costa. A few brown scales can be seen with a lens in areas 1b and 2. On the underside of f.-w. the ochreous areas are replaced by pale greenish, and in the h.-w. the basal area and hind margin are pale green, and the central band creamy white.

Of this form there are three ♂♂ in the Berlin Museum. One has the black nervule ends and rays in h.-w. underside not joined together as they are in the type figured, and has an additional spot in areas 6 and 5. All three examples were taken at Misahöhe Station near Tongbe in Togoland.

A. penelope translucida, subsp. n. Pl. IV, f. 4 (♂), f. 6 (♀).

♂. Rather smaller than typical *penelope*. F.-w. transparent. Costa, apical area, and hind margin black, this colour being somewhat edentate on the nervules. Some black powdering in and beyond cell, and a slight blackish longitudinal streak in cell. A little dusting of red scales in basal half of area 1b, and distal portion of 1a.

H.-w. much as in typical *penelope* but dark basal suffusion only slight and hind-marginal border rather narrower.

Underside as in typical *penelope*, but the greater part of f.-w. devoid of scales and vitreous. H.-w. clear ochre yellow with a greenish tinge at base and on hind-marginal border.

♀. F.-w. more rounded than in ♂ but otherwise similar, though more thinly scaled, the dark portions having a grey appearance.

H.-w. salmon pink, the spots of underside irregularly reproduced. Hind margin powdered with sepia scales, the nervule ends and rays slightly accentuated. Underside much as in ♂ but the nervule ends and rays brownish rather than black. The usual variability occurs in the black spots.

This form has lately been bred near Lagos by Mr. W. A. Lamborn. Unfortunately none of the larvae were preserved on that occasion, and a further supply has not yet been obtained. They feed on the same plant as the larvae of *A. peneleos*. Miss Sharpe's *A. newtoni* from the Island of St. Thomas is probably also a form of *A. penelope*. I have not however been able to see the type of this form which is in the Lisbon Museum, my appeal to the authorities of that institution not having elicited the courtesy of a reply.

104. Acraea newtoni.

Acraea newtoni, E. M. B. Sharpe, Proc. Zool. Soc., p. 554 (1893); Smith and Kirby, Rhop. Exot. (*Acraea*), 5, p. 17, pl. 5, f. 8, 9 (1894); Aurivillius, Rhop. Aeth., p. 113 (1898).

São Thomé.

♂. Expanse 50 mm. F.-w. elongated, black brown. A subapical band of three dusky translucent spots separated by nervules 6 and 5, and a somewhat larger similar spot near base of area 2.

H.-w. black brown showing a few black spots near base and having a narrow (3 mm.) orange red curved central band which scarcely reaches the inner margin.

Underside. F.-w. vitreous the pattern of upperside showing through. H.-w. base greenish grey, the band of upperside represented in pink. Hind-marginal border grey brown. An outer row of black spots of which there are three in 7, 6 and 5, the first well beyond origin of nervule 7. A spot near base of area 2 followed by one in 1c and 1b, all in a straight line at right angles to inner margin. Also two spots in cell the second above origin of nervule 2, a subbasal in 7, a subbasal in 1c, a basal and a subbasal in 1b, and a spot in 1a.

Head and thorax black with a few whitish dots. Abdomen black above with lateral yellowish spots. Palpi white.

I have not had an opportunity of examining the type of this species which is in the Lisbon Museum. I am inclined to regard it as a local form of *A. penelope*, Staud. It occurs only in the Island of St. Thomas. The ♀ is not yet known. Should this form ultimately prove to be conspecific with *penelope* the name *newtoni* will take precedence.

105. ACRAEA MAIRESSEI. Pl. 13, f. 19.

Acraea mairessei, Aurivillius, Ent. Tidskr., 25, p. 93, f. 33 (April 1904).

= *servona* (*nec* Godt.), Aurivillius, Rhop. Aeth., p. 113 (1898).

= *melanosticta*, Em. M. B. Sharpe, Entomologist, p. 181 (July 1904).

CONGO (Ligunda, Kassai, Betw. Ft. Beni and Ituri R.); UGANDA (Toro, Unyoro, Entebbe, Nandi, Pt. Alice).

f. *dewitzi*, Aurivillius, Ent. Tidskr., p. 94 (1904).

= *peneleos*, var., Dewitz, Nov. Act. Nat. Cur., 41, 2, p. 19, pl. 1, f. 7 (1879).

CONGO (Kassai).

♂. Expanse 50–54. F.-w. black. At end of cell an irregularly shaped transparent spot often indented on the basal side by the ground-colour. Beyond cell a series of three subquadrate transparent spots separated by the black nervules. A large transparent spot at base of area 2, not always extending right into angle between median and nervule 2. The discal edge of this spot powdered with black scales. Beneath it a small ill-defined transparent spot. Examined by reflected light the inner and sometimes also the subapical spots are seen to be slightly scaled with yellowish white. H.-w. black, slightly less dense in basal area, on which the black spots corresponding to those beneath, can be discerned. An irregular discal patch of lemon ochreous beginning in area 6 and ending in 1b, its inner edge edentate in cell, and its outer edge edentate between the nervules especially in 6, 5 and 4.

Underside. F.-w. Costa, apical area, and hind margin dusky brown ochreous, striated by the black nervules, which join in a fine marginal line. In areas 6–2 short black inter-nervular rays beginning at inner edge of the yellow colour and rapidly diminishing to a point some distance short of the margin. Remainder of wing rather thinly scaled with black except in way of transparent spots, these having a slight dusting of yellowish white scales as on upperside.

H.-w. lemon ochreous with a greenish tint at base and over outer marginal border. On the latter the nervule ends are rather broadly black and join a fine marginal black line. Between them are short black internervular marks separated from margin by a distance about equal to their own length. Black spots as follows:—One in 9 at base, two in 7 occasionally coalescent, one at base of area 6 (rarely absent), two on disco-cellulars (these, and that in 6, often confluent). One in cell near base. A large crescentic spot in 1c (rarely divided into two). Two in 1b (sometimes coalescent), a basal linear mark in the same area, and two spots in 1a.

In one (♀) example before me the internervular marks are inwardly confluent with the black powdering of the nervules.

Head black with a white dot between eyes and two on collar. Thorax black with some yellowish dorsal and lateral spots. Abdomen black with yellowish lateral spots. Claws equal.

♀. Expanse 52–54 mm. Resembles ♂ but the transparent spots, especially the subapical series tend to be larger, except that in 1b, which is sometimes wanting. The h.-w. patch is, in one example, white.

A. mairessei f. *dewitzi*.

F.-w. thinly scaled with black. The transparent spot in cell is reduced to a mere streak, as also is that in 1b. The h.-w. patch is tawny red, and reaches the costa and inner margin. The underside is like that of the typical form but the yellow areas are of a more golden tint, and the inter-nervular marks are rather more slender. They are not proximally confluent with the black of the nervules.

The example above referred to was described by Dewitz as a variety of *A. peneleos*. Aurivillius has pointed out (*l. c.*) that it appears to be a red form of his *mairessei*, and having seen the specimen I agree entirely with this view. It is remarkable that these small black and yellow Acraeas occasionally produce forms in which the yellow is replaced by red, whilst the red and black species produce yellow and black varieties. Thus there is a ♀ form of *A. penelope* with yellow h.-w., and a ♀ form of *servona* with the typical yellow replaced by red. The case of *orestia* is still more peculiar since we have the red, an orange intermediate, a yellow, and a colourless form.

The present species has a wide distribution, extending from the neighbourhood of the Kassai R. to Entebbe.

106. Acraea melanoxantha.

Acraea melanoxantha, Em. M. B. Sharpe, Proc. Zool. Soc., p. 193, pl. 17, f. 4 (1891); Aurivillius, Rhop. Aeth., p. 114 (1898).

Mt. Elgon.

♂. Expanse about 44 mm. F.-w. brownish black. At end of cell a large lemon ochreous spot occupying the outer third of cell, its proximal edge indented by the ground-colour, and beneath it at base of area 2 a somewhat similar lemon ochreous spot. Beyond cell, midway between cell end and apex a slightly curved row of three subquadrate spots. These spots are translucent and appear to be white, but if examined by reflected light only they are seen to be lightly scaled with lemon ochreous.

H.-w. brownish black with a lemon ochreous central patch, occupying basal part of 6, 5, 4, 3 (very slightly) and 2, extending thence in a narrow continuation nearly to inner margin, and also occupying the lower outer half of cell. On the dark basal portion the spots of underside are just visible, and in addition there is a black mark at extreme base of areas 5 and 4 on the discocellulars and plainly visible on the pale yellow ground. On the outer dark coloured half of the wing the dark internervular rays are visible.

Underside. F.-w. costa pale greyish ochreous, remainder of wing blackish with pale spots as above but the large yellow spots are only very slightly scaled and inclined to be larger than above. At apex between the branches of subcostal, and along apical and hind-marginal border, between the black nervules and rays, pale lemon ochreous.

H.-w. lemon ochreous, slightly dusky over those areas which are black on upperside. The marginal border is striated by rather heavily sepia powdered nervule ends and rays. The latter though coming to a point at margin do not stop short of the margin as in *mairessei*. The inner edge of this striated border is often tinged with reddish brown. Black spots as follows:—Two in seven, the second just beyond origin of nervules 7 and 6, one at base of 5 and 4 on discocellulars. One spot (sometimes absent) in cell, a subbasal and central spot in 1c, two spots in 1b, and one in 1a. Some irregular black at base of nervules.

Head black with a lemon ochreous transverse line and two ochreous tufts on collar. Thorax black with a few pale lines and spots. Abdomen black above with pale lateral spots. Claws equal.

I have not seen a ♀ of this species. The colouring of the underside is rather variable. The foregoing description is taken from the type, but another example has the basal and marginal areas of the h.-w. underside reddish brown, whilst another has the whole of the pale ochreous portions of the underside of both wings (except the spots of f.-w. and the central patch of h.-w.) rich chestnut brown, the marginal border of h.-w. being rather blacker towards its inner edge. In this example there is no black spot in the cell.

All the examples which I have up to the present examined were taken on the southern slopes of Mt. Elgon. But for the absence of the pale spot in f.-w. 1b, and the fact that the spots in 2 and cell are, on the upperside, fully scaled with yellow, the species has a very similar appearance to *A. mairessei*, Auriv., and indeed may ultimately prove to be a local race of that species.

107. Acraea conradti. Pl. XIII, f. 21.

Acraea conradti, Oberthür, Etud. d'Ent, 17, p. 22, pl. 1, f. 10 (1893); Aurivillius, Rhop. Aeth., p. 112 (1898).

German E. Africa (Nguelo, Usambara, Amani, Mkulumusi); Nyassaland (Mlanji Boma).

♂. Expanse 46–50 mm. F.-w. Costa, hind margin, basal half of 1a, and apical half from end of cell, black. Cell, and areas 1b, and 2 except at margin, and central portion of area 1a, dark brick red. A subapical band of three transparent spots in 6, 5, and 4. Lower side of subcostal somewhat powdered with black, a little black at base of cell, and a short linear black mark at base of area 1b.

H.-w. dark brick red with a black hind margin some 2 mm. broad from apex to nervule 4, and 3 mm. broad thence to anal angle, from which it extends as a narrow black line along inner margin. The black scaling projects inwardly somewhat along the nervules. Base with a considerable black suffusion extending for about half the length of areas 7, 1c, 1b, and 1a, and occupying lower half of cell as far as origin of nervule 2. A number of black spots somewhat obscured basally by the black suffusion, and more easily distinguished on the underside. Ground-colour tending to yellowish along inner margin.

Underside. F.-w. Costa, hind margin, and apical portion beyond transparent spots dull sage green traversed by broadly black nervules and narrow black internervular rays. Lower side of subcostal, area from end of cell to subapical spots, and basal half of area 3 powdered with black. Extreme base of costa black, and a black linear basal mark in cell and 1b.

H.-w. Base and hind-marginal border dull sage green. Central area pink or pale yellow. Nervule ends on margin broadly powdered with black, and between them a series of narrow black internervular rays broadest at their proximal ends and barely reaching the margin. Black spots as follows:— A large spot in 7 near the middle, followed by two graduated smaller spots in 6 and 5, each slightly more distally placed. An irregular black mark on upper part of discocellulars formed of confluent spots. A spot at base of area 2 followed by a larger spot in 1c, another in 1b rather more distally placed, and a third more proximal in 1a. Base of cell and area 9, black. A dot in 8 near precostal. A subbasal, a median, and a distal spot in cell, a basal and a subbasal in 1c. Base of 1b black, followed by a median spot. Base of 1a black followed by a subbasal spot.

Head and thorax black with a few pale dots and marks. Abdomen black with minute lateral yellowish white dots. Claws equal.

♀. Expanse about 60 mm. Wings more rounded than in ♂. Generally paler, duller, and more thinly scaled. F.-w. Subapical transparent spots as in ♂ but larger. H.-w. with somewhat less basal black in area 7, but the black spots less defined and more confluent. Marginal border not continuously black, but having a reddish brown ground-colour and elongated triangular black markings on nervule ends, between which are short, narrow black internervular rays which barely reach margin.

Underside. F.-w. as above but thinly scaled and somewhat glossy. H.-w. with reddish brown base on which the black spots are ill defined and confluent. Central area occupied by a conspicuous broad curved pink band. Marginal border reddish brown marked as in ♂.

Head, thorax, and abdomen with the pale spots rather more conspicuous.

Acraea conradti seems to be a well-defined species of narrow distribution.

In the Vosseler collection at Berlin there is a fine series of 18 ♂ and 5 ♀, taken in German E. Africa. Two examples in the Tring collection are from Nguelo.

108. Acraea buschbecki. Pl. XIII, f. 20.

Acraea buschbecki, Dewitz, Ent. Nachr. 15, p. 102, pl. 1, f. 2 (Apr. 1889); Aurivillius, Rhop. Aeth. p. 112 (1898).

= *zaire*, Rogenhofer, Ann. Mus. Wien., 4, p. 551 (Dec. 1889).

Congo State (Quango, Stanley Falls, Luebo, Kassai R.); Cameroon (Bitjé R., Asokko).

♂. Expanse about 54 mm. F.-w. narrow and elongated. Brownish black. Cell as far as origin of 3, basal two-thirds of area 2, basal three-quarters of 1b, and subbasal portion of 1a, brick red. An oblique subapical series of three elongated contiguous quadrate brick-red spots in 6, 5, and 4, followed by a smaller, more rounded, and isolated spot in 3. Projecting into cell from subcostal, above origin of nervule 2, an outwardly curved blackish brown spot. In area 1a a large subtriangular blackish brown spot, its base on the submedian, and its apex meeting nervule 2 just beyond the origin of the latter. A linear basal black mark in area 2.

H.-w. brick red, yellowish at inner margin and with a slight blackish basal suffusion. A blackish brown hind-marginal border, some 2 mm. wide, its inner edge somewhat edentate on the nervules and rather less so between them. A series of black spots somewhat ill defined and partly confluent.

Underside. F.-w. as above but basal red areas orange ochreous, subapical spots dull ochreous, and the apex and hind margin striated by ochreous internervular marks, each divided by a narrow central dark ray. Costa dull ochreous.

H.-w. dull ochreous with a blackish brown hind-marginal border as on upperside but bearing a series of marginal internervular ochreous spots each of which is divided by a short internervular ray which scarcely reaches the margin. Black spots as follows :—One in 7, near middle, followed by two rather smaller spots in 6, and 5, each rather more distally placed. Two spots on upper part of discocellulars (usually confluent) a spot at extreme base of area 4, a dot at base of 3, a large spot at base of 2, followed in area 1c by a large figure of eight mark formed by two coalescing spots. Beneath this, two spots in 1b, and, more proximally placed, two in 1a. A spot in 8 rather beyond precostal, three in cell, the second large and lying beyond origin of nervule 2. Some black at base of 9, cell, 1c, 1b, and 1a. Head, thorax, and abdomen black, with ochreous marks and segmental dots. Claws unequal.

♀. Resembles ♂ but the subapical red spots are rather larger.

I have seen but few examples of this apparently rare species. It is quite peculiar in appearance and easily recognised.

109. Acraea servona. Pl. XIII, f. 22.

Acraea servona, Godart, Enc. Méth., 9, p. 239 (♀), (1819); Grimshaw, Trans. R. Soc. Edin., 39 (1897), p. 4 (1898); Aurivillius, Ent. Tidskr., p. 94 (1904).

= *lycoides*, Boisduval, Spec. Gen., 1, pl. 11, f. 5 (♀), (1836).

= *circeis* var. *lycoides*, Aurivillius, Rhop. Aeth., p. 114 (1898).

= *dejana* (♂), Godman and Salvin, Hist. Relief Exp., p. 431 (1890); Grose-Smith (*circeis* var.), Proc. Zool. Soc., p. 466 (1890); Em. M. B. Sharpe (*ntebiae*),* Ann. Nat. Hist. (6) 19, p. 581 (1897); Grimshaw, Trans. R. Soc. Edin., 39 (1897), p. 4 (1898).

Gaboon (L. Asebbe, L. Asingo, Abanga R.); Cameroon (Ja R.); Congo (Ituri R., Kassai R., Aruwimi, Bopoto, Ft. Beni, Leopoldville); Angola (Pungo Andongo).

A. servona subsp. *orientis*.

Aurivillius, Ent. Tidskr., p. 94 (1904).

German E. Africa (Ukami).

f. *depunctella*, Strand, Int. Ent. Zeit. (Guben), 41, p. 221 (1911).

German E. Africa (Amani).

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* Miss Sharpe's description of this form does not enable me to distinguish it from the usual Eastern examples. The most remarkable feature of the description is the alleged pale ochreous colour of the h.-w. underside. I have examined a very large number of examples from Entebbe and have never seen one which did not exhibit the chestnut brown colour described under the subspecies *rhodina*. After a most diligent search, assisted by Miss Sharpe herself, I have failed to discover the type of this form, and I am therefore unable to obtain any further information concerning it.

f. *unipunctella*, Strand, *l. c.*

GERMAN E. AFRICA (Amani, Bomole, Herue, Dar-es-Salaam, Ukami).

f. *semipunctella*, Strand (*l. c.*).

GERMAN E. AFRICA (Derema).

f. *transienda*, Strand (*l. c.*).

GERMAN E. AFRICA (? Derema).

A. servona subsp. *rhodina*.

= *circeis rhodina*, Rothschild and Jordan, Novit. Zool., xii, p. 184 (1905).

= *circeis* v. *subochreata*.

Grünberg, Sitzb. Gesellschaft. naturf. Fr., p. 164 (1910).

UGANDA (Entebbe, Kampala, Mumias); ABYSSINIA (Banka Malo, Gamitscha to Anderatcha).

A. servona ♀ f. *rubra*, f. n.

ANGOLA (Pungo Andongo); GABOON (Fernan Vaz).

A. servona subsp. *limonata*, subsp. n. (♂).

FERNANDO PO.

A. servona tenebrosa, subsp. n. (♂).

GERMAN E. AFRICA (Kwidgwi I., L. Kiwu).

A. servona f. *reversa*, f. nov.

CONGO (Bopoto, Ituri Forest, Stanley Pool, Kassai).

A. servona servona.

♂. Expanse 42–60 mm. F.-w. elongate and resembling in shape that of *parrhasia*. Sepia black to black. Basal two-thirds of cell, area 1b, and base of area 2, rather thinly and irregularly scaled. Beyond cell three elongate transparent spots separated by nervules 5 and 6, and proximally somewhat powdered with black. Beneath these, in basal part of area 3, a smaller, elongate, partially transparent spot. In area 2 a large, and beneath it in 1b a smaller transparent patch, the latter traversed by a blackish internervular ray. These transparent areas, when viewed by reflected light, are seen to be very sparsely dusted with white scales.

H.-w. At base, and from costa to nervule 7 sepia black, a hind-marginal border of the same colour some 4–5 mm. wide. Central area occupied by a lemon ochreous patch somewhat edentate basally in cell, its outer edge angulated at nervule 3.

Underside. F.-w. costa, apical area and hind margin dusky lemon ochreous, striated by black nervules and rays. The hind-marginal ochreous almost obliterated towards the hind-angle by a suffusion of brownish black. A black spot at base of costa, remainder of wing almost devoid of scales, except the median nervure and the basal portions of its branches which have a narrow but very dense lateral clothing of large ochreous scales.

H.-w. Those areas which on the upperside are black, are here dusky lemon ochreous. The hind-marginal border regularly striated by black nervule ends and rays, the latter reaching the margin. Black spots somewhat variable, but usually as follows:—One at base in 9, one in 8 against precostal, two rather close together in 7, two in cell, the second over the origin of nervule 2. A basal, a subbasal, and a median in 1c. A basal streak and two median spots in 1b, and two in 1a.

Head black with a yellowish white dot between the eyes, and two on collar. Thorax black with pale dorsal and lateral marks. Abdomen black above with pale lemon ochreous lateral dots. Claws equal (but see f. *reversa*, p. 296).

♀. Expanse 62–66 mm. F.-w. much more rounded, and dark areas usually tending to a browner shade. The transparent patches are more clearly defined, those parts which in the ♂ are thinly scaled, are here of the same depth as the general ground-colour. The yellow patch in h.-w. is often of a duller ochreous. In other respects the ♀ resembles the ♂.

A. serrona orientis, subsp. Pl. III, f. 5 (♀).

Ground-colour a much richer black. The f.-w. transparent spots rather smaller, more clearly defined, and more obviously scaled with white. Those in 1b and 3 almost or quite absent. In the h.-w. the yellow area is broader owing to the greatly decreased extent of the basal black. On the underside the f.-w. is correspondingly blacker, though the cell, transparent patches, and bases of areas 6–1b are still almost devoid of scales. The ♀ also has the ground-colour blacker, though scarcely so black as in the ♂.

The black spots of the h.-w. underside seem to be more variable in this race than in most of the more western examples, and Dr. Strand has proposed form names for the principal variations of this feature.* These forms are as follows—

f. *depunctella*.

No black spots in cell, one to two in area 7.

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* I am not sure that the naming of forms on the variation of the black spots is not carrying nomenclature to excess. There are species of *Acraea* in which the number of black spots is so variable that almost as many names might be made as there are spots on the insects. In the present species the spots are not even constant in both wings of the same specimen.

f. *unipunctella.*

One spot in cell and two in area 7.

f. *semipunctella.*

One spot in cell, one in area 7.

f. *transienda.*

One spot in cell, one in 7, the transparent spots in areas 1b and 3 of f.-w. present.

A. servona rhodina, subsp. Pl. III, f. 4 (♂).

This form was originally described as *circeis rhodina* by Messrs. Rothschild and Jordan and differs from typical examples in having the yellow areas of the underside replaced by chestnut brown. The type was described from Abyssinia but the subspecies is not confined to that area, since all the examples I have seen from Entebbe and extending as far as Mumias (Tiriki Hills) have this brown colour well developed.

A. servona ♀ f. *rubra.* Pl. III, f. 9.

Three examples of the insect I have figured occur in the Tring collection, and I feel bound to refer them to *A. servona.* Two were taken at Fernan Vaz (Gaboon) in company with several red and black forms, which latter were undoubtedly *A. peneleos.* It is certainly not a ♀ form of the latter. In the specimen figured the h.-w. black spots are large and confluent. They are also rather more numerous than in average examples of *servona*, but fortunately the second specimen already referred to supplies an intermediate in which these spots are quite as in typical *servona.* The third example was taken at Pundo Andongo in Angola. It differs from the others in having a narrower and inwardly less well-defined marginal band in the h.-w. The underside is more orange ochreous, and the h.-w. nervule ends are less broadly black. The central area of the h.-w. underside is pale ochreous.

A. servona limonata, subsp.

This form occurs at Fernando Po, a small series in the British Museum from the Hewitson collection being at present labelled *A. lycoides.* Five examples of the same form are in the Joicey collection (lately the property of Mr. H. Grose-Smith) and these are somewhat vaguely labelled Angola. All differ from typical *servona* in having the spots in f.-w. 1b and 2 lemon ochreous instead of transparent white, and all are ♂ ♂. For some time I was unable to decide whether this form were the true *lycoides*, but M. Charles Oberthür has kindly sent me a most careful description of Boisduval's type. This example is a ♀ and evidently agrees with Godart's *servona.* In the explanation of Boisduval's plates the locality is vaguely given as "Guinea," and there appears to be no reference to it in the text. Godart gives Angola as the locality of his *A. serrona*. The type of this is also a ♀. Now I am unable to say whether the ♀ ♀ of the Fernando Po form have transparent or yellow spots on the f.-w., as I have seen no ♀ examples from that locality. I cannot therefore definitely connect the Fernando Po specimens with the types of either *lycoides* or *servona*. The fact that yellow spotted ♂ ♂ occur in the Grose-Smith collection labelled "Angola" would support the conclusion that they were the ♂ ♂ of Godart's *serrona*. If this were established our synonymy would have to be slightly altered. *Serrona* would still remain the name of the species, but it would refer to the yellow spotted form, and the ♂ (*dejana*) and ♀ (*lycoides*) would form a subspecies. I have however reason to suppose that the labels referred to are not sufficiently reliable, and until further material is available for the study of these forms, I must regard *serrona* and *lycoides* as synonyms, giving a distinctive name to the distinctly yellow spotted form, of which I have at present seen only male examples.

A. serrona tenebrosa, subsp. n.

This form, of which I have only seen the ♂, differs from other forms in the following particulars :—The ground-colour is intensely black. There are no clear spots in f.-w. 1b, and 3. The remaining clear spots are reduced in size and quite appreciably scaled with white. The h.-w. pale yellow patch is much reduced, only just extending into area 7, and partially into 1b. On the underside those areas which in the typical form are pale yellow are here of a very dark red brown. It occurs on Kwidgwi Island, L. Kivu.

A. servona f. *reversa*.

This form differs constantly from *serrona servona* solely in the fact that the tarsal claws of the male are unequal. It should however be noted that in all the eight examples known to me the transparent spot in f.-w. area 3 is larger and better defined than in the majority of examples of *servona servona*. Also there is a general tendency for the nervule ends on the underside to be more heavily scaled with black brown. In one example this scaling is developed to such an extent that the outer half of the wing is almost completely black, an extreme condition which I have not observed in the type form.

A. servona occurs from Fernando Po to Angola and across the Congo State to Entebbe, thence northwards into Abyssinia, and southwards into German E. Africa. I have not yet found the dividing line between the typical form and the subspecies *rhodina*, nor between the latter and the subspecies *orientis*. The species does not occur in Neave's collections from N. Rhodesia and Katanga, nor have I seen examples from E. of the Kikuyu Escarpment. It would appear, therefore, to extend into German E. Africa by way of the Urundi Country. It is remarkable that at L. Kivu the subspecies *tenebrosa* represents a form which, in the absence of clear spots in f.-w. 1b and 3, agrees with the German E. African form *orientis*, whilst in the dark red brown areas of the underside it shows affinity with the subspecies *rhodina*. The much-reduced yellow patch of the h.-w. separates it from either form.

The occurrence of the form which I have named *reversa*, adds one more to the many difficulties of classification which the genus *Acraea* presents. An examination of hundreds of typical *servona* together with the few available specimens of *reversa*, reveals no *constant* difference which would serve as a basis for specific distinction, with the sole exception of the structure of the male tarsal claws. In the other species of the genus these claws are constantly either equal or unequal, but in this one case their structure appears to be inconstant. The genitalia are as closely alike as possible, within the limits of individual variation. I have retained this form *reversa* under the heading of *servona* since there seems no sufficient evidence of specific difference. Moreover, to separate it would at once raise still greater difficulties. The type of *servona* is a ♀. Amongst the examples before me are many ♀♀ which are certainly *servona*. Assuming *servona servona* and *servona reversa* to be different species, to which species do all these ♀♀ belong? Breeding experiments and the acquisition of further material may one day throw some light on the matter. Meanwhile I prefer merely to record the fact that there occur amongst large series of male *servona*, certain examples differing from the rest only in the structure of the tarsal claws. I have not yet discovered any means of deciding whether such forms are or are not specifically distinct.

110. Acraea circeis. Pl. XIII, f. 23.

Acraea circeis, Drury, Ill. Exot. Ins., 3, p. 24, pl. 18, f. 5, 6 (1782); Herbst, Naturs. Schmett., 5, p. 13, pl. 81, f. 6, 7 (1792); Aurivillius, Rhop. Aeth., p. 114 (part), (1898).

= *mandane*, Fabricius, Ent. Syst., 3, 1, p. 183 (1793); Godart, Enc. Méth., p. 239 (1819).

= *opis*, Herbst, Naturs. Schmett, 6, pl. 136, f. 1, 2 (1793).

S. Leone; Ashanti; Cape Coast Castle; Gaboon; N. Angola (Kibokolo).

♂. Expanse 52 mm. F.-w. for the most part transparent, the transparency being caused by reduction in number and width of the scales. Costa, apex, nervures and hind margin more heavily dusted with brownish black. Near base of 2, and in 1b near margin, a few yellowish white scales representing two obsolescent spots.

H.-w. base with a triangular dusky grey area bearing black spots more easily observed on the underside. A central band of very pale lemon ochreous beginning in area 6, its outer edge slightly curved as far as nervule 5, thence traversing the wing parallel to inner edge and reaching the inner margin, where the band is about 4 mm. wide. Remainder of wing dusky grey forming a marginal band which joins the basal grey along costa in 7.

Underside f.-w. as above but without the yellow scaling in 2 and 1b. Costa dusky ochreous with a black spot at base. Main nervures laterally covered with brownish scales.

H.-w. As on upperside but paler, the marginal border having the nervule ends and internervular rays heavily dusted with dull brown, and the intervening spaces powdered with dull ochreous. On the grey basal portion black spots as follows:— One in 9, one in 8, two in 7, sometimes a small dot near base of area 6, one (sometimes two) on discocellulars, two in cell (the second in the middle and large), a basal spot in 1c followed by two large spots often coalescent, two in 1b, and two in 1a. Head and thorax black with a few pale marks, abdomen black above with whitish lateral spots. Claws unequal.

♀. Resembles ♂ but the f.-w. are more rounded, and there is a little yellow scaling in 1b, at base of 2, and at end of cell in f.-w.

Acraea circeis is somewhat rare in collections. At one time I was of opinion that it was a form of *A. servona*, but careful examination of a number of preparations of male genitalia convince me that it must be regarded as distinct. It appears to be an exclusively western species.

111. Acraea oreas. Pl. XIII, f. 25.

Acraea oreas, Em. M. B. Sharpe, Proc. Zool. Soc., p. 193, pl. 17, f. 5 (1891); Aurivillius, Rhop. Aeth., p. 114 (1898);

Butler, Proc. Zool. Soc., p. 46 (1902) ; Neave, Novit. Zool., 12, p. 346 (1904).

f. *albimaculata*, Neave, Novit. Zool., 12, p. 329, 346 (1904).

ANGOLA (Bihé, Lucalla, Benguella); GERMAN E. AFRICA (Mwanza); CONGO (90 km. w. of L. Albert Nyanza); BRITISH E. AFRICA (Mt. Elgon, Nandi, Sotik); UGANDA (Toro, Entebbe).

f. *angolanus*, Lathy (*A. angolanus*), Trans. Ent. Soc., p. 3, pl. 1, f. 4, 5 (1906).

ANGOLA.

A. oreas oreas.

♂. Expanse 48 to 58 mm. F.-w. much angulated and hind margin markedly convex. Black with large lemon yellow spots.* Of these there is one in cell extending from subcostal to median and lying between origin of 2 and 3. A subapical band of three in 6, 5, and 4, the last somewhat more distally placed, one in 2 not quite touching the median, and beneath it and nearer margin a spot in 1b. Usually a small yellow streak near base of 1b close to median.

H.-w. black with a central lemon yellow patch of peculiar shape. This patch occupies the basal portion of 7, nearly the whole of cell except a small streak on lower side at base, and extends beyond cell slightly into 6, 5, 4, 3, and 2.

Underside. F.-w. Costa dark to pale reddish brown. Yellow spots as on upperside but paler. From base to subapical spots brown-black, base of cell and the edges of median nervure and its branches laterally dusted with large yellowish scales. Apical and hind-marginal borders in some cases also brown-black but more usually reddish brown to brownish ochreous striated by the black nervules and internervular rays.

H.-w. varying from black-brown to reddish ochreous. A central yellow patch as above but paler and usually extending in a narrow suffused streak across areas 1c, and 1b, near their middle. Area 8, a streak on lower side of base of cell, and basal part of 1c, 1b, and 1a more distinctly reddish than remainder of ground-colour. A small black spot in 8, rarely one near base of cell, two in 1c (the second on the inner edge of extension of yellow patch) two in 1b and usually one in 1a. Outer half of wing striated by black nervule ends and internervular rays.

* Miss Sharpe's figure shows yellow spots in f.-w., whilst her description states that they are white. I have, however, examined the type in the Jackson collection, and it has yellow spots agreeing with the figure.

Head black with a few whitish marks, thorax black with two anterior dorsal whitish streaks. Abdomen black above with pale yellowish segmental lines and lateral spots. Claws equal.

♀. Expanse 50-60 mm. Resembles the ♂ but f.-w. less angulated.

f. *albimaculata*.

Differs from typical examples in having the spots of f.-w. white. At present I have only seen ♂ ♂ of this form though ♀ ♀ probably also occur.

f. *angolanus*.

Differs from the typical or eastern form in being larger (♂ 60 mm. ♀ 68 mm.). The f.-w. spots are white, in both sexes the ground-colour of the marginal borders in both wings on underside is generally, though not invariably, pale greyish ochreous. On h.-w. underside areas 8. 9, a streak on lower side of base of cell, areas 1c, 1b, and 1a remain reddish as in typical specimens.

Lathy describes an aberration of the ♀ in which the f.-w. spots are tinged with pale yellow and the h.-w. patch is radiated into the marginal black. This would appear to be a not uncommon form, examples agreeing with Lathy's figure occur both in the Tring Museum and in my own collection.

I do not think the differences between the Angola and other forms warrant the separation of the former as a subspecies. The f.-w. white spots do not distinguish it from the *albimaculata* form, and they are not constant as shown by the ♀ aberration above described. The pale colour of the wing borders on the underside though predominant, is also not quite constant. The variation of this marginal colour is peculiar. In Angola it is, as stated, usually dusky ochreous. Passing eastwards it gradually becomes darker, and at Toro and on to the Tiriki Hills it is deep red brown or black. In German East African examples it again becomes paler turning to a rusty red or orange ochreous. The species is easily recognised by the angulated wings and by the peculiar shape of the yellow central patch of the h.-w.

112. Acraea semivitrea. Pl. XIII, f. 26.

Acraea semivitrea, Aurivillius, Ent. Tidskr., 16, p. 111 (1895); Rhop. Aeth., p. 114, pl. 1, f. 2 (1898).

= *perva.* E. M. B. Sharpe, Ann. Nat. Hist. (6), 19, p. 581 (1897); Neave, Novit. Zool., 11, p. 346 (1904).

CONGO (Lualuaburg, Yakusu, Ituri Forest); UGANDA (Entebbe, Port Alice); BRITISH E. AFRICA.

♂. Expanse 54–62 mm. F.-w. transparent, elongated. Costa and nervures narrowly black, apex narrowly black, continuing as a narrow hind-marginal border expanded into triangular marks at nervule ends. A little black at base most extensive in area 1a. The transparency of the wing is caused by a total absence of scales, there being no sign even of scale sockets in the glass-like membrane.

H.-w. brown black at base nearly to end of cell, obscuring some rather large black spots. A black hind-marginal border narrow at apex, about 2 mm. wide as far as nervule 3, afterwards widening out to about 5 mm. at 2. An inner-marginal pale ochreous patch extending partially into area 2.

Underside f.-w. black portions replaced by pale ochreous striated by black nervule ends and rays, the black powdering of which gradually obliterates the yellow towards the hind angle. Some black at base of area 1b.

In h.-w. the area which is occupied above by the basal black and the inner marginal patch, is here entirely lemon ochreous, the hind-marginal border being of a darker shade of the same colour traversed by black nervule ends and rays. Black spots somewhat variable as follows:—One at base in area 9, one (sometimes two) in area 7, one on discocellular at origin of 6 and 7, three in cell, the first on subbasal sometimes absent, and the others often confluent. A spot at base of 2, a basal and two more distally placed spots in 1c (the latter often confluent), two spots in 1b (sometimes confluent) and two in 1a.

Head black with a pale yellow spot between eyes and two on collar. Thorax black with a few paler marks. Abdomen black above with lemon ochreous lateral spots and faint segmental lines. Claws equal.

♀. Expanse 60–72 mm. Resembles ♂ but dark areas rather browner, and the h.-w. inner marginal patch creamy white. In one example before me this patch is reduced to a mere dusting of whitish scales. On the underside the yellow is correspondingly paler and duller.

This species is quite unlike any other *Acraea*, and is easily recognised. The type in the Brussels Museum was taken at Lualuaburg in the Southern Congo. A long series of examples in the Oxford collection are from Entebbe and Kisumu. It doubtless occurs in the intermediate region, and I find no marked difference between the Congo examples and those from Uganda. I have inspected the type of Miss Sharpe's *A. pervia*, and find it does not differ from other Uganda specimens now before me.

GROUP XVIII.

113. ACRAEA IGOLA. Pl. XV, f. 6.

Acraea igola, Trimen, S. Af. Butt., 3, p. 379 (1889); Smith and Kirby, Rhop. Exot., 21, *Acraea*, p. 12, pl. 4, f. 5 (1892); Aurivillius, Rhop. Aeth., p. 112 (1898).

= *cerasa*, Smith and Kirby, *l. c.*, f. 2 (non f. 1) (1892).

= *obeira*, Trimen, Proc. Zool. Soc., p. 23 (1894).

♀. f. *maculiventris*, Smith and Kirby, Rhop. Exot., 29, *Acraea*, p. 16, pl. 5, f. 4, 5 (1894).

= *obeira*, ♀, Trimen, Trans. Ent. Soc., p. 172 (1891).

ZULULAND (Etshowe); RHODESIA (Chirinda); MANICALAND (Christmas Pass); NATAL (Malvern, Durban); GERMAN E. AFRICA (Amani, Usambara)

A. igola.

♂. Expanse 44–50 mm. F.-w. costa, apex, and hind margin black, broadest at apex. Basal portion almost to end of cell, proximal half of area 2, and the whole of areas 1a and 1b, except at hind margin, rather thinly scaled with brick red, remainder of wing almost transparent crossed by black scaled nervules, and slightly dusted with black scales which are much reduced in width. A black basal linear mark between median and submedian, and another in area 1a. The hind-marginal black is somewhat indented between the nervules by the transparent area. H.-w. brick red with a black hind-marginal border projecting inwardly on the nervules, and to a less extent between them. A greyish black basal suffusion widest in 1c. The inner margin yellowish. Black spots as on underside but somewhat less pronounced especially those in areas 3, 4, 5, and 6.

Underside, f.-w. very thinly scaled and having a glazed appearance, in some examples iridescent. The black areas replaced by reddish brown, and the red portions showing through from upperside.

H.-w. dull reddish, the marginal border brown crossed by black nervule ends and brown internervular streaks, the latter short and scarcely reaching the margin. Basal suffusion as above but dark greenish grey. Black spots as follows:—An outer or discal series of eight, the first, in 7, large, the second, third, and fourth, decreasing in size, and lying almost parallel to the hind margin, though the fourth, a minute spot not always present, is rather less distally placed. The fifth, in 3, small and close to end of cell, the sixth, seventh, and eighth large and nearly in a straight line almost at right angles to inner margin. Two spots on the discocellulars, a large subbasal in 7, two in cell, the second just before origin of 2, in 1c a basal and a subbasal, and beneath the latter a spot in 1b. A subbasal in 1a, and sometimes a very small additional spot in the same area. Some basal black in area 9, and a dot in 8 close to precostal.

Head, thorax, and abdomen black with a few very small yellowish spots. Claws equal.

♀. Expanse 50–54 mm. Markings as in ♂ but wings more rounded and red areas replaced by very pale ochreous or creamy white, and the black margins are suffused and thinly scaled. In some examples there is an indication of reddish internervular marks on the h.-w. marginal border. The subbasal spot in h.-w. cell is sometimes absent.

A. igola ♀ f. *maculiventris.*

The ♀ *igola* is dimorphic and judging from a long series before me the present form named *A. maculiventris* by Grose-Smith, would appear to be commoner than the whitish form described by Trimen as the type. The present form resembles the ♂ but the red areas are duller and paler, whilst the h.-w. hind-marginal border is invaded by the red ground-colour to a varying extent. In most cases the h.-w. underside presents a remarkable difference from that of the ♂. The marginal border is reddish brown and well developed, whilst the basal portion is chocolate brown extending to the discal row of spots. Between these and the marginal border is a broad, curved discal band of a dull pinkish colour. The general effect of this pattern is to give the underside a marked resemblance to that of *A. conradti.*

In the Vosseler collection at Berlin I found a very fine series of *A. igola* from Amani and Usambara in German E. Africa. The ♂♂ have the black spots of the upperside very distinct. On the underside the f.-w. is very iridescent, whilst the h.w. has a tendency to be yellowish rather than red. Some ♂ examples have all the scaling much reduced, the h.-w. marginal border being almost absent. The ♀ ♀ are of the *maculiventris* form, and one example before me has no black border in the h.-w. On the underside the discal curved band is pink, due to a sprinkling of whitish scales on a brownish ground. The hind-marginal border is orange brown.

114. Acraea aubyni. Pl. V, f. 6 (♂). Pl. XV, f. 9.

Acraea aubyni, sp. nov.

British E. Africa (Mwaeba Hill, 35 m. N.N.W. of Rabai).

♂. Expanse 50–56 mm. F.-w. elongated and with hind margin slightly concave. Cell, basal two-thirds of area 3, greater part of areas 2, and 1b, and a streak beyond middle of 1a, pale brick red. Costa, apex, a short space beyond cell, and greater part of 1a, sepia. A short blackish basal streak in area 1b. A subapical patch of three more or less transparent elongated spots in 6, 5, and 4. H.-w. basal half of 7, and 1c, base of cell, most of 1b, and all of 1a sepia. A sepia black marginal border 1·5 to 2·5 mm. broad, slightly edentate inwardly on and between the nervules. Remainder of wing pale brick red with black spots more easily observed beneath.

Underside. F.-w. very sparsely scaled except at apex and hind margin. Nervures and nervules finely black. Resembles upperside but all the sepia areas dull ochreous and there is an indication of a small blackish streak in cell. H.-w. dull ochreous, those areas which are sepia above being represented by a slightly darker ochreous shade. Hind margin bears short internervular rays which barely reach the margin or only do so in a fine point. Nervule ends on margin slightly thickened with black brown. Black spots as follows:—Two in 7, the second just beyond origin of nervule 7. Beneath the second and rather more distal a spot in 6, followed by one still more distal in 5. A spot at base of 5 on discocellular and a similar but smaller one at base of 4. One at base of 2, a basal, a subbasal and a distal in 1c and 1b, the two outer spots in latter area being rather further from base than the corresponding ones in 1c. A subbasal in 1a.

Head black with a yellowish spot between the eyes and two on collar. Thorax black. Abdomen black above with yellowish lateral spots. Claws equal.

♀. Expanse 60 mm. F.-w. for the most part transparent. Costa dusted with blackish. Apex rather broadly blackish as far as area 4 where the dark scales become confined to a narrow hind-marginal border fading into reddish in areas 1b and 1a. A slight dusting of dark scales on the discocellulars and beyond the cell, and a very small dark spot in cell, close to subcostal above the origin of nervule 2. Base slightly blackened and the whole of cell, and the greater part of 2, 1b and 1a faintly powdered with red. H.-w. blackish at base, and having a dark hind-marginal border as in ♂. Remainder of wing brick red but very thinly scaled. Black spots as in ♂ but those in 7, 6 and 5 beyond cell more distinct. Underside f.-w. as above but almost devoid of scales except at apex and hind margin where it is brownish ochreous. H.-w. base and marginal border brownish ochreous. Ends of nervules black with short dark internervular rays which do not reach margin. Central area sparsely scaled with whitish to which a pink tinge is transmitted from the red scales of the upperside.

This species is represented by a few examples kindly presented to the Oxford collection by the Rev. K. St. A. Rogers. It adds one more form to a very difficult group, the true affinities of which are very obscure. A single ♀ example has just been received. The species is apparently very closely allied to *igola*, but the h.-w. spots in 7, 6, and 5 are much nearer the cell than in that species. I have much pleasure in dedicating it to the Rev. K. St. Aubyn Rogers, to whose skill and generosity the Oxford collection owes so many valuable accessions.

115. ACRAEA ORESTIA. Pl. XV, f. 10.

Acraea orestia, Hewitson, Ent. Mo. Mag. 11, p. 131 (1874); Exot. Butt. *Acraea*, pl. 7, f. 47 (1875); Snellen, Tijdschr. v. Ent. 25, p. 217 (1882); Aurivillius, Ent. Tidskr., 14, p. 273 (1893); Rhop. Aeth., p. 112 (1898); Lathy, Trans. Ent. Soc., p. 186 (1903).

= *orestina*, Plötz, Stett. Ent. Zeit., 41, p. 190 (1880).

= *iturina*, Neave, Novit. Zool., xi, p. 346 (1904).

NIGERIA; FERNANDO PO; GABOON; CAMEROON; ANGOLA; CONGO (Bangala); UGANDA (Entebbe, Damba I.); BRITISH E. AFRICA (Tiriki Hills).

f. *humilis*, Em. M. B. Sharpe (*A. humilis*), Ann. Nat. Hist. (6) 19, p. 582 (1897); Aurivillius, Rhop. Aeth., p. 86 (1898); Smith & Kirby, Rhop. Exot. *Acraea*, 7, p. 23, pl. 7, f. 3 (1901).

BRITISH E. AFRICA (Tiriki Hills); UGANDA (Entebbe, Damba I.).

f. *transita*, f. nov.

= *humilis* ♂, Smith & Kirby, Rhop. Exot. *Acraea*, 7, p. 23, pl. 7, f. 1, 2 (1901).

British E. Africa (Tiriki Hills); Uganda (Entebbe, Damba I.).

A. orestia orestia.

♂. Expanse 38–40 mm. F.-w. transparent and highly iridescent, the scales much reduced in width. Base, costa, apex, and hind margin suffused with blackish. In some examples, as in those mentioned by Aurivillius (*l.c.*) from Bonge, Cameroon, as also in some from Agberi on the Niger, now before me, the black is of much less extent than in Hewitson's figure and the base of 1a, 1b, 2, and part of cell are flushed with red. The h.-w. is red with a little dusky suffusion at base and a blackish hind-marginal border 2–2·5 mm. wide rather noticeably darker near the anal angle. Numerous black spots often, as in the type, with a tendency to elongation. These are somewhat more distinct especially at base, on underside.

Underside. F.-w. like the upperside but very sparsely scaled and vitreous. Costa brownish yellow with a black spot at base.

H.-w. very thinly scaled and paler than above except for the black spots which are prominent, and often somewhat confluent. Of these there are, one in 8, two in 7 the outer one forming the first of a curved discal band of 5, in 7, 6, 5, 4, and 3 lying parallel to apical margin. One or two very small spots on discocellulars. A spot at base of area 2 followed by one in 1c and 1b, that in 1c being slightly nearer base. A subbasal and a central spot in cell, a subbasal in 1c and 1a, and a central spot in 1b. Ends of nervules blackish, and short blackish internervular rays.

Head and thorax black with a few pale spots. Abdomen black above with white segmental lines and lateral spots. Claws unequal.

♀. Expanse 44 mm. Like the ♂ but with more rounded wings and altogether paler. H.-w. underside has the reddish areas pinkish ochreous with some greyish ochreous near inner margin.

A. orestia f. *humilis.*

♂. Expanse about 38 mm. Wings transparent owing to reduction in width of scales and in some places to hairs. No red or yellow scales. F.-w. dusted with blackish brown at base, costa, apex, and slightly on hind margin. H.-w.

irregularly blackish at base, extending into cell and below median, with slight blackish scaling at anal angle. Thorax black, with pale spots, abdomen black above, yellowish beneath, and bearing small white lateral segmental spots.

♀ resembles ♂.

f. *transita.*

This form has the typical basal red of the f.-w. replaced by a black suffusion and the h.-w. red is replaced by white, yellow or orange. It is liable to occur in both sexes.

Almost every grade of intermediate may occur between the forms above described. Some time after I had decided that Miss Sharpe's *A. humilis* was a form of Hewitson's *orestia* a series of specimens was received at Oxford from Dr. G. D. H. Carpenter, who had bred them on Damba I. These contain both the typical red and the f. *transita*, and taken in conjunction with another series captured in the Tiriki Hills by Dr. C. A. Wiggins, containing all three forms, fully confirm my conclusion. The larva is described by Dr. Carpenter as having been mistaken by him for that of *A. alciope*,* from which I gather that the resemblance is extremely close.

116. Acraea cinerea. Pl. XV, f. 8.

Acraea cinerea, Neave, Novit. Zool., xi, p. 325, pl. 1, f. 16 (1904).
British E. Africa (Tiriki Hills, 5,000 ft.)

A. cinerea alberta, subsp.
Eltringham, Novit. Zool., xviii, p. 151 (1911).
90 km. W. of L. Albert Edward, 3,250 ft.

A. cinerea cinerea.

♂. Expanse 40 mm. F.-w. transparent owing to reduction in width of scales (hairs not present). Costa and apical region finely dusted with blackish scales. H.-w. evenly and fairly thickly clothed with blackish scales.

Underside f.-w. almost devoid of scales, deep red at base of costa. H.-w. thinly scaled and having deep red basal patch extending along lower half of cell nearly to end and inwardly to inner margin. A few minute and obsolescent black spots on margin of red area in 1b, 1c, and 2, and on upper discocellular, one spot in middle of cell, one near base in 1b, and two or three against the body at base. Marginal internervular folds distinct. Thorax and abdomen black above, brownish beneath. Abdomen with pale lateral segmental spots. Claws equal.

* See Pl. VI, f. 10.

♀. Expanse 45 mm. Resembles ♂ but margin of h.-w. rather less thickly scaled. Spots on underside rather more distinct and visible on upperside. A second spot in cell nearer base.

A. cinerea alberta. Pl. IV, f. 1 (♂).

♂. Expanse 45–50 mm. F.-w. as in *cinerea* but costal and apical scaling sooty black. H.-w. sooty black with a large central patch of crimson occupying base of 7, 6, 5, 4, 3, 2, middle of 1c, and end of cell.

Underside as in *cinerea* but the crimson area appears as a deep pink. Basal dark red as in *cinerea*. One example has no black spots on underside of h.-w.

♀ unknown.

A. cinerea occurs in the Tiriki Hills, N. of Kisumu at an elevation of over 5,000 ft.

The examples of *cinerea alberta* were taken some sixty miles W. of L. Albert Nyanza at an elevation of about 3,250 ft.

There is no difficulty in recognising this species as it is quite unlike any other African *Acraea*. The male armature is of a very simple though fairly distinctive character.

117. Acraea quirinalis. Pl. XV, f. 7.

Acraea quirinalis, Grose-Smith, Novit. Zool., vii, p. 544 (1900); Rhop. Exot. *Acraea*, 7, p. 24, pl. 7, f. 5 (1901).

German E. Africa (Usukuma); British E. Africa (Kisumu, Nandi); Uganda (Entebbe); Congo (Ituri Forest).

♂. Expanse 40–50 mm. F.-w. rather elongated, greyish, almost transparent (scales almost reduced to hairs). Base nearly to end of cell, base of area 2, and greater part of areas 1b and 1a flushed with red. Costa, apex and hind margin faintly darker than the remainder. At base of area 1b a well-marked black longitudinal streak, and in cell along the subcostal a well-developed black streak extending to a point above the origin of nervule 2.

H.-w. also thinly scaled, a little black at base, followed by a well-defined red patch which extends a little beyond the end of cell leaving a broad greyish semitransparent marginal border. This border is almost twice the width of that in the red form of *orestia humilis* and is not, or only very faintly, darker at anal angle. Black spots less distinct than on underside.

Underside f.-w. almost scaleless. H.-w. also nearly scaleless except the black spots which are arranged as follows:—One at base in 9, one in 8, two in 7, the second over origin of nervule 7, and forming the first of an outer row of eight. Of these the first five are roughly parallel to the outer margin, the sixth near base of area 2, the seventh in 1c at the same level, and the eighth in 1b rather more distal. In addition to these there are two spots in cell, the second just before origin of nervule 2; a basal and a subbasal in 1c, an additional spot in 1b, and two in 1a.

Head and thorax black with a few pale dots, abdomen black above with minute whitish lateral dots. Claws equal.

♀. Resembles ♂ but has rather more rounded wings, and the red of f.-w. is of rather less extent. In the h.-w. the red patch is outwardly much less sharply defined being invaded by the greyish dusting of the border both on and between the nervules. The spots in the upper part of the outer row may be absent.

It was some time before I was able to decide the correct nomenclature of *A. quirinalis* and *A. iturina* owing to the fact that the red form of *A. orestia* was nearly always found with them, and all three were mixed together in collections. Indeed of two alleged co-types of *quirinalis* sent to me for examination, one was *quirinalis* and the other the red form of *orestia*, Mr. Grose-Smith having failed to distinguish between them. I have since seen the type of *quirinalis* and find that it is not, as I thought it might be, only the red form of *orestia*. Familiarity with these forms enables them to be easily distinguished without regard to the colour or pattern, since *iturina* has the nervules 6 and 7 of the h.-w. stalked, whilst they arise independently in *quirinalis* and *orestia*, and the tarsal claws of the ♂ *quirinalis* are symmetrical, whilst those of *orestia* are asymmetrical.

Quirinalis occurs from Usukuma to Kisumu and Entebbe, and into the Ituri forest.

118. ACRAEA FORNAX. Pl. XV, f. 11.

Acraea fornax, Butler, Ann. Nat. Hist. (5), 4, p. 230 (1879); Mabille, Nat. Hist. Mad. Lep., 1, p. 106, pl. 9a, ff. 10, 10a (1885–7); Aurivillius, Rhop. Aeth., p. 103 (1898).

= *smithii*, Mabille, Ann. Ent. Fr. (5), 9, p. 341 (1879).*

MADAGASCAR (Fianarantsoa).

♂. Expanse 50 to 52 mm. F.-w. Basal half bright red extending to end of cell, very slightly into area 3, about half

* Strictly speaking, Mabille's name should stand. His paper was *read* on Jan. 8th, but not published till Oct. Butler's description was published in Sept. Mabille has himself, however, in the work on Madagascar, adopted the above synonymy.

the length of area 2, and to within about 3 mm. of the margin in 1b and 1a. Costa black with a little red at base. Outer portion of wing black, rather thinly scaled in discal area, and a more or less distinct partially transparent subapical patch formed of three spots in 6, 5, and 4. Nervules black and internervular black spurs along margin. A linear black mark at base of 1b. Sometimes a black spot in the proximal half of 2, and another in 1b nearer margin.

H.-w. bright red with a black hind-marginal border about 3 mm. wide having a somewhat irregular inner outline, being indented by the red ground-colour between the nervules especially in 3, 2, and 1c. Traces of red submarginal spots in 2 and 1c. Black spots corresponding with those on underside.

Underside f.-w. a pale replica of the upper with the addition of a black spot at base of costa and a marginal row of triangular brownish red internervular marks edged with black.

H.-w. Base pale pink followed by a dusting of madder brown scales, outside this a pale pink curved median band from costa to inner margin. Marginal band madder brown 2–3 mm. wide. A series of deep orange triangular marginal spots, their bases on the margin, and each enclosed in a black triangle the apex of which is produced in 4, 3, 2, and 1c into a short internervular ray. Black spots large. Three discal spots in 7, 6, and 5 parallel to apical margin. A large composite spot formed of one on discocellulars and one at base of areas 6, 5, and 4. A spot at base of 3 and of 2, the latter followed by a spot in 1c and 1b, all in a straight line at right angles to inner margin. A spot in 8 against precostal, one at base and one in middle of cell, a subbasal in 1c, one in 1b, and two in 1a. Some irregular black at base of wing.

Head black with a pale mark between the eyes, and two reddish tufts on collar. Thorax black with one or two minute pale spots. Abdomen black above with reddish lateral spots. Claws unequal.

♀. Expanse about 58 mm. Upperside like that of the ♂ but rather more thinly scaled, and the red colour paler and duller. The black spots of h.-w. show a tendency to elongation and the h.-w. black hind-marginal border is nearly twice as broad as in the ♂.

Underside much paler and duller than that in ♂ especially on the h.-w. hind-marginal border, the characteristic pattern of which is merely indicated. One ♀ in the Staudinger collection has the red areas replaced by white and the transparent part of f.-w. apical area much larger than in ♂. The underside is also whitish without any trace of the reddish marginal spots on either wing.

The species would appear to be rare. It occurs only in Madagascar.

119. Acraea strattipocles. Pl. XV, f. 13.

Acraea strattipocles, Oberthür, Etud. d'Ent., 17, p. 18, pl. 1, f. 9, pl. 3, f. 25 (1893); Aurivillius, Rhop. Aeth., p. 112 (1898).

Madagascar (Antsianaka, Alaotra).

♂. Expanse 50 to 54 mm. F.-w. Costa, apex, and hind margin black, widest at apex. About two-thirds of length of cell, proximal half of area 2, the whole of area 1b, except at margin, and the distal part of 1a except at margin, deep brick red. Remainder of wing transparent crossed by the black nervules, the transparency somewhat invading the marginal black between the nervules, and caused by a reduction in number but not in size, of the scales. Sometimes a trace of a black spot near base of area 2.

H.-w. deep brick red, yellowish at inner margin, and having a black hind-marginal border, the inner edge of which is fairly regular and not deeply indented by the ground-colour. Numerous large, more or less confluent, black spots more easily distinguished on underside.

Underside f.-w. nearly devoid of scales and very shining, the pattern of upperside showing through. Costa, apex, and hind margin dusted with umber brown, and a black spot at base of costa.

H.-w. pinkish varying from nearly white to dusky pink, more or less suffused with brown in lower half of cell, and basal portion of 3, 2, and 1c. Marginal border russet brown, divided by darker, broadly scaled nervule ends and narrow short internervular rays. Black spots as follows :—An outer or discal row of eight. The first large, in area 7, the second and third (in 6 and 5) rather smaller and respectively rather more distally placed. The fourth slightly more proximal, the fifth and sixth large and occupying the base of areas 3 and 2 respectively. The seventh and eighth large and nearly in a straight line with the sixth, at right angles to inner margin. This row of spots is practically confluent. In addition to these, a basal spot in 9, a dot in 8 near precostal, a large subbasal spot in 7, a smaller spot near base of cell, and a second and larger spot in cell *beyond origin of nervule* 2. A basal and a subbasal in 1c, beneath the latter a spot in 1b, and two spots in 1a.

Head black, thorax black with white dots, and reddish tufts on collar. Abdomen black above with white segmental dots and lines. Claws unequal.

♀. Expanse 64–66 mm. Pattern and markings much as in ♂ but the red colour duller and browner, and the black margins browner than in the ♂. The hind-marginal border of h.-w. has its inner edge more softly outlined though it remains fairly regular as in the ♂.

A. strattipocles may be distinguished from *A. masamba* and *A. sambavae* by the more distal position of the second spot in the h.-w. cell.

120. Acraea masamba. Pl. XV, f. 14.

Acraea masamba, Ward, Ent. Mo. Mag., 9, p. 3 (1872); Af. Lep., p. 10, pl. 7, f. 3 (1874); Saalmüller, Lep. Mad., 1, p. 75, pl. 3, f. 32 (1884); Mabille, Nat. Hist. Mad. Lep., 1, p. 103, pl. 9a, f. 1, 1a, 2 (1885–7); Aurivillius, Rhop. Aeth., p. 112 (1898).

= *rüppelli*, Saalmüller, Ber. Senck. Ges., p. 80 (1878).

Madagascar (Ste. Marie, Fenerive, L. Humblot, Antakares, Tamatave).

f. *silia*, Mabille, Nat. Hist. Mad. Lep., 1, p. 105, pl. 9a, f. 3, 4 (1885–7).

= *masamba*, Ward, Af. Lep., pl. 7, f. 4 (1874).

Madagascar (Antsianaka, L. Alaotra).

♀ f. *boscae*, Saalmüller, Ber. Senck. Ges., p. 259 (1880); Lep. Mad., 1, p. 76, pl. 1, f. 3 (1884); Mabille, Nat. Hist. Mad. Lep., p. 106 (1885–7).

A. masamba masamba.

♂. Expanse 48–56 mm. F.-w. Transparent, owing to a reduction in size and number of the scales. Costa and apex black, and the nervule ends along hind margin expanded into black triangles their bases joined on the margin. About two-thirds of cell, base of area 2, and the greater part of area 1b suffused with bright brick red. Area 1a black with a slight powdering of red in the outer half. In some examples a small black mark in cell, near middle, close to subcostal, occasionally extended into a blackish suffused line running obliquely across cell to near origin of nervule 3. Usually a black linear mark at base of area 1b.

H.-w. bright brick red, usually with a slight black basal suffusion, most extensive in 1c. A black hind-marginal border 2–3 mm. wide, edentate inwardly on the nervules, thus producing a much more broken inner outline than in *A. strattipocles.* Black spots as on underside. Inner margin yellowish white.

Underside. F.-w., the greater part almost devoid of scales. The red areas showing through from the upperside. The black of upperside reproduced in sepia scales. Both sides of the median nervure, and the basis of nervules 2 and 3 densely clothed with large, ovate, golden ochreous scales. (This feature is not present in *strattipocles.*) Costa with a small black mark at base.

H.-w. pinkish white, the black border of the upperside reproduced in sepia, nervule ends and short fine internervular rays rather darker. Black spots as follows :—An outer row of nine, the first very large in area 7 above origin of nervule 7, the second smaller in 6 and nearer margin, third still smaller in 5 and nearer margin, fourth minute in 4 and further from margin than third (third and fourth sometimes very minute or absent,) fifth of medium size at base of area 3, sixth, about as large as first, at base of area 2, and often somewhat produced outwardly, seventh large, more or less heart-shaped, its inner edge at level of origin of 2, eighth in 1b, rather smaller, and nearer margin, ninth small in 1a nearer base. A spot in 9, one in 8 against precostal, two in cell, the second lying *before origin of nervule* 2, a basal and a subbasal in 1c, a little basal black and a subbasal spot in 1b, and a subbasal in 1a on a level with that in 1c.

Head black with a yellow spot between eyes and two on collar, thorax black above with whitish dorsal and lateral marks, abdomen black above with whitish lateral spots and segmental lines. Claws unequal.

♀. Expanse about 66 mm. Resembles ♂ but f.-w. more rounded, and general colouring paler and duller. On the f.-w. underside there are a few large yellow and orange scales on the median nervure but not so closely packed as in ♂.

A. masamba f. *silia.*

Ward's figures show a red form which is the typical *masamba* and a yellow form (not described in the text) which is really somewhat intermediate between the f. *silia* and f. *boseae* of Saalmüller. The form *silia* resembles the type form except that the red colour is replaced by a rich golden yellow, much paler in the ♀. There seems to be a constant tendency towards absence of the spots in areas 5 and 4 of h.-w.

M. Charles Oberthür, to whom I am indebted for the opportunity of making a careful examination of a series of *masamba*, *silia* and *strattipocles*, asserts, in a letter, his firm opinion that *masamba* and *silia* are distinct species. I regret that I should feel compelled to differ from the view of an eminent collector to whom I owe so much valuable assistance. The sole difference between the two forms is one of colour. Certainly the ground-colour in h.-w. seems, in *silia*, always to be slightly extended outwards in area 4, thus causing an indentation in the black of the marginal border, but the same feature is observable in varying degrees of development in a series of *masamba*. On the other hand, there is in both forms the same heavy yellow scaling of the f.-w. median nervure on the underside, the transparency of the f.-w. is caused in the same manner, and the male armatures are not distinguishable. The alternation of red, yellow, and white is a common phenomenon in other species, and I feel bound therefore to consider *silia* as merely a form of *masamba*.

A. masamba ♀ f. *boseae*.

This is a form in which the red areas are replaced by pale yellowish white, with a perhaps still greater tendency than in f. *silia* to absence of spots in h.-w. areas. So far I have only seen ♀♀ of this form, and judging by the analogy of other Madagascan species the white colour is probably confined to that sex. A ♀ of the *silia* form now before me has, in the h.-w., the inner margin, and the space between the marginal border and the spots in areas 1b to 3, almost white.

121. Acraea sambavae. Pl. XV, f. 15.

Acraea sambavae, Ward, Ent. Mo. Mag., 10, p. 59 (1873); Mabille, Nat. Hist. Mad. Lep., 1, p. 101, pl. 10, f. 7–9 (1885–7); Aurivillius, Rhop. Aeth., p. 112 (1898).

Madagascar.

♂. Expanse 54–56 mm. F.-w. Costa and apex powdered with black, nervule ends broadly powdered with black on hind margin forming a narrow border with a sinuous inner outline. Cell almost to end, base of area 3, basal half of 2, and the whole of area 1b, except just on margin, powdered with deep brick red. Area 1a black powdered with red. Remainder of wing transparent, due to a reduction in number and not in size of the scales, these being also set somewhat on edge. H.-w. brick red, yellowish in areas 1a, 1b, and 1c, and having a slight black basal suffusion. At extremities of nervules there are black triangles, their bases contiguous on the margin. Black spots as on underside, but those of outer row rather larger.

Underside. F.-w. for the most part devoid of scales. Dusted with sepia on costa, apex, and along hind margin. H.-w. Base to outer row of spots, and on hind margin, brownish pink, intervening space dull pale pink. Nervule ends on margin blackish brown. Short internervular folds rather distinct but not blackened. Black spots as follows :—An outer row of eight (sometimes nine). The first two in 7 and 6 large, and placed beyond origin of nervule 7, the third and fourth in 5 and 4 smaller, and placed much nearer margin, the fifth at base of area 3, sixth adjacent to it in 2, and the seventh and eighth in 1c, and 1b, in line with the sixth and nearly at right angles to inner margin. Sometimes a ninth spot in area 1a. Some black at base of wing, a spot in 8 against precostal, a large transverse subbasal spot in 7, two in cell, the second lying at or before origin of nervule 2, one or two spots on upper part of discocellulars, a subbasal in 1c and 1a, and more distally placed than these a spot in 1b.

Head black with a reddish dot between the eyes and two on collar, thorax black above with indications of a few pale markings, abdomen black above with dull yellowish lateral spots and intersegmental lines. Claws unequal.

♀. Expanse 60–70 mm. Resembles the male but the red areas are either duller and paler, or may vary to yellowish white.

I have seen but few examples of this species. It may be distinguished from *masamba* by the more distal position of the h.-w. spots in areas 4 and 5, by the much less developed h.-w. marginal border, and by the greater extent of red in the f.-w.

I have no special localities for this purely Madagascan species. Mabille describes the species as rare in that island and as inhabiting the eastern wooded areas. One example in the Oxford collection is labelled S.W. Madagascar.

GROUP XIX.

122. Acraea safie. Pl. XV, f. 1.

Acraea safie, Felder, Reise Novara Lep., p. 370 (1867); Aurivillius, Rhop. Aeth., p. 114 (1898); Rothschild and Jordan, Novit. Zool., xii, p. 183 (1905).

ABYSSINIA (Gardulla).

A. safie f. *antinorii*, Oberthür (*A. antinorii*), Ann. Mus. Genov., xv, p. 157, pl. 1, f. 3 (1880); xviii, p. 719 (1883); Aurivillius (var.? *antinorii*), Rhop. Aeth., p. 114 (1898); Pagenstecher (*safie* var. *antinorii*), Jahrb. Nass. Ver. Nat., lv, p. 136 (1902); Roth. and Jord., Novit. Zool. xii, p. 183 (1905).

ABYSSINIA (Gara Daij, Abulcassim, Schoa, Dara R., Malo, Kaffa).

A. safie safie.

♂. Expanse 44–45 mm. F.-w. brown black. Beyond cell a series of four translucent spots, dusted with ochreous. The first very small in area 9, the remainder large, subquadrate, and separated only by nervules 5 and 6. At base of area 2 a large ochre yellow spot, and beneath it in 1b a somewhat larger patch of the same colour.

H.-w. brown black with a central band of ochre yellow, extending from costa almost to inner margin, the portion above nervule 4 being some 2 mm. broader than the remainder.

Underside. F.-w. Central portion greyish brown. Costa, apex, and hind margin pale ochreous, striated by narrowly black nervules and rays. The subapical spots white, those in 2 and 1b as above but paler.

H.-w. pale dusky ochreous, with the central band as above but paler. Hind-marginal border striated by very narrowly darkened nervules and rays. A few very small black spots so variable in number as to be of little use as a character. When two are present in cell, the second is situated before the origin of nervule 2.

Head and thorax black with a few pale markings. Abdomen black above with pale ochreous lateral dots. Claws equal.

♀. I have not seen a ♀ corresponding to this form.

A. safie f. *antinorii.*

This form differs from typical examples principally in having the spots and h.-w. band much reduced. In one example before me there are three small whitish subapical spots, a small ochreous mark at base of area 2, and beneath it a very slight trace of ochreous in 1b. The h.-w. is all brown black with just a few ochreous scales in area 6. A trace of such scales may also be discerned with a lens in areas 7 and 5.

Underside extremely variable. In one example before me it is much as in the type form. In a second the h.-w. is all dull greyish ochreous, slightly darker on the hind-marginal border, whilst in a third the basal portion of h.-w. is dull ochreous, and the inner portion of the hind-marginal border is dusted with reddish brown, this suffusion reaching the cell in area 3. This example has only three black spots on the underside, viz. two on the discocellulars, and one in 1b.

♀ resembles the ♂.

This species, which is quite distinctive in appearance, appears to occur only in Abyssinia.

123. Acraea amicitiae. Pl. XV, f. 12.

Acraea amicitiae, Heron. Trans. Zool. Soc., 19, p. 148, pl. 5, f. 11 (1909).

Mt. Ruwenzori.

♂. Expanse 50–56 mm. F.-w. hind margin rather markedly concave. Base, costa, distal half of wing, hind margin and inner margin brown black. Cell, middle of 2, and greater part of 1b, tawny red. Beyond cell a band of three pale spots separated by nervules 6 and 5, sometimes transparent, sometimes dusted with reddish yellow, and followed by a small separate spot in 3 similarly variable. In cell an irregular black spot wide at subcostal, narrowing suddenly in the middle and reaching median at origin of nervule 2. A black spot at base of 2 distally indented by the red colour, and beneath it a sinuous black spot in 1b. In some examples indications of reddish submarginal dots.

H.-w. tawny-red, base of area 7, upperside of median to end of cell, base of 2, and basal half of 1c, 1b and 1a black. A black submarginal line beginning at costa and proceeding parallel to margin as far as nervule 3 where it suddenly widens out to a broad black submarginal band which reaches inner margin. Between this and the margin the nervule ends are rather broadly black and join a fine black marginal line, thus enclosing large quadrate spots of the ground-colour. A few small black spots corresponding to those beneath.

Underside. F.-w. Costa, apex, and margin dark ochreous crossed by black nervules, and having on margin orange brown internervular rays. Those parts which above are red or black are here almost scaleless, the black marks only showing through from upperside. A black dot at extreme base of costa. A fine black line round margin.

H.-w. Basal and distal part of 7, base of cell, and basal half of 1c, 1b, and 1a pale grey. Middle of 7, end of cell, and bases of 6 and 5, reddish. Beyond cell pale brownish pink, the margin tawny orange, and the black submarginal line and band of upperside showing slightly through. Nervule ends black joining in a fine black marginal line. Small black spots as follows:—One, minute, in 8 (often absent), two in 7 close together, the second just beyond origin of nervule 7. Beneath this and nearer margin two small spots in 6 and 5. A spot at base of 2, a V-shaped spot in 1c (often divided) and a spot in 1b, these three all in a straight line at right angles to inner margin. One spot in middle of cell and one at extreme end, one on discocellulars at base of nervule 6, and a similar one at base of 5, a basal and a subbasal in 1c, beneath it a spot in 1b, and another in 1a, also a subbasal in the latter area.

Head and thorax black with yellowish dots; abdomen black above with yellowish lateral dots and fine pale segmental lines. Claws unequal.

I have not seen a ♀ of this species.

A. amicitiae is a very distinct and apparently local species. It occurs on Mt. Ruwenzori from 6,000 to 13,000 ft.

124. Acraea ansorgei. Pl. XVI, f. 5 (♀).

Acraea ansorgei, Grose-Smith, Novit. Zool. v, p. 351 (1898); Aurivillius, Rhop. Aeth., p. 117 (1898); Grose-Smith, Rhop. Exot. (*Acraea*), 6, p. 21, pl. 6, f. 9, 10 (1901).

British E. Africa (Nandi Station, Limoru).

There are before me four examples of this species, all ♀ ♀. Grose-Smith first described the type as a ♀ and afterwards figured it as a ♂, but his first conclusion was the correct one. His figure is like the insect in pattern only, as it shows the paler areas bright yellow, whereas in the type they are orange tawny.

As no two of the examples before me are alike, I will first describe the typical form, afterwards indicating the points in which the remaining three respectively differ.

♀. Expanse 40–50 mm. F.-w. Base suffused with dark brown as far as origin of nervule 2. Beyond this the costa, cell, extreme base of area 3, basal half of 2, and the whole of 1b and 1a, orange tawny. Remainder of wing dark brown. A series of three subapical tawny spots separated only by the subcostal and nervule 6, followed by a submarginal spot in area 4.

H.-w. entirely orange tawny except for a very slight brownish suffusion at base, and faint indications of two or three minute black subbasal dots.

Underside. The tawny colour of a duller shade. F.-w. slightly darkened at base. Between end of cell and the outer tawny spots, as dark as on upperside, the spots paler, and the apical and marginal area dull red brown.

H.-w. with a faintly indicated dusky curved band beyond cell extending from costa to inner margin. A few small black dots variable in number, the specimen with the greatest number of these shows one at base in 9 and 1c, one in 8, two in 7 the second well beyond origin of nervule 7, two in cell, the second before origin of nervule 2, faint indications of discal spots in 6, 5, 4, and 3, and two in 1c, 1b, and 1a respectively.

Head and thorax black with two reddish tufts on collar, abdomen black above with yellowish lateral white dots.

The three other examples of this species now before me differ from that above described in the following manner:—

(1) The central band of f.-w. is pale tawny, the spots rather darker in shade. The h.-w. is pale creamy white, slightly blackened at base.

(2) All the light areas in both wings pale ochreous.

(3) F.-w. central band and the whole of h.-w., except at base, pale creamy white. F.-w. subapical spots pure white.

This peculiar species seems to occur only on the east side of L. V. Nyanza, two of the above examples being labelled Nandi country, one "60 m. along the Anglo-German Boundary," the fourth Limoru, at mile-post 407 on the Uganda Railway. It is remarkable that they should be all ♀♀, and one is tempted to suppose that they are merely one more form of the polymorphic *A. conjuncta.* Though such may well be the fact, it seems better, with the present paucity of material, to keep the form separate.

125. Acraea conjuncta. Pl. XIV, f. 13.

Acraea conjuncta, Grose-Smith, Novit. Zool., v, p. 351 (1898); Aurivillius, Rhop. Aeth., p. 117 (1898); Grose-Smith, Rhop. Exot. (*Acraea*), vi, p. 22, pl. 6, f. 11, 12 (1901).

f. *interrupta* f. n.

♀ f. *silacea* f. n.

♀ f. *mutata* f. n.

♀ f. *pica* f. n.

♀ f. *lutealba* f. n.

♀ f. *suffusa* f. n.

British E. Africa (Kavirondo, Nairobi, Aberdare Hills, Mt. Kokanjero).

A. conjuncta conjuncta.

♂. Expanse 40–46 mm. F.-w. deep brown-black. A central curved band of deep ochreous formed by a quadrate spot occupying the whole of distal end of cell, a similar patch in 2 not quite reaching the base of that area, and a central patch in 1b, and 1a. A small spot of the same colour at base of area 3. Beyond cell a subapical series of 3–4 small deep ochreous spots in 10, 9, 6, and 5, followed by a submarginal spot of the same colour in area 4.

H.-w. deep ochreous, the base suffused with dark brown, the inner margin powdered with the same colour as far as 1b. A hind-marginal border of dark brown 3–4 mm. wide its inner edge somewhat irregular and edentate between the nervules. A few minute black discal spots faintly indicated.

Underside paler and duller, the pattern much less distinct. In h.-w. some minute black spots very variable in number. The example before me having the largest number of these spots shows the following :—A basal spot in 9 and in 1c. Two in 7, the outermost well beyond origin of 7, one in cell before origin of 2, a series of three small discal spots in areas 5, 4, and 3 in a nearly vertical line, one in 1c and 1b, and one in 1a.

Head black with two reddish tufts in collar. Thorax black, abdomen black above, with minute lateral yellowish dots. Claws unequal.

♀. Expanse about 35 mm. Resembles the ♂.

f. *interrupta.*

In this form which occurs in both sexes the central band of the f.-w. is not continuous but is broken into spots, that in area 1b being sometimes reduced to a mere streak.

♀. f. *silacea.*

The f.-w. spots, and the central patch of h.-w. are pale ochreous.

♀. f. *mutata.*

Resembles the foregoing but the f.-w. subapical spots are white.

♀. f. *pica.*

All the pale markings are white.

♀. f. *lutealba.*

The pale markings of f.-w. are orange ochreous, whilst the central patch of h.-w. is white.

♀. f. *suffusa.*

In the f.-w. the brown black ground-colour is much reduced in area and remains only as a basal and a subapical suffusion, a little dark scaling remaining on the nervules in the subapical region. The remainder of the wing is orange ochreous. In the h.-w. the dark border, though nearly as wide as in other forms has a much browner appearance owing to an admixture of orange ochreous scales. Base and inner margin suffused with greyish. Remainder of wing orange ochreous.

A. conjuncta is still rare in collections, indeed until quite recently only very few examples were known. It has however lately been taken in some numbers by Neave on Mt. Kokanjero, and his series contains all the forms mentioned above. The polymorphism of the species appears to be associated with that of *A. johnstoni*, a great number of forms of the latter having been taken at the same time and place.

126. ACRAEA DISJUNCTA. Pl. XIV, f. 12.

Acraea disjuncta, Grose-Smith, Novit. Zool., 5, p. 351 (1898); Aurivillius, Rhop. Aeth., p. 117 (1898); Grose-Smith, Rhop. Exot. (*Acraea*), vi, p. 20, pl. 6, f. 7, 8 (1901); Heron, Trans. Zool. Soc. xix, p. 148 (1909).

= *Planema nandensis.*, E. M. B. Sharpe, Ann. Nat. Hist., iii, p. 244 (1899).

BRITISH E. AFRICA (Nandi); CONGO (nr. L. Kivu; Mt. Ruwenzori, 5–7,000 ft.; "90 km. W. of Albert Nyanza").

♂. Expanse 44–48 mm. F.-w. Costa, cell, base of 1b and 1a, apical area, and hind margin sepia black. A large subapical and inner marginal patch of pale ochre yellow. The dark colour extends a little beyond cell and is continued in area 3 so as to join, or nearly join, that of the hind margin, thus isolating a subapical patch of the paler colour. This patch is almost 4 mm. wide in areas 6, 5, and 4, is somewhat narrower at costa, and in area 3 is reduced to about 2 mm. The inner marginal patch occupies the whole of area 2 except at hind margin, and becomes gradually wider to the inner margin.

H.-w. pale ochre yellow with a slight dusting of brownish scales at base, and a hind-marginal border of sepia brown the inner edge of which is slightly suffused.

Underside. A pale replica of the upper, the f.-w. cell somewhat suffused with pale ochreous, and the darker colour of apex, margin, and base of area 1b, dusky ochreous. Nervule ends and rays finely marked in black brown. H.-w. margin dusky ochreous. Nervules and rays finely marked in black brown, the latter long and extending inwards almost to cell.

A few minute black spots of which there are, one at base in 9, one in 8, 2 in 7, two in cell (close together, the second just before origin of nervule 2) and two in 1c, 1b, and 1a.

Head and thorax black with a few yellowish spots. Abdomen black above with dark ochreous lateral spots and segmental lines. Claws unequal.

♀. Expanse 50 mm. Resembles ♂ but in some examples there is a dusting of ochreous scales near end of f.-w. cell and the brown basal colour is sometimes not quite extended to the marginal border, the subapical and hind-marginal patches thus being continuous. In the h.-w. the inner edge of the marginal border is rather more suffused than in the ♂ and is sometimes slightly powdered with orange ochreous scales whilst the dark colour is narrowly edentate on the nervules.

On the underside the h.-w. base a curved suffused band of brownish colour beyond the cell, followed by a paler area, and the marginal border is inclined to reddish brown.

This species appears to be fairly common some 20 m. N. of Kisumu, whence a good series has been received by the Oxford Museum from Mr. C. A. Wiggins. Examples from other localities than Nandi have usually much heavier black markings. It is a much smaller insect than *A. jodutta*, and is easily distinguished from *A. alciope* by the extension of the f.-w. dark costal colour to the margin, and by its duller ochreous colour. At the same time it is very closely allied to *alciope*, though the latter has equal claws in the ♂.

127. Acraea alciope. Pl. XIV, f. 11.

Acraea alciope, Hewitson, Exot. Butt. (*Acraea*), pl. 1, f. 4 (♀ non ♂), 1852; Karsch, Berl. Ent. Zeit., 38, p. 196 (1893); Aurivillius, Rhop. Aeth., p. 116 (1898); Eltringham, Af. Mim. Butt., p. 44, pl. 3, f. 23 (1910); Poulton, Bedrock, p. 59 et seq., ff. 3, 4, 8, 9, 10 (1912).

♂ (=*cydonia*), Ward, Ent. Mo. Mag., 10, p. 59 (1873); Karsch, Berl. Ent. Zeit., 38, p. 196 (1893); Aurivillius, Ent. Tidskr., 14, p. 278 (1893); Eltringham, Af. Mim. Butt., p. 44, pl. 3, f. 16 (1910).

Ivory Coast; Ashanti; Togo; Cameroon; Fernando Po; Congo (Inkissi R., Aruwimi R., Kassai R.) to Uganda (Toro, Entebbe).

♀ f. *macarina*, Butler, Proc. Zool. Soc., p. 221, pl. 17, f. 6 (1868); Hewitson, Exot. Butt. (*Acraea*), pl. 1, f. 5 (1852); Aurivillius, Ent. Tidskr., 14, p. 278, f. 6 (1893); Rhop.

Aeth., p. 116 (1898); (metamorph.), Ent. Tidskr., 14, p. 278, pl. 5, f. 3 (1883).

Gold Coast; Ashanti; Calabar; Cameroon; Fernando Po; Congo (Maringa, Kassai R., Stanley Pool, Bopoto, Ft. Beni).

♀ f. *cretacea*, f. nov.

= *alciope* ♀ Poulton, Bedrock, 1, p. 63, f. 11 (1912).

Lagos.

♀ f. *fumida*, f. nov.

Lagos.

♀ f. *aurivillii*.

= *A. aurivillii*, Staudinger, Iris, 9, p. 209, pl. 2, f. 2 (1896); Aurivillius, Rhop. Aeth., p. 117 (1898); Eltringham, Proc. Ent. Soc., p. lxvii (1909); Af. Mim. Butt., p. 45, pl. 8, f. 4 (1910).

= *Planema alicia* ♀, Grose-Smith, Novit. Zool. vii, p. 546 (1900); Smith and Kirby, Rhop. Exot. (*Acraea*), 8, p. 30, pl. 8, f. 11 (1901).

= *alciope* ♀ Poulton, Bedrock, p. 62, ff. 7, 14 (1912).

Cameroon to Uganda (Toro, Entebbe).

f. *latifasciata*, Grünberg, Sitzb. Gesell. naturf. Freunde, p. 164 (1910).

♀ f. *tella*, f. nov.*

= *Planema alicia* "♂," Grose-Smith, Novit. Zool., p. 546 (1900); Smith and Kirby, Rhop. Exot. (*Acraea*), 8, p. 30, pl. 8, f. 9, 10 (1901).

= *alciope* ♀ Poulton, Bedrock, p. 62, f. 12 (1912).

Uganda (Entebbe, Pt. Alice).

A. alciope schecana, subsp., Roth. and Jord., Novit. Zool., xii, p. 184 (1905); Eltringham, Af. Mim. Butt., p. 44 (1910).

Abyssinia (Scheko).

A. alciope alciope. Pl. VI, f. 10 (larva).

♂. Expanse, 54–64 mm. F.-w. Cell, base of 1a, 1b, 3, 4, 5, and 6, costa, apex, and hind margin brown-black. Remainder golden ochreous, this colour forming an angulated band across the wing, narrow at costa, and proceeding downwards and outwards to nervule 3, where it becomes wider, occupying the whole of area 2 except the hind margin, and reaches its maximum width on inner margin.

H.-w. golden ochreous. A very little brown black at base, and a hind-marginal border of the same colour some 3–4 mm.

* The name *alicia* cannot be retained, as I indicated in Proc. Ent. Soc., *l. c.* (1909).

wide, its inner edge rather deeply edentate on and between the nervules. Near base the spots of the underside are faintly indicated.

Underside. F.-w. The dark areas of upperside are here replaced by dusky yellow, somewhat blacker just beyond cell. The nervule ends and rays black. A dark spot enclosing a pale dot at base of costa, yellow band as on upperside, but paler and duller.

H.-w. warm ochre yellow with a dusky powdering on hind-marginal border. Nervules and rays black. Black spots as follows :—One at base in 9, one in 8, two in 7, the second over origin of nervule 7, two in cell, the second over origin of nervule 2. Sometimes a small dot near base of area 5. A basal, a subbasal, and a median spot in 1c, and the same in 1b. A subbasal in 1a, and sometimes a second very small spot in the same area.

Head black with a yellowish dot between, and two white lines behind the eyes. Thorax black with yellowish dorsal and lateral spots. Abdomen black above with deep yellow lateral spots increasing in size towards the extremity. Between the spots pale transverse segmental lines. Claws equal.

♀.* Expanse 57–70 mm. F.-w. Costa, cell, and base of areas 1b, 4, 5, and 6, powdered with black. Outer half of wing grey black. Subcostal, median, base of area 2, middle of area 1b, and the greater part of 1a, orange tawny, this colour radiating somewhat along the nervules in the central area of wing. At base of area 3 a black spot, beneath it in 2 a larger transverse spot, and beneath the latter, but rather nearer base, a subcrescentic spot in 1b.

H.-w. slightly darkened at base. Basal half orange tawny. Hind margin broadly grey black, its inner edge deeply radiate. The basal spots of underside are visible as brownish markings.

Underside much as above, but f.-w. ochreous grey with some black just beyond, and a black streak at end of cell. A dull orange suffusion about median, base of area 2, and middle of area 1b. On outer half of wing the nervule ends are reddish brown, and between them are rather broad black rays. H.-w. brownish at base, a pinkish white flush beyond cell, remainder ochreous grey striated by black nervures and nervules. Spots as in ♂ but larger, and often an extra spot in cell and one near base of areas 6 and 2.

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* I regard the typical ♀ as the form figured by Hewitson (*l. c.*), and it is this form which is here described.

A. alciope ♀ f. *macarina.*

This form more nearly resembles the ♂ in that it has a continuous band of dark ochreous in the f.-w., but this band is narrow, and in areas 3, 2 and 1b is deeply indented by the grey-brown of the hind margin. The black spots in the same areas are outwardly well defined but basally, especially in 2 and 1b, they become diffused into the basal brown. The h.-w. is deep ochreous with a powdering of brown black about apex and along hind margin. Nervules and rays well marked, and scaled with black-brown. The underside corresponds to the upper, but in the f.-w. the dark areas are replaced by dusky ochreous, and the black spots in 3, 2, and 1b are well defined.

A. alciope ♀ f. *cretacea.*

Basal half of wing sepia black, somewhat darker just beyond cell and in areas 3, 2, and 1b, where the spots occur in the typical form. An inner marginal suffusion of reddish brown extending into middle of area 1b. Beyond the dark basal portion a band of white which is inwardly sharply defined but outwardly becomes rapidly diffused into the sepia grey which occupies the distal half of wing.

H.-w. tawny brown, the hind margin sepia grey radiating deeply into the ground-colour. Underside corresponding to the upper, but distal portion of f.-w. ochreous grey, and the curved black mark in 1b very distinct. H.-w. pale ochreous brown, otherwise as in typical examples.

A. alciope ♀ f. *fumida.*

The pattern of the wings is almost obliterated. Both wings are sepia brown somewhat darker at base, a slight reddish powdering in the middle, and with traces of the normal black spots.

A. alciope ♀ f. *aurivillii.*

Bears a striking resemblance to *Planema poggei nelsoni*, and allied forms.

F.-w. brown black with a broad central band of orange ochreous inwardly irregular though sharply defined; outwardly, especially in areas 3, 2, and 1b, often deeply indented by the brown-black ground-colour.

H.-w. a triangular umber brown patch at base, followed by a central transverse band of white, the remainder of wing brown black, reddish brown, or even tawny; this area being heavily striated by the dark nervules and rays.

Underside. F.-w. as above but paler and duller. Traces of the black spots in 3, 2, and 1b are visible. H.-w. basal triangular patch chocolate brown with the usual black spots more developed than in western forms. Remainder of wing as on upperside.

The outline of the orange band of f.-w. is somewhat variable, being sometimes deeply indented, sometimes nearly straight. Examples presenting the latter condition have been named var. *latifasciata* by Grünberg.

A. alciope ♀ f. *tella*.

This is the form figured by Grose-Smith as the ♂ of his "*Planema alicia*." It is however a ♀ and differs from the usual *aurivillii* form in having the ground-colour of h.-w. tawny without any white bar, and bearing a narrow dark hind-marginal border, widest at apex and tapering to anal angle.

A. alciope schecana, subsp.

This is the Abyssinian form of the species, and is described by Rothschild and Jordan from one ♂ in the Tring collection. The ochreous band of the f.-w. upperside is somewhat paler than in West African examples, and the black distal border of the h.-w. is wider. On the underside the black spots of h.-w. are reduced in size and number.

The descriptions of the larva and pupa, given by Aurivillius (*l. c.*) are as follows:—

Larva pale (yellowish?) with narrow dark transverse lines. Head, true legs, and spines, black. The sublateral spines, however, only black at the ends. The spines distinctly longer than the diameter of the body, and arising from brownish tubercles.

Pupa, having the usual black markings of the *Acraea* pupae. The spots of the abdomen have pale centres, and the two dorsal rows converge in a black spot on the first segment. In the pale centres of the dorsal spots of segments 2–5 (6) are small pointed tubercles, largest at segment 2 and decreasing posteriorly.

These descriptions agree fairly well with specimens received from Mr. Lamborn, from Lagos. One of these larvae I have figured on Pl. VI, fig. 10. It will be noted that the ground-colour is green. This colour is rapidly lost in spirit, a fact which would account for the doubt expressed by Aurivillius as to the colour of the larva. At Lagos it feeds on *Fleurya podocarpa*, Wedd. (*Urticaceae*). I cannot regard the *aurivillii* f. of *A. alciope* as a subspecies, since it occurs with the typical form in Cameroon as well as in Uganda, and probably occasionally in the intervening country. It is an interesting fact that at Entebbe, where this is the usual form of ♀, it habitually flies with the *Planema* which it so closely resembles, whilst the typical ♀, which is much the commonest form in its western range, also accompanies an entirely different *Planema* which it appears to imitate. Uganda examples of *A. alciope* ♂ seem often to have the black distal border in the h.-w. broader than in more western specimens.

128. ACRAEA JODUTTA. Pl. XIV, f. 10.

Acraea jodutta, Fabricius (*Pap.*), Ent. Syst., 3, 1, p. 175 (1793)*; Butler (*A*), Fabr. Lepid., p. 130 (1869); Aurivillius, Rhop. Aeth., p. 116 (1898); Ann. Mus. Genov., 3, iv, p. 20 (513) (1910); Eltringham, Af. Mim. Butt., p. 80 (1910); Grünberg, Sitzb. Ges. nat. Fr., p. 150 (1910).

♂ = *flava*, Dewitz, Nov. Act. Nat. Cur., 41, 2, No. 2, p. 19, pl. 1, f. 10 (1879).

= *gea*, Möschler, Abhandl. Senckenb. Ges., 15, p. 55 (1887).

SENEGAL; S. LEONE; ASHANTI; CAMEROON; NIGERIA; PRINCE'S I.; UGANDA (Entebbe); BRITISH E. AFRICA (Kisumu); NYASSALAND.

♀ f. *carmentis*, Doubl. Hew. and Westw., Gen. Di. Lep., p. 140, pl. 19, f. 1 (1848).

= *Planema dorotheae* ♀, E. M. B. Sharpe, Entomologist, p. 135 (1902).

Appears liable to occur throughout the range of the species.

♀ f. *dorotheae*.

= *Planema dorotheae* "♂," E. M. B. Sharpe, Entomologist, p. 135 (1902).

= *jodutta*, ♀ var., Eltringham, Af. Mim. Butt., p. 81, pl. 8, f. 9 (1910).

UGANDA (Entebbe); BRITISH E. AFRICA (Kisuma).

♀ f. *interjecta*, f. nov.

BRITISH E. AFRICA (Tiriki).

♀ f. *subfulva*, f. nov.

S. LEONE.

* The type is evidently a ♀, as it is described as black with white markings. Westwood's copy of Jones' figure in "Icones" (ined.) shows a ♂ with buff markings, but there is a note beneath it in Westwood's writing mentioning that Jones' figure is uncoloured.

♀ f. *castanea*, f. nov.
Lagos (Oni).

♀ f. *inaureata*, f. nov.
Nyasaland (Nr. Florence Bay).

A. jodutta aethiops, subsp.
Roth. and Jord., Novit. Zool. xii, p. 183 (1905).
Abyssinia (Dereta Mts. ; Gamitscha to Anderatscha).

A. jodutta jodutta.

♂. Expanse 60–70 mm. F.-w. sepia brown. Beyond the cell a curved subapical band of elongate pale ochreous spots separated only by the nervules beginning close to costa and becoming gradually wider as far as nervule 4. Beneath this nervule the band ends with a much shorter spot, the lower edge of which reaches the middle of area 3. An inner marginal patch of pale ochreous reaching almost to base and to hind angle in 1a, becoming narrower as it extends upwards and ending in area 2 with a width of about 8 mm.

H.-w. with a slight sepia brown basal suffusion on which can be discerned a few minute dark spots. Central area pale ochre yellow. Hind margin broadly dusted with sepia brown forming a wide marginal border, the inner edge of which is usually quite indistinctly defined, the whole wing beyond cell being striated by well-marked dark internervular rays and nervules.

Underside. F.-w. Cell and area beyond it, as far as the subapical band, sepia, the cell somewhat dusted with pale ochreous. Costa, apical area and hind margin dusky ochreous, traversed by fine black nervules and rays. Subapical band and inner marginal patch as above but paler. A dusky suffusion at base of area 1b.

H.-w. pale dusky ochreous, the base and hind-marginal area just perceptibly darker. Nervures and nervules narrowly but strongly marked and the internervular rays extend in well-marked lines right up to the cell in each space. A dusky line in the cell. A few small black dots near base arranged as follows :—One in 9, one in 8 against precostal, two in 7 rather close together, two in cell the second before the origin of nervule 2, a basal and a subbasal in 1c, and in the same area a third spot at the level of origin of nervule 2 (often doubled), two in 1b, and 1a.

Head and thorax black with a few pale dots. Abdomen black above and orange beneath with orange lateral spots, and whitish segmental lines. Claws unequal.

♀. Expanse about 70 mm. Resembles ♂ in pattern but the dark areas are somewhat blacker, and the pale ochreous areas are replaced by white. In f.-w. the subapical band is somewhat reduced in width, and the inner marginal patch is very small and ill defined. On the underside the pattern is the same as above, and the blackish areas are the same, and are not replaced by ochreous as in ♂.

A. jodutta ♀ f. *carmentis.*

In this form the white of f.-w. subapical band and of inner margin is much extended and almost joined in the neighbourhood of nervule 2.

A. jodutta ♀ f. *dorotheae.*

The f.-w. subapical band is rather broader than usual, and is golden yellow shading to rather paler or even white, towards costa. The inner marginal patch is nearly as large as in the ♂ and is golden yellow. The h.-w. is a slightly deeper shade of the same colour, and though very distinctly striated by black nervules and long black rays has very little dark marginal suffusion, there being just a little powdering towards the apex.

On the underside the f.-w. has the cell and central portion blackish and the apical and hind-marginal area dull orange ochreous. H.-w. dull orange ochreous with fine black nervules and rays.

Some examples of this form have the subapical patch white.

A. jodutta ♀ f. *interjecta.*

The f.-w. subapical band is white as in typical ♀, but the inner marginal patch is a mere sprinkling of pale ochreous scales, except in 1a where it is well defined. In the centre of area 2 is a longitudinal submarginal white streak.

H.-w. basal area pale ochreous with a slight brownish basal suffusion. Outer half of wing dusted with reddish brown suffused with sepia at apex.

Underside. F.-w. apex and hind margin dull reddish brown. H.-w. dull orange at base, outer half suffused with dull reddish brown.

A. jodutta ♀ f. *subfulva.*

Resembles the typical ♀, but the outer half of h.-w. is reddish brown, the inner edge of this colour being rather sharply defined. A dusting of sepia brown about apex and along hind margin.

♀ f. *castanea.* Pl. V, f. 1.

F.-w. rich sepia-black. The subapical patch almost obliterated and appearing only as a mark slightly paler than the ground-colour. Inner marginal patch rather narrow, tawny brown.

H.-w. rich chestnut, slightly darkened at base and having a very narrow sepia black hind-marginal border, inwardly suffused and broadest at apex. Nervules and rays well marked black.

Underside. F.-w. basal half black with the inner marginal patch somewhat duller than above. Subapical patch whitish brown. Apex umber brown.

H.-w. umber brown, reddish at base, and rather pale over end of cell and bases of areas 4, 5, and 6. Spots as in typical forms.

♀ f. *inaureata*. Pl. V, f. 8.

F.-w. basal half rich golden yellow. Apical half black with a large oblique white patch extending from near costa into area 3. A small white streak in area 2 near margin and a slight powdering of white in area 1b.

H.-w. rich golden yellow without basal suffusion or hind-marginal border. A fine black marginal line. Ends of nervules and rays black, especially toward apex.

Underside. F.-w. as above but duller, the apex dark ochreous with finely marked nervules and rays. H.-w. as above but duller. Slightly reddish at base. Black spots as in other forms.

This beautiful form was taken by Neave on the road to Florence Bay, Nyassaland, at an elevation of 4,500 ft.

A. jodutta aethiops, subsp.

♂. On the upperside the f.-w. has the inner marginal patch extending closer to base, and there is a diffused buff patch in cell. The h.-w. basal patch is reduced and the black distal border is narrower and more sharply defined between costa and nervule 3.

♀ has the subapical band either orange or white. The inner marginal patch is golden orange and is much larger than in the typical form.

H.-w. golden orange with very little brown at base and only a dusting of that colour at apex. The internervular rays are scarcely visible in areas 3 to 1a, whilst on the underside they are much reduced in 7 to 4.

It is not always easy to distinguish examples of *A. jodutta* from those of *A. eschria*. The former may, however, usually be known by the very suffused appearance of the dark hind-marginal colour in the h.-w. Also the internervular rays of the h.-w., especially on the underside, are much longer than in *esebria* and almost touch the cell. There is some temptation to regard *jodutta* as the western form of *esebria*, but I am quite satisfied that they are distinct species. There is a marked peculiarity in the male armature of *esebria*, viz. the internal tooth-like process on the inner side of the claspers towards their base, which is quite constant in that species from Angola to the Comoro Is., and which does not occur in that of *jodutta*. It is, however, a very remarkable fact that the male armatures of *jodutta* and *alciope* are very similar, suggesting a close alliance, whilst at the same time *alciope* belongs to the small minority of species in which the ♂ tarsal claws are symmetrical.

A. jodutta extends from Senegal through S. Leone, Ashanti, Nigeria, and Cameroon across the Congo State to Uganda and Abyssinia.

The form *dorotheae* is most common near Entebbe, where it closely resembles a form of *Planema tellus*, common in that locality.

129. Acraea esebria. Pl. XIV, f. 9.

Acraea esebria, Hewitson, Exot. Butt., pl. 2, f. 11 (1861); Weale, Trans. Ent. Soc., p. 271 (1877); Möschler, Verh. z. b. Ges. Wien., 33, p. 283 (1883); Trimen, S. Af. Butt., 1, p. 177, pl. 1, f. 2, 2a (metamorph.), (1887); Aurivillius, Rhop. Aeth., p. 115 (1898).

= *protea*, var. B, Trimen, Rhop. Af. Austr., p. 111, pl. 3, f. 2 (1866).

Cape Colony: Natal; Zululand; Mashonaland; Belgian Congo (Katanga); German E. Africa; British E. Africa.

f. *protea*, Trimen, Rhop. Af. Austr., p. 110 (1866).

= *esebria*, ♀, Hew., Exot. Butt. (*Acraea*), pl. 2, f. 12 (1861); Staud., Exot. Schmett., 1, p. 85, pl. 33 (1885).

= *esebria*, var. A, Trimen, S. Af. Butt., 1, p. 178 (1887).

= *arctifascia*, Butler, Trans. Ent. Soc., p. 427 (1874).

Angola; Cape Colony; Natal; Zululand; Mashonaland; German E. Africa; British E. Africa.

f. *pseudoprotea*, Butler, Trans. Ent. Soc., p. 428 (1874).
Angola.

♀ f. *amphiprotea*, Butler, Trans. Ent. Soc., p. 428 (1874).
Angola.

♀ f. *metaprotea*, Butler, Cist. Ent., 1, p. 211 (1874).
Angola (Ambriz).

f. *jacksoni*, E. M. B. Sharpe, Ann. Nat. Hist. (6), 5, p. 335 (1890); Waterhouse, Aid., pl. 189, f. 1 (1890); Rogenhofer in Baumann, Usambara, p. 326 (1891).

MASHONALAND; GERMAN E. AFRICA; BRITISH E. AFRICA.

f. *monteironis*, Butler, Cist. Ent. 1, p. 211 (1874); Trans. Ent. Soc., p. 427 (1874); Grünberg, Sitzb. Ges. nat. Fr., p. 150 (1910).

ANGOLA; MASHONALAND; BRITISH E. AFRICA; UGANDA (Sesse I.).

♀ f. *nubilata* f. nov.

E. CENTRAL ZULULAND (Llabisa).

f. *ertli*.

= *A. ertli*, Aurivillius, Ent. Tidskr., p. 94, f. 34 (1904).

GERMAN E. AFRICA (Usambara).

A. esebria masaris, subsp.

= *A. masaris*, Oberthür, Etud. d'Ent., 17, p. 27, pl. 1, f. 3, 12, pl. 2, f. 18, pl. 3, f. 30 (1893).

COMORO I.

A. esebria esebria.

♂. Expanse 56–68 mm. F.-w. black brown. A subapical band of five pale ochreous spots in 10, 6, 5, 4, and 3, the spot in 4 being the longest, the others 2–3 mm. in length. That in 3 short and only extending to half the width of the internervular space. An inner marginal patch of tawny orange occupying nearly the whole of area 1a, the middle two-thirds of 1b, and extending slightly into 2 at its base.

H.-w. slightly darkened at base, remainder tawny orange, with a hind-marginal band of brown black about 4 mm. wide, but very variable, and radiating inwardly on and between the nervules. A few small black spots about the base.

Underside. F.-w. basal portion as far as subapical band sepia black, somewhat inclined to tawny on costa. Apical and hind-marginal areas tawny brown striated by black nervules and rays. Subapical band and inner-marginal patch as above but paler.

H.-w. tawny brown, inclined to dusky on hind margin. Black spots variable, generally as follows:—One at base in 9, one in 8 against precostal, two in 7, the second before origin of nervule 7, two in cell close together in basal half, a minute dot near base of areas 2, 4, and 5. A basal and a subbasal in 1c, followed by a twin spot below origin of nervule 2. A basal, a subbasal, and a distal in 1b, and two minute dots in 1a. Nervules and rays narrowly black, the latter not usually extending inwardly so nearly to the cell as in *jodutta*.

Head black with a tawny spot between the eyes, and two on the collar. Thorax black with a few paler spots. Abdomen black above with orange tawny lateral spots and fine intersegmental lines. Claws unequal.

♀. Expanse 64–74 mm. Resembles the ♂ but the ground-colour is rather browner, and the f.-w. subapical band is broader, and white instead of ochreous. Inner edge of h.-w. marginal border usually less well defined.

A. esebria f. *protea.*

♂. F.-w. pattern as in typical form but the subapical band and inner marginal patch are pale dull ochreous.

H.-w. rather more darkened at base. Hind-marginal border inwardly more sharply defined, and the central area is pale dull ochreous.

♀ like the ♂ but the f.-w. subapical band is broader, and white, and the inner-marginal patch and central area of h.-w. are pale creamy ochreous.

A. esebria f. *pseudoprotea.*

♂ rather smaller than typical form. Ground-colour pale ochreous brown. F.-w. subapical band rather broader, pale ochreous, inner-marginal patch pale ochreous. H.-w. also pale ochreous, the hind-marginal border narrow and inwardly much suffused.

♀ (type) rather larger, having the ground-colour as in ♂, the subapical band and inner-marginal patch pale tawny, h.-w. much as in ♂ but marginal border broader and rather better defined.

A. esebria f. *amphiprotea* (♀).

The type is a large ♀ from Angola. Ground-colour medium dark brown, the subapical band pale tawny and about twice the width of that in the typical ♀. There is a tawny submarginal streak in area 2, and the inner-marginal patch, and the central area of the h.-w. are pale tawny. The h.-w. marginal border is of medium width and inwardly suffused. There seems to be no particular form of ♂ associated with it.

A. esebria f. *metaprotea* (♀).

This form is very like *A. jodutta.* The type is a large ♀. The f.-w. is nearly all pale tawny with the cell black brown, and a band of the same colour extending from costa to middle of area 2 where it becomes broken up. The apical and hind-marginal areas brown. The h.-w. is very pale tawny and has only a dark marginal line and hardly any basal suffusion. The nervules and rays are narrowly darkened.

A. esebria f. *jacksoni*.

The ♂ resembles the type but has the f.-w. subapical band rather broader and tawny orange instead of ochreous.

The ♀ has the subapical band very broad, tawny, and joining the inner-marginal patch near the end of area 2 leaving only the cell and apex dark, and a somewhat broken dark central band. The h.-w. marginal band varies in width from about 4 mm., to a mere darkening of the edge.

A. esebria f. *monteironis*.

♂ resembles the ♂ *pseudoprotea* but the pale areas are white.

♀. The f.-w. subapical band is very broad formed by six large white spots in 6, 5, 4, 3, and 2, and a little above subcostal. The inner-marginal patch is white and does not extend beyond area 2. The h.-w. is white with a small basal brown suffusion and a broad well-defined hind-marginal border.

A. esebria ♀ f. *nubilata*.

The darker areas are sepia black. The base of f.-w. cell, the inner-marginal patch, and the basal half of the h.-w. are dark sepia grey. The f.-w. subapical band is greyish white.

There is a single example of this form in the Oxford collection, taken at Llabisa, in E. Central Zululand.

A. esebria ♀ f. *ertli*.

This form the type of which has been kindly lent to me by Herr Ertl, was described by Aurivillius as a new species. I am satisfied however that it is in fact a form of *esebria*, and in this conclusion Professor Aurivillius now concurs. Its most striking feature is the f.-w. subapical band which is very wide and strongly curved. It consists of six elongated spots the inner edge of which traverses the wing at right angles to the costa as far as nervule 4 where it curves round, first inwards and then outwards, reaching nervule 2. The outer ends of these spots are rounded and somewhat separated by nervular edentations of the ground-colour which, over the apical and hind-marginal areas, is black brown. The cell and the costa above it are brownish grey, followed by a band of black brown from the end of cell to the subapical white. This band occupies the base of area 3 and beneath that tapers to an outwardly curved point in area 2. The inner-marginal patch is tawny and extends inwardly to the base in areas 1a and 1b. The white spot in area 2 is powdered with tawny at its basal side.

H.-w. tawny brown with a narrow black brown hind-marginal border deeply edentate on and between the nervules.

The underside corresponds to the upper in the same way as in typical examples.

I have seen only one example of this form, viz. the type, though in the collection of Mr. C. J. Grist there is an example which comes very near it in pattern, but the f.-w. subapical bar is pale tawny instead of white.

A. esebria masaris, subsp.

This island form of *esebria* is characterised by its smaller average size, the ♂ being about 50 mm. and the ♀ about 56 mm. in expanse, and by the larger size of the pale spot in f.-w. area 2. The wings are somewhat more rounded than in the type form. The ♂ has the f.-w. black brown with a rather narrow subapical band varying in colour from ochreous to orange, and a narrow inner marginal patch of the same colour. The h.-w. has a dark grey basal area extending to about the middle of cell, followed by an orange or ochreous central band and a broad black brown hind-marginal border usually well defined inwardly.

The ♀ presents the same pattern but the f.-w. subapical band is somewhat broader, and the paler markings may be either orange ochreous or white.

This form may usually be recognised by the much larger pale spot in f.-w. area 2, but though specimens have a generally different appearance from those taken on the mainland it is difficult to point out a really constant difference.

The larva of *A. esebria* is described by Trimen as follows :—

"About $1\frac{1}{4}$ in. long Pale ochreous brown ; each segment (except head, and segment next to it) banded transversely and centrally with a black streak edged on both sides with a pale yellow streak. A lateral stripe of the same pale yellow. Head black. Second, twelfth, and thirteenth segments each with two black spines ; third and fourth segments each with two pairs of black spines, each of the remaining segments with four black spines springing from central black streak, and two lateral pale yellow spines. On a species of *Fleurya*, in February and March."

The same author thus describes the pupa :—

"About $\frac{3}{4}$ in. long. Chalky white with a faint yellowish tinge. A series of very fine linear black markings along dorso-thoracic ridge. Antennae and wing-nervures faintly indicated by delicate linear black markings. Five rows of abdominal black spots, viz. two dorsal, two lateral, and one ventral; these markings are sometimes slightly tinged with orange, and *the dorsal ones on the first three segments of the abdomen are conspicuously orange, black edged, tubercular, and pointed.* At anal extremity three looped black marks. Head very slightly bifid. Thorax prominently angulated at bases of wing covers, and with a pair of smaller projections posteriorly. Duration of pupal state eight days."

Acraea esebria is very closely allied to *A. jodutta* and both seem to vary in similar directions. The latter species can usually be recognised by the much less distinct definition of the hind-wing marginal border (when present) and by the longer internervular rays on the underside of the hind-wing, these rays reaching almost to the cell. In the case of so variable a species much more material is required before we can decide whether any of the foregoing forms should be regarded as subspecies.

130. ACRAEA LYCOA. Pl. XIV, f. 6.

Acraea lycoa, Godart, Enc. Méth., 9, p. 239 (1819); Staudinger, Exot. Schmett., 1, p. 85 (1885); Dewitz, Ent. Nachr., p. 104 (1889); Aurivillius, Rhop. Aeth., p. 115 (1898); Poulton, Trans. Ent. Soc., p. 305 (1906); Eltringham, Af. Mim. Butt., p. 47 (1910); Trans. Ent. Soc., p. 12, pl. 1, f. 1, 2, pl. 2, f. 1, 4 (1911).

S. LEONE to NIGERIA; PRINCES I.

A. lycoa media, subsp.

Eltringham, Trans. Ent. Soc., p. 12 (1911).

= *lycoa*, Aurivillius, Ent. Tidskr, 14, p. 277, Aurivillius (metamorph.); p. 278, pl. 5, f. 2, 2a, 2b (1893).

FERNANDO PO to TORO.

A. lycoa bukoba, subsp.

Eltringham, Trans. Ent. Soc., p. 12, pl. 1, f. 3, 4 (1911).

? = *lycoa*, Grünberg, Sitzb. Ges. nat. Fr., p. 150 (1910); [Sesse I.].

URUNDI COUNTRY between L. Tanganyika and L. V. NYANZA.

A. lycoa entebbia, subsp.

Eltringham, Trans. Ent. Soc., p. 12, pl. 1, f. 5 (1911).

UGANDA (Entebbe.)

A. lycoa tirika, subsp.

Eltringham, Trans. Ent. Soc., p. 13, pl. 1, f. 6 (1911).

BRITISH E. AFRICA (Tiriki Hills).

A. lycoa fallax, subsp.

Rogenhofer (*Planema*), Ann. d. K. K. Naturhist. Hofmus, Wien. 6, p. 459, pl. 15, f. 6 (1891); Butler, Proc. Zool. Soc., p. 113 (1896); Aurivillius, Rhop. Aeth., p. 115 (1898); Poulton, Trans. Ent. Soc., p. 305, pl. 21, f. 1a, 2a (1906); Heron, Trans. Zool. Soc., xix, p. 147 (1909); Eltringham, Af. Mim. Butt., p. 47, pl. 3, f. 24, 25 (1910); Trans. Ent. Soc., p. 13, pl. 1, f. 7 (1911).

= *kilimandjara*, Oberthur, Etud. d'Ent. 17, p. 26, pl. 2, f. 17 (1893); Butler, Proc. Zool. Soc., p. 113 (1896); Poulton, Trans. Ent. Soc., p. 305 (1906).

German E. Africa (Mt. Kilimandjaro).

A. lycoa kenia, subsp.

Eltringham, Trans. Ent. Soc., p. 13, pl. 2, f. 7 (1911).

British E. Africa (Mt. Kenia, Kikuyu Escarpment).

A. lycoa aequalis, subsp.

Roth. and Jord., Novit. Zool., 12, p. 184 (1905); Eltringham, Trans. Ent. Soc., p. 13, pl. 1, f. 8, 9 (1911).

Abyssinia (L. Abassi, Dara R., Banka, Dereta Mts., Wonda).

A. lycoa lycoa. Pl. VI, f. 8 (larva).

♂. Exp. 58–60 mm.

F.-w. thinly scaled, translucent. Brownish sepia. Beyond cell a faint indication of a subapical band of three large paler spots the third of which is nearer margin than those above it. Similar indications of a pale patch in basal half of area 2, and beneath it of a smaller one in 1b. Costa, apex and hind-margin slightly darker.

H.-w. not quite so thinly scaled but still translucent, slightly darkened at base and along hind-margin, remainder of wing dull reddish ochreous. Nervures and rays well marked in dark brown.

Underside almost scaleless. H.-w. with a few black spots near base; one at base in 9, 1c, and 1b, one in 8, one in 7, two in cell the second small and just before origin of nervule 2, one in 1c, 1b, and 1a.

Head and thorax black with small white spots, abdomen black above with reddish ochreous lateral spots and segmental lines. Claws unequal.

♀. Expanse about 64 mm.

F.-w. rather thinly scaled with grey black. A subapical band of white beginning just beneath costa and continuous as far as nervule 5, beneath which in area 4 is a white spot of about the same width as the band but placed nearer margin so that its inner edge is just under the outer edge of the band. A large white patch in basal half of area 2 and beneath its distal extremity a smaller white patch in 1b. H.-w. with a slight dusky suffusion at base, followed by a large white patch extending beyond cell and enclosed by a broad dusky marginal band inclined to tawny about anal angle.

Underside a replica of the upper but base of wing reddish tawny on which are black spots as in ♂ but usually rather more distinct.

A. lycoa media, subsp.

The male is distinguished by slightly heavier scaling and greater distinctness of the pale spots in f.-w. The ♀ has a darker ground-colour and a slightly smaller and more distinctly outlined white h.-w. patch.

A. lycoa bukoba, subsp.

♂. F.-w. dark olive brown. The spots reduced in size and pale ochreous. The band reduced to two quadrate spots in 5 and 6 well separated from the spot in 4. The patch in 2 well separated from the submarginal spot in 1b.

H.-w. basal patch ill defined, warm ochreous, followed by a dark hind-marginal border which is inwardly inclined to tawny.

♀. F.-w. with brown black ground-colour, spots white and well defined. H.-w. pale patch well defined and faintly yellow enclosed by a broad marginal border of tawny brown on which the nervules and rays are well marked.

A. lycoa entebbia, subsp.

♂. F.-w. dusky ochreous grey. Spots much reduced in size. H.-w. ground-colour much as in f.-w. and the pale patch but little developed.

♀. F.-w. ground-colour very dark, white spots smaller and more sharply defined than in *bukoba*. H.-w. patch small and very faintly yellow.

A. lycoa tirika, subsp.

♂. Resembles *entebbia* but f.-w. ground-colour is olive brown, the pale spots smaller and sharply defined. H.-w. patch large, pale ochreous, enclosed by a broad dark marginal border of tawny brown.

♀. With very dark f.-w. ground-colour, white spots small and very distinct h.-w. patch very small and distinctly yellow.

A. lycoa fallax, subsp.

♂. F.-w. nearly black in both sexes. Spots small, white in

♀ and ochreous in ♂. H.-w. patch rather larger than in previous forms and sharply defined.

A. lycoa kenia, subsp.

Both sexes smaller than in other forms. Ground-colour nearly black. H.-w. patch slighly edentate between nervules 3 and 4. Dark areas on underside smoky black. ♂ with spots and h.-w. patch lemon ochreous. ♀ h.-w. patch lemon ochreous, f.-w. spots white.

A. lycoa aequalis, subsp.

The sexes are similar. The f.-w. spots and h.-w. patch dull ochreous. H.-w. marginal border inclined to tawny.

The larva and pupa are described by Aurivillius (*l. c.*) the former being yellowish without markings and having a black head and black spines, the latter scarcely as long as the diameter of the body.

The pupa has the usual black markings, those of the abdomen enclosing pale centres and being irregularly angulated. Segments 2–4 each have a pair of short black dorsal spines, yellowish at their bases.

On Pl. VI, f. 8, I have figured an example of the larva taken by Mr. Lamborn near Lagos.

I have already (Trans. Ent. Soc., 1911) discussed at some length the variation which occurs in this species coincident with its geographical distribution. The depth of colour increases as we pass eastwards, whilst it is a remarkable fact that it exhibits constant sexual dimorphism until it reaches Abyssinia, where the ♀ becomes yellow spotted in the f.-w. as in the ♂. Forms intermediate between those here described are of course found on the overlapping areas of the districts to which each form is peculiar, but within those districts the forms are very constant. The species has lately been bred in very large numbers by Mr. W. A. Lamborn near Lagos. These series are now in the Oxford collection and show little or no variation.

131. Acraea johnstoni. Pl. XIV, f. 5.

Acraea johnstoni, Godman, Proc. Zool. Soc., p. 537 (1885); Holland, Ann. Nat. Hist., p. 248 (1893); Butler, Proc. Zool. Soc., p. 113 (1896); Aurivillius, Rhop. Aeth., p. 114 (1898); Poulton, Trans. Ent. Soc., p. 300 (1906); Eltringham, Af. Mim. Butt., p. 47 (1910); Trans. Ent. Soc., p. 13 pl. 1, f. 12 (1911); pl. 2, f. 2, larva f. 6.

= *Planema telekiana*, Rogenhofer, Ann. d. K.K. Naturhist. Hofmus. Wien., p. 459, pl. 15, f. 4 (1891).

= *A. proteina semifulvescens*, Oberthür, Etud. d'Ent., 17, p. 26, pl. 2, f. 21 (1893); Butler, Proc. Zool. Soc., p. 113 (1896); Poulton, Trans. Ent. Soc., p. 302, pl. 22, f. 2a, pl. 21, f. 3a (1906); Eltringham, Af. Mim. Butt., p. 47, pl. 8, f. 13 (1910).

German E. Africa (Mt. Meru, Mt. Kilimandjaro, Usambara); British E. Africa (Taveta).

A. johnstoni f. *confusa*, Rogenhofer in Baumann, "Usambara" Suppl., p. 326 (1891); Ann. d. K. K. Natur. Hist. Hofmus. Wein., p. 459, pl. 15, f. 5 (1891); Aurivillius, Rhop. Aeth., p. 115 (1898); Eltringham, Trans. Ent. Soc., p. 14, pl. 1, f. 13, 15 (white var. f. 13), (1911).

= *johnstoni* ♀, Butler, Proc. Zool. Soc., p. 91 (1888).

= *proteina*, Oberthür, Etud. d'Ent., 17, p. 26, pl. 2, f. 14; Poulton, Trans. Ent. Soc., pl. 22, f. 1a, 1b (1906).

Nyassaland; German E. Africa (Usambara, Kilimandjaro, Nguelo); Rhodesia (Chirinda); British E. Africa (Taita, Taveta, Kikuyu, Tiriki); Uganda (Entebbe).

A. johnstoni f. *flavescens*, Oberthür (*proteina flavescens*), Etud. d'Ent., 17, p. 26, pl. 1, f. 4 (1893); Aurivillius, Rhop. Aeth., p. 115 (1898); Eltringham (f. *confusa* part), Trans. Ent. Soc., p. 14 (1911).

(Localities as f. *confusa*.)

A. johnstoni f. *semialbescens*, Oberthür (*proteina semialbescens*), Etud. d'Ent., 17, p. 26, pl. 3, f. 29 (1893); Aurivillius, Rhop. Aeth., p. 115 (1898); Eltringham (f. *confusa* part), Trans. Ent. Soc., p. 14 (1911).

Nyassaland; German E. Africa (Mrogoro, Usambara).

A. johnstoni f. *fulvescens*, Oberthür (*proteina fulvescens*), Etud. d'Ent., p. 26, pl. 2, f. 21 (1893); Aurivillius, Rhop. Aeth., p. 114 (1898); Poulton, Trans. Ent. Soc., p. 304, pl. 21, f. 4a (1906); Eltringham, Af. Mim., p. 47, pl. 3, f. 26 (1910); Trans. Ent. Soc., p. 14, pl. 1, f. 11 (1911).

German E. Africa (Kilimandjaro, Nguelo); British E. Africa (Taita).

A. johnstoni f. *octobalia*, Karsch, Ent. Nachr., 20, p. 222 (1894); Aurivillius, Rhop. Aeth., p. 114 (1898); Eltringham, Trans. Ent. Soc., p. 15 (1911).

German E. Africa (Mpwapwa).

A. johnstoni butleri.

= *lycoa* ♀ var. Butler, Proc. Zool. Soc., p. 731 (1895).

= *lycoa* ab. *butleri*, Aurivillius, Rhop. Aeth., p. 115 (1898).

= *A. toruna*, Grose-Smith, Novit. Zool., 7, p. 546 (1900); Rhop. Exot., *Acraea*, 8, p. 27, pl. 8, f. 1 (1901); Poulton, Trans. Ent. Soc., p. 303, pl. 22, f. 3a (1906): Heron, Trans. Zool. Soc., xix, p. 148 (1909); Eltringham, Af. Mim. Butt., p. 47, pl. 3, f. 28 (1910); Trans. Ent. Soc., p. 15, pl. 1, f. 10 (1911).

German E. Africa (Urundi); Uganda (Toro).

A. johnstoni johnstoni.

Expanse 58–60 mm. Pattern very unstable. F.-w. Base suffused with black to a varying extent. Following this suffusion is an irregular tawny orange area extending a little beyond the pale spots in areas 11, 10, 6, and 5, as far as the spot in 4, over the basal parts of 3 and 2, as far as the submarginal spot in 1b, and nearly as far as 1a. The spots referred to are pale pinkish ochreous and arranged as follows. A subapical series of three or four separated only by the nervules 10, subcostal, and 6. A submarginal spot in area 4, a large rounded spot in 2 touching 2, 3, and median, and a smaller spot near margin in 1b. Beyond these spots the apex and margin is brown black.

H.-w. white, slightly blackened at base, and having a broad black marginal border somewhat indented at area 4. This indentation gives the inner edge of the border an angulated appearance characteristic of *A. johnstoni* throughout its numerous forms.

Underside. F.-w. Resembles the upper, but the dark areas are replaced by ochreous grey, striated by the dark nervules and rays, and the whole pattern is paler and duller, the pale spots often almost devoid of scales.

H.-w. much as above but there are a few black spots close to base arranged for the most part as a basal and subbasal series, one in 9, 8, 7, and cell, two in 1c, 1b, and 1a. The central area less clear white than above, the marginal border ochreous grey, inwardly inclined to reddish brown.

Head and thorax black with a few white dots. Abdomen black above with orange lateral spots and whitish segmental lines. Claws unequal.

♀. Except that it is larger, one example before me having an expanse of 74 mm., the female resembles the ♂, or at least ♀♀ can be found which resemble the ♂. The species is so extremely variable that it is not always easy to find two examples exactly alike.

A. johnstoni f. *confusa*.

F.-w. brown black. The pale spots as in typical form but white. H.-w. as in typical form but basal patch pale ochreous.

The ♀ resembles the ♂.

This is the commonest form of *A. johnstoni* and it is rather unfortunate that the previous form should have become the type since it is in reality a rather rare variety. A variety of the *confusa* form has the h.-w. basal patch white as well as the f.-w. spots. I have figured this form in Trans. Ent. Soc., pl. 1, f. 13 (1911).

A. johnstoni f. *flavescens*.

In this form the f.-w. spots are pale ochreous the same as the h.-w. patch.

A. johnstoni f. *semialbescens*.

The f.-w. spots are white and the h.-w. patch is tawny yellow.

A. johnstoni f. *fulvescens*.

The f.-w. is tawny yellow, the spots only a shade paler, and there is a blackish apical and hind-marginal border. The h.-w. is tawny yellow a little paler over the area which in *confusa* is pale ochreous. A more or less well-defined but narrow blackish hind-marginal border.

A. johnstoni f. *octobalia*.

The spots of f.-w. and basal patch of h.-w. are tawny yellow instead of white and pale ochreous.

A. johnstoni butleri, subsp.

Basal half of f.-w. purplish red with a slight blackish suffusion at base, beyond the red colour is a very irregular band of rather tawny yellow its inner edge comparatively straight as far as area 4, projecting sharply inwards in area 2, and continued as a submarginal patch in 1b and sometimes also in 1a. Below area 3 the outer edge of this band is often much suffused. Beyond the band the apex and hind margin are brown black. H.-w. basal patch white to dull pink followed by a broad blackish hind-marginal band.

The tawny yellow band in the f.-w. of this form is so variable in shape that it is not easy to find two examples alike.

The ♀ resembles the ♂, but may be rather larger and less richly coloured.

The larva of *A. johnstoni* has the body yellowish beneath and brownish black above, each segment with a ring of yellowish white, edged with brown and divided in the middle by a dark brown line widened somewhat at the base of each of the papillae which carry the spines. Head black, and the first and last three segments somewhat darker than the remainder. Twenty-four dorsal black spines arranged in a double row. Eleven lateral spines on each side, the last two projecting backwards. Eight sublateral spines yellow on each side the first pair arising from the fourth segment.

I have already (Trans. Ent. Soc., 1906) entered rather fully into a discussion of the forms of this extremely variable species. I have slightly altered the list of references and synonymy from that given on the previous occasion and have separated out the form named *flavescens* by Oberthür, and also his *semialbescens* as they seem sufficiently different to stand as separate forms. Karsch's form *octobalia* I then knew only from a sketch I discovered at Oxford, but having now seen the actual specimen I find that the sketch is quite inaccurate, the form being as above described. In addition to the forms noted, intermediates of all kinds may be found in a long series. In Nyassaland Neave has lately found a form which resembles f. *semifulvescens*, but has the f.-w. spots brilliantly white instead of obsolescent. In Mr. Trimen's collection there is a ♀ from Naivasha (British E. Africa) which is of the black and white variety of the *confusa* form but has a trace of deep tawny yellow in the central area of the f.-w. In Mr. Joicey's collection there is a ♀ which has the f.-w. sepia, the outer part of areas 2, 3, 4, 5, and 6 tawny yellow, the spots a vivid white, the h.-w. basal patch tawny with the marginal border of a deeper shade and the margin dusted with brown.

In the general collection of the Berlin Museum there is a ♀ from Mpwapwa which has all the pale markings orange ochreous.

The larva which I figured (*l. c.*) was one of a company bred at Nguelo, Usambara, resulting in nine specimens which were of the following forms, 2 ♂♂ and 1 ♀ of the type form, 2 ♂♂ and 2 ♀♀ of f. *fulvescens*, one ♀ of the black and white variety of *confusa*, and one ♂ *confusa* with white f.-w. spots and pale ochreous h.-w. patch.

The species ranges from N. Rhodesia through German E. Africa to British E. Africa and Uganda, but no form seems peculiar to any particular district except *butleri*, which, so far as I know, is only found in Urundi and Toro. At Chirinda only the form *confusa* seems to occur. A long series taken by Neave on Mt. Kokanjero (British E. Africa) contains a large number of intermediates between *fulvescens* and *semifulvescens*.

The two following species cannot be assigned to any of the foregoing groups, and present no special affinities.

132. ACRAEA NIOBE.

Acraea niobe, Em. M. B. Sharpe, Proc. Zool. Soc., p. 554 (1893); Smith and Kirby, Rhop. Exot., *Acraea*, 5, p. 18, pl. 5, f. 10 (1894); Aurivillius, Rhop. Aeth., p. 92 (1898).

SÃO THOMÉ.

♂. Expanse 60 mm.

F.-w. Thinly scaled, elongated, more or less translucent. Brown-black. Base, costa, apical and hind-marginal borders darker. Large rounded black spots as follows. One in cell over origin of nervule 2, one at end of cell. A subapical row of three contiguous spots in 6, 5, and 4, followed by a spot in 3 more proximally placed. One at base of area 2, and beneath it but nearer margin a spot in 1b, and in the same area a subbasal spot against median, midway between base and origin of 2.

H.-w. thinly scaled, brown black, rather darker at base and having a narrow black border, widest in areas 2 and 1c. Black spots as on underside.

Underside. F.-w. almost scaleless except on spots which are as on upperside.

H.-w. as above. Black spots as follows. An outer row of nine, the first three in 7, 6, and 5, small and parallel to apical margin. The fourth in 4 rather more proximal, the fifth larger, a short distance from base of area 3, sixth large, at base of area 2, followed by a large spot in 1c and 1b all in a straight line at right angles to inner margin, ninth very small in 1a. In addition to these a small subbasal in 7, two spots in cell, the second very large, a large spot on discocellulars, a basal and a subbasal in 1c and 1b and an additional spot in 1a.

Head black with a crimson collar. Thorax black above. Basal half of abdomen black above with red lateral spots. Distal half crimson. Claws unequal.

♀ at present unknown.

This interesting species is only found on the Island of São Thomé. It is quite unlike any other known form. The figure in Rhop. Exot. seems scarcely black enough, the spots having in reality a somewhat velvety appearance. I have examined two ♂♂ in the Staudinger collection. These and the type in the Lisbon Museum are the only examples known to me.

133. ACRAEA INSULARIS.

Acraea insularis, Em. M. B. Sharpe, Proc. Zool. Soc., p. 555 (1893); Smith and Kirby, Rhop. Exot., *Acraea*, 5, p. 16, pl. 5, ff. 6, 7 (1894); Aurivillius, Rhop. Aeth., p. 112 (1898).

SÃO THOMÉ.

♂. Exp. 48 mm.

F.-w. black brown. In cell, just before origin of nervule 2, a yellow transverse spot traversing the whole width of cell. Just before end of cell a broad orange quadrate patch contiguous with a large orange spot at base of area 2, and beneath the latter a crescentic orange spot in 1b nearer margin. Two small orange subapical spots separated by nervule 6, and beneath these but rather nearer margin a smaller spot in area 4. In the transverse area between the spots the ground-colour is somewhat darker.

H.-w. with a dark basal suffusion followed by a yellow patch outwardly shading into orange. A dark brown marginal border, its inner edge traversing the wing almost perpendicularly as far as nervule 4, where it bends sharply inwards to inner margin. Black spots as on underside.

Underside. F.-w. much as above but spots pale ochreous dusted with reddish, and ground-colour somewhat paler with dark streaks in cell and areas 6, 4, and 1b.

H.-w. pale greenish grey with a brown border as on upperside but outwardly bounded by a paler marginal line. Black spots as follows. One in 9 at base, two in 7 rather close together the second just beyond origin of nervule 7, three discal spots in 5, 4, and 3 the middle one larger and more proximal. Two in cell and two on discocellulars, a basal, a subbasal and a distal in 1c, two distal spots in 1b, and a subbasal in 1a.

Head, thorax and abdomen black.

I have not had an opportunity of examining the type of this species which is in the Lisbon Museum. As Prof. Aurivillius has noted (*l. c.*) its true affinity is obscure. It does not resemble any other species with which I am acquainted.

SUPPLEMENT ON THE ORIENTAL SPECIES OF *ACRAEA*.

Key. (Applying to both sexes.)

F.-w. more or less transparent . . . . (*a*)
F.-w. fully scaled . . . . (*g*)
(*a*) F.-w. with numerous blackish spots . . . . . . (*b*)
F.-w. without spots, or at most with a dark mark at end of cell . . . . (*c*)
(*b*) H.-w. black spots but little confluent *andromache andromache* (346)
H.-w. black spots tending to coalesce and form a patch *andromache* f. *oenone* (347)
H.-w. black spots very confluent and forming a black basal patch . . . . . . *andromache sanderi* (347)
(*c*) Submarginal spots of h.-w. underside orange colour . . (*d*)
Submarginal spots of h.-w. underside ochreous . . (*e*)
(*d*) H.-w. cell on underside nearly devoid of scales *moluccana parce* (348)
H.-w. cell on underside almost entirely scaled with black *moluccana burnensis* (348)
(*e*) H.-w. upperside with a broad discal orange band *moluccana meyeri* (348)
H.-w. upperside without a discal orange band . . . (*f*)
(*f*) H.-w. upperside with a continuous, or almost continuous, whitish band . . . . . . *moluccana dohertyi* (348)
H.-w. upperside with broken white band or only an inner marginal pale patch . . *moluccana moluccana* (347)
(*g*) H.-w. beneath with basal black spots enclosing or tending to enclose pale markings . . . . . . *violae* (348)
H.-w. beneath without basal spots or markings . *vesta* (349)

1. Acraea andromache.

Acraea andromache, Fabricius (*Pap. andromacha**), Syst. Ent., p. 466 (1775); Schmeltz, Verh. Zool. bot. Gesell. Wien., p. 593 (1866); Butler, Ann. Mag. Nat. Hist., 4, v. p. 361 (1870); Schmeltz, Verh. Ver. Hamburg, ii, p. 186 (1876); In Journ. Mus. Godeffroy, xii, p. 174 (1877); Staudinger, Exot. Schmett., p. 85, pl. 33 (1885); Olliff (metam.), Ann. Mag. Nat. Hist. 6, 1, p. 359 (1888); Mathew (metam.), Trans. Ent. Soc., p. 143, pl. VI, f. 14, 14a (1888); Fruhstorfer, Stettin Ent. Zeit., 68, 1, p. 21 (1907).

* I have not hesitated to alter the last letter of the name. It is printed *andromacha* in Syst. Ent., but there can be little doubt that it is a misprint for *andromache*.

= *A. entoria*, Godart, Enc. Méth., ix, p. 231 (1819).
= *andromache* f. *indica*, Röber, Iris, 2, p. 22 (1885); Fruhstorfer, Stettin Ent. Zeit., 68, 1, p. 21 (1907) (Kabia I.).

N. AUSTRALIA (Pt. Darwin, Cooktown, Rockingham Bay, Pt. Denison, Moreton Bay, Toowoomba); FLORES I.; SEMAO I.; LOYALTY IS.; ESPIRITU SANTO; NEW CALEDONIA; FIJI; MANGO; SAMOA (Oinainisa); SUMBA; LETTI; TOEKAN; SERMATTA; MOA; KABIA; NEW HEBRIDES (Malekula); FERGUSSON I.

f. *oenone*, Kirby, Ann. Mag. Nat. Hist., 6, iv, p. 163 (1889); Allen's Nat. Lib., Butt., vol. i, p. 36, pl. 37, f. 3 (1894).

EUST I.; ST. AIGNAN; MEKEO; BRITISH NEW GUINEA.

A. andromache subsp. *sanderi*, Rothschild, Ann. Mag., Nat. Hist., 6, 12, p. 455 (1893); Fruhstorfer, Stettin Ent. Zeit., 68, 1, p. 21 (1907).
= var. *agema* Fruhstorfer, Stettin Ent. Zeit., 68, 1, p. 21 (1907).

NEW GUINEA; ? WAIGEU.

I cannot separate the form *indica* from other examples of the species. Röber states that it is smaller than the Australian examples, but in a long series the size varies greatly and this character is of little value. Kirby's *oenone* is merely an intermediate between typical *andromache* and *andromache sanderi*. The figure in Allen's Naturalist's Library (*l.c.*) shows the ground-colour of the h.-w. too yellow. The male armature of *A. andromache* is barely distinguishable from that of *A. igati*.

2. ACRAEA MOLUCCANA.

Acraea moluccana, Felder, Sitz. Akad. Wiss. Wien. Math. Nat. Cl. xl, p. 449 (1860); Fruhstorfer, Stettin Ent. Zeit., 68, 1, p. 20 (1907).

AMBOINA.

= *nebulosa*, Hewitson, Exot. Butt. (*Acraea*), pl. 2, f. 13 (1861).

CERAM.

= *fumigata*, Honrath, Berlin Ent. Zeit., xxx, p. 130, pl. 4, f. 3 (1886); Hagen, Jahrb. d. nass. Ver. f. Naturk. (Wiesbaden), p. 82 (1897); Ribbe, Iris. p. 109 (1898); Fruhstorfer, Stettin Ent. Zeit., 68, 1, p. 20 (1907).

NEW BRITAIN.

= *pollonia*, Godman and Salvin, Ann. Mag. Nat. Hist., p. 110 (1888); Gr.-Smith, Rhop. Exot., i, f. 1, 2 (1889); Fruhstorfer, Stettin Ent. Zeit., 68, 1, p. 20 (1907).

GUADALCANAR, SHORTLAND I.

= *moluccana pella*, Fruhstorfer, Stettin Ent. Zeit 68, 1, p. 19 (1907).

WOODLARK I.

A. moluccana meyeri, subsp.

Kirsch, Mitt. Mus. Dresden, p. 123, pl. 6, f. 2 (1877); Fruhstorfer, Stettin Ent. Zeit., 68, 1, p. 20 (1907).

New Guinea.

A. moluccana dohertyi, subsp.

Holland, Proc. Boston Soc., xxv, p. 61, pl. 5, f. 7 (1891); Rothschild, Iris, v, p. 435 (1892); Fruhstorfer, Stettin Ent. Zeit., 68, 1, p. 19 (1907).

Celebes.

A. moluccana parce, subsp.

Staudinger, Iris, 9, p. 193, pl. 1, f. 8 (1896); Fruhstorfer, Stettin Ent. Zeit., 68, 1, p. 19 (1907).

Xulla Is. (Mangola).

A. moluccana buruensis, subsp.

Rothschild, Novit. Zool., vi, p. 68 (1899).

Buru.

I cannot find any satisfactory means of distinguishing between the forms which I have here made synonymous. Fruhstorfer (*l. c.*) gives several points of difference between his subsp. *pella* and *pollonia*, but these do not remain constant in a series. Holland's *dohertyi* is perhaps rather more entitled to subspecific rank, though I have not yet examined a large number of examples. *Parce* and *buruensis* may easily be distinguished by the very black h.-w. *Meyeri* with its velvety black wings and rich orange band is very distinct in appearance though I cannot regard it as a separate species. All the forms which I have included under *A. moluccana* exhibit a beautiful greenish blue iridescence on the underside of the f.-w. This is produced in a peculiar manner. The iridescence is really on the underside of the scales which are on the upper surface of the wing, and is seen through the transparent wing membrane. The effect is more brilliant in *moluccana meyeri* than in the other forms. The male armatures of these forms are similar and are of the same type as that of *A. admatha*. The ♀ plate is like that of *A. neobule*, and the opening of the *bursa copulatrix* is eccentric.

Acraea violae.

Acraea violae, Fabricius (*Pap.*), Syst. Ent., p. 460 (1775); Sulzer, Gesch. Iris (*cepheus*), pl. 15, f. 2, p. 143 (1776); Goetze, Entom. Beytr., 3, 1, p. 97 (*cepheus*) (1779); Horsfield, (metam.), Cat.

Lep. E.I.C., pl. 8, f. 2, 2a (1829); Doubleday, Hew. & Westw., Gen. Di. Lep., p. 142 (1848); Moore, Cat. Lep. Mus., E.I.C. (metam.) p. 135, pl. 5, f. 1, 1a (1857); Chaumette, Ent. Mo. Mag., p. 37 (1865); Butler, Cat. Fabr. Lep. in B.M., p. 131 (1869); Moore, Lep. Ceyl. (metam.) 1, p. 66, pl. 33, f. 1, 1a, 1b (1881); Marshall & de Nicéville, Butt. Ind., 1, p. 320, fig. ♂, (1883); de Nicéville, Journ. As. Soc. Bengal, p. 43 (1885); Swinhoe, Proc. Zool. Soc., p. 127 (1885); Proc. Zool. Soc., p. 424 (1886); Aitken, Journ. Bomb. Nat. Hist. Soc., p. 129 (1886); Hampson, Journ. As. Soc. Bengal, p. 352 (1888); Davidson & Aitken, Journ. Bomb. Nat. Hist. Soc., v, p. 268 (1890); Fergusson, Journ. As. Soc. Bengal, p. 7 (1891); Swinhoe, Trans. Ent. Soc., p. 276 (1893); de Nicéville, Sikkim Gazetteer, p. 131 (1894); Davidson & Aitken, Journ. Bomb. Nat. Hist. Soc., p. 246 (1896); Moore, Lep. Ind., v (metam.), p. 36, pl. 388, f. 1–1g (1901–1903); Suffert (*viola*), Iris, p. 34 (1904); Bingham, Faun. Brit. Ind. Butt., i, p. 471, f. 85 (1905).

= *Pap. cephea*, Cramer, Pap. Exot., iv, pl. 298, f. D, E (1782).

= *Tel. cephea*, Hübner, Verz. bek. Schmett, p. 27 (1816).

CEYLON; MADRAS; MYSORE; NILGHERRIES; BERHAMPORE; BOMBAY; DARJEELING; N. W. PROVINCES.

This species is quite easily recognised by its orange ground-colour and numerous black spots. Suffert's suggestion (*l. c.*) that it has been taken in German East Africa is not confirmed.

ACRAEA VESTA.

Acraea vesta, Fabricius (*Pap.*), Mant. Ins., ii, p. 14 (1787); Donovan, Ins. China, pl. 30, f. 1 (1799); Godart, Encycl. Méth. ix, p. 233 (1819); Doubleday, Hew. & Westw., Gen. Di. Lep. (*Pareba*), p. 142 (1846–50); Butler, Cat. Fabr. Lep. in B.M., p. 132 (1869); Graham Young, Proc. Zool. Soc., p. 243 (1882); Marshall & de Nicéville, Butt. Ind. 1, p. 318 (1883); Staudinger, Exot. Schmett., p. 85, pl. 33 (1885); Doherty, Journ. As. Soc. Bengal, p. 114 (1886); Elwes, Trans. Ent. Soc., p. 334 (1888); Manders, Trans. Ent. Soc., p. 520 (1890); Leech, Butt. fr. China, etc., 1, p. 14 (1892); de Nicéville, Sikkim Gazetteer, p. 131 (1894); Watson, Journ. Bomb. Nat. Hist. Soc., p. 652 (1897); Leech, Trans. Ent. Soc., p. 104 (1899); Johannis, Bull. Sci. Fr. et Belg., p. 325 (1901); Moore, Lep. Ind., v. (metam.), p. 31, pl. 387, f. 1, 1a–1f (1901); Bingham, Faun. Brit. Ind. Butt. i, p. 469, f. 84 (1905); Fruhstorfer Wiener. Ent. Zeit., p. 308 (1906).

= *terpsichore*, Cramer, (*nec* Linn.) Pap. Exot., iv, pl. 298, f. A–C (1782).

= *issoria*, Hübner, Verzeich. bek. Schmett., p. 27 (1816).

= *anomala*, Kollar, in Hügel's Kaschmir, iv, 2, p. 425, pl. 3, f. 3, 4 (1848); Staudinger, Exot. Schmett., p. 85 (1885).

N. India; Assam; Burmah; W. and S. China.

A. vesta f. *vestalina*, Fruhstorfer, Wiener, Ent. Zeit., p. 308 (1906).

S. Annam.

[F.-w. dusky with spots whitish, h.-w. with broad dark border.]

A. vesta vestita, subsp.

de Nicéville, Journ. As. Soc. Bengal, lxiv, p. 397 (1895); Moore, Lep. Ind., v, p. 35 (1901); Fruhstorfer, Wiener Ent. Zeit., p. 309 (1906).

= *vesta*, Snellen van Vollenhoven, Midden-Sumatra, p. 13, pl. 2, f. 3–5 (1892).

N.E. Sumatra.

[Small. ♂ with broad dusky border in both wings, nervules black. ♀ F.-w. dusky with pale spots, h.-w. with broad dusky marginal border.]

A. vesta vestita f. *alticola*, Fruhstorfer, Wiener Ent. Zeit., p. 309 (1906).

W. Sumatra.

[Intermediate to *vesta vestoides*.]

A. vesta vestoides, subsp.

Moore (*Pareba*), Lep. Ind., v, p. 35 (1901); Fruhstorfer, Wiener Ent. Ziet., p. 308, 309 (1906).

= *vesta*, Horsfield, Cat. Lep. Mus. E.I.C., pl. 3, f. 21 (larva) (1829).

W. Java.

[Small. ♂ usually with dark spots in f.-w. cell and discal area. H.-w. with reddish submarginal band of underside showing through to upper surface. Marginal pale spots well marked in both wings. All nervules black. ♀ F.-w. with dark colour predominating. H.-w. with nervules heavily marked, dark border broad, and usually with reddish ochreous internervular patches towards anal angle. Examples from E. Java are often without spots in f.-w.]

I see no reason for separating *A. vesta* from other Acraeas and making it a separate genus (*Pareba*). It appears to be closely allied to *A. anacreon*, and the stalked condition of nervules 6 and 7 in the h.-w. is not constant. The size, pattern, and ground-colour are extremely variable. Both wings occasionally have discal spots, and these when present in the h.-w. are suggestive of the characteristic arrangement seen in *anacreon*. Both ♂ and ♀ genitalia are very similar to those of the African species. Careful examination of long series might disclose the existence of other local races in addition to the Javan and Sumatran forms above described, though judging from the variability exhibited by some seventy-five examples now before me, instability of pattern would seem to be the most constant characteristic.

LIST OF TYPES.

LIST OF AFRICAN SPECIES AND FORMS OF *ACRAEA* WITH LOCATION OF TYPES WHERE KNOWN.

Explanation of references.

London	= British Museum of Natural History, South Kensington, London.
Oxford	= Hope Department, University Museum, Oxford.
Tring	= The Private Museum of the Hon. W. Rothschild, Tring, England.
Berlin	= Kgl. Museum für Naturkunde, Berlin.
Vienna	= K. K. Naturhistorisches Hofmuseum, Vienna.
Brussels	= Musée Royal d'Histoire Naturelle de Belgique, Brussels.
Cape Town	= South African Museum, Cape Town.
Stockholm	= Naturhistoriska Riksmuseum, Stockholm.
Upsala	= Kgl. Universitetets Zoologiska Museum, Upsala.
Lisbon	= Museu Nacional de Lisboa, Lisbon.
Edinburgh	= Museum of Science and Art, Edinburgh.
Frankfurt	= Senckenbergisches Museum, Frankfurt a. M.
Washington	= United States National Museum, Washington.
Genoa	= Museo Civico di Storia Naturale, Genoa.
S. Fiel	= Museu Collegio de S. Fiel, Portugal.
Pieter-maritzburg	= Natal Museum, Pietermaritzburg.

(Drury's collection was sold about a hundred years ago and his types have become dispersed.)

A. acerata, Hew.	London.
f. *vinidia*, Hew.	London.
f. *brahmsi*, Suff.	Coll. Suffert.
f. *diavina*, Suff.	Berlin.
subsp. *tenella*, Rogenh.	Vienna.
A. acrita, Hew.	London.
f. *msamwiae*, Strand	Berlin.
f. *aquilina*, Strand	Berlin.
f. *nyassicola*, Strand	Berlin.
subsp. *pudorina*, Staud.	Berlin.
f. *utengulensis*, Thur.	Berlin.
subsp. *littoralis*, Eltr.	Tring.

f. *aquilia*, Thur. Berlin.
f. *chacribulula*, Strand Berlin.
f. *usaramensis*, Strand Berlin.
subsp. *manca*, Thur. Berlin.
f. *lindica*, Strand Berlin.
subsp. *ambigua*, Trim. Coll. Trimen.
f. *bella*, Weymer Coll. Weymer.
subsp. *bellona*, Weymer.
A. admatha, Hew. . London.
f. *leucographa*, Ribbe Berlin.
A. aglaonice, Westw.. Oxford.
A. alciope, Hew. . London.
♀ f. *macarina*, Butl. London.
♀ f. *cretacea*, Eltr. Oxford.
♀ f. *fumida*, Eltr. Oxford.
♀ f. *aurivillii*, Staud. Berlin.
♀ f. *tella*, Eltr. . Oxford.
subsp. *schecana*, R. and J. Tring
A. althoffi, Dewitz . Berlin.
f. *rubrofasciata*, Auriv. Brussels.
♀ f. *télloides*, Eltr. Oxford.
♀ f. *drucei*, Eltr. . Coll. Druce.
♀ f. *ochreata*, Eltr. Oxford.
subsp. *pseudepaea*, Dudgeon Coll. Dudgeon.
A. amicitiae, Heron London.
A. anacreon, Trimen Coll. Trimen.
subsp. *bomba*, Gr.-Smith Coll. Joicey.
f. *induna*, Trim. Cape Town.
subsp. *anacreontica*, Gr.-Smith Tring.
subsp. *speciosa*, Wichgr. Coll. Wichgraf.
A. anemosa, Hew. . London.
f. *arcticincta*, Butl. London.
f. *interrupta*, Thur. Berlin.
f. *mosana*, Suff. Berlin.
f. *dubiosa*, Suff. . Coll. Suffert.
f. *ufipana*, Strand Berlin.
f. *urungensis*, Strand Berlin.
A. ansorgei, Gr.-Smith Tring.

A. asboloplintha, Karsch Berlin.
subsp. *rubescens*, Trim. Oxford.
A. asema, Hew. . London.
f. *gracilis*, Wichgr. Coll. Wichgraf.
A. atergatis, Westw. Oxford.
A. atolmis, Westw. Oxford.
f. *decora*, Weymer Coll. Weymer.
A. aureola, Eltr. Tring.
A. aubyni, Eltr. Oxford.
A. axina, Westw. Oxford.
A. baxteri, Sharpe . Coll. Joicey.
f. *fulleborni*, Thur. Berlin.
f. *subsquamia*, Thur. Berlin.
A. bonasia, Fab. London.
♀ f. *cynthius*, Drur.
♀ f. *praeponina*, Staud. Berlin.
♀ f. *siabona*, Suff. Berlin.
subsp. *alicia*, Sharpe Coll. Jackson.
♀ f. *cabiroides*, Poulton Oxford.
♀ f. *tenellides*, Poulton Oxford.
subsp. *banka*, Eltr. Oxford.
A. braesia, Godm. . London.
f. *regalis*, Oberth. Coll. Oberthür.
A. buschbecki, Dew. . Berlin.
A. büttneri, Rogenh. Vienna.
A. cabira, Hopff. . Berlin.
f. *apecida*, Oberth. Coll. Oberthür.
f. *abrupta*, Grünberg. Berlin.
f. *natalensis*, Staud. Berlin.
f. *karschi*, Auriv. . Berlin.
f. *biraca*, Suff. . Berlin.
A. caecilia, Fabr. . London.
♀ f. *hypatia*, Drur.
♀ f. *artemisa*, Stoll
subsp. *pudora*, Auriv. Stockholm.
f. *umbrina*, Auriv. Stockholm.
A. caldarena, Hew. London.
♀ f. *nero*, Butl. . London.

f. *neluska*, Oberth.	Coll. Oberthür.
A. camaena, Drur.	
A. cepheus, Linn.	
f. *abdera*, Hew.	London.
f. *eginopsis*, Auriv.	Stockholm.
♀ f. *sucepha*, Suff.	Berlin.
♀ f. *nigrescens*, Eltr.	Tring.
A. cerasa, Hew.	London.
A. cerita, Sharpe	Coll. Joicey.
A. chaeribula, Oberth.	Coll. Oberthür.
A. chambezi, Neave	London.
A. chilo, Godm.	London.
♀ f. *hoeneli*, Holl.	Washington.
A. cinerea, Neave	Oxford.
subsp. *alberta*, Eltr.	Tring.
A. circeis, Drur.	
A. conjuncta, Gr.-Smith	Tring.
f. *interrupta*, Eltr.	London.
♀ f. *silacea*, Eltr.	London.
♀ f. *mutata*, Eltr.	London.
♀ f. *pica*, Eltr.	London.
♀ f. *lutealba*, Eltr.	London.
♀ f. *suffusa*, Eltr.	London.
A. conradti, Oberth.	Coll. Oberthür.
A. damii, Vollenh.	
subsp. *cuva*, Gr.-Smith	Coll. Joicey.
f. *nidama*, Suff.	Berlin.
A. diogenes, Suff.	Berlin.
A. disjuncta, Gr.-Smith	Tring.
A. doubledayi, Guérin	London.
subsp. *sykesi*, Sharpe	Tring.
subsp. *arabica*, Eltr.	Tring.
A. egina, Cram.	
f. *harrisoni*, Sharpe	Coll. Harrison.
subsp. *areca*, Mab.	
subsp. *medea*, Cram.	
A. ella, Eltr.	Tring.
A. encedon, Linn.	
f. *infuscata*, Staud.	Berlin.
f. *alcippina*, Auriv.	Stockholm.
f. *sganzini*, Boisd.	Coll. Oberthür.
f. *lycia*, Fab.	London.
f. *necoda*, Hew.	London.
f. *daira*, Godm.	London.
f. *radiata*, Auriv.	Stockholm.
A. esebria, Hew.	London.
f. *protea*, Trim.	CapeTown(?).
f. *pseudoprotea*, Butl.	London.
♀ f. *amphiprotea*, Butl.	London.
♀ f. *metaprotea*, Butl.	London.
f. *jacksoni*, Sharpe	Coll. Jackson.
f. *monteironis*, Butl.	London.
f. *nubilata*, Eltr.	Oxford.
f. *ertli*, Auriv.	Coll. Ertl.
subsp. *masaris*, Oberth.	Coll. Oberthür.
A. equatorialis, Neave	Oxford.
subsp. *anaemia*, Eltr.	Oxford.
A. excelsior, Sharpe	Coll. Jackson.
A. eugenia, Karsch	Berlin.
A. fornax, Butl.	London.
A. goetzi, Thur.	Berlin.
A. guillemei, Oberth.	Coll. Oberthür.
A. grosvenori, Eltr.	Tring.
A. hova, Boisd.	Coll. Oberthür.
A. horta, Linn.	Upsala.
A. igola, Trim.	Coll. d' Aguilar.
♀ f. *maculiventris*, Gr.-Smith	Coll. Joicey.
A. igati, Boisd.	Coll. Oberthür.
A. insignis, Dist.	
f. *siginna*, Suff.	Coll. Suffert.
A. insularis, Sharpe	Lisbon.
A. intermedia, Wichgr.	Coll. Wichgraf.
A. iturina, Gr.-Sm.	Coll. Joicey.
subsp. *kakana*, Eltr.	London.
A. jodutta, Fabr.	
♀ f. *carmentis*, Doubl.	London.
♀ f. *dorotheae*, Sharpe.	Tring.

♀ f. *interjecta*, Eltr.	Oxford.
♀ f. *subfulva*, Eltr.	Oxford.
♀ f. *castanea*, Eltr.	Oxford.
♀ f. *inaureata*, Eltr.	London.
subsp. *aethiops*, R. and J.	Tring.
A. johnstoni, Godm.	London.
f. *confusa*, Rogenh.	Vienna.
f. *flavescens*, Oberth.	Coll. Oberthür.
f. *semialbescens*, Oberth.	Coll. Oberthür.
f. *fulvescens*, Oberth.	Coll. Oberthür.
f. *octobalia*, Karsch	Berlin.
subsp. *butleri*, Gr.-Sm.	Coll. Joicey.
A. kraka, Auriv.	Stockholm.
A. leucopyga, Auriv.	Stockholm.
A. lia, Mab.	Coll. Mabille. (?)
A. lualabae, Neave	London.
A. lumiri, B.-Bak.	Coll. Powell Cotton.
A. lycoa, Godt.	Edinburgh (?)
subsp. *media*, Eltr.	Tring.
subsp. *bukoba*, Eltr.	Tring.
subsp. *entebbia*, Eltr	Tring.
subsp. *tirika*, Eltr.	Oxford.
„ *fallax*, Rogenh.	Vienna.
subsp. *kenia*, Eltr.	Oxford.
A. machequena, Gr.-Sm.	Coll. Joicey.
A. maheta, Boisd.	Coll. Oberthür.
A. mairessei, Auriv.	Brussels.
f. *dewitzi*, Auriv.	Berlin.
A. mansya, Eltr.	Oxford.
A. masamba, Ward	Coll. Oberthür.
f. *silia*, Mab.	Coll. Mabille. (?)
♀ f. *boseae*, Saalm.	Frankfurt.
A. marnois, Rogenh.	Vienna.
A. melanoxantha, Sharpe	Coll. Jackson.
A. mima, Neave	London.
A. mirabilis, Butl.	London.
A. mirifica, Lathy	Coll. Adams.
A. natalica, Boisd.	Coll. Oberthür.
f. *umbrata*, Suff.	Coll. Suffert.
subsp. *pseudegina*, Westw.	
subsp. *abadima*, Ribbe	Berlin.
A. neobule, Doubl.	London.
f. *sokotrana*, Rebel	Vienna.
subsp. *seis*, Feisth.	Coll. Oberthür.
subsp. *arabica*, Rebel	Tring.
A. newtoni, Sharpe	Lisbon.
A. niobe, Sharpe	Lisbon.
A. nohara, Boisd.	Coll. Oberthür.
subsp. *halali*, Marshall	Pietermaritzburg.
subsp. *pseudatolmis*, Eltr.	Oxford.
subsp. *punctellata*, Eltr.	Oxford.
A. obeira, Hew.	London.
subsp. *burni*, Butl.	London.
A. oberthüri, Butl.	London.
f. *confluens*, Suff.	Berlin.
A. oncaea, Hoppf.	Berlin.
♂ f. *caoncius*, Suff.	Coll. Suffert.
♀ f. *alboradiata*, Suff.	Coll. Suffert.
♀ f. *modesta*, Suff.	Berlin.
♀ f. *obscura*, Suff.	Berlin.
♀ f. *defasciata*, Suff.	Berlin.
subsp. *lineea*, Suff.	Berlin.
A. onerata, Trim.	Cape Town.
A. omrora, Trim.	Coll. Trimen.
subsp. *umbrata*, Wichgr.	Coll. Wichgraf.
A. oreas, Sharpe,	Coll. Jackson.
f. *albimaculata*, Neave	Oxford.
f. *angolanus*, Lathy.	Coll. Adams.
A. orestia, Hew.	London.
f. *humilis*, Sharpe	Coll. Jackson.
f. *transita*, Eltr.	Oxford.
A. orina, Hew.	London.
f. *nigroapicalis*, Auriv.	Stockholm.

f. *orinata*, Oberth.	Coll. Oberthür.
subsp. *orineta*, Eltr.	Oxford.
A. oscari, R. and J.	Tring.
A. parrhasia, Fabr.	London.
♀ f. *oppidia*, Hew.	London.
♀ f. *parrhoppidia*, Staud.	Berlin.
♀ f. *leona*, Staud.	Berlin.
A. pelopeia, Staud.	Berlin.
A. peneleos, Ward.	Coll. Oberthür.
♀ f. *helvimaculata*, Eltr.	Oxford.
♀ f. *lactimaculata*, Eltr.	Tring.
♀ f. *sepia*, Eltr.	Oxford.
subsp. *gelonica*, R. and J.	Tring.
A. penelope, Staud.	Berlin.
♀ f. *argentea*	Oxford.
♀ f. *exalbescens*	Oxford.
♀ f. *penella*	Tring.
subsp *vitrea*, Eltr.	Oxford.
subsp. *derubescens*, Eltr.	Berlin.
subsp. *translucida*, Eltr.	Oxford.
A. pentapolis, Ward.	Coll. Oberthür.
subsp. *epidica*, Oberth.	Coll. Oberthür.
A. perenna, Doubl.	London.
subsp. *thesprio*, Oberth.	Coll. Oberthür.
subsp. *kaffana*, Roth.	Tring.
A. periphanes, Oberth.	Coll. Oberthür.
f. *beni*, B.-Bak.	Coll. Bethune-Baker.
f. *melaina*, Eltr.	Oxford.
f. *umida*, Wichgr.	Coll. Wichgraf.
f. *acritoides*, Eltr.	Oxford.
A. petraea, Boisd.	Coll. Oberthür.
f. *taborana*, Suff.	Coll. Suffert.
A. pharsalus, Ward.	Coll. Oberthür.
f. *pharsaloides*, Holl.	Washington.
f. *pallidepicta*, Strand	Berlin.
f. *nia*, Strand	Berlin.
subsp. *vuilloti*, Mab.	Coll. Mabille.
subsp. *rhodina*, Roth.	Tring.
A. pseudolycia, Butl.	London.
f. *astrigera*, Butl.	London.
♀ f. *emini*, Weym.	Coll. Richelmann.
f. *brunnea*, Eltr.	Tring.
A. pudorella, Auriv.	Stockholm.
subsp. *detecta*, Neave	London.
A. quirina, Fab.	London.
subsp. *rosa*, Eltr.	Oxford.
A. quirinalis, Gr.-Sm.	Coll. Joicey.
A. rabbaiae, Ward	Coll. Oberthür.
subsp. *mombasae*, Gr.-Sm.	Coll. Joicey.
A. rahira, Boisd.	Coll. Oberthür.
A. ranavalona, Boisd.	Coll. Oberthür.
f. *maransetra*, Ward	Coll. Oberthür.
♀ f. *manandaza*, Ward	Coll. Oberthür.
A. rhodesiana, Wichgr.	Coll. Wichgraf.
A. rogersi, Hew.	London.
f. *salambo*, Gr.-Sm.	Coll. Joicey.
subsp. *lamborni*, Eltr.	Oxford.
A. rohlfsi, Suff.	Coll. Ertl.
A. safie, Feld.	Frankfurt.
f. *antinorii*, Auriv.	Genoa.
A. sambavae, Ward	Coll. Oberthür.
A. satis, Ward	Coll. Oberthür.
A. semivitrea, Auriv.	Brussels.
A. serrona, Godt.	Edinburgh.
f. *reversa*, Eltr.	Tring.
♀ f. *rubra*, Eltr.	Tring.
subsp. *orientis*, Auriv.	Stockholm.
f. *depunctella*, Strand	Berlin.
f. *unipunctella*, Strand	Berlin.
f. *semipunctella*, Strand	Berlin.
f. *transienda*, Strand	Berlin.

subsp. *rhodina*, R. and J.	Tring.
subsp. *limonata*, Eltr.	London.
subsp. *tenebrosa*, Eltr.	Tring.
A. sotikensis, Sharpe	Coll. Jackson.
subsp. *katana*, Eltr.	Oxford.
f. *supponina*, Staud.	Berlin.
subsp. *rowena*, Eltr.	Tring.
A. stenobea, Wallengr.	Stockholm.
A. strattipocles, Oberth.	Coll. Oberthür.
A. terpsichore, Linn.	
♀ f. *janisca*, Godt.	Edinburgh.
f. *rougeti*, Guérin.	
f. *melas*, Oberth. .	Coll. Oberthür.
f. *subserena*, Gr.-Sm.	Tring.
f. *venturina*, Thur.	Berlin.
f. *connexa*, Thur.	Berlin.
f. *intermediana*, Strand	Berlin.
f. *ventura*, Hew. .	London.
f. *rangatana*, Eltr.	London.
subsp. *ochrascens*, Sharpe.	Coll. Jackson.
A. turna, Mab.	
f. *marmorata*, Gr.-Smith.	Coll. Joicey.
A. uvui, Gr.-Smith .	Coll. Joicey.
subsp. *balina*, Karsch	Berlin.
A. unimaculata, Gr.-Smith	Coll. Joicey.
A. vesperalis, Gr.-Sm.	Coll. Joicey.
subsp. *catori*, B.-Bak.	Coll. Cator.
A. violarum, Boisd. .	Coll. Oberthür.
A. viviana, Staud. .	Berlin.
A. welwitschii, Rogenh.	Vienna.
subsp. *alboradiata*, Auriv.	
subsp. *lobemba*, Eltr.	Oxford.
A. wigginsi, Neave .	Oxford.
A. zambesina, Auriv.	S. Fiel.
A. zetes, Linn.	
f. *menippe*, Drur.	
f. *jalema*, Godt. .	Edinburgh.
subsp. *acara*, Hew.	London.
f. *caffra*, Feld. .	Tring.
f. *mhondana*, Suff.	Coll. Suffert.
f. *tescea*, Suff. .	Coll. Suffert.
A. zitja, Boisd. .	Coll. Oberthür.
f. *radiata*, Guénee	
f. *calida*, Butl. .	London.
f. *rakeli*, Boisd. .	Coll. Oberthür.
f. *fumida*, Mab. .	Coll. Mabille. (?)
A. zonata, Hew. .	London.

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INDEX TO SPECIFIC NAMES

JULY 12, 1912.

Explanation of Plate I.

Fig.

1. *A. pseudolycia* f. *astrigera*, Butl. ♂, Machakos. (Oxford.)
2. *A. pseudolycia* f. *emini*, Weymer ♀, Kibaoni, Uhamba. (Tring.)
3. *A. pseudolycia* f. *brunnea*, Eltr. ♀ (Type), Masindi. (Tring.)
4. *A. pseudolycia* f. *brunnea*, Eltr. ♂ (Type), Guimbungo, Angola. (Tring.)
5. *A. pseudolycia pseudolycia*, Butl. ♂, Pungo Andongo, Angola (Tring.)
6. *A. nohara pseudatolmis*, Eltr. ♂ (Type), Mahakata R., Gazaland. (Oxford.)
7. *A. rohlfsi*, Suff. ♂ (Type), Ukerewe I. (Coll. Ertl.)
8. *A. lofua*, Eltr. ♂ (Type), Lofu R., N.E. Rhodesia. (Oxford.)
9. *A. lofua*, Eltr. ♀ (Type), Lofu R , N.E. Rhodesia. (Oxford.)
10. *A. pseudolycia astrigera*, Butl. ♀, Machakos. (Oxford.)
11. *A. pharsalus vuilloti*, Mab. ♂, German E. Africa. (Coll. Joicey.)
12. *A. mansya*, Eltr. ♀ (Type), Mansya R., N.E. Rhodesia. (Oxford.)
13. *A. mansya*, Eltr. ♂ (Type), Mansya R., N.E.Rhodesia. (Oxford.)

H. Eltringham del.

West, Newman chr.

NEW AND LITTLE KNOWN FORMS OF ACRAEA.

Explanation of Plate II.

Fig.

1. *A. egina medea*, Cram. ♂, ? Senegal. (Berlin.)
2. *A. doubledayi arabica*, Eltr. ♂ (Type), Azvaki Ravine, Arabia. (Tring.)
3. *A. doubledayi doubledayi*, Guér. ♂, Abyssinia. (Tring.)
4. *A. welwitschii welwitschii*, Rogenh. ♂, Cerambé, Bihé, Angola. (Tring.)
5. *A. welwitschii welwitschii*, Rogenh. ♀, Bumba, Angola. (Tring.)
6. *A. rhodesiana*, Wichgr. ♂, Rhodesia. (London.)
7. *A. ella*, Eltr. ♂ (Type), Benguella. (Tring.)
8. *A. aureola*, Eltr. ♂ (Type), Bihé, Angola. (Tring.)
9. *A. grosvenori*, Eltr. ♂ (Type), Rutschuru R. (Tring.)
10. *A. equatorialis equatorialis*, Neave ♂, Kisumu. (Oxford.)
11. *A. equatorialis equatorialis*, Neave ♀, Kisumu. (Oxford.)

H. Eltringham del.

West, Newman chr.

NEW AND LITTLE KNOWN FORMS OF ACRAEA.

Explanation of Plate III.

Fig.

1. *A. parrhasia parrhasia*, Fabr. ♀, near Lagos. (Oxford.)
2. *A. parrhasia* f. *leona*, Staud. ♀, S. Leone. (Tring.)
3. *A. peneleos* f. *lactimaculata*, Eltr. ♀ (Type), Fishtown, Fernando Po. (Tring.)
4. *A. serrona rhodina*, R. and J. ♂, Entebbe. (Oxford.)
5. *A. serrona orientis*, Auriv. ♀, Amani, German E. Africa. (Oxford.)
6. *A. oscari*, Roth. ♂, Charada Forest, Kaffa. (London.)
7. *A. pudorella pudorella*, Auriv. ♂, Campi-ya-Simba. (Tring.)
8. *A. acrita manca*, Thur, ♂, Itumba, German E. Africa. (Tring.)
9. *A. serrona* f. *rubra*, Eltr. ♀ (Type), L. Assebe, Fernan Vaz. (Tring.)
10. *A. periphanes* f. *melaina*, Eltr. ♀, Chambezi Valley. (Oxford.)
11. *A. periphanes* f. *acritoides*, Eltr. ♂ (Type), Luwingu, L. Bangweolo. (Oxford.)

H. Eltringham del.

West, Newman chr.

NEW AND LITTLE KNOWN FORMS OF ACRAEA.

EXPLANATION OF PLATE IV.

FIG.

1. *A. cinerea alberta*, Eltr. ♂ (Type), 90 km. W. of L. Albert Edward. (Tring.)
2. *A. peneleos pelasgius*, Gr.-Sm. ♂, Toro. (Oxford.)
3. *A. parrhasia parrhasia*, Fabr. ♂, near Lagos. (Oxford.)
4. *A. penelope translucida*, Eltr. ♂ (Type), near Lagos. (Oxford.)
5. *A. penelope derubescens*, Eltr. ♂ (Type), Misahöhe Station, Togo. (Berlin.)
6. *A. penelope translucida*, Eltr. ♀ (Type), near Lagos. (Oxford.)
7. *A. penelope vitrea*, Eltr. ♂ (Type), Tiriki Hills. (Oxford.)
8. *A. penelope* ♀ f. *argentea*, Eltr. (Type), Entebbe. (Oxford.)
9. *A. cerita*, Sharpe ♂ (Type), Toro. (Coll. Joicey.)
10. *A. peneleos peneleos*, Ward ♂, near Lagos. (Oxford.)
11. *A. peneleos* f. *helvimaculata*, Eltr. ♀ (Type), near Lagos. (Oxford.)
12. *A. peneleos peneleos*, Ward ♀, near Lagos. (Oxford.)
13. *A. eugenia*, Karsch. ♀, Canhoca, Angola. (Tring.)
14. *A. iturina kakana*, Eltr. ♂ (Type), Adie Kaka, Kaffa. (London.)
15. *A. sotikensis supponina*, Staud. ♂ (Type), "Congo Region." (Berlin.)
16. *A. lumiri*, B. Baker ♂ (Type), Kissegneis. (Coll. Powell-Cotton.)

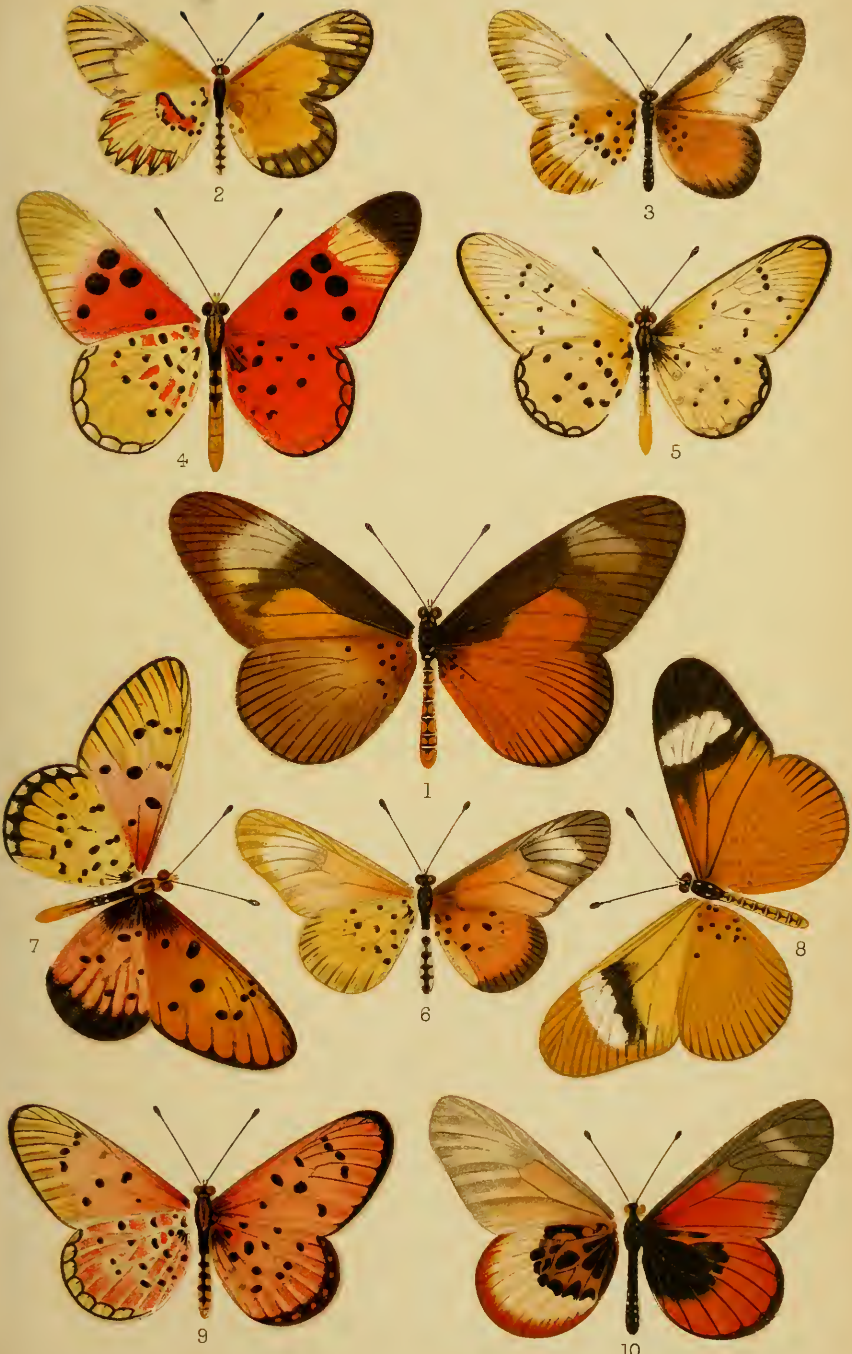
H. Eltringham del. West, Newman chr.

NEW AND LITTLE KNOWN FORMS OF ACRAEA.

Explanation of Plate V.

Fig.

1. *A. jodutta* f. *castanea*, Eltr. ♀ (Type), bred near Lagos by Lamborn. (Oxford.)
2. *A. terpsichore rangatana*, Eltr. ♂ (Type), Rangatan. (London.)
3. *A. penelope* ♀ f. *penella*, Eltr. (Type), Kitanwa, Unyoro. (Tring.)
4. *A. acrita bellona*, Weym. ♂, Bailundo, Angola. (Coll. Ertl.)
5. *A. equatorialis anaemia*, Eltr. ♂ (Type), Rabai. (Oxford.)
6. *A. aubyni*, Eltr. ♂ (Type), Mwaeba Hill, Mombasa. (Oxford.)
7. *A. periphanes* f. *umida*, Wichgr. ♂, L. Bangweolo. (Oxford.)
8. *A. jodutta* f. *inaureata*, Eltr. ♀ (Type), Rukuru Val., Nyassaland. (London.)
9. *A. nohara* f. *punctellata*, Eltr. ♂ (Type), Dedza Mt., Central Angoniland. (Oxford.)
10. *A. baxteri*, Sharpe ♂ (Type), Mpwapwa. (Coll. Joicey.)



H. Eltringham del.

West, Newman chr.

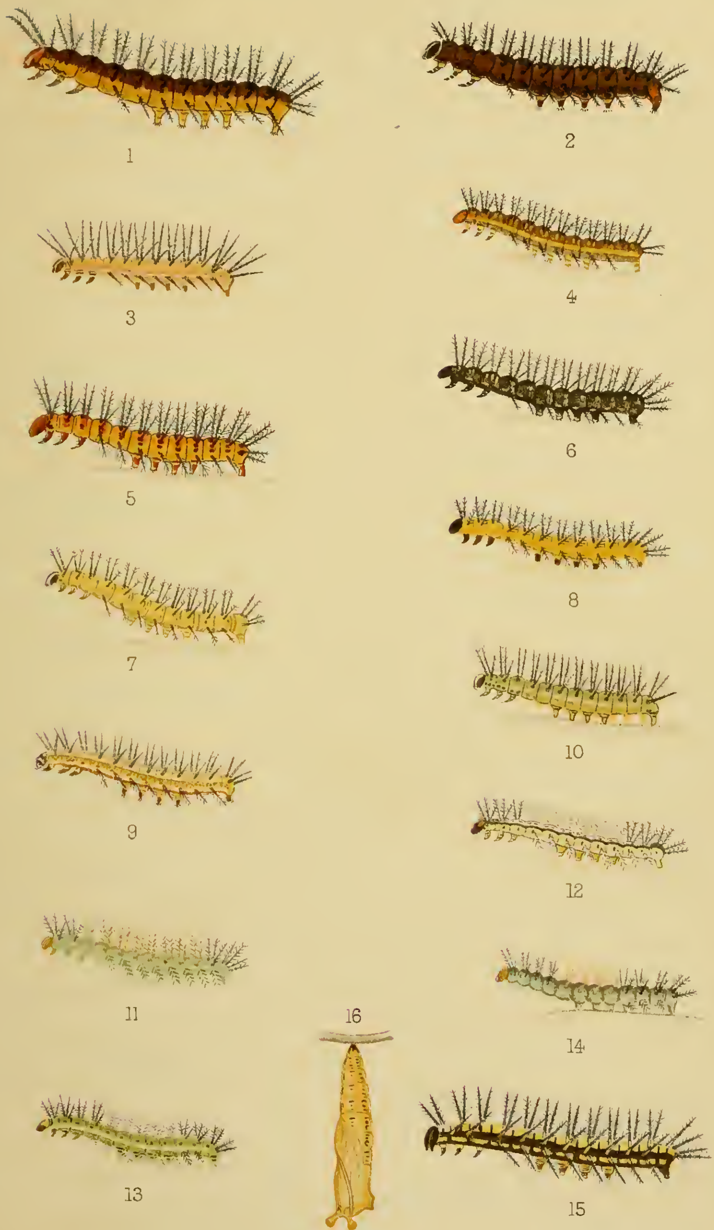
NEW AND LITTLE KNOWN FORMS OF ACRAEA.

Explanation of Plate VI.

Fig.

1. Larva of *A. pentapolis pentapolis.*
2. ,, ,, *A. rogersi lamborni.*
3. ,, ,, *A. parrhasia parrhasia.*
4. ,, ,, *A. peneleos peneleos.*
5. ,, ,, *A. zetes zetes.*
6. ,, ,, *A. perenna perenna.*
7. ,, ,, *A. pharsalus pharsalus.*
8. ,, ,, *A. lycoa lycoa.*
9. ,, ,, *A. natalica pseudegina.*
10. ,, ,, *A. alciope alciope.*
11. ,, ,, *A. bonasia bonasia* (pale form).
12. ,, ,, ,, ,, ,, (dark form).
13. ,, ,, *A. acerata vinidia.*
14. ,, ,, *A. oberthüri oberthüri.*
15. ,, ,, *A. egina egina.*
16. Pupa ,, *A. rogersi lamborni.*

All the above are drawn from specimens taken and preserved by Mr. W. A. Lamborn at Oni near Lagos, and are now in the Hope Department at Oxford. Some of the larvae are probably not quite fully grown.



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LARVAE OF ACRAEA.

Explanation of Plates VII–XVI.

The accompanying figures of genitalia are for the most part drawn as viewed from the side. In cases where they appear symmetrical about a central line they are viewed either from above or below. In many cases, as on Plates XI and XII, the view is from above, with the uncus cut away in order to give an uninterrupted view of the structure of the claspers. In almost every case the penis has been removed and drawn separately.

The following explanations may be noted :—

Pl. VII. 11*c* the ventral abdominal plate or velum. Figs. 5, 7, 8, 11*b*, 17, are viewed from below.

Pl. VIII. Figs. 1, 12, 13 viewed from above, Figs. 10 and 11 from below. Figs. 2, 3, 4, 5 appear to show considerable differences, but examination of a series of preparations shows such differences to be inconstant. The same applies to Figs. 6 and 7.

Pl. IX. Figs. 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 16 viewed from above (uncus removed in *f*. 9). Fig. 6 is the dorsal abdominal plate spread out and viewed from beneath. Figs. 7 and 13 are viewed from below. Fig. 15 is the dorsal abdominal plate viewed posteriorly to show the peculiar manner in which it is folded. Fig. 18 is the dorsal plate viewed from below.

Pl. X. Figs. 4, 5, 6, 10, 11, 12, 14 are the dorsal plates viewed from below. Figs. 15 and 16 are viewed from above with the uncus removed.

Pl. XI. All viewed from above with the uncus removed.

Pl. XII. Ditto.

Pl. XIII. Figs. 3, 22, 23, 24, ditto.

Pl. XIV. Figs. 2, 3, 7, 8, 9, 10, 11, 12, 13, ditto. Fig. 14 is a side view of the genital armature with the dorsal and ventral plates *in situ*. Fig. 14*a* is the dorsal plate viewed from below, Fig. 14*c* the ventral plate viewed from above, and Fig. 14*b* is the armature alone viewed from above.

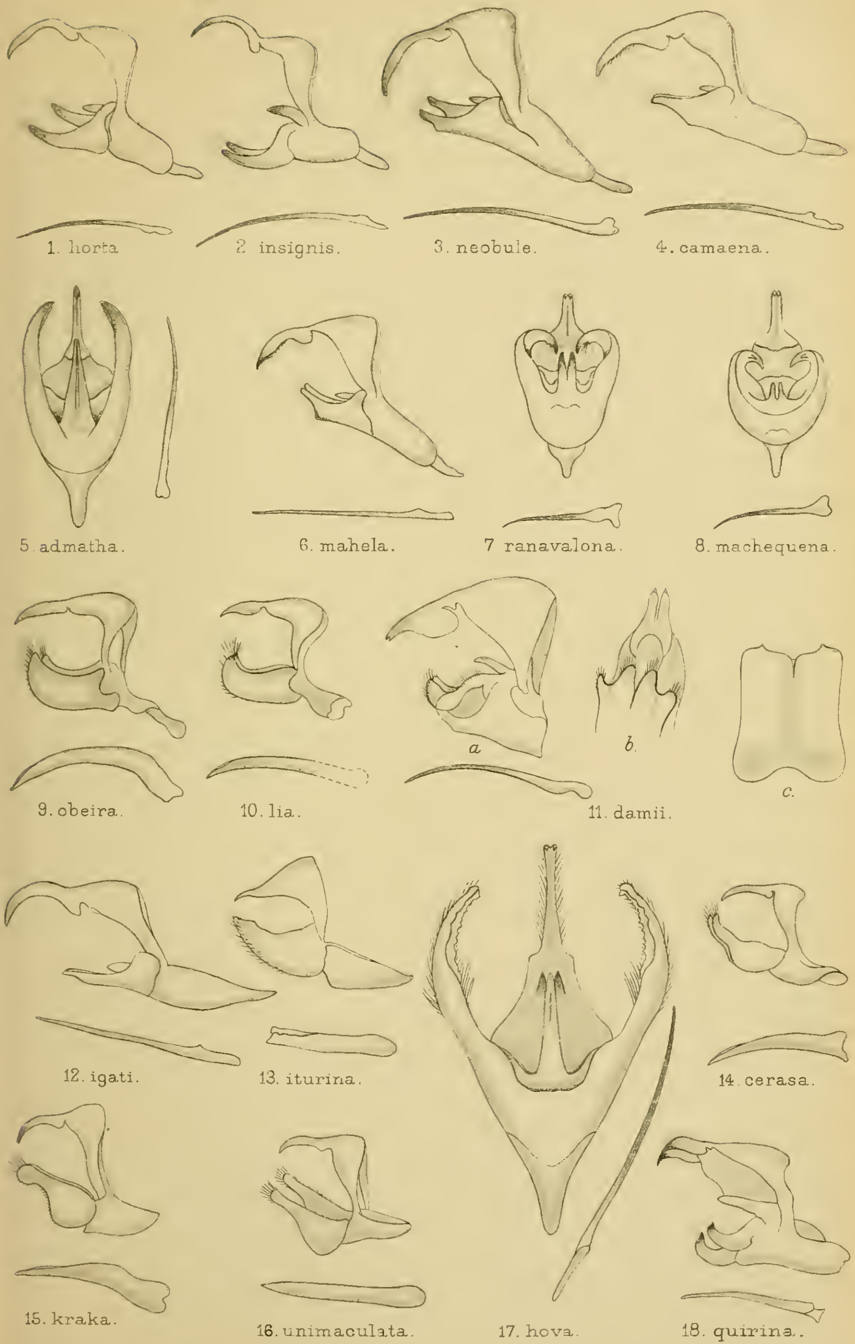
Pl. XV. Figs. 4, 13, 14, 15 are viewed from above with the uncus removed. Figs. 16–28 are the ventral chitinous plates which surround the orifice of the bursa copulatrix. all showing the ventral side.

Explanation of Plate XVI

Pl. XVI. Figs. 1–13 are further examples of ♀ chitinous plates, viewed in the same way. The posterior end of these plates is in each case uppermost.

Figs. 14 to 21 are views of the copulatory seals found on the ♀♀ after pairing. Though these structures exhibit a certain degree of constancy in each species they are often scarcely distinguishable in species which are closely allied and therefore are of little use in just those cases where small recognisable peculiarities would be of value.

The magnification varies from about eight to twelve diameters, but as the actual size of the organs illustrated is not of much systematic importance I have not thought it necessary to state the magnification in each case.



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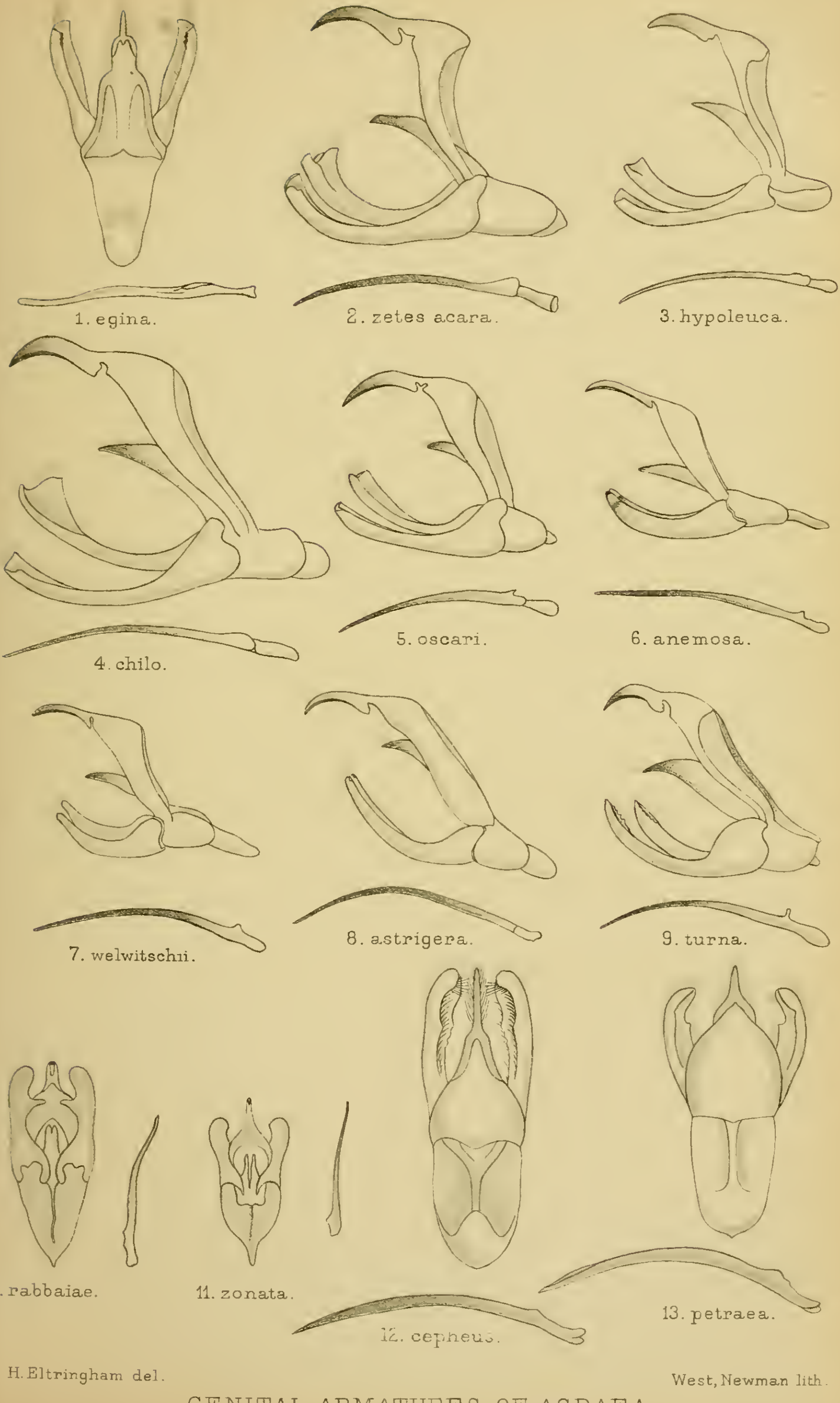
GENITAL ARMATURES OF ACRAEA.



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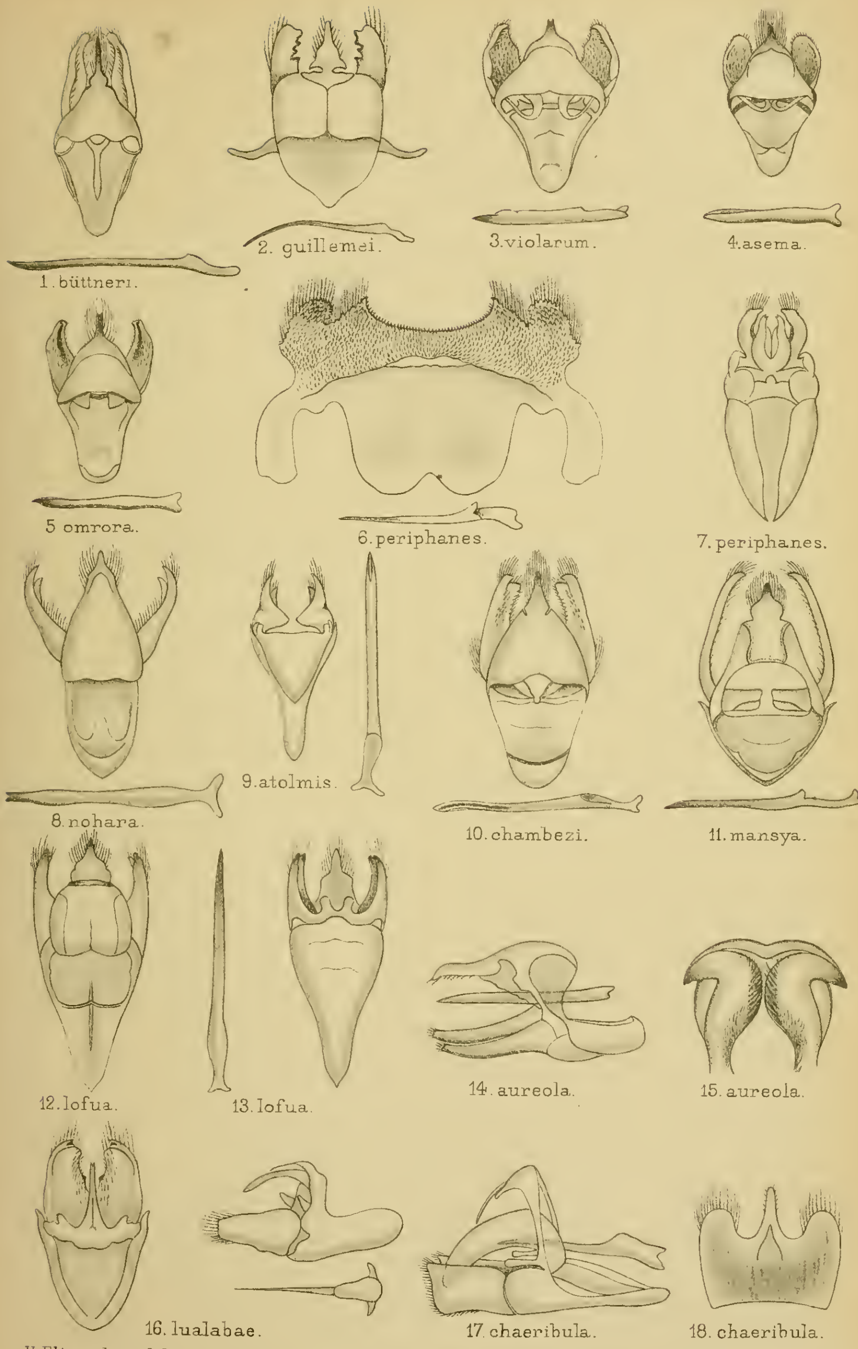

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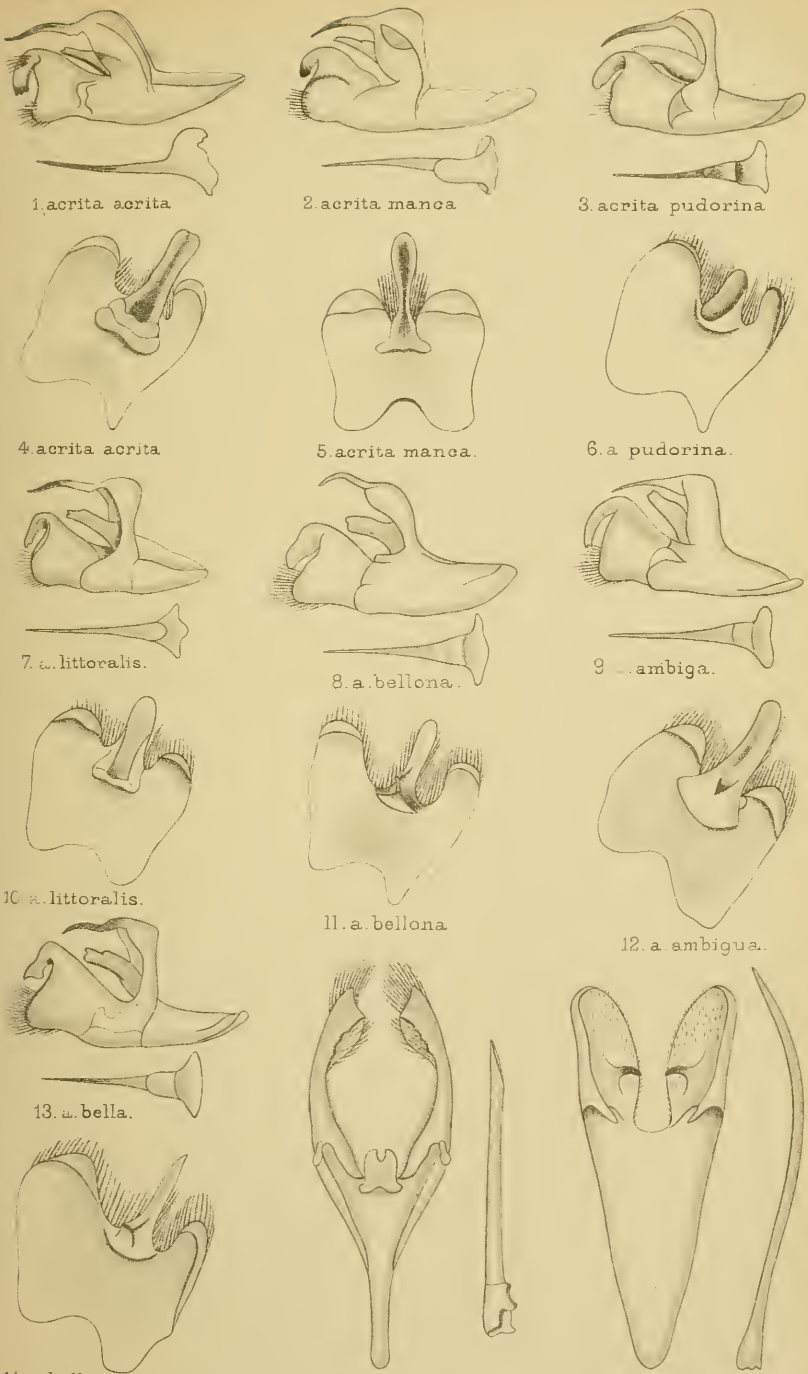
GENITAL ARMATURES OF ACRAEA.



1. acrita acrita
2. acrita manca
3. acrita pudorina
4. acrita acrita
5. acrita manca.
6. a. pudorina.
7. a. littoralis.
8. a. bellona.
9. ambiga.
10. a. littoralis.
11. a. bellona
12. a. ambigua.
13. a. bella.
14. a. bella
15. stenobea.
16. aglaonice

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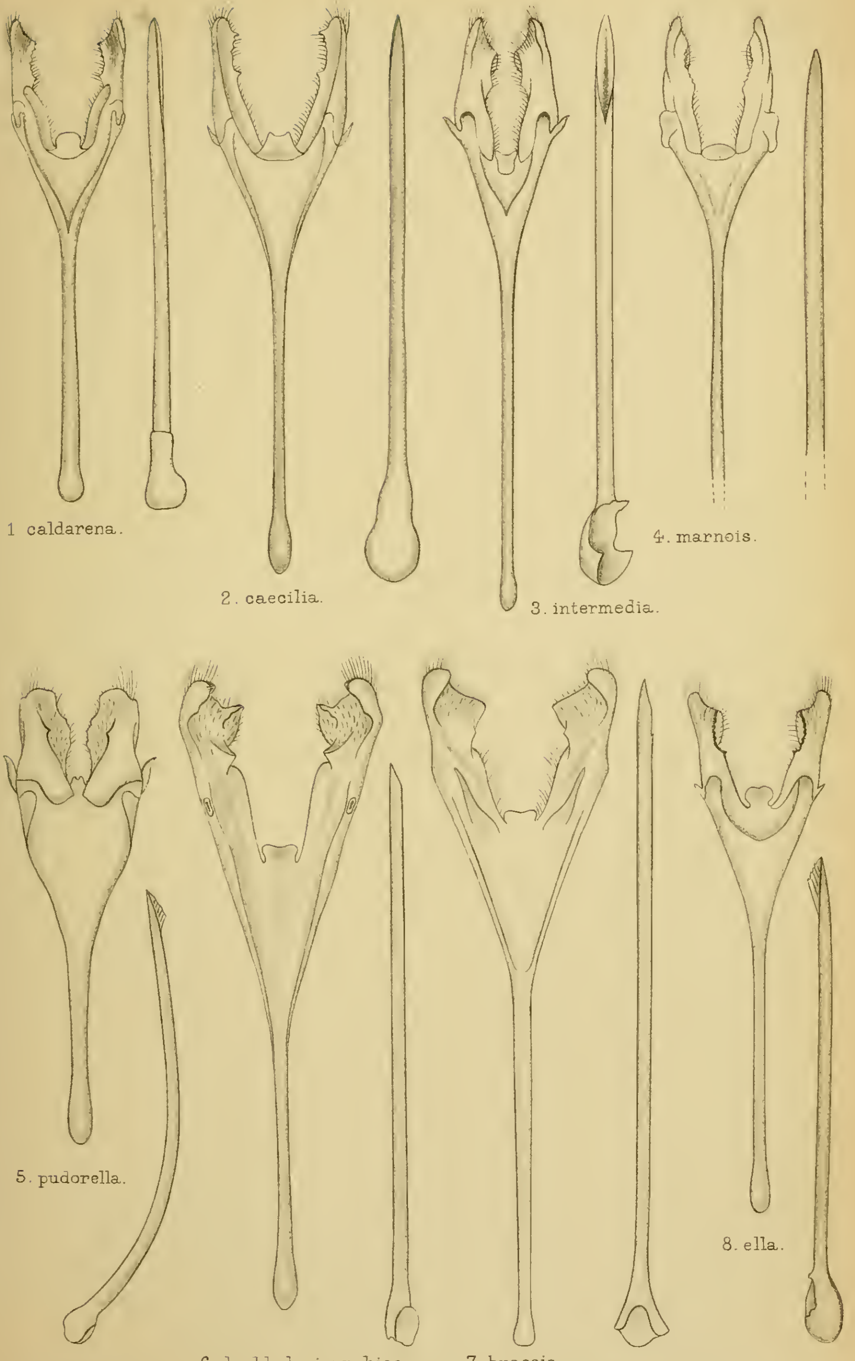
West, Newman lith.

GENITAL ARMATURES OF ACRAEA.



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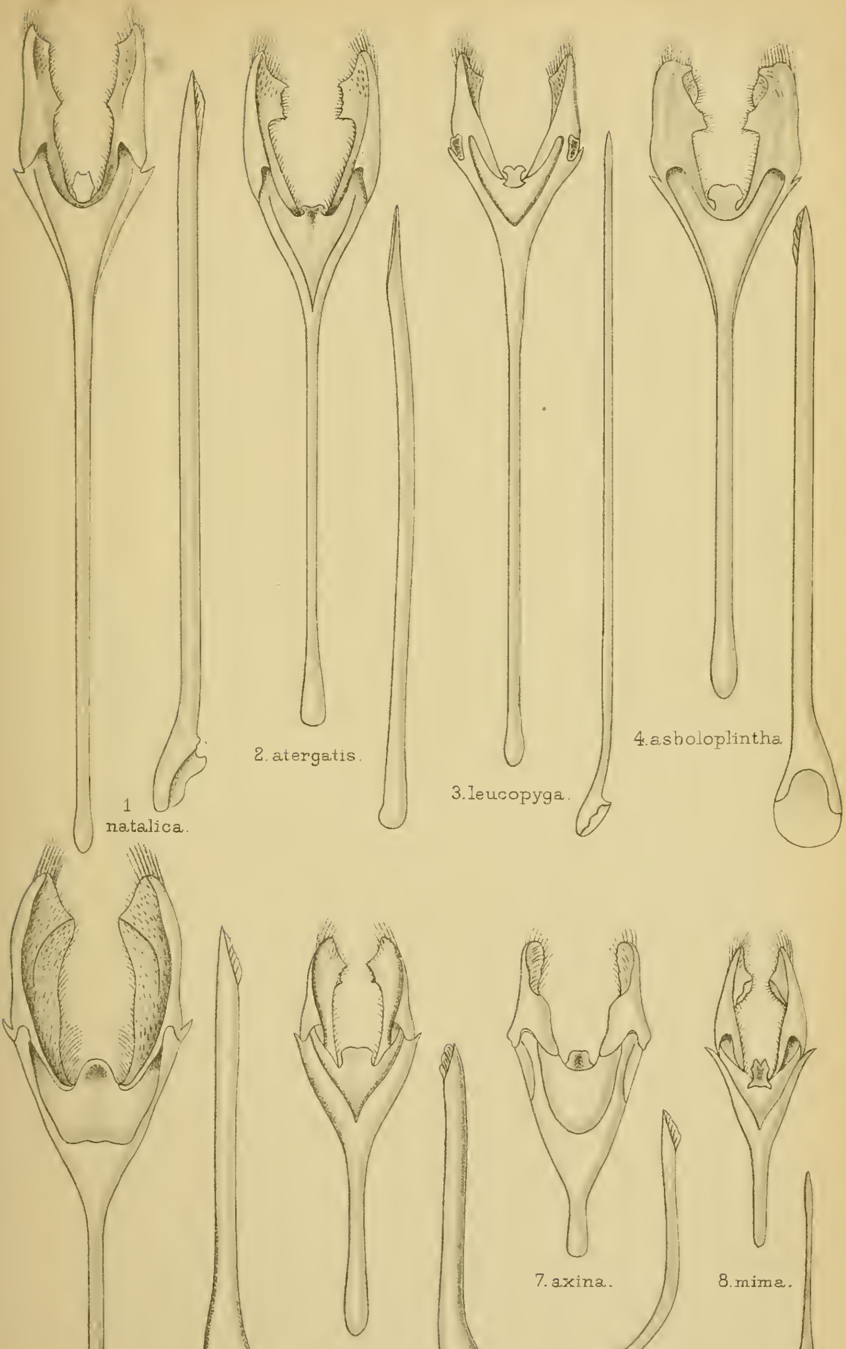
GENITAL ARMATURES OF ACRAEA.



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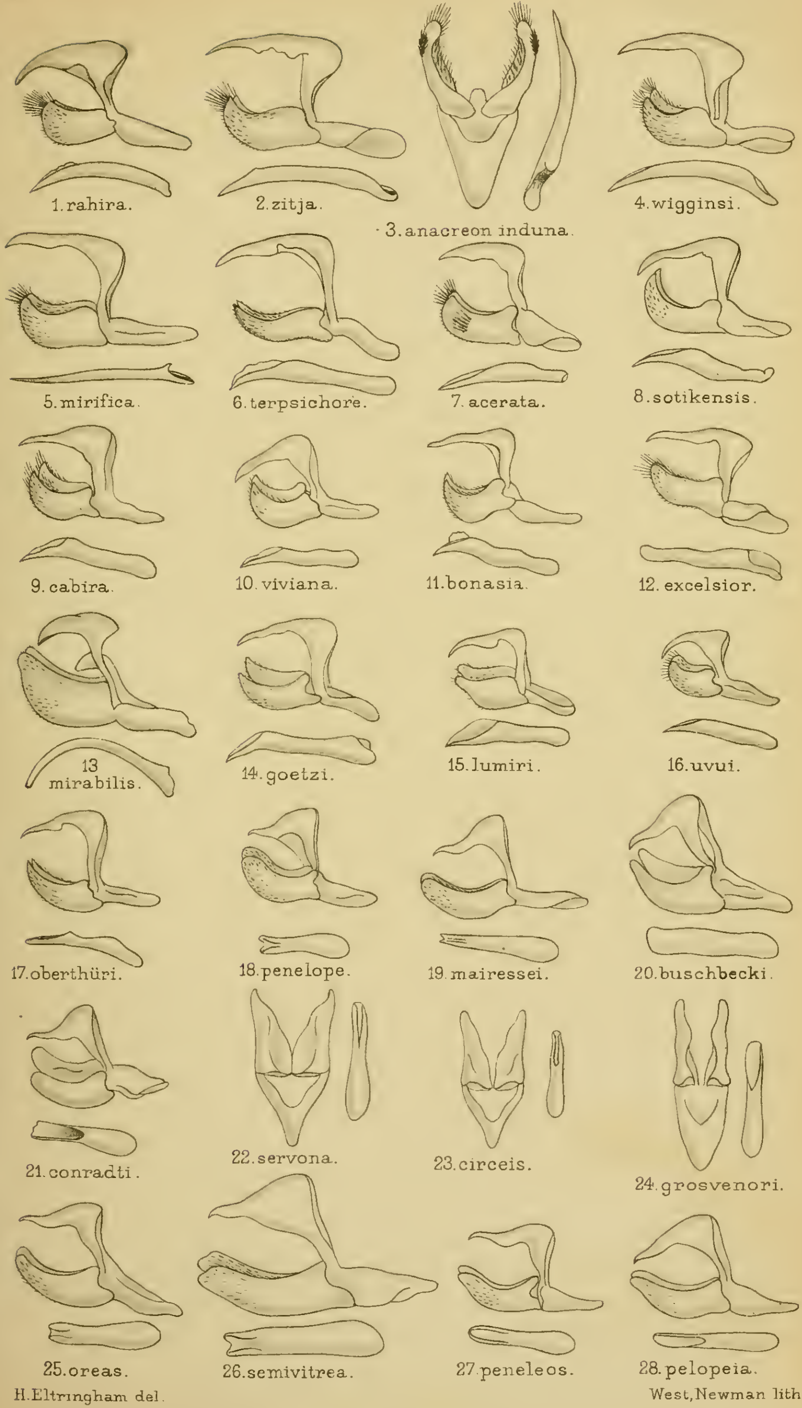
GENITAL ARMATURES OF ACRAEA.



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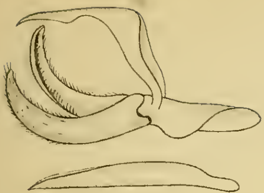
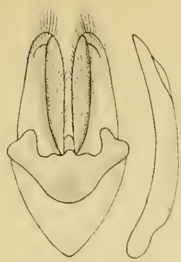
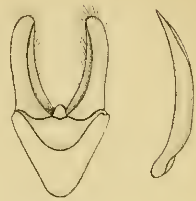
GENITAL ARMATURES OF ACRAEA.



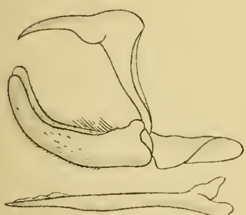
1. althoffi.



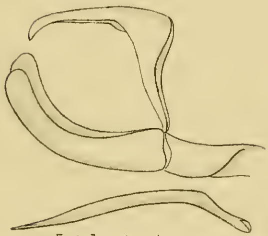
2. pentapolis.



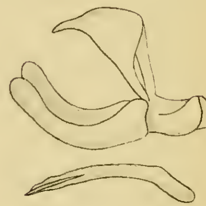
3. vesperalis.



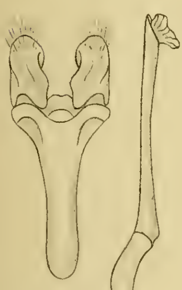
4. encedon.



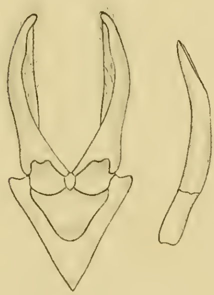
5. johnstoni.



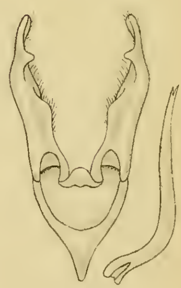
6. lycoa.



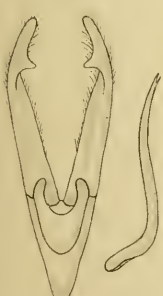
7. rogersi.



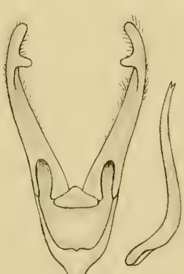
8. pharsalus.



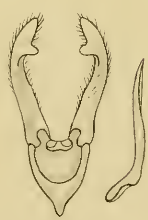
9. esebria.



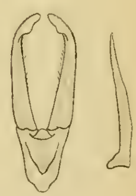
10. jodutta.



11. alciope.

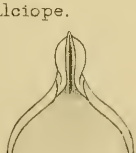


12. disjuncta.



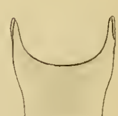
13. conjuncta.

14. satis.



14a. satis.

14b. satis.



14c. satis.

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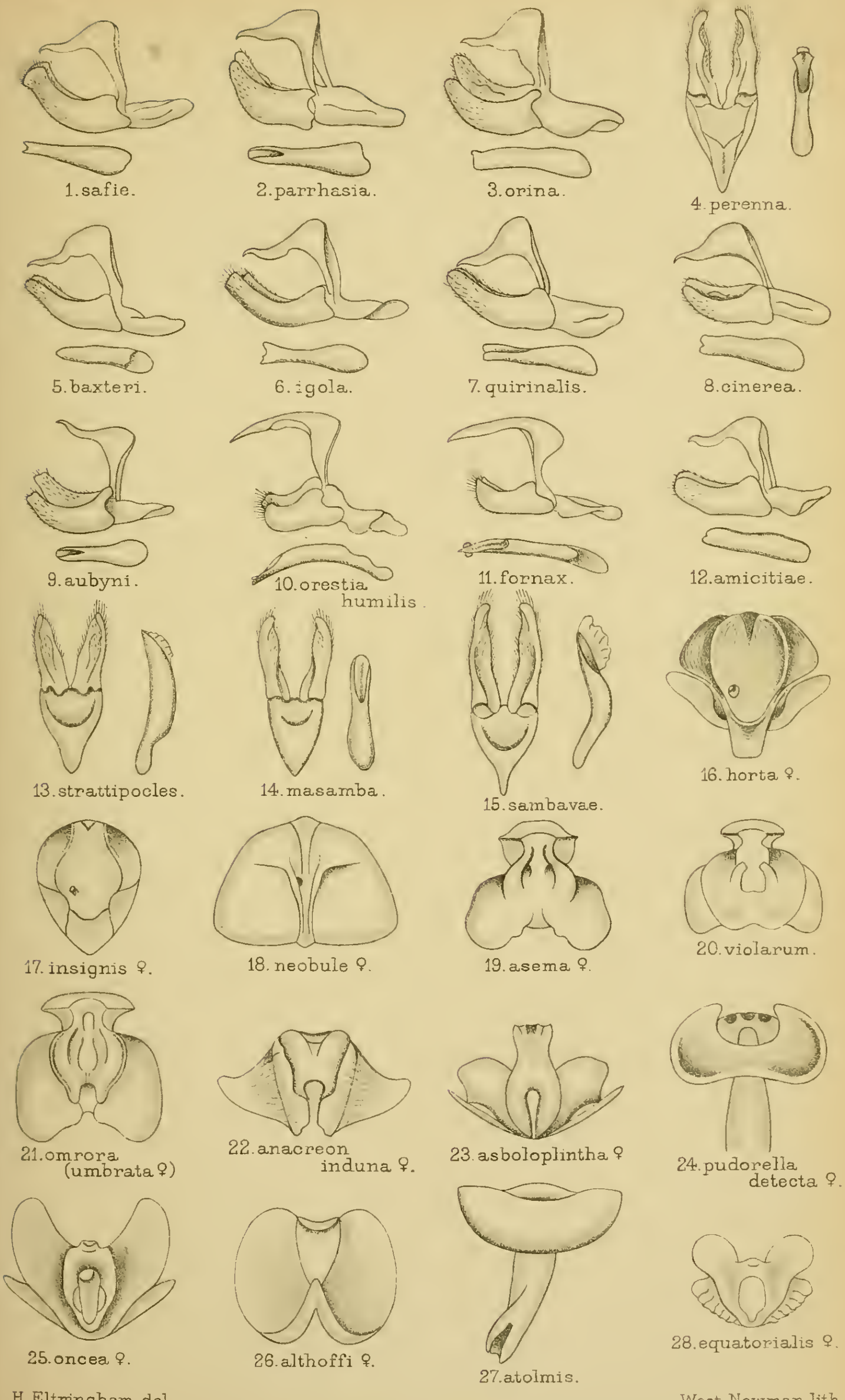
GENITAL ARMATURES OF ACRAEA.



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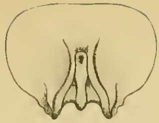
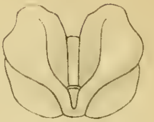
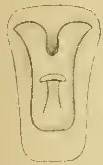
GENITAL ARMATURES OF ACRAEA.


1. cerasa ♀.


2. ranavalona ♀.


3. mahela ♀.


4. petraea ♀.


5. ansorgei ♀.


6. quirina ♀.


7. leucopyga ♀.

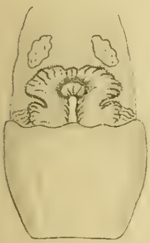

8. chaeribula ♀.

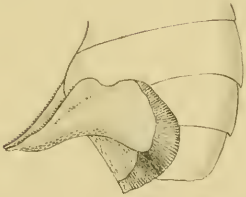

9. orestia humilis ♀.


10. acrita acrita ♀.


11. acrita bellona ♀.

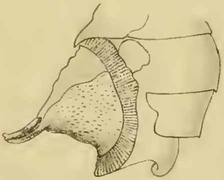

12. acrita manca ♀.


13. diogenes ♀.


14. anacreon induna ♀.


15. mirifica ♀.


16. wigginsi ♀.


17. egina areca ♀.


18. anemosa ♀.


19. nohara ♀.


20. insignis ♀.


21. obeira ♀.

H. Eltringham del.

West, Newman lith.

GENITAL ARMATURES OF ACRAEA.

II. *South African and Australian* Aculeate Hymenoptera *in the Oxford Museum.* By the late Col. C. T. Bingham, F.Z.S.

[Read May 3rd, 1911.]

The following paper forms the concluding section of the lamented author's memoir published in these Transactions for 1911 (No. XXII, p. 528). When the proofs of this memoir were received from the printers, it was realised that the concluding portion was wanting. Publication could not well be delayed, and the paper appeared with the introductory note adjusted to suit the circumstances. The missing manuscript—mislaid as the result of a curious accident—having been lately recovered, it is obviously desirable that the memoir should be completed as soon as possible, and that its second part should appear in as close proximity as possible to the first.

The following paper contains the description of one Aculeate captured by Dr. F. A. Dixey, and four by Dr. G. B. Longstaff, in South Africa in 1905. It also includes descriptions of five Australian Aculeates in the Hope Collection. I had long been interested in the peculiar types of synaposematic pattern found in all large groups of Australian Aculeates, and reproduced in many non-Hymenopterous mimics. Col. Bingham very kindly determined the species in an illustrative collection, and wrote the following descriptions of those which were new to science.

The types of all descriptions are in the Hope Department of the Oxford University Museum.

In this, as in the first part of the memoir, I have acted under the kind and skilled advice of Mr. Rowland E. Turner.

E. B. Poulton.

Family SPHEGIDAE.

1. Cerceris cucullata, sp. nov.

N. Australia : Port Essington.

♂. Black, the front of the head below the base of the antennae, the scape, a spot behind the eyes, a spot on each side of the pronotum, the scutellum and postscutellum, a spot on each side of the median segment, the legs, the base above of the 2nd abdominal segment and the whole of the 4th and 6th segments, chrome yellow ; the basal two-thirds of the mandibles and the underside of the basal three or four joints of the flagellum fulvous. Head thorax and abdomen finely punctured, rugose and opaque. Head broad transverse above, broader than the thorax. Thorax subglobose, the enclosed space at the base of the median segment smooth triangular convex, and divided medially by a broad longitudinal furrow. Abdomen elongate narrower than the thorax, the basal segment subpetiolate, the constrictions between the segments well-marked ; pygidial area flat, punctured and laterally margined. Wings hyaline slightly infuscate towards the apex.

Length ♂ 11 mm. Exp. 23 mm.

Described from a single example.

Nearest to *C. australis*, Saussure, but the enclosed space at the base of the median segment of *C. australis* is closely punctured like the rest of the median segment ; the punctation of the abdomen much coarser and the distribution of the black and yellow colours especially on the abdomen quite different.

2. Gorytes austrinus, sp. nov.

Locality doubtful. The specimen originally belonged to Prof. Westwood's private collection and it bears in pencil the following words written by him : " N. H. Hunter's R. or V. D. L. [Horsley]." The Australian type of pattern suggests that the first-named locality is correct. " N.H." stands for " New Holland."

♀. Black, the clypeus pale yellow, the scape and basal joint of the antennae, the pronotum, the tegulae and a short broad line on the mesonotum above them, the scutellum, postscutellum, legs, basal abdominal segment a small spot on either side of the 2nd, the apical margins broadly of the 3rd to the 5th and the whole of the apical segment orange red ; the coxae and femora of the legs variegated with black ; wings fusco-hyaline darkening towards the costal margins of the forewings. Head above and the thorax somewhat coarsely punctured, rugose and pubescent, abdomen pubescent, the apical margin of the 1st segment widely emarginate in the middle above, the apical three segments strongly curved downwards, a well-marked constriction between the basal two segments. Legs stout and powerful, the tibiae furnished with strong spines.

Length ♀ 13 mm. Exp. 26 mm.

Described from a single example.

Notogonia dixeyi, form n.

Natal: The Bluff, near Durban: Aug. 16, 1905 (*F. A. Dixey*).

♀. Black, the scape of the antennae, and the tarsi of the legs dull red, the claw-joint of the latter more or less blackish above; on the anterior legs the red spreads to the apex of the tibiae. Head, thorax (except the median segment), and abdomen smooth unpunctured; on the head the inner orbits of the eyes and the sides of the clypeus clothed with dense golden pubescence, very rich and shining in certain lights; wings fuscous with a rich purple effulgence; the apical margins of the abdominal segments above with transverse, minutely pubescent, whitish narrow bands; pygidial area well defined covered with stiff black hairs. Head: the anterior margin of the clypeus with a few coarse punctures; the flagellum of the antennae dull and opaque, 2nd and 3rd joints subequal, each twice the length of the basal joint. Thorax: massive, the mesonotum slightly convex, with a short longitudinal carina on each side above the tegulae; median segment long rounded above, finely, but irregularly, transversely striate, abruptly truncate posteriorly, the apex above slightly projecting in the middle above at the edge of the truncation; legs with strong short spines on the tibiae and tarsi, the tibial calcaria long, on the posterior tibiae as long as the basal joint of the tarsi, claws long and curved. Abdomen short, not longer than the thorax, moderately massive, basal ventral segment with a preapical, transverse, strongly marked groove, 2nd segment with a basal broad shallow depression on each side of a bluntly raised medial carina that does not extend to its apical margin.

Length ♀ 16 mm. Exp. 26 mm.

Described from a single example. Figured in Dr. Longstaff's "Butterfly Hunting in Many Lands," Plate II, fig. 4 (1912).

Note.—The name given in the manuscript of this memoir was "*vafra*," but a label on the type specimen records "*dixeyi*," and not "*vafra*." Dr. Longstaff tells me that he knew of Col. Bingham's intention to alter his MSS. to "*dixeyi*."—E. B. P.

Family EUMENIDAE.

Odynerus longstaffi, form n.

Cape Colony: Creek on the Buffalo River, near East London: Sept. 28, 1905 (*G. B. Longstaff*).

♂. Dull red, base of the mandibles, the clypeus, the front immediately above it, the inner orbits of the eyes from the base of the clypeus to the middle of the emargination in the eyes, a line along the scape of the antennae in front, a transverse band along the apex of the postscutellum, two obliquely placed oval spots one on each side on the middle of the basal abdominal segment, two larger spots one on each side at the base of the 2nd segment, and transverse preapical bands on the 2nd and 3rd segments bright yellow; a cone-shaped large patch above the clypeus extends up to the vertex including the ocelli, the mesonotum and the middle of the posterior face of the median segment, black, the mesonotum with a central, short, longitudinal red line. The red of the antennae and legs is of a paler tint verging on orange, the tibiae and tarsi of the latter still paler. Wings flavo-hyaline, the radial cell and terminal edge of the forewings lightly fuscous. Head above, pro- and mesonotum, scutellum, postscutellum and median segment very closely and finely punctured. Head: the clypeus slightly convex, its posterior and side margins above rounded, the sides below straight, inclined obliquely inwards, the apex truncate and circularly emarginate; emargination of the eyes deep; antennae slender, circularly curled at their apices; head from above transversely rectangular, broader than long and as broad as the thorax. Thorax massive, the median segment short, its posterior face concave with a slender groove down the middle, posteriorly the sides are rounded, and tuberculate or subdentate in the middle. Abdomen: sessile, basal segment campanulate, slightly strangulate before the apex, 2nd segment as broad as long; 7th broadly rounded posteriorly and fringed with brown hairs.

Length ♂ 13 mm. Exp. 26 mm.

Described from one example in the British Museum and one at Oxford: figured in "Butterfly Hunting in Many Lands," Plate II, fig. 6.

Comes nearest to *O. mutans*, Sauss., from Senegambia, which however has two tubercles between the antennae, the median segment transversely striate, the apical margin of the basal abdominal segment angulated posteriorly and bears transverse yellow bands on the 1–4 abdominal segments.

ODYNERUS DECORATUS, sp. nov.

W. AUSTRALIA: Towranna Plains between Yule River and Sherlock River: Jan. to May, 1898 (*R. Clement*).

♂. Lemon yellow, the mandibles, the bases of the antennae, the apex of the scape, the flagellum, a large square mark on the vertex surrounding the ocelli and reaching the upper margin of the eyes on each side, a square mark on the collar, the mesonotum, scutellum and postscutellum, an oblong mark on the 2nd abdominal segment, the base of the 4th and 5th narrowly and the apical two segments black, a spot at the base of the mandibles, two minute spots on the vertex at the upper angles of the eyes, a square mark at the base of the mesonotum, a transverse mark on the scutellum divided medially by a fine black line and the middle of the postscutellum yellow. Head, thorax and abdomen punctured rugose and covered with a minute, short, silky pubescence; clypeus pyriform truncate at apex; prothorax vertically truncate in front, almost concave, the pronotum margined anteriorly; mesonotum slightly convex, scutellum and postscutellum not prominent, median segment rounded at the sides, the apex slightly concave. Wings hyaline brown along the costal margin, nervures brown, tegulae yellow with a faint brown spot in the middle. Abdomen massive, sessile, longer than the head and thorax united, the apical margin of the 2nd segment crenulate,

♀. Similar to the ♂ but in the two specimens before me the ground-colour is reddish (in one specimen certainly, and in the other probably darkened by cyanide). It differs in being larger and more strongly built than the ♂ and has the apical two abdominal segments reddish brown, not black: the shape and character of the black markings however are very similar.

Length ♂ 10 mm.; ♀ 11·5 mm. (to apex of second abdominal segment). Exp. ♂ 23 mm.; ♀ 27 mm.

Described from a single example of each sex.
Belongs to Saussure's subgenus *Lionotus*.

I have preferred to give a full description of the ♂ rather than of the ♀ because, as noted above, I consider the ground-colour of the two female specimens I have before me altered by cyanide.

RHYNCHIUM NIGROLIMBATUM, sp. nov.

W. AUSTRALIA : Towranna Plains : 1898 (*Clement*).

♀. Chrome yellow, the head above and the 2nd abdominal segment black, the clypeus, the front below the anterior ocellus extending into the emargination of the eyes, and the antennae chrome yellow, mandibles reddish yellow ; wings dark fuscous purple, hyaline along their posterior margins. Head above closely and coarsely rugose punctate, the punctures on the front in certain lights running into striae, clypeus sparsely and very shallowly punctured almost smooth, the apex transversely truncate not emarginate, eyes large reaching the base of the mandibles ; these latter coarsely longitudinally striate and punctured. Thorax longer than broad finely punctured, the prothorax vertically transversely truncate anteriorly, mesonotum convex, scutellum and postscutellum flat, the former almost square the latter transverse, both separated from the mesonotum anteriorly, from each other, and from the median segment posteriorly by well-marked transverse sutures ; median segment long, concave posteriorly bearing a medial fine longitudinally impressed line, and with the lower posterior angles somewhat produced. Wings ample, the 2nd cubital cell in the forewing trapezoidal receiving both recurrent nervures ; legs short slender pubescent, claws unidentate. Abdomen massive, the basal segment narrow, beneath with a triangular depression and a subapical transverse groove, above convex and rounded ; 2nd segment elongate broadening posteriorly.

Length ♀ 14 mm. (to apex of 2nd abdominal segment). Exp. 30 mm.

Described from a single example.

ALASTOR ABNORMIS, sp. nov.

W. AUSTRALIA : Towranna Plains : 1898 (*Clement*).

♂. Orange yellow, head and the 2nd abdominal segment black, the clypeus, a mark somewhat in the shape of a chess pawn above it on the front, and the scape in front orange yellow ; wings fuscous, hyaline along the posterior margins. Head from above transverse as broad as the thorax, closely and somewhat coarsely rugose punctate above and behind the eyes more finely and sparsely punctured on the front and clypeus, the latter covered with a fine silky short white pubescence, somewhat pyriform with the apex truncato-emarginate. Front with the orange macula raised carinate. Eyes large reaching to the base of the mandibles, mandibles long toothed on the inner margins. Antennae subclavate somewhat like that of

Masaris. Thorax broad and rounded coarsely punctured, the prothorax vertically truncate anteriorly, the pronotum margined in front; mesonotum convex; scutellum and postscutellum raised gibbous separated from the mesonotum in front from each other and from the median segment by well-marked sutures; median segment very short somewhat suppressed under the scutellum and postscutellum, the sides rounded not produced posteriorly. Wings ample, the 2nd cubital cell of the forewing petiolate; legs stout pubescent, claws unidentate. Abdomen sessile the 1st segment somewhat compressed and campanulate posteriorly, 2nd segment long broadening gradually from front to back.

Length ♂ 12 mm. (to apex of 2nd abdominal segment). Exp. 27 mm.

Described from four examples.

This remarkable and handsome species may afterwards have to be separated generically. I have seen only four males, and they are strikingly aberrant, differing from all known wasps, fossorial or social, in having *only 9 joints in the antennae.* The closest scrutiny under a microscope reveals no more than 9 joints, the apical joint being exceedingly small and sunk in the apex of the subapical joint.

There can be no question of the insect belonging to the *Diploptera*; and in the rest of its structure, particularly in the venation of the forewing, it closely resembles *Alastor*, under which genus I have provisionally placed it.

ANTHOPHILA.

Family COLLETIDAE.

PROSOPIS SIMPLEX, form n.

CAPE COLONY: Queen's Park, East London: Sept. 26, 1905 (*G. B. Longstaff*).

♀. Black immaculate, the tibiae and tarsi turning to slightly reddish brown, the flagellum of the antennae except the basal joint, beneath maroon. Head and thorax closely but not very coarsely punctured, the abdomen smooth and slightly shining in certain lights, but not polished. Head broader than the thorax, flat in front, clypeus large, broad, anteriorly truncate antennae short, robust, their apices roundly blunt. Thorax: pronotum transverse, forming a mere narrow ridge; mesonotum convex with an anterior medial and a lateral, impressed, short longitudinal line which are short and shining;

median segment compressed posteriorly, the apex truncate, the face of the truncation crossed by a vertical, well-marked carina and bordered on each side by similar carinae, the basal concavity on the segment lunate and edged anteriorly and posteriorly by a series of large punctures or pits ; wings hyaline, slightly fuscous, legs slender, minutely pubescent. Abdomen about as long as the head and thorax united, the 2nd segment with traces on each side of a fringe of white hairs.

Length ♀ 5 mm. Exp. 9 mm.

Described from a single example.

Easily distinguishable from all described forms of *Prosopis* by the sculpture and by its uniform black colour entirely devoid of yellow markings.

Family APIDAE.

Halictus inornatus, form n.

Cape Colony : Zwartkops, near Port Elizabeth : Aug. 11, 1905 (*G. B. Longstaff*).

♀. Dull black, covered with soft long reddish-brown erect hairs, the 2nd to the 5th abdominal segments with lateral transverse short bands of whitish-yellow pubescence at their bases, the anal rims ferruginous, the legs covered with yellowish pubescence which turns to ferruginous on the inner side of the posterior metatarsi, the tibial calcaria of the posterior legs yellowish-white at base, ferruginous towards their apices, the claw joint and claws of all the tarsi ferruginous. Head as broad as the thorax, flat in front, closely punctured, the clypeus slightly convex transversely and broadly truncate anteriorly. Thorax more sparsely and finely punctured, the depressed area at base of the median segment lunate and very closely punctured, the punctures running into longitudinal striae. Abdomen very minutely and sparsely punctured, shining above.

Length ♀ 10 mm. Exp. 18 mm.

Described from a single example.

Ceratina vittata, form n.

Orange River Colony : "Wonderboom," near Pretoria : Aug. 31, 1905 (*G. B. Longstaff*).

♀. Black, two large coalescent spots on the labrum, a very broad ⊥-shaped mark on the clypeus and a narrow line on the front of the anterior tibiae pale yellow ; the humeral angles of the pronotum and transverse laterally broadened bands on the 2nd to the 5th abdominal segments fringed with short stiff white hairs. Head, thorax and abdomen very closely and uniformly punctured and granulate. The median segment of the thorax is very short abruptly sloped downwards from the postscutellum, the usual depression at the base of the segment very ill-defined, scarcely perceptible. Abdomen stout and comparatively massive, the 6th segment with a sharp longitudinal carina towards apex. Wings hyaline, nervures and tegulae dark brown.

Length ♀ 7 mm. Exp. 12 mm.

Described from a single example.

III. *On some hitherto imperfectly-known South African* Lepidoptera. By Roland Trimen, M.A., F.R.S., etc.

[Read February 7th, 1912.]

PLATE XVII.

The few forms here figured are such as need illustration either from their close alliance to congeners or from their rarity.

Mycalesis ena, Hewits., *Pyrgus zebra*, Butl., and *P. secessus*, Trim., *form. aestiv.*, have been received from my friend Mr. H. L. Langley Feltham, of Johannesburg; the *Mycalesis* and *P. secessus* being now for the first time recorded from extra-tropical South Africa.* *Pseudonympha d'urbani*, Trim., and *Leptoneura bowkeri*, Trim., ♀, are figured from examples collected in N.E. Cape Colony by Mr. F. Graham in 1891; and *Ps. hippia* (Cram.), from one taken on Table Mountain in 1890, by Mr. R. M. Lightfoot.

The Smerinthine hawkmoth, *Platysphinx bourkei*, Trim., is figured from the type (a ♀) captured in Zululand by Admiral E. Bourke, in 1909.

Fam. NYMPHALIDAE.

Sub-fam. Satyrinae.

Mycalesis ena, Hewits.

Mycalesis ena, Hewits., Ent. Mo. Mag., p. 107 (1877).

Plate XVII, figs. 1 (♂), 1*a* (♀).

This form is, as Hewitson (*l. c.*) pointed out, very close to the West African *M. miriam* (Fab.), but readily distinguished by its larger size and paler colouring, and by having on the *upperside*, as well as on the underside, of

* Mr. Feltham also sent another interesting addition to the extra-tropical South African list of *Hesperidae, vid. Platylesches robustus*, Neave (Proc. Zool. Soc. Lond., 1910, p. 83, pl. iii, f. 7, ♂), hitherto recorded from N. and S. Rhodesia only, but taken (three examples) by Mr. A. T. Cooke at White River in the Transvaal, in August 1907.

the forewings the ordinary two ocellate spots well developed. Hewitson's type specimens are from Lake Nyassa,* but the form has since been found as far to the southward as the Transvaal. The first examples from the latter region that came under my notice were taken in the Barberton District in the year 1888 by Mr. J. P. Cloete and Mr. C. F. Palmer; and the specimens now figured are a dry-season ♂, captured at Nelspruit by Mr. H. L. Feltham on May 10, 1904, and a wet-season ♀, taken by Mr. A. T. Cooke at White River, near Nelspruit, in 1909. Mr. Feltham writes that he met with this *Mycalesis* very sparsely, flying in wet, grassy spruits or hollows in company with *Ypthima asterope*, and notes the resemblance between the two butterflies when on the wing.

I think it likely that *M. ena* will prove—when a good series of it can be compared with one of *M. miriam* throughout its range—to be not separable as a distinct species.

Pseudonympha d'urbani, Trim.

Pseudonympha d'urbani, Trim., S.-Afr. Butt., i, p. 80 (1887).

Plate XVII, fig. 2 (♂).

This butterfly is nearly allied to *P. neita*, Wallengren,† but it is constantly recognisable by the absence on the underside of the hindwing of the basal fulvous, and by the presence there of a third (ante-median) dark transverse streak as well as of a paler discal fascia. On the upperside, too, as well as on the underside, all the ocelli are smaller and in much duller rings, especially those of the hindwings.

The sexes differ scarcely at all, except that the ♀ has blunter forewings, and is usually rather paler. As regards the ocellate spots there is a good deal of variation in both sexes, the ocellus of the forewing varying in size, and being in many examples rather ovate than circular, and the two minute ocelli of the hindwing being seldom both present. On the underside the ocelli of the hindwing

* Mr. S. A. Neave (Proc. Zool. Soc., 1910, p. 9) notes *M. ena* as occurring throughout N. Rhodesia, and being especially common in the Luangwa Valley.

† K. Sv. Vet.-Akad. Förhandl., 1875, p. 84, n. 3; see also Trimen (*l. c.*), p. 79, pl. 7, f. 2 (1887).

are usually all represented, but are rarely more than minute, and in some cases one or two are barely indicated or actually wanting, while in three ♂♂ I found all four completely obsolete. The three dark-brown irregular transverse streaks on the underside of the hindwing, and the paler fascia between the middle and outer streaks, are also variable in their definition.

This *Pseudonympha* was discovered near King William's Town, as far back as the year 1861, by my friend Mr. W. S. M. D'Urban, and I had the pleasure of naming it after him in my work quoted above, and of recording the few other specimens that had reached me from other localities in Eastern Cape Colony, *vid.* Grahamstown (Mrs. M. E. Barber), and the north of the Albert District (Col. J. H. Bowker). It was not until 1891–93 that I received a fine series of the insect, from Dordrecht, in the Wodehouse District of N.E. Cape Colony, taken by an ardent and successful entomological observer, Mr. Francis Graham, then resident magistrate of the district. He reported it as occurring numerously from October to January, but as being almost exclusively confined to the higher hill-slopes.

Pseudonympha hippia (Cramer).

Papilio hippia, Cram., Pap. Exot., iii, pl. ccxxii, ff. C, D (1779).

Pseudonympha hippia, Trim., S.-Afr. Butt., l, p. 82 (1887).

Plate XVIII, fig. 3 (♂).

In my work above cited I was able to mention only two examples which agreed satisfactorily with Cramer's rough figures, and to a less extent with the equally rough woodcut given by Burchell * of the upperside of his *Papilio* (*Hipparchia*) *montana*. These examples were taken by myself on the summit of the southern projection of the Table Mountain range, respectively in February 1864, and January 1865; and Burchell's insect is similarly recorded as having been taken on the summit of the eastern side of Table Mountain on January 24, 1811. In the Appendix to Vol. iii of my work, I noted (p. 395) the capture by Mr. H. L. Feltham of a third example in the same locality in January 1888, and of three others at a

* "Travels, Int. S. Africa," i, p. 45 (1822).

somewhat lower elevation, by Mr. R. M. Lightfoot in February 1889. Subsequently, on December 28, 1889, Mr. Feltham met with four *hippia*, and on January 2, 1890, with four more; these occurred on the lower plateau of the same mountain, above the top of Hout Bay gorge. On the last-named date Mr. Lightfoot in the same place took no less than twelve specimens.

There is good reason for considering this *Pseudonympha* to be confined to the higher levels of the Cape Promontory, in marked contrast to its nearest congener and companion *P. vigilans*, Trim.*—with which at first I confused it—the latter extending in range (and under some variation as regards the tint and ocellate marking of the underside of the hindwings) over the greater part of South Africa.

Leptoneura bowkeri, Trim.

Leptoneura bowkeri, Trim., Trans. Ent. Soc. Lond., 1870, p. 347, pl. vi, f. 2 (♂); and S.-Afr., Butt., i, pp. 98–9 (♂, ♀) (1887).

Plate XVII, fig. 4 (♀).

Only the ♂ of this very distinct form of *Leptoneura* was known to me when I first described it, and in 1887 (*op. cit.*) I could record but a solitary ♀, sent in 1879 from the Lydenburg district of the Transvaal by Mr. T. Ayres. It was not until 1891–93 that an extensive series of both sexes was secured, at Dordrecht, in N.E. Cape Colony, by Mr. Francis Graham, who forwarded to me no fewer than twenty-seven ♀♀ and sixty-nine ♂♂; and I am glad to have the opportunity of giving here a figure of one of these ♀♀, and of indicating the variation exhibited by both sexes in so numerous a series all collected in one locality.

The ♂♂ vary much, on the upperside of the forewing, in the size and distinctness of the whitish submarginal spots, and the extent to which the lower three spots are reddish-tinged—in thirty-one ♂♂ there exists a seventh spot (often indistinct) below the first median nervule; and there is considerable instability as to the number of ocelli, twenty-four specimens having only a single ocellus, twenty having also a minute second ocellus

* For a figure (♂) of this form from the Weenen District of Natal, see Butler, Proc. Zool. Soc. Lond., 1897, pl. l, f. 1 (1898).

on outer edge of the third submarginal whitish spot, and two having besides a minute *third* ocellus as in the ♀. A similar variableness prevails as regards the ocelli on the upperside of the hindwing; though usually four in number, no fewer than fourteen examples exhibit a more or less ill-defined fifth ocellus (as in ♀) below the first median nervule; in one ♂ these markings are so small as to be only just visible, while in another they are reduced to minute rufous rings. The ♀♀ vary on the upperside as follows, *vid.* in the forewing, nine want the third ocellus; and, in the hindwing, six want the small inferior fifth ocellus, but eight have another (usually more distinct) additional ocellus between the subcostal nervules. On the underside of the hindwing there is variation in the development of the greyish scaling—in two examples this is exceptionally strong—between the two median dark transverse stripes and about the upper three of the ocelli.

This *Leptoneura* ranges widely over eastern South Africa, from the Bedford District of the Cape to the Lydenburg District of Transvaal, but appears to be strictly confined to elevated areas and lofty hill-ridges. Mr. Graham, who carefully observed this species in the neighbourhood of Dordrecht, found that, in its principal locality ("The Kloof"), and in other similar spots, it was confined to the bush growing below the bare crest of the slope on the north (shady) side of the ravine, and was found chiefly among long wiry grass in the open spaces between the thickets. He was struck with the apparent excess in number of the ♂♂, but estimated it as very much less than I had judged it to be in *L. clytus* (Linn.), and not more than from twelve to fifteen for every ♀ met with.

Fam. HESPERIIDAE.

Sub-fam. Hesperiinae.

Pyrgus zebra, Butl.

Pyrgus zebra, Butl., Ann. and Mag. Nat. Hist. (6), i, p. 207 (1888).

Plate XVII, fig. 5 (♀).

The type of this species was recorded by Dr. A. G. Butler as a native of India—"Campbellpore and Chittur Pahar (*Major Yerbury*)"—but I referred to it in my "S.-Afr.

Butt." (iii, p. 290, 1889) because it was described as nearest to *P. sataspes, mihi*, a common South African species. In 1897 (Proc. Zool. Soc. Lond. p. 856) Dr. Butler noted the interesting fact that Mr. G. A. K. Marshall had taken specimens of *P. zebra* on the River Tugela in Natal in November 1896, and remarked, "These Natal examples cannot be distinguished from those of N.W. India, excepting in their slightly blacker ground-colour (which, by the way, is probably due to the superior freshness of the specimens)." It is also from Weenen, in Natal, that Mr. H. L. Feltham's specimen, which I here figure, was obtained.

I have compared this example with three others, in the Hope Department of the Oxford University Museum, which appear to be referable to the same species, and which were taken in N.E. Rhodesia (2) and Makanga, Tette (1), by Mr. S. A. Neave early in 1908. The Weenen example differs in being considerably smaller, and in having on the upperside the three median white spots of the forewing distinct instead of faint, and the median white band of the hindwing more even and continuous. Mr. Neave (Proc. Zool. Soc. Lond., 1910, p. 93) notes that the few individuals from Fort Jameson and the Luangwa Valley in Rhodesia are "considerably larger than Mashonaland specimens in the National Collection, which are in their turn larger than the type from India." *P. zebra* is not closely allied to *P. sataspes, mihi*, but comes nearest to the East African *P. diomus*, Hopff., especially in the conspicuous feature of an additional outer narrow white stripe from apex to near anal angle on the underside of the hindwings.

Pyrgus secessus, Trim.

Pyrgus secessus, Trim., Proc. Zool. Soc. Lond., 1891, p. 102, pl. ix, f. 22 (♂).

Plate XVII, figs. 6 (♂), 7 (♀).

Since I described and figured (*l.c.*) this *Pyrgus* from two examples taken by A. W. Eriksson at Omrora, S.W. Africa (about 15° 15′ S. Lat.), it does not seem to have been much noticed till Mr. S. A. Neave (Proc. Zool. Soc. Lond., 1910, p. 73) recorded it as not uncommon in N.E. Rhodesia, especially in the Lake Bangweolo District. But Mr. G. A. K. Marshall met with it near Salisbury and in the Mazoe District, Mashonaland, as far back as 1894 and 1895. Among the few specimens received from Mr. Marshall there were several which differed strikingly from typical *secessus* in presenting on the underside of the hind-wing a conspicuous creamy-whitish median band and other markings, instead of the very faint ones characteristic of *secessus*, which are scarcely distinguishable from the pale dull brownish-ochreous ground-colour. I thought that these white-marked individuals represented a very distinct variety or possibly a closely allied species; and it was not until the year 1905 that my attention was again recalled to them by receiving from Mr. H. L. Feltham and Mr. A. T. Cooke two quite similar but larger examples taken by the latter in the Transvaal. The occurrence of this conspicuously-banded form so much further southward rather confirmed my impression that it might be distinct from *secessus;* and Mr. Feltham and Mr. Cooke kindly promised to endeavour to secure more material towards deciding the question. This endeavour has been successful, and I have received from them thirteen examples (8 ♂♂, 5 ♀♀)—four taken at Nelspruit, and nine at White River (about eight miles from Nelspruit). All these are of the same conspicuous white marking on the underside of the hind-wing, presenting no variation in the direction of the obscure colouring of typical *secessus*. Eleven of them bear dates of capture, ranging from October to January; and the dates of Mr. Marshall's three Mashonaland examples of the same form were respectively October 21 and 30 and November 4. Similarly, in a series of thirteen N. Rhodesian examples collected by Mr. Neave, which are in the Hope Department of the Oxford University Museum,* the only one with the underside of the hind-wings white-banded is dated November, while three with the band much paler than in typical *secessus* are dated respectively September 18, October 29, and December 1. The remaining nine specimens are dated as captured in July and August, and though varying in depth of tint all present the dull underside colouring of typical *secessus;* and I have recorded (*l.c.*) that Mr. Eriksson took the South-Angolan type examples in August 1887.

The dates given by the several captors appear to indicate

* I am indebted to my friend, Mr. H. Eltringham, for supplying these dates of capture of Mr. Neave's specimens, which in a rather hurried examination I had omitted to note.

clearly that the case is one of seasonal dimorphism, quite akin to those presented by many species of the Pierine genus *Teracolus* in the same regions, in which the conspicuous white or whitish underside of the hindwings during the wet season is replaced during the dry season by one more or less obscured with paler or deeper tints of reddish-ochreous or even brownish-ochreous.

I have not hitherto found recorded any other instance of seasonal modification in the species of *Pyrgus*, either in Africa or elsewhere; but—considering how large a genus this is, how very widely dispersed over the tropical and temperate regions of the globe, and how many of its forms are so variable and so closely allied as to be with difficulty distinguishable—it seems by no means improbable that "dry" and "wet" phases are not rare among them, but until now have been mistakenly regarded as distinct species. The phenomenon has indeed been recognised as occurring among some species of other genera of the *Hesperiinae;* Mr. Neave mentioning (*l.c.* pp. 68 and 71) specially two cases in N. Rhodesia which came under his notice, *vid.* those of *Eagris jamesoni*, E. M. Sharpe, and *Abantis venosa*, Trim. The latter instance is closely comparable with that of *Pyrgus secessus*, for Mr. Neave writes of this species of *Abantis*: "Extreme dry specimens are of a golden-brown colour, losing all the white discal area and black margin of the hindwing underside."

Fam. SPHINGIDAE.

Sub-fam. SMERINTHINAE.

Platysphinx bourkei, Trim.

Platysphinx bourkei, Trim., Ent. M. Mag. (2), xxi, p. 209 (1910).

Plate XVII, fig. 7 (♀).

I take this opportunity of giving a figure of the only example (a ♀) known to me of this very striking Smerinthine hawkmoth, which was taken in Zululand in 1909 by my friend Rear-Admiral Edmund Bourke, as noted in my description above cited. In pointing out the relation of this form to the Los Islands *P. phyllis*, Rothsch. and Jord., and the larger Congo *P. stigmatica*, Mab., I omitted to mention that a specimen of the latter species, taken on grass near trees at Cowie's Hill, Pinetown, Natal, by Mr. T. L. Ayres, was in May 1891, lent to me by the captor for determination. The circumstances of the discovery of this example of *P. stigmatica* are remarkably similar to those recorded (*l.c.* p. 210) in the case of *P. bourkei;* and of neither species does any other South African specimen appear to have been noticed.

Explanation of Plate XVII.

[*See Explanation facing the* Plate.]

Explanation of Plate XVII.

Figs. 1, 1*a*. *Mycalesis ena*, Hewits., ♂, ♀. *Hab.* Nelspruit, Transvaal.

,, 2. *Pseudonympha d'urbani*, Trim., ♂. *Hab.* Dordrecht, Cape Colony.

,, 3. *Pseudonympha hippia*, Cram., ♂. *Hab.* Table Mountain, Cape Town.

,, 4. *Leptoneura bowkeri*, Trim., ♀. *Hab.* Dordrecht, Cape Colony.

,, 5. *Pyrgus zebra*, Butl., ♀. *Hab.* Weenen, Natal.

,, 6, 6*a*. *Pyrgus secessus*, Trim., ♂, ♀. *Hab.* White River and Nelspruit, Transvaal.

,, 7. *Platysphinx bourkei*, Trim., ♀. *Hab.* Etshowe, Zululand.

Horace Knight del. et lith.

West, Newman chr.

SOUTH AFRICAN LEPIDOPTERA.

IV. *On the Early Stages of* Albulina pheretes, *a Myrmecophilous Plebeiid blue butterfly.* By T. A. Chapman, M.D.

[Read February 7th, 1912.]

Plates XVIII–XXXVI.

In November 1910 I reported to the Society that the larva of *Latiorina orbitulus* was without the honey-gland so usual in the group of *Lycaenids* to which it belongs, agreeing therein with the larva of *Vacciniina optilete.* There seemed some reason to suspect that the unrecorded larva of *Albulina pheretes* might be a third species in this section. I determined, therefore, if possible, to learn something of the life history of *A. pheretes.* In this I had some success last summer, and found that *L. pheretes* does possess the larval honey-gland and does not therefore belong to the group of *orbitulus* and *optilete.*

All that was previously known of the larva was told me by Mr. St. Quintin, to the effect that he had seen the imago ovipositing on *Phaca alpina*, and had got the larvae to about their second instar when his supply of the food-plant gave out.

By a slip of the pen Mr. St. Quintin led me somewhat astray in my search for larvae; the plant he meant was not *Phaca alpina*, but *Astragalus alpinus*, known also as *Phaea astragalina.* A search for larvae in June on *Phaea alpina* and on *Phaea frigida* was naturally unavailing, though I found afterwards that *Phaca frigida* at least was welcome to the imago to lay her eggs on.

It was not therefore till well into July that I found a locality where *L. pheretes* occurred sparingly, and obviously in association with a plant that proved to be *Astragalus alpinus.*

I had about the same time obtained some eggs from a butterfly taken in a locality where the *Astragalus* did not grow within a long distance. This specimen laid on *Phaca frigida*, and not unwillingly on *Trifolium pratense.*

In the Heuthal the butterfly was very strictly confined to two patches of the *Astragalus alpinus*, one specimen only being found at a considerable distance amongst *Phaca frigida.* Amongst various plants given to the butterflies to tempt them to oviposit and by way of flowers for food, they refused to lay except accidentally on any plant but the food-plant (*Astragalus alpinus*), *Phaca frigida* and common red clover. The *Astragalus* was preferred, but clover was well patronised. Except a very few on flowers of the *Astragalus*, all the eggs were laid on the leaves and green petioles of the plants, apparently indifferently as to upper or under surface; but this was of course in confinement.

My attempts to rear the larvae might have had no more success than Mr. St. Quintin's, as the *Astragalus*, though it keeps alive, fails under the ill-usage of being brought to England to provide an adequate supply of pabulum, but that it so happened, that in view of this danger I tried my larvae with clover and various other plants, and found, that though they refused all my other offerings, they took to the leaves of *Colutea arborescens* quite as readily as to their proper fodder.

I may observe here, that the amyrmecophilous larvae of *V. optilete* and of *C. orbitulus* have eccentric food-plants, Ericaceae and Primulaceae, but that *A. pheretes* is more normal to the group it belongs to in having Papilionaceous food-plants, and is also more normal in possessing a honey-gland.

The egg is about 0·60 mm. wide and 0·30 mm. high, rather flat above and below, the sides almost a semicircle in vertical section, but a little more rounded above than below. The colour is white, modified by green when fresh so far as the bases of the cells of the covering are seen, therefore (when the egg is new) always with a green tone as one looks down the nearest cells. Towards the top the cells are very deep, deeper than wide, and of a very honeycomb aspect, being sometimes arranged hexagonally; in other places they are square, as many as thirty-five together may be found arranged as squares towards the sides, where however they are shallower and the knobs at the angles more prominent.

The cells are about ·025 mm. across, and the white material has a solid look as if carved out of ivory. The depth of the cells is such that in some empty egg-shells the shell proper is eaten away by the escaping larva, beneath a width of several cells, whose walls are left as an open network.

The micropylar area is in a deep hollow, owing to the high walls of the surrounding cells, and is about 0·03 mm. across. The cells are very small, a third of the diameter of the general cells and all nearly round, with no definite "rosette."

Mr. Clark's photographs of the egg and portion including the micropylar area will supplement these notes. Photographs of the egg and similar area in *V. optilete* are added for comparison; the difference in size of the micropylar area is remarkable in two eggs otherwise so similar.

The newly hatched larva is a bare mm. long, of white or faintly straw or ochreous colour, with black head and black hairs—when full grown in this instar is perhaps rather white, but still with faint ochreous tint on the first segment, more definitely ochreous towards the middle segments, and again paler on the posterior ones, but darker than in front—in a few there is a tendency to almost yellowish colouring laterally, but not amounting to a lateral line or band. They eat small mines in the leaves, in the narrow leaves of *Astragalus alpina* they amount to the whole width of the leaflet, but in *Phaca frigida* and *Colutea* the mines are small circles about 1·6 mm. in diameter with a central hole only just large enough to admit the larval head. The measurements suggest that the length of the head and larval neck are together equal to half the diameter of the mine, viz. 0·8 mm. The larva makes a succession of these little mines and never attempts to enlarge one.

In the second instar the larva works in the same way and makes a mine differing only in its larger size and larger entrance opening, the width of the mine may be 3·3 mm. In the third instar mining may occur, but the usual method is to attack the leaf from above or below and eat the whole thickness except the opposite cuticle. The size and shape of these patches is irregular, but are often bounded by the secondary veins of the leaf.

In the second instar the larva reaches a length of 3 mm., and is green in colour, with dark (black ?) hair bases and head, a rather darker green dorsal line. The upper part of the slope pale, as if overshaded with white, in the middle of this the pair of lenticles on each segment are conspicuous, along the middle of the slope is a brownish line, thicker in the middle of each segment, suggesting what is perhaps the case, that it represents the diagonal markings of so many Lycaenid larvae. There is some difference of tint along the lateral region, like a faint superficial brownish wash, but nothing to call a lateral line.

In the third instar the larva is a clear apple green, fairly uniform until a lens is used, when there appears a darker green dorsal line; on the slopes are two diagonal white lines (downwards and backwards) and traces of a third, so that in three following segments the three lines form one. In another specimen, the general tone is ochreous due to the green being largely overlaid by brownish especially the dorsal line or band and the median line on the slope noted in second instar, which to a great extent breaks up the white diagonal line.

There are a good many larvae intermediate between these two. One for instance has the brown most pronounced on the fourth, fifth and sixth abdominal segments and paler behind and fading to green only on the prothorax ; the pale green forms are, however, the most numerous.

One of these larvae observed feeding presented a rather astonishing and weird object. The larva was absolutely at rest and immovable on a leaf, a little over 4 mm. long and 1·5 mm. broad; round its prothorax was on the leaf a halo consisting of the pale area of the mine the larva had nearly completed. Through the transparent leaf cuticle was seen the " neck " of the larva stretching from the margin of the prothorax to the black head, the neck looking like a transparent hose. The weird item was to have, in connection with the immobile larva and the apparently structureless and water-like hose, the head, at the end of the latter, and quite at a distance from the larva, moving rapidly to and fro and from side to side, the jaws actively at work devouring the parenchyma and extending the mine. As the latter was nearly completed, the larva left it a minute later. The neck was fully stretched, and the contrast between the robust thickset larva and the structureless neck, flattened to an almost invisible nothing in the mine, and the black active head working strenuously in the most purposeful way with so vague a connection with the larva, was quite uncanny. Notwithstanding the hundreds of mines, I happened to see this curious spectacle only on one occasion, yet it must occur as the normal process in the making of each mine.

In the third instar there is a great variation in colouring, several with the markings most pronounced are shown on Plate XX ; fig. 4 presents the most highly-coloured specimen ; others are simply green, much as in figures of fourth and fifth instar, but with the yellow lateral line still undeveloped. In the second instar a few specimens show traces of the darker markings seen in the third, and in the fourth they are present still more rarely and faintly. The few last instar examples seen showed no trace of dark marking ; they are, however, possibly present in rare instances.

The full-grown larva (described Sept. 10th), 14 mm. at rest, 17 when moving, in length, 4·3 mm. wide from thoracic 3rd to abl. 6th, tapering at each end, usual Lycaenid form, but rather rounded, of the *rutilus* character, rather than angular in cross section. There are no definite dorsal ridges, and the lateral flange is not very marked, but sufficiently to give a transparent margin when seen from above. The colour is a lively apple green with darker dorsal band (dorsal vessel ?). This area is flattened a little (between evanescent rounded dorsal ridges, part of the darkness is due to abundant black hair bases of very short hairs). The whitish oblique streaks are hardly to be made out. On the slopes the hairs are short, dark with black bases. Viewed laterally, there is a yellow lateral line, apparently sunk deep in the tissues, so far from the surface as to be invisible except on a perpendicular view. The head is small, black. A special feature that is not observed in previous stages is that the hair bases, both of the more conspicuous black hairs and of the smaller pale and inconspicuous but more numerous hairs, are white and glistening as if made of glass ; they are nearly globular, with fine radiating spikes. There is a honey-gland with a row of lenticles round it, but sparse, not, as often, crowded ; dimples are also seen outside the last spiracles, indicating position of fans, that have not been seen extended. The hairs are so inconspicuous that, without a lens, one might perhaps think the skin of the larva a little rough, but could hardly say how.

The prothoracic plate is small, depressed, and darkened by rather more numerous dark hairs, or rather, perhaps, that the hair bases are here dark, as they are in only a few other scattered instances.

It is noted on

September 13, that this forward larva has been laid up for pupation since description taken and seems close to change; it is at top of box, but appears to have little or no silken pad and no visible girth. There are also one or two that seem to be possibly forward. The mass have ceased feeding and are divisible into two distinct sets, the majority in third skin, but a small number in fourth, both sets torpid and apparently contemplating hibernation. Some of the third stage examples have been quiet for nearly ten days ; the whole of them now appear to be so.

As I had so few last instar larvae, the following note as another example may be desirable.

September 24.—A larva moulted into last skin three or four days ago, but now refuses to eat, and looks shrunk. It has the glassy stars forming hair bases like the previous ones; these are largely belonging to the less conspicuous hairs of the slope. The more conspicuous hairs are four or five black ones on the dorsal flanges, *i. e.* on each side of the middle line; some hairs on the lateral flange, pale brownish in colour, are also more conspicuous.

The larva itself is a dirty green (not so bright and lively as the well-fed specimen), with an interrupted darker dorsal line, and a dark line across at each incision (shadow ?). The spiracles are darker points; there is a very marked lateral flange, but no difference in colouring, nor are there any oblique lines, but the cushioned hollows of the slope look slightly darker.

I note on—

October 13.—The majority have gone into hibernation, some in third instar and some in fourth. Some of the third instar have only been laid up during the last few days, but for the most part they became lethargic two or three weeks ago. The fourth instars, on the contrary, have only recently become quiescent, except one or two earlier individuals. There remain one or two of each instar, perhaps feeding, not at any rate laid up. There are also a full-grown larva still feeding, however, 13 mm. when sulking, 15–16 when active, 4·5 mm. broad and 3·5 high (sulking). The segments full and rounded, back flattened but no distinct dorsal flanges, the lateral flange marked, and thrown into greater prominence, by the brilliant line of yellow in it some way below the surface and, therefore, more or less indistinct, except on direct lateral view. There is a dark dorsal line or band; seen at some angles, it has a paler margin. On the slopes are two parallel pale oblique lines on each segment (2nd thor. to 6th and, partially, 7th abl.), sloping downwards and backwards.

The hairs and their bases are hardly visible without a lens. The hairs are very fine and small, longest on dorsal and lateral flanges, ruddy, almost brown, a less long and paler set on middle of slope, the rest very small.

Along the dorsum the hair bases are nearly all black, below this the pale glassy form is abundant.

The glassy bases seem less abundant as the larva gets older. I cannot say whether some of them change and become dark; I suspect not, and that the appearance is perhaps due to examining specimens in different lights.

There is a second specimen in last skin, not quite so large (13 mm.) and duller in colour, possibly has done feeding.

A third specimen, 10 mm. long, also appears to be in last skin.

In fourth instar length appears to be 7–7·5 mm. (before shrinking into quiescence for hibernation).

The only pupa I obtained did not quite fully get rid of the larval skin, and so some of the appendages did not fall properly into place, but it was sufficiently perfect to enable its principal features to be noted. It appears to belong to the Corydon group in having practically no cremaster, and the few silk threads, that can hardly be called a girth or even a pad, break down on the slightest disturbance. This must, of course, be accepted with the caution that my specimen was a weak untimely one, and that the silken work of a robust specimen might be stronger and more purposeful.

The pupa is green, and remains so, apparently, till the imago begins to mature; with only the very conspicuous brown glazed eyes as an exception, these are so coloured from the first. The dorsum carries a number of closely-placed, very short, brownish hairs.

Further details may be gathered from the photographs of portions of the mounted skin (figs. 33 to 38).

I placed various newly-hatched larvae on living plants of *Astragalus*, both indoors and out, but these all came to grief chiefly by the plants dying; I believe the young larvae wandered away (one or two were found) from the plants when they become unpalatable and before they died.

The only partial success was that on—

October 15.—I found a larva of *A. pheretes* on a plant of *Astragalus alpinus* (amongst grass, etc.) that has been out of doors since I put some newly hatched larvae on it, early in August. The larva seemed to be large in third instar, but was not very well seen as it was in a sort of nest of dead leaves of the *Astragalus*, about half an inch to an inch above the soil level, and closed in except on one side; there was no other place affording such a nest on the plant, though hiding places low in the grass were abundant enough.

It suggests itself that this may be a place selected for hibernation, as being far enough from the ground not to be too wet and yet affording sufficient hiding.

P.S.—The results in the Spring may be noted.

February 27.—Found all the larvae that went into hibernation (some dozens), and were placed in cellar, dead, except five individuals of which two were of those in fourth instar and three those in third. These larvae had left the leaves on which they had laid up and were on muslin and paper in a jar, which was covered with muslin and paper, so that not much change of air probably occurred, and the outer jar contained a small glass of water, so that desiccation could hardly occur. On the other hand, there was hardly any mould anywhere. About a dozen larvae in this jar had died. In other receptacles under different conditions all were dead. These surviving larvae do not seem of any high vitality, and do not seem hopeful. Some opening buds of *Colutea* were, however, found and supplied to them.

March 6.—Found four of the above five larvae had died, but one seemed alive and well. It was put on the plant of *Astragalus* on which a living larva was seen late in the autumn and the plant brought indoors.

March 8.—The larva has taken its station on a very small young shoot of the *Astragalus,* and another larva, probably the one seen last autumn, is resting on the ground close by.

March 11.—The larva wintered indoors is making itself at home and eating a little on the young *Astragalus* shoots. The other larva appears to be dead, though it looked all right a few days ago.

March 26.—The larva looked very sickly for some days, and on 24th actually dropped off its perch, showing that it had made no silken carpet, and it lay on its side on the moss in the flower-pot where I placed it after looking at it and feeling some doubts as to its condition. This morning the empty skin, well distended as before moulting, lay on its side, as I had placed the larva, but the larva had emerged from it and had found some growing material about two inches distant.

March 29.—The larva is now freely eating the half-expanded leaflets of the *Astragalus.* It is 7·5 mm. long, and is much darker than any autumn specimen at this stage, almost as dark as the darkest autumn specimen at any stage; there is a dark dorsal band, then a greenish stripe, followed by the dark lateral oblique bands which dominate the rest of the slope and sides. The whole larva has a brownish-grey effect, with green only on the broad subdorsal band, which is not however continuous, but rather a series of large patches one on each segment. The larva is probably (this proved to be so) in its last skin, if one may judge (1st) from its being in fourth stage during hibernation, and (2nd) by the density and length of the hairs, which will obviously stand considerable spreading as the larva grows.

April 1.—Is to-day eating down the (young and succulent) petiole instead of merely the leaflets. It is now more distinctly of a dark green colour, with an overlying grey tone, largely due to the hairs and dark hair bases, but also to the dorsal and oblique dark lines.

April 3.—Eleven mm. long, dark green with darker dorsal band and oblique lines, not so marked on second thoracic or seventh abl. segments as between, wanting before and behind these, a pale lateral line, looking like a yellow thread sunk some distance beneath the surface, line of honey-gland well marked, the fans on eighth abdominal are marked by whitish spots. These fans were seen on one occasion extended, a transparent green cylinder, with flat top, rather higher than wide, and with a number of fine hairs on top and just below, of a length about equal to thickness of cylinder. Any spiculation was not observable with a hand lens.

April 9.—Has grown considerably and feeds constantly, having much damaged the plant it is on. It is now 13 mm. long when moving. The yellow lateral line is brighter, and has a slight dark shade along its upper border. It does not look as if sunk so deeply below the surface.

April 10.—Put on *Colutea*, its own plant being practically exhausted, it set to, at once, to eat the leaves in their whole thickness, they are about $\frac{3}{4}$ of an inch long.

April 15.—Has got a good deal thicker, but has for the last two days been lethargic and keeping on the bottom of its jar. It seems desirous of finding a place to pupate, but moss and other provisions made for it do not please it; it now rests on bottom of glass jar.

April 21.—Has remained quite quiescent since last date (15th), the thoracic segments enlarging at the expense of the others, it is entirely without any spinning, nor though it wandered, apparently in search of suitable quarters, did I see it make any attempt at spinning. This afternoon it changed to pupa; it seemed to be a very slow process, lasting from about 3.15 to 4.30 p.m. The newly-changed pupa is quite green, with only a very small black spot for the eyes, less than a quarter of the glazed eye surface.

April 27.—Must have now acquired mature pupal colouring, although the wings are still so transparent that all the tracheae of the neuration are very distinct. The length is 8·5 mm.; the colour is green, rather dark, slightly approaching olive. There is a dark dorsal band down the abdominal segments, which is rather dorsal vessel than actual colouring. There is no trace of the oblique bands, that were quite conspicuous at first, after change, of much the same aspect as the dorsal band, which was then probably like them, persistence of larval colouring, rather than as now apparently structural. The glazed eyes are black, and there is a faint brownish tone about the head. The cast larva skin adheres to the last segment, much as in *corydon* and *thetis*. The waist is marked by a slight dorsal depression, but seen from above the waist does not exist. The width is about 3·8 mm. at third abl. segment, tapering very slightly forwards.

May 4.—The wings are assuming a brownish tone, and the tracheae are becoming obscured, but still visible near the base.

May 10.—The further change yesterday was only some increase of opacity and brownness, but this morning the wings are nearly black.

May 11.—Emerged at 10.25 a.m. and expanded wings rapidly; a ♀, had no difficulty in leaving the pupa case, though that was quite loose and unattached.

I had at the same time as the *A. pheretes*, ova of *L. orbitulus* and *V. optilete*, and some comparative notes are of interest.

L. orbitulus fed up in a most healthy way on *Soldanella*, so much so as to imperil my stock of the food-plant.

The great mass of them went into hibernation in the third instar, but several went on into the fifth and last, and from this I bred one ♀ specimen, now in Mr. Bethune-Baker's collection.

V. optilete presented a variation in the duration of the egg-state that questions of temperature and climate do not seem to me sufficiently to account for. I sent eggs of *V. optilete* and *L. pheretes* to Mr. Tonge (from Pontresina), and both hatched almost immediately he received them. Of those kept at Pontresina, *L. orbitulus* and *A. pheretes* hatched a week to ten days after being laid, but those of *optilete* did not hatch, and were still unhatched when I returned home, and learned that those sent to Mr.

Tonge had already hatched and died. I therefore thought I must somehow have killed my store of eggs of *V. optilete.* They began, however, to hatch when they had been laid more than fourteen days, being a full week longer as eggs than the other two species, or their own brothers sent to England by post.

The larvae of *V. optilete* fed slowly and steadily and ate *Vaccinium myrtillus* as readily as *V. uliginosum.* They all fed up to third stage and went into hibernation, not one offering to feed up as an autumn specimen. The young larvae do not mine like those of *A. pheretes,* but eat out little pits, between the nervures.

The *A. pheretes* feed up at considerably different rates. A majority elected to hibernate in the third instar, a fair number went on into the fourth instar, and I imagined all these intended to feed up as autumn specimens. Most of them, however, selected to hibernate, and only three or four went forward; these were not very vigorous and only one succeeded in reaching the pupal stage and that not quite healthily. Their doing so, however, enabled me to follow through the life history.

It seems probable that neither of these three species can ever produce an autumn brood naturally; and it is curious that *V. optilete,* the lowest level species, if there be any difference, resisted all temptation to produce an autumn emergence, whilst *orbitulus* did so readily and *pheretes* very sparingly. It is necessary of course to remember the very warm August during which they were reared at Reigate.

It is important to call attention to the circumstance that the larva of *A. pheretes,* hibernates, preferably perhaps in the third instar, but nearly as commonly in the fourth, and it was one of the latter that I successfully hibernated. All other larvae of "Blues" of which I have accurate notes, that hibernate half grown, do so in the third instar, a habit to which *optilete* and *orbitulus* strictly conform.

Explanation of Plates XVIII–XXXVI

Plate XVIII shows the larva in third, fourth and fifth instars. The third and fourth instars differ little except that the dark colouring is more frequently distinct and even pronounced in the third instar. So that the figures of fourth instar would be equally good for the third, only that larvae of different colouring have been selected, only a few even of the third instar are as well-marked as those figured, which give some idea of its aspect in different individuals.

The last (fifth) stage, differs from the preceding ones by the development of the starlike hair bases. These are colourless and in most lights sparkle like crystals (under a lens, they can hardly be differentiated without) with remarkable effect. One segment enlarged aims at showing their aspect—

Fig. 1, 2, 3, 4 Third stage enlarged × 5 or 6.
5, 6. Fourth stage × 5 or 6.
7, 8. Fifth stage × about 4.
9. One segment, last stage, more enlarged, inverted.

Plate XIX. Fig. 10. Egg, *A. pheretes* × 60.
Fig. 11. Egg, *V. optilete* × 60.

Plate XX. Fig. 12. Portion of egg of *A. pheretes* × 150, showing sculpture and very small micropylar area.
13. Similar portion of egg of *V. optilete* × 150 (same enlargement) showing much larger micropylar area.

Plate XXI. Fig. 14. Skin of first stage larva *A. pheretes* × 48.

Plate XXII. Fig. 15. Skin of second stage larva *A. pheretes* × 40.

Plate XXIII. Fig. 16. Skin of third stage larva *A. pheretes* × 20.

Plate XXIV. Fig. 17. Skin of fourth stage larva *A. pheretes* × 16.

Plate XXV. Fig. 18. Skin of fifth (last) stage larva *A. pheretes* × 13.
This photograph is marred by a few bubbles having got into the preparation.

Plate XXVI. Fig. 19. Prothoracic plate of second stage larva × 100. The filiform hairs are distinct, compared with Fig. 14, though the hairs around are much multiplied, those of the plate are diminished in numbers.
20. Honey-gland of second stage larva, the claspers are seen through the transparent upper skin, just above them is the seventh abdominal spiracle, the honey-gland is in the line joining these × 100.

PLATE XXVII. FIG. 21. Prothoracic plate of third stage larva. The left filiform (angular special) hair is very distinct, the right one is fainter, its base is 20 mm. (about $\frac{3}{4}$ inch) to the right, distinct enough when seen, these show the area of the plate, whose hairs are larger but hardly more numerous than in previous instar × 100.

22. Honey-gland third instar × 100. The gland, hairs, lenticles and skin reticulation are all very distinct.

PLATE XXVIII. FIG. 23. Honey-gland fourth instar × 100.

24. Honey-gland fifth instar × 100.

PLATE XXIX. FIG. 25. Prothoracic plate fifth instar × 100. The bases of filiform hairs are 50 mm. (2 inches) apart, hairs directed forwards. Small hairs with large stellate bases are numerous.

26. Shows character of hairs, a lenticle or two, and especially the skin reticulations and points in last instar × 100.

PLATE XXX. FIG. 27. Spiracular region (left) of the sixth abdominal segment in last instar × 100, shows lenticles numerous near spiracle.

28. Fan area (eighth abdominal segment) last instar × 100, half-way between spiracle and other side of picture.

PLATE XXXI. FIGS. 29 and 30. Spiracular regions of fourth abdominal segment, to show flat oval plates in intersegmental membrane in front, others occur across the dorsum, fifth instar × 100. The large dorsal intermediate area is not shown, these plates represent muscular attachment.

PLATE XXXII. FIG. 31. Head of larva in last instar × 100 shows antennae, jaws, and some other mouth parts × 100.

32. Left prolegs third abdominal segment last instar × 100.

PLATE XXXIII. FIG. 33. Abdominal segments of pupa × 16.

PLATE XXXIV. FIG. 34. Portion of head, with eye and antennal base, of pupa × 100.

35. Cremastral area of pupa × 60. There are a few hairs but no hooks. The genital area, with opening in eighth abdominal segment, extreme right of figure, indicates a ♀ individual.

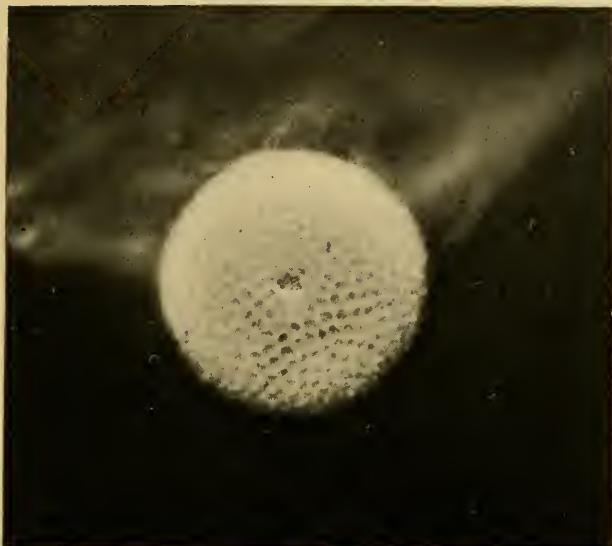
PLATE XXXV. FIG. 36. Mesothoracic plate of pupa (left side) × 30. The marking off of left hind-wing plate (angular projection down to left) is obvious. Hairs, lenticles, network on thorax, but only reticulations on wing.

37. Fifth abdominal segment (and part of sixth) of pupa on ventral aspect, showing massing of lenticles × 100.

PLATE XXXVI. FIG. 38. A portion of fifth abdominal segment showing structure of lenticles × 400.

E. C. Knight del. West, Newman chr.

LARVAE OF ALBULINA PHERETES.



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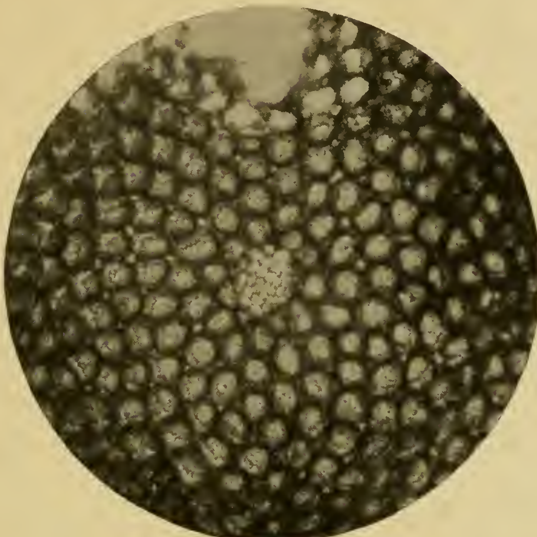
11

Photo, F. N. Clark. *C. Hentschel.*

Eggs of (10) A. pheretes. (11) V. optilete × 60.



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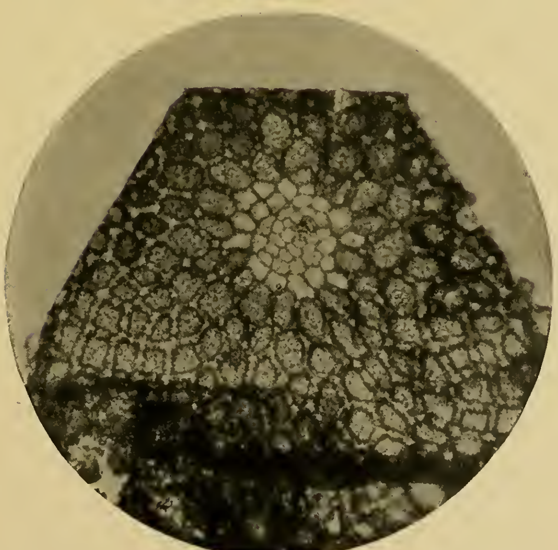

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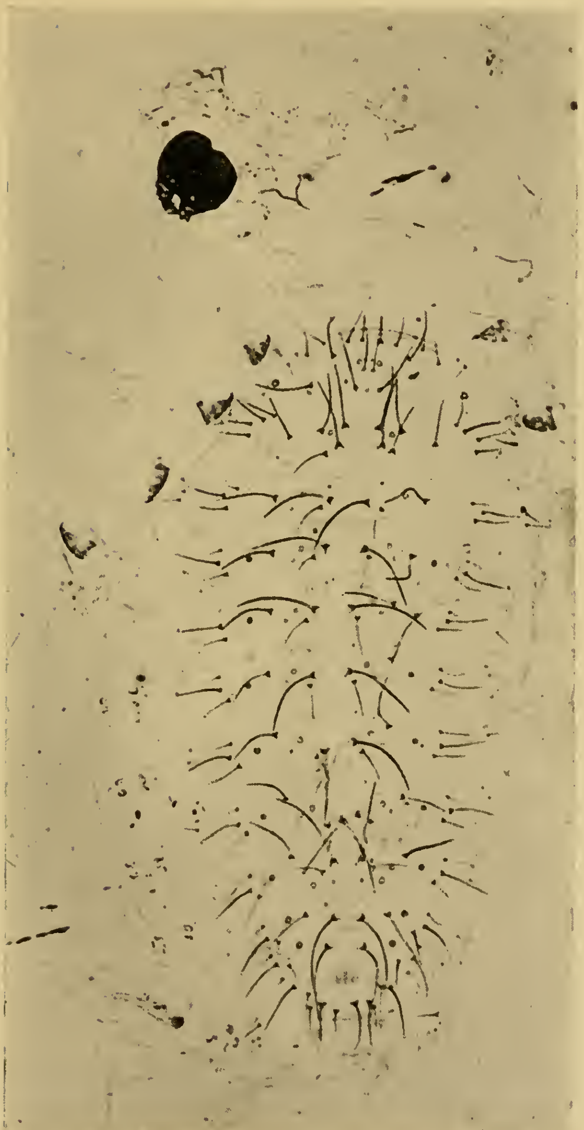
Photo, F. N. Clark. *C. Hentschel.*

Eggshells. Portions showing micropylar area.
(12) A. pheretes. (13) V. optilete × 150.



Photo, F. N. Clark. *C. Hentschel.*

Fig. 14.—Skin of larva of A. pheretes, first stage × 48.

Photo, F. N. Clark. *C. Hentschel.*

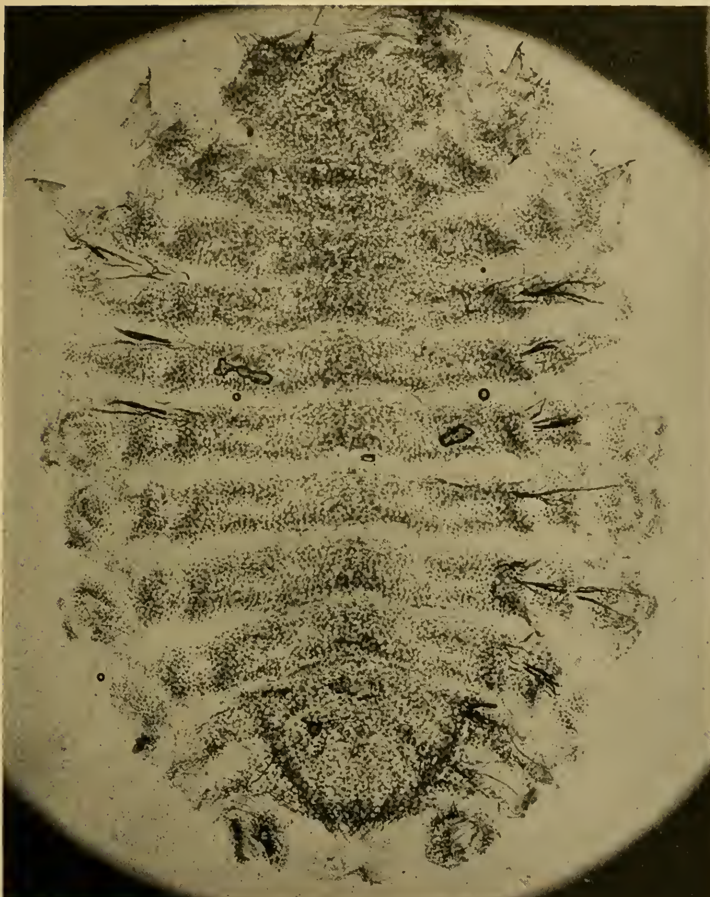
Fig. 15.—Skin of larva of A. pheretes, second stage × 40.

Photo, F. N. Clark. *C. Hentschel.*

Fig. 16.—Skin of larva of A. pheretes, third stage × 20.

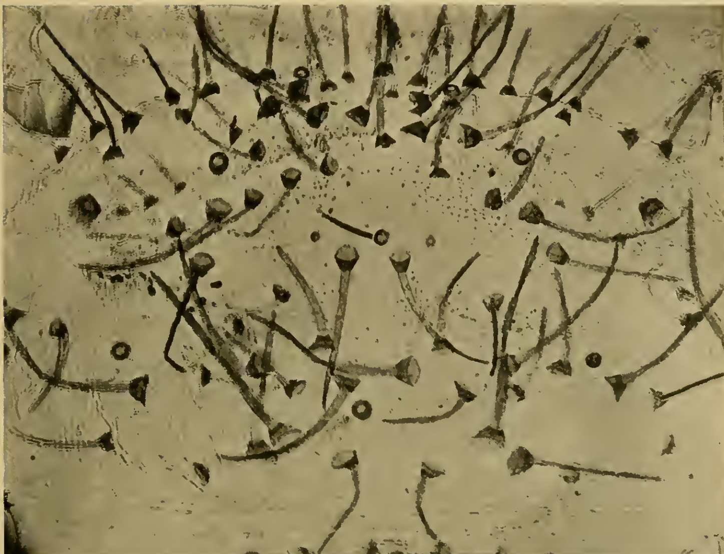
Photo, F. N. Clark. *C. Hentschel.*

Fig. 17.—Skin of larva of A. pheretes, fourth stage × 16.



Photo, F. N. Clark. *C. Hentschel.*

Fig. 18.—Skin of larva of A. pheretes, fifth (last) stage × 13.



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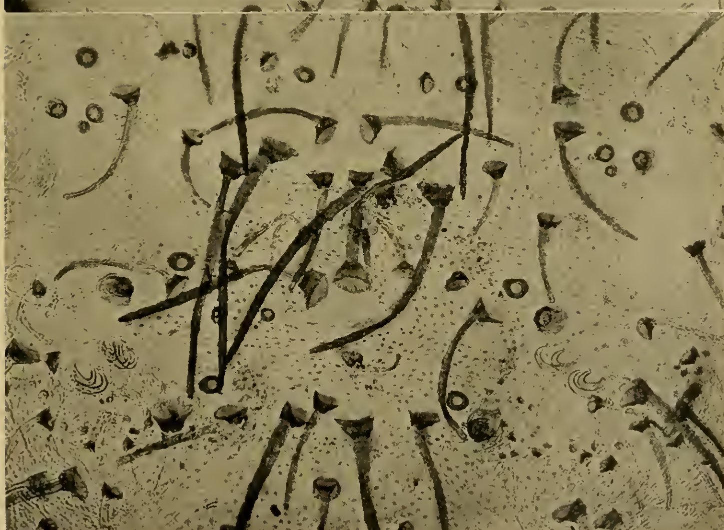

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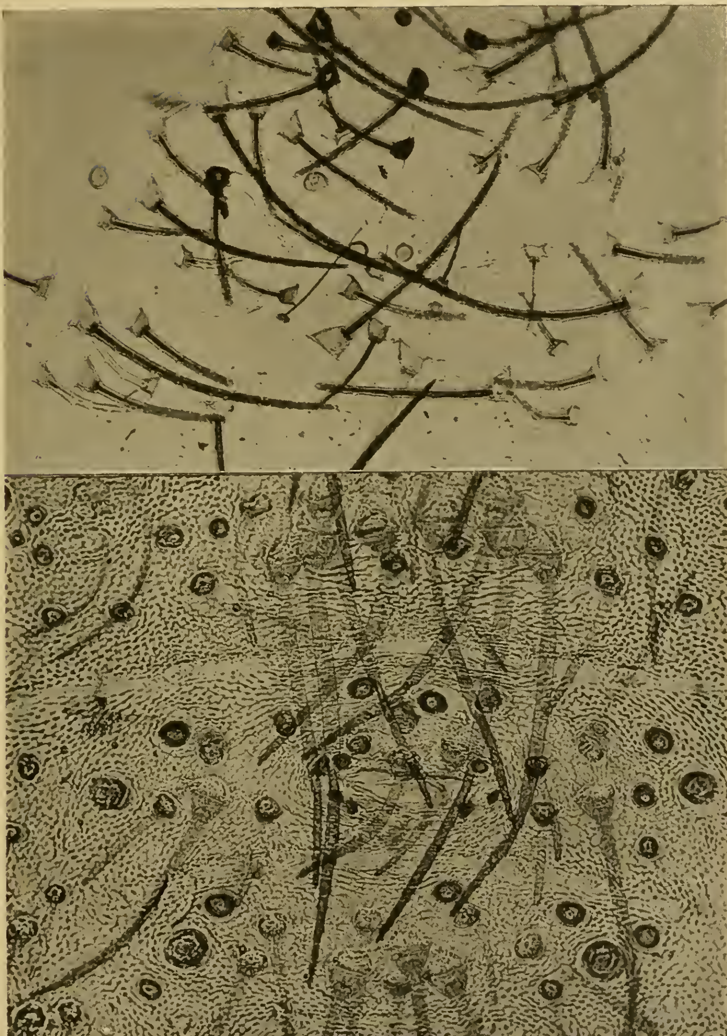
Photo, F. N. Clark. *C. Hentschel.*

A. pheretes. Second stage larva. Prothoracic plate and Honey gland area × 100.



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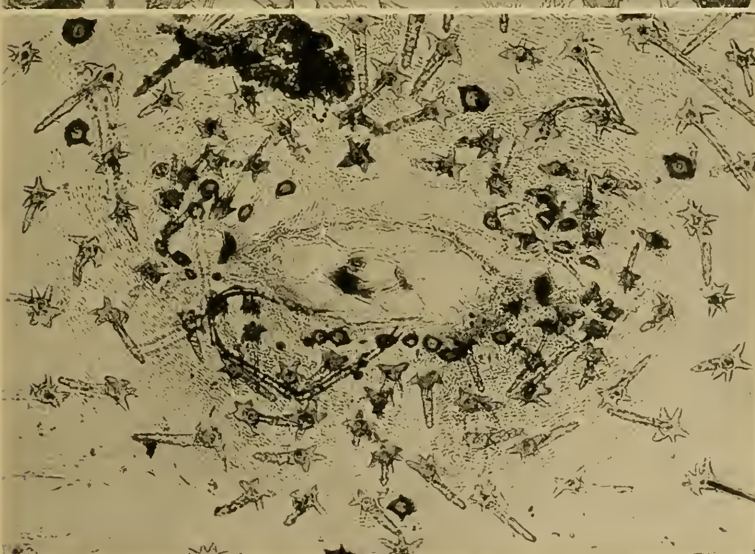
22

Photo, F. N. Clark. *C. Hentschel.*

A. pheretes, third stage. (21) Prothoracic plate. (22) Honey gland area × 100.

23



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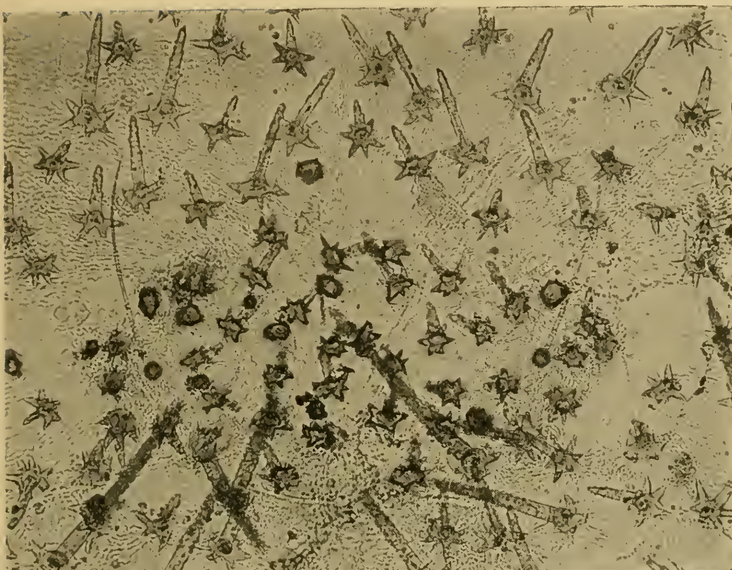
Photo, F. N. Clark. *C. Hentschel.*

A. pheretes, Honey-gland area, (23) fourth and (24) fifth stage × 100.



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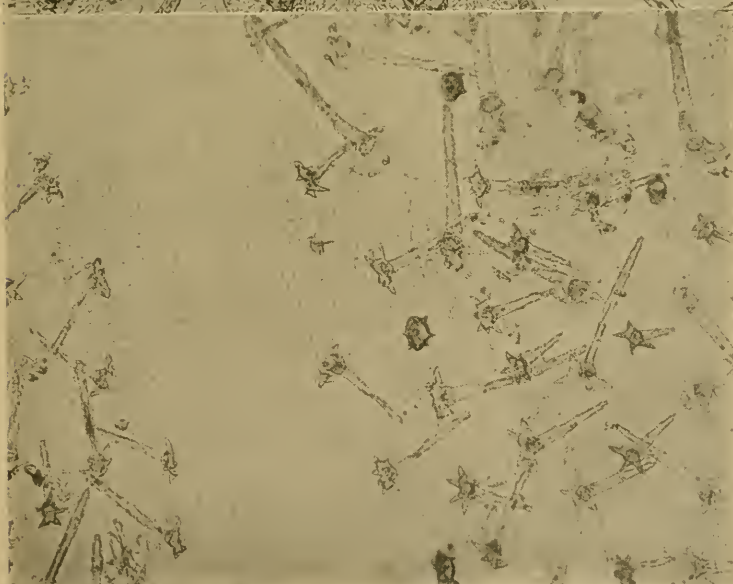
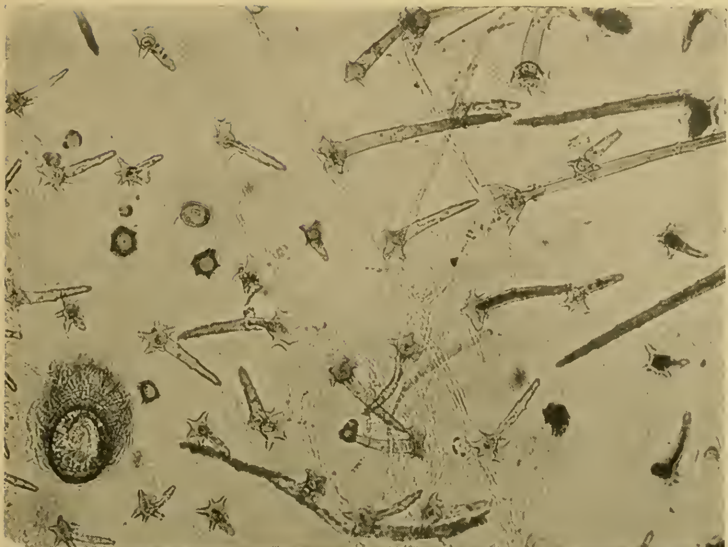


26

Photo, F. N. Clark. *C. Hentschel.*

A. pheretes, last stage × 100. (25) Prothoracic plate, (26) to show skin structure.



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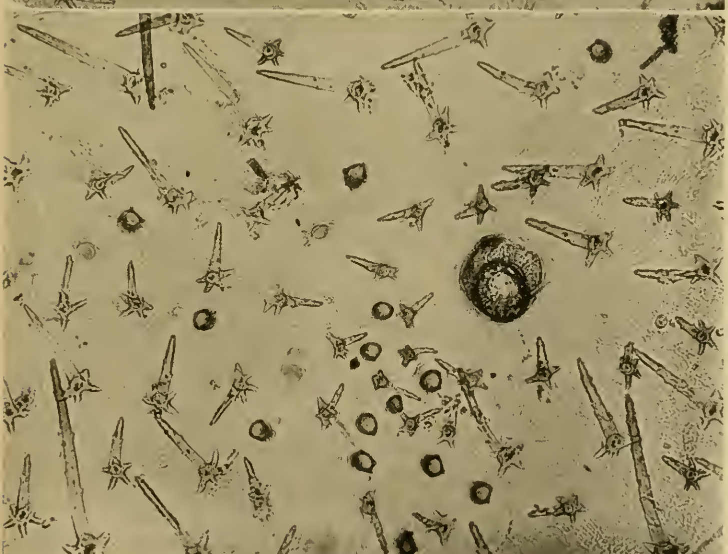


28

Photo, F. N. Clark. *C. Hentschel.*

A. pheretes, portions of last stage larva skin × 100.

29

30

Photo, F. N. Clark. *C. Hentschel.*

A. pheretes, portions of last stage larval skin × 100.
Spiracular regions of 4th segment of abdomen.

31

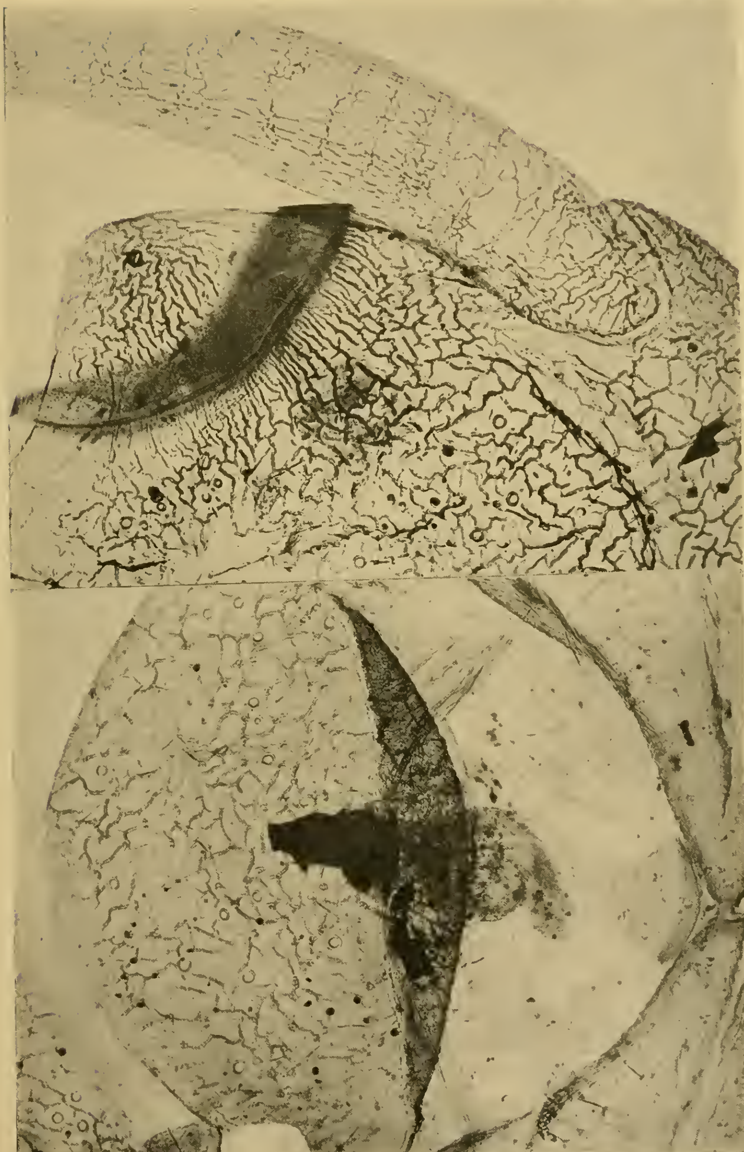
32

Photo, F. N. Clark. *C. Hentschel.*

A. pheretes, head and prolegs, last stage larva × 100.

Photo, F. N. Clark. *C. Hentschel.*

A. pheretes. Fig. 33.—Abdominal segments of pupa × 16.

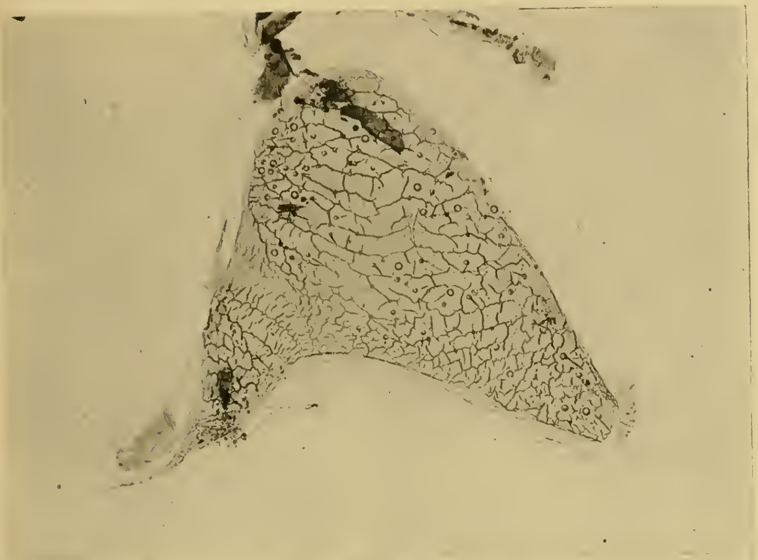


34

35

Photo, F. N. Clark. *C. Hentschel.*

A. pheretes, pupa, (34) portions of head ($\times$ 100) and (35) cremastral area $\times$ 60.



36

37

Photo, F. N. Clark. *C. Hentschel.*

A. pheretes, portions of pupa. (36) Mesothorax × 30. (37) 9th segment × 100.

38

Photo, F. N. Clark. *C. Hentschel.*

A. pheretes, pupa. Lenticles × 400.

V. *An experiment on the development of the male appendages in* Lepidoptera. By T. A. Chapman, M.D.

[Read February 7th, 1912.]

Plates XXXVII, XXXVIII.

In the Proc. Ent. Soc., 1910, p. lx, and more at length in the Proc. South London Ent. Soc., 1910-1911, p. 50, I described (with photographs) a remarkable and so far as I yet know a unique specimen of the ♂ genitalia of *Acronycta tridens* found by Mr. Burrows. I thought it desirable to investigate the matter more fully, and instituted some experiments the results of which I report.

Assuming the ♂ appendages to be internal in the larva and that they come to the surface at the pupal moult, not of course becoming external as in the imago, but presenting on the surface the well-known two tubercles of the pupa, it seemed that some abnormal result would appear if such emergence from the interior could be prevented. In order to attain this result, I produced in certain larvae of *L. dispar* a small cicatrix at the critical position between the ninth and tenth abdominal segments in the midventral line. The result was what I anticipated, the production of specimens almost identical with Mr. Burrows's example of *A. tridens.* The clasps, penis-sheath (*penis-tasche*) and penis (aedoeagus and vesica) form a mass in the interior of the abdomen.

The several organs are more or less recognisable, though, for want of the usual position in which to develop, more or less pressed together and distorted. These specimens show, as did Mr. Burrows's, the parts that remain external, as being the actual ninth and tenth abdominal segments apart from the special developments of which the appendages consist.

So far as I can ascertain from the literature bearing on the development of the male appendages, the parts imprisoned thus in the interior develop from a body described nearly a hundred years ago by Herold, and called by him a *Körperehen* (a small body, a corpuscule).

This corpuscule, though apparently a single mass, consists really of two parts, one of which is strictly internal and arises at the extremity of the seminal ducts, the other is external and is an invagination of the posterior margin of the ninth abdominal segment, and some trace of the line of invagination connects Herold's corpuscule with the surface to guide its emergence at pupation. The invaginated constituents of Herold's corpuscule forms the clasps, which present evidence of being ectodermal structures. The portions of the corpuscule of internal origin form the penis and penis-sheath, which never show any evidence of dermal origin, such as hairs, scales, etc.

I have also seen Professor Meisenheimer's recent essay on experiments by way of excision, transplantation, etc. *Liparis dispar* as a very abundant and hardy insect was the subject of his experiments as it was of mine and many others. The species being the same, the interesting result is that where Professor Meisenheimer excised the corpuscule of Herold in the larva, the imago presented precisely the same development of the ninth and tenth segments as it does in my specimens with the corpuscule imprisoned, but of course in his specimens there is a vacancy where mine show the internally developed appendages.

Explanation of Plates XXXVII, XXXVIII.

Fig. 1. Last three abdominal segments of ♂ *L. dispar* × 10.

Fig. 2. Last segment × 25 showing normal structure and disposition of the ♂ appendages.

Fig. 3. Specimen in which the point of exit of the ♂ appendages was occluded in the larval state × 10.

Fig. 4. Portion of the same specimen × 25. These compared with figs. 1 and 2 show the ninth and tenth abdominal segments as in figs. 1 and 2, but without the special sexual appendages, which form a mass lying in the sixth abdominal segment. In this mass the aedoeagus is obvious, as also the clasps, the latter enlarged by still possessing their pupal envelopes. The organs so conspicuous in the seventh segment are merely the spiracles, as may be seen by comparing with other segments and specimens.

Fig. 5. Is a similar specimen × 10, in which the mass has made a nearer approach to the outlet without however breaking through.

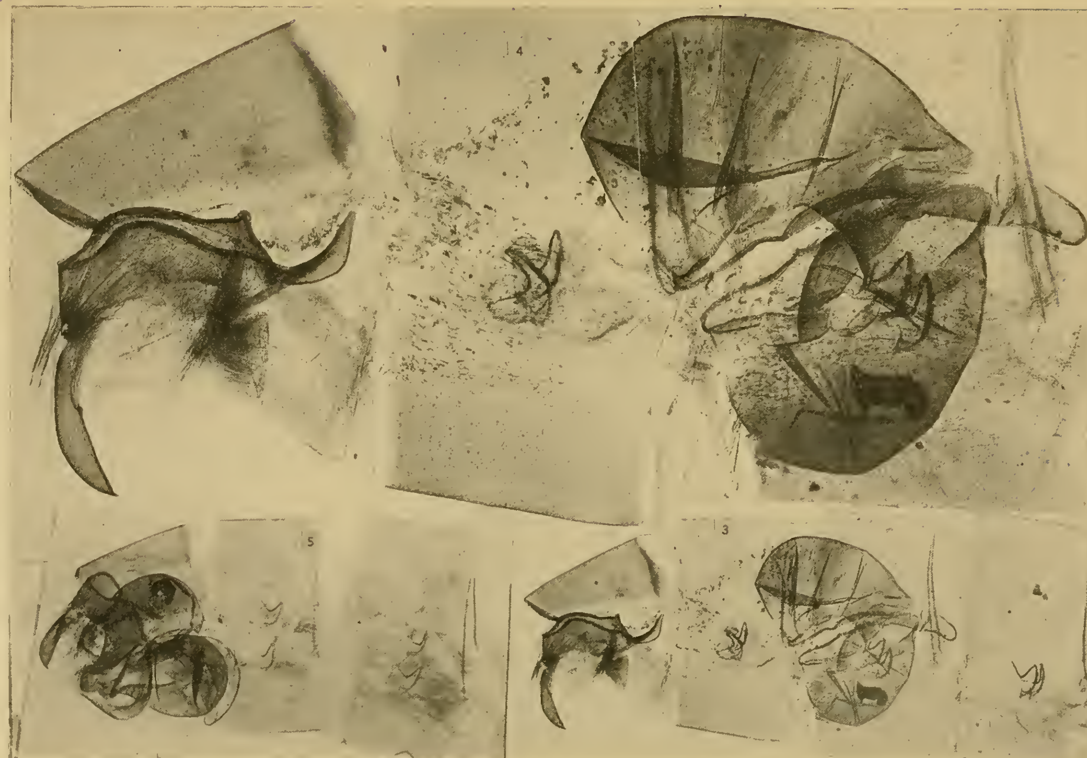
Fig. 6. An intermediate specimen with the mass in the eighth segment.

It is very possible that the position of the mass (Herold's corpuscule developed) within the abdomen is accidental and due to movements during preparation of the specimens, figs. 3 and 4 being perhaps least disturbed thereby.

Within one of the clasps in each specimen (figs. 3, 5, 6) is a dark body whose nature I have not determined. In fig. 6 is a separate portion, which is probably a detached pupal covering.

Photo, F. N. Clark. *C. Hentschel.*

Liparis dispar. Male appendages.



Photo, F. N. Clark. *C. Hentschel.*

Liparis dispar. Male appendages.

VI. *The food-plant of* Callophrys avis. By T. A. Chapman, M.D.

[Read February 7th, 1912.]

I took my first specimen of *Callophrys avis* at Hyères in 1906 and a second in the same district in 1907. In 1909 I took it at Amelie-les-Bains and there found its food-plant to be *Coriaria myrtifolia*; Prof. Reverdin took a specimen near Cap Negre (some 20 km. east of Hyères), so that the capture of three specimens in the Hyères region of the Riviera made me feel sure that *Coriaria* must grow there, and the statements of the botanists that it did not, led me to think it might be possible they had overlooked some restricted colonies of the plant.

In 1910 and 1911 I visited Hyères at the proper season in hopes of solving the questions raised, did *Coriaria* grow near Hyères? had *avis* some other food-plant in that region?

In 1910, I utterly failed to meet with a single specimen of *C. avis*, and though bad weather might account for this to some extent, it proved that *C. avis* was very rare there, for I certainly worked over the ground where I had previously taken it, though, as a matter of fact, I did not know the spots with any precision. I satisfied myself that there was no *Coriaria* anywhere near where I had taken the butterfly nor anywhere in the district in which Prof. Reverdin's specimen was taken. There was therefore certainly an alternative food-plant. In 1911 I again tried to investigate this point, but again bad weather may take some blame for my failure to secure the first step in the investigation, viz. to meet with *C. avis*. At the end of the season, with fear of being too late, I went to Amelie-les-Bains and succeeded in obtaining a few eggs of *C. avis*, with a view to approach the problem in another way.

A point by the way is interesting.

I brought home two *C. avis* ♀♀ taken on April 28. One of these proved to be infertile and died on May 23.

The other one laid two eggs about May 22, and three afterwards (about May 30), was still alive on June 1, but died by June 3. It thus lived five weeks in captivity.

Amongst the *Coriaria*, both growing and that gathered for food for *C. avis*, a noctua larva spinning the leaves together was not uncommon, these were assumed from their appearance to be *Orthosia fulvago* (*cerago*), but on emergence proved to be *O. lota*, of very large size and highly variable in colouring. Milliere records the larvae of *O. lota* as common at Cannes on the "Roudou" (*Coriaria*).

Assuming these larvae to be *fulvago* (and had I known they were *lota* the result would have been the same), I concluded that *Coriaria* as a food-plant must have something in common with sallow. On trial, the *lota* took sallow readily, but *C. avis* would not try it, but seemed to find osier (*Salix viminalis*) with which I also supplied them, as much to their taste as the *Coriaria*. The question of providing them with food at Reigate was thus much simplified. Had I also answered the question of the alternative food-plant? I felt quite sure that I had not, because in that part of the Riviera, sallows and willows of all sorts are rare, osiers perhaps especially, and are quite absent in the places where *C. avis* had been taken. I offered the larvae of *C. avis* many other plants, trees and shrubs, with the result of uniform refusal to look at them, until I offered them *Arbutus*, the young shoots of which they took to with great readiness and fed and throve on them as well as they did on *Coriaria* or osier. *C. rubi* took both osier and *Arbutus* but not very willingly, and on *Arbutus* failed to thrive and finally refused it.

Admitting that I may be in error, I feel satisfied that the food-plant of *C. avis* on the Riviera is *Arbutus unedo*, which grows in each of the spots where *C. avis* has been taken.

An interesting point arises here in regard to the distribution of *C. avis*. Both *Coriaria* and *Arbutus* are plentiful enough about Cannes, yet I think we may assert that *C. avis* has never been taken there. Cannes has been well-worked by many entomologists, foremost amongst whom stand Milliere and Constant. I never met with it there myself nor in the Esterel where *Ch. jasius* occurs freely, and one would attribute a more southern constitution to *Ch. jasius* than to *C. avis*. There is something still to be discovered as a governing fact in the distribution of *C. avis*. I found, for instance, that large areas of *Coriaria* in the valley of the Tet, only a few miles from

Amelie-les-Bains as the crow flies, seemed to be entirely uninhabited by *C. avis.* Of course this may not be so, my last two years' researches at Hyères would of course lead to the erroneous conclusion that the species does not occur there, and further examination may show that it occurs though rarely in the Tet Valley.

Vernet-les-Bains is in the Valley of the Tet, but much higher up than the *Coriaria* ground, or than one would expect *C. avis* to appear at.

P.S.—Mr. H. Powell writes under date April 7, 1912, that over a dozen *C. avis*, of which he took some, have been taken at Cap Negre, "all near one place flying round and settling in large *Arbutus* trees;" he also took an odd specimen some distance up the hill near Cavaliere, flying round an *Arbutus.* The butterflies are reported as being confined to a very small area. This seems to give the required confirmation to the conclusion I drew from my observations that the food-plant of *C. avis* on the Riviera is *Arbutus.*

It is, of course, quite possible there may be still another one.

VII. *The effect of Oil of Citronella on two species of* Dacus. By F. M. Howlett, B.A., F.E.S.

[Read February 7th, 1912.]

Plates XXXIX, XL.

The observations which form the subject of this paper were made in the course of work on fruit-flies at the Pusa Research Institute.

The common fruit-flies of Pusa are *Dacus diversus*, Coq., and *D. zonatus*, Saund. (*Rivellia persicae*, Big.). Of these the latter is a serious pest of peaches and mangoes, and like other fruit-flies it is a pest whose attacks are particularly difficult to combat.

With the idea of attracting the females of *zonatus* to lay eggs, by imitating the smell of ripe peaches or mangoes, a large number of essential oils were experimented with. In the course of these experiments I heard that a neighbour had been troubled by some kind of fly settling on him at a time when he was using oil of citronella, sprinkled on his handkerchief, as a mosquito deterrent. Since the smell of this oil in no way resembles that of mangoes or peaches, its effect on *Dacus* had not been tried, but as soon as a handkerchief wetted with the oil was exposed in the neighbourhood of the peach-orchard it became evident that the smell exercised an extraordinarily powerful attraction. In less than half an hour the handkerchief, lying in a crumpled heap, was almost hidden by a crowd of *D. zonatus*, and presented a very striking appearance. I jumped at once to the conclusion that the economic problem of how to destroy female fruit-flies had found an easy solution, but on examination it was soon apparent that all the flies on the handkerchief were males; they almost refused to leave the neighbourhood of the handkerchief, and a considerable number of them followed me home when I removed it. A handkerchief was pinned to a sheet of cork and exposed in the peach-orchard for twenty minutes, the centre of the handkerchief being moistened with citronella. Plate XXXIX shows the male flies assembled. The cork sheet was then removed for a distance of about five yards and vigorously shaken and waved in the air to dislodge and disturb the flies; it was then replaced, and the flies which had returned to it are shown in Plate XL, which is a photograph taken exactly three minutes after its first removal, or perhaps two minutes after it was replaced.

In both the photographs it will be noticed that the flies are congregated not actually on the moistened patch but round its margin. This is their usual custom, and was taken advantage of in catching the flies with fly-papers. If citronella is put in the middle of the fly-paper (on the gummy substance) many flies escape capture by sitting on the edge of the paper which is free of adhesive; if, instead of this, the citronella is put on the edge of the paper, they will not sit on it, but settle on the sticky surface: a very sensible difference is thus made in the number of flies caught. Fly-papers treated with citronella were exposed in the orchard during the months of March, April, May and June. A careful estimate of the number caught during part of this period gave approximately eighteen thousand, and among these not more than fifty females were seen, or 0·3 per cent. Since the reaction was confined to the male sex and did not appear to be in any way connected with feeding habits, it seemed most reasonable to suppose that the smell might resemble some sexual odour of the female which in natural conditions served to guide the male to her.

Six or seven freshly killed females were therefore placed in a clean glass tube which was closed for about an hour with clean cotton-wool. On smelling the tube a faint odour resembling that of citronella was just perceptible, but although the presence of the smell was confirmed by my assistant, it was so faint that I feared the influence of unconscious "auto-suggestion" on our judgment, and repeated the experiment with about twenty living females which had emerged from the pupa from 6 to 24 hours previously. In this case the smell was distinctly perceptible and closely resembled the citronella smell; its presence and nature were confirmed by an independent observer who did not know what smell was being looked for or expected. When a similar number of males were tried in the same way, no smell of citronella was detected.

It seems probable, therefore, that this smell is the sexual attracting smell of *D. zonatus*. It is noteworthy that the oil also has an attraction for males of the species *D. diversus*, and a considerable number of them were caught on the fly-papers in March and April; the attraction in this case, however, seems to be perhaps a trifle less powerful than with *zonatus*, though it is difficult to be certain on the point. The number of *diversus* caught probably did not exceed 25 per cent. of the total of the two species, as towards the end of April *diversus* became scarce and *zonatus* very abundant up to the end of June. The quality of the oil affected the result, old oil being more effective than new; I have been unable to get analyses which would show wherein the difference lies, and what is the precise constituent which is of most importance. Some samples of eucalyptus oil seemed also to possess some slight attraction for *zonatus* males, but they never came to it in large numbers, nor did they come when there was any oil of citronella exposed in the neighbourhood. The distance at which the flies are able to perceive the smell of citronella is doubtful, but seems to be considerable; half a mile is probably not an extravagant estimate if the wind be favourable. By exposing a rag moistened with oil for half an hour or so in places where ordinary collecting fails to reveal the presence of a single fly, it is often possible to catch considerable numbers.

The smell is in all probability perceived by means of the antennae. To test this a rag wet with citronella was exposed, and of the visiting flies six or eight were caught and their antennae were carefully amputated at the base of the second joint; they were then liberated, seeming none the worse for the operation, and the rag was watched to see whether they again visited it. None of the flies operated on returned to the rag, though normally flies caught and liberated anywhere near such a rag will always return to it sooner or later, and generally quite quickly (cf. Plate XL). On one occasion a marked fly was driven away five times, but returned almost immediately after each repulse.

A curious fact is that the oil has an actually poisonous effect on the fly when the latter is exposed to its vapour in a fairly concentrated form, this effect being independent of the presence or absence of the antennae.

Four male *zonatus* were taken and the antennae of two of them were amputated; they were then confined in glass vessels, each of the vessels containing a fragment of blotting-paper wetted with citronella oil. Four others similarly treated were confined in vessels without any citronella. The result was as follows:

With citronella. 2 amputated ♂ put in 10.40 a.m., dead at 11.0.
2 normal ♂ put in at 10.20 a.m., dead at 11.0.

Without citronella. 2 amputated ♂ put in at 10.30 a.m., June 16th. Both lively 7.30 a.m., 17th. Both found dead at 7.0 a.m., 18th.
2 normal ♂ put in at 10.25 a.m., 16th. One dead 7.30 a.m., 17th. Other dead 7.0 a.m., 18th.

This poisonous action may account for the fact that the attractiveness of a rag is not proportional to the amount of citronella with which it is wetted, a rag thoroughly soaked being a less effective trap than one merely moistened with a few drops of the oil. The flies prefer the smell to be not too strong, but even when this is the case it seems to have a stupefying effect on them, making them dazed and lethargic, and quite impervious to ordinary alarms. A very effective trap for them is a clean kerosene-tin nearly filled with water to which ten or twenty drops of citronella oil are added. The flies sit on the sides of the tin, now and then approaching the water; as they sit they get more and more stupid, and finish by falling into the water and getting drowned. This way of catching them is quite as effective as using citronella fly-papers, and cheaper. On one occasion I exposed a glass tube of half-inch bore and about three and a half feet long, inserted a piece of cotton-wool wet with citronella at one end and corked it, leaving the other end open. Seven *zonatus* entered the narrow mouth of the tube and there remained until they died, sitting in a line with their heads toward the closed end of the tube.

When in the neighbourhood of citronella the flies sit or move here and there with wings expanded, often quickly extending the proboscis, and now and then cleaning the head with the fore-legs and rubbing them together. Not infrequently they stand and rock their bodies to and fro, a movement which seems to be associated with "courtship" in all species of *Dacus* that occur at Pusa.

On two occasions a number of males and females have been confined together in order to see whether the citronella smell would induce copulation, but without success. Too much importance must not be attached to this result, however, as the conditions were abnormal, and I have never succeeded in getting *D. zonatus* to copulate in the laboratory. These observations afford at least another argument that the olfactory sense of Diptera, or at any rate of *D. zonatus*, is not dissimilar in kind from our own: smells which in us give rise to similar sensations (*i.e.* citronella and ♀ *zonatus*) affect the male *zonatus* in the same way, though its perception of them is far keener than ours.

Among well-known instances of attraction by smells resembling the food of the larva or adult is the case of certain evil-smelling Aroids which are attractive to various flies and beetles accustomed to infest putrescent matter. It has been found that a mixture of certain proportions of acetic acid and ethyl alcohol is most attractive to *Drosophila ampelophila*, whose larvae live in over-ripe fruit. Similarly, I have myself observed *Sarcophaga* to be very strongly attracted by a flask containing a solution of skatol, a substance normally present in faeces; many larvae were laid in the flask and were drowned in the liquid. The same fate attended the eggs of *Stomoxys calcitrans* which I have obtained in numbers on cotton-wool soaked in valerianic acid, one of the acids present in the fermenting vegetable stuff in which the eggs of this species are naturally deposited; both valerianic and butyric acids have a similar attraction for an Ortalid fly of the genus *Ulidia* (?) which is not uncommon at Pusa.

Our own sense of smell seems to be practically limited to substances having a molecular weight of about 30 or over; those with molecular weight less than this have no smell or only a very faint one, though they may have an irritant effect on the mucous membrane of the nose. The fact that house-flies will suck freely a dilute solution of formaldehyde (mol. wt. 30) may perhaps indicate that their sense is limited in the same way (Alex. Hill, *Nature*). I have found that they will sometimes take a solution of hydrocyanic acid (mol. wt. 27), and this might be regarded as evidence supporting this supposition.

Another suggestion is that the olfactory sense of flies may be highly developed in certain directions and within certain narrow limits, while outside these limits it is comparatively inoperative. We should on this hypothesis expect to find instances where the males were very sensitive to the smell of the females or *vice versa*, the sensitiveness being, however, probably confined to one sex; the smell of the food of the adult fly would attract both sexes if they fed on the same substances, while the food of the larva would, by its smell, direct the female in oviposition. Other smells, unless very strong, would have little effect.

Regarding the matter as thus crudely put, we might look on each species as tuned to respond to three or four notes on the scale of smell, and we should expect to find the most delicate adjustment and most accurate "tuning" in the direction of the sexual smell, since errors of perception would here be most disadvantageous to the species. There would be a correlation between the degree of specialisation of the larva in the matter of diet and the definiteness of the smell which would prompt the female to lay eggs. In many cases the food-smell of the adult fly would be least narrowly adjusted. At all times other senses such as those of sight and touch might play a more or less important part as auxiliaries or controls.

If we accept for the moment some such view as this, then among those species in which the male finds the female by smell we must regard each one as an assemblage of individuals in which one sex is tuned to respond to a certain definite kind of molecular vibration corresponding to some compound or mixture of compounds emitted by the other sex, and these compounds would thus constitute definite specific characters. We might even perhaps go further and define some of the larger groups by those "generic" smells which characterise certain kinds of chemical substances, such, for instance, as the organic acids, the alcohols, amines, terpenes, etc., and which depend on the presence of certain atoms or of atomic groups of some particular configuration.

In any case it seems a very remarkable fact that two species such as *D. zonatus* and *D. diversus* which live in the same district, and have always been regarded as quite distinct, should have exactly the same sexual smell. There is, of course, the possibility that citronella does not represent the sexual smell, but owes its attractions to some other cause: the proof is at present incomplete. There remain at least two other solutions of the difficulty. One is that the samples of citronella used contained two or more active ingredients which appealed respectively to *zonatus* and *diversus*, and the other is that *zonatus* and *diversus* are not really distinct species at all, but varieties. I hope to be able to give further attention to these points.

If my conclusions are correct regarding the nature of the phenomena, they afford an interesting example of the imitation by artificial means of a sexual attraction probably similar in kind to that which operates in most cases of "assembling." It has occurred to me as possible that the curious predilection of another fruit-fly (*Ceratitis capitata*) for kerosene oil might perhaps be explained in the same way, but I do not remember to have seen any record of the relative numbers of males and females captured by this method.

Explanation of Plates XXXIX, XL.

Plate XXXIX. Males of *Dacus zonatus* attracted to handkerchief moistened with oil of citronella.

Plate XL. The same three minutes after the flies had been dispersed.

Photo, F. M. Howlett. *C. Hentschel.*

EFFECT OF OIL OF CITRONELLA ON DACUS.

Photo, F. M. Howlett. *C. Hentschel.*

EFFECT OF OIL OF CITRONELLA ON DACUS.

VIII. *Descriptions of New Species of* Lepidoptera-Heterocera *from South-East Brazil.* By E. DUKINFIELD JONES, F.E.S., F.Z.S.

[Read February 7th, 1912.]

Fam. SYNTOMIDAE.

Psilopleura sanguinea, n. sp.

Palpi and antennae fuscous; head brown; tegulae brown edged with silvery white; thorax brown with some crimson and scattered white scales anteriorly; patagia with broad edge of crimson inwardly and in front; a crimson spot edged with white on shoulder and on breast; coxae inwardly crimson; legs brown; abdomen crimson, first segment brown with lateral crimson and white spot; a dorsal brown stripe, lighter in centre; subdorsal patches of silvery white scattered scales on segments 4–6. Forewings yellowish, slightly hyaline, suffused with black; base black, followed by yellow subcostal streak; a large yellow spot at end of cell, extending from costa to origin of veins 2 and 3, shaded with black inwardly and outwardly. Hindwings from costa to median fold black, from median fold to tornus hyaline, termen black.

Expanse ♂ 20 mm., ♀ 22 mm.

Hab. CASTRO, Paraná, Brazil.

Rhynohopyga castra, n. sp.

♂. Palpi brown, white hairs at base; frons brown with white scattered scales; antennae brown with white scales at base; central and lateral white points at back of head; tegulae brown edged with white; thorax brown with scattered white scales, some crimson and white underneath; patagia crimson in front; abdomen brown above, crimson and white beneath; large lateral crimson patches irrorated with white on segments 2 and 3; a series of lateral white spots on remaining segments; coxae and femora streaked with white. Forewings semihyaline, the inner and postmedial areas heavily suffused with black-brown; a yellow spot from costa to median fold beyond the cell. Hindwings semihyaline, costally and terminally broadly suffused with black.

♀. The coxae less white and the femora none at all; abdomen brown underneath from segment 4 to anus; wings more heavily suffused with black.

Expanse ♂ 20 mm., ♀ 20 mm.

Hab. Castro, Paraná, Brazil.

Closely allied to *R. meisteri*, Burm., but readily distinguished from it by the very narrow base of the wings and the absence of basal yellow spot.

Fam. ARCTIADAE.

Amaxia collaris, n. sp.

♀. Palpi crimson-pink; frons white, surrounded by fawn and red scales; vertex light brown; antennae darker brown, terminal third greyish white; cheeks and pectus crimson-pink; fore femora brown, striped with crimson-pink; tegulae white, anteriorly edged with crimson-pink; thorax light brown shaded with pink; a white spot at base of patagia; underneath ochreous white; abdomen crimson-pink, ochreous beneath. Forewings greyish brown, irrorated with crimson on outer half; a basal white spot on costa, followed by crimson; a geminate, broken, crimson antemedial line, widening out at costa, the space between the lines pale yellow forming two small spots between cell and vein 1 and a large truncate triangular spot at costa; two small medial spots between cell and vein 1; a postmedial line from inner margin to just above vein 2, enclosing yellow spots; the ante- and post-medial lines joined on inner margin by yellow; a subterminal very irregular crimson-pink line from just below vein 2 to apex, the space beyond to termen pale yellow; terminal row of spots between the veins; termen pale yellow; a large yellow patch on medial third of costa extending nearly to vein 2; a minute dark grey spot at end of cell and two beyond cell; a few crimson scales on subcostal at end of cell; two confluent yellow subapical spots; all the veins on the brown portion of the wing and a streak at base of cell crimson-pink. Hindwings rose-pink; costa ochreous; termen irregularly brown.

Expanse 37 mm.

Hab. Alto da Serra, Santos, S.E. Brazil.

Castronia, gen. nov.

Proboscis fully developed; palpi upturned, not reaching vertex of head; antennae bipectinate with branches long, slightly dilated at extremities and ending in a bristle; tibiae with spurs short. Forewings: vein 3 close to angle of cell; veins 4 and 5 from angle, separate at base; 6 and 7 from upper angle; 10 and 11 from cell. Hindwings: vein 3 from close to angle; 4 from angle; 5 from well above angle; 6 and 7 from upper angle; 8 from middle of cell.

Type of genus, *C. collaris*.

Castronia collaris, n. sp.

♂. Brownish black ; antennae, abdomen, and a streak on patagia black ; back of head, tegulae and anal tuft golden brown. Forewings semihyaline, the veins dark. Hindwings semihyaline suffused with black, the margins lighter.

Expanse, 26–30 mm.

Hab. CASTRO, Paraná, Brazil.

Opharus paulina, n. sp.

♀. Brownish black. Palpi with two orange spots ; head with orange points before and behind antennae ; coxae orange and black ; orange points on shoulders and patagia ; tegulae suffused with orange ; thorax with posterior tufts of orange hairs ; abdomen orange, dorsally black, narrowing down to a thin line on last segment, segments 1–5 rough ; laterally black with series of sublateral orange spots ; underneath brown. Forewings black brown ; a diffused basal black line containing orange point at costa, a diffused antemedial line strongly excurved and containing orange points in cell, on submedian fold and just above vein 1 ; medial area darker than the rest of the wing; an indistinct subterminal line of diffused black spots. Hindwings black brown, the basal half in and below cell, and a spot beyond cell semihyaline.

Expanse 54 mm.

Hab. SÃO PAULO, S.E. Brazil.

Antarctia uniformis, n. sp.

♀. Body and wings light brown; antennae shaft white ; abdomen dorsally brown, laterally yellow, anal segment white. Forewings uniform light brown, the scales brown and the hairs light greyish brown ; a dark discocellular spot ; cilia brown. Hindwings very thinly scaled at base and medially, the margins more heavily clothed ; veins darker ; cilia ochreous.

Expanse 45 mm.

Hab. CASTRO, Paraná, Brazil.

Differs from *A. paula*, Schaus, in the lateral yellow stripe and white termination of abdomen.

Fam. NOCTUIDAE.

Sub-fam. HADENINAE.

Chabuata nephroleuca, n. sp.

♂. Head, palpi, antennae and abdomen light reddish brown ; tegulae and thorax dark purplish brown. Forewings brown, suffused with darker purplish brown in and below cell; basal line indistinct, geminate; antemedial indistinct, wavy, geminate, clearly marked at costa; postmedial similar, the outer member represented by black points on the veins; a pale subterminal line from vein 2–7, preceded by three wedge-shaped black spots between veins 4–7; termen finely dark, cilia light; orbicular light brown enclosed in black; reniform almost obliterated by large, grey, oblique discocellular spot, preceded and followed by dark shade; a light, triangular apical spot. Hindwings uniform brown. Underneath: forewings ochreous brown; postmedial line darker. Hindwings ochreous, irrorated with brown; postmedial line darker; an indistinct discocellar spot.

♀ darker.

Expanse ♂ 33 mm., ♀ 35 mm.

Hab. CASTRO, Paraná, Brazil.

Eriopyga velutina, n. sp.

♂. Head, palpi and thorax purplish brown, the scales tipped with grey; pectus and legs red brown; tarsi ringed with ochreous; abdomen ochreous suffused with brown, except at base; lateral and anal tufts rufous; underside red brown. Forewings glossy purplish brown, suffused with greyish gloss; an indistinct subbasal line from costa to vein 1; some ochreous hairs at base on inner margin; antemedial line oblique, wavy, dark brown, excurved below costa, incurved in cell, strongly angled outwards below vein 1; outer half of medial area dark brown; postmedial geminate, dark brown, filled in with greyish, the inner member fine, diffused, the outer broader, diffused, followed by dark shade to near subterminal line which is dark brown, wavy, almost broken into spots between the veins; terminal line fine, crenulate; cilia greyish with outer fine brown line. Hindwings ochreous; veins and outer area heavily suffused with brown; cilia ochreous. Underside ochreous; forewings centrally suffused with brown, costa, apex and termen suffused with pinkish brown; hindwings, costa and apex suffused with pinkish brown irrorated with fuscous.

Expanse, 38 mm.

Hab. CASTRO, Paraná, Brazil.

Closely allied to *E. mediorufa*, Schaus, but readily distinguished from it by the difference in the antemedial line.

Sub-fam. ACRONYCTINAE.

Trachea viridirena, n. sp.

♂. Palpi light brown, a fuscous shade at side of second joint; legs reddish brown ; frons yellowish brown ; vertex of head, tegulae and thorax light brown mixed with dark brown and grey ; patagia light purplish brown with a black streak followed by purplish brown fringe on inner side ; abdomen brown. Forewings purplish brown ; a pale green streak at base of cell ; a black streak above inner margin from near base to antemedial line ; antemedial line geminate, straight from costa to median nervure, excurved to vein 1, where it is sharply angled inwards, then excurved to inner margin, the inner member diffused brown, the outer black ; postmedial line very wavy, excurved from costa to vein 5, where it is slightly angled outwards, then slightly incurved to vein 3, excurved to submedian fold and incurved to inner margin ; a subterminal line of indistinct diffused dark spots, large and distinct below vein 2 ; claviform black ; orbicular and reniform pale olive green suffused with brown and slightly defined by black ; a dark medial shade through reniform to postmedial line ; space between claviform and antemedial and between orbicular and antemedial fuscous; an indistinct green shade above vein 8 ; terminal line dark brown, whitish points at end of veins ; cilia dark brown with lighter line at base. Hindwings white thickly irrorated with brown on costal area, apex, veins and termen. Underside white, suffused with ochreous on costal and brown on terminal areas.

♀ similar, but hindwings darker and the underside more heavily suffused with brown.

Expanse 29 mm.

Hab. CASTRO, Paraná, Brazil.

Macapta lydia, n. sp.

♂. Palpi, legs and antennae brown ; pectus ochreous ; head red brown ; tegulae red brown mixed with yellow posteriorly ; thorax red brown mixed with yellow, a white dorsal spot at base ; abdomen light brown with indistinct darker transverse bands ; anal tuft purplish. Forewings dull yellow thickly irrorated with red and purplish brown ; a dark subbasal line ; antemedial line diffused purplish brown, wavy, angled outwards on subcostal, inwards in cell, outwards on median nervure, inwards on vein 1, then strongly excurved to inner margin, a yellow space follows the line across median fold; postmedial broad, geminate, filled in with yellow irrorated with red, excurved at vein 5, then incurved to inner margin, the inner member diffused purplish brown, outer member strongly dentate, black, followed by some grey scales, the points of the teeth forming subterminal line of black points on veins; orbicular minute, white defined by dark brown; reniform almost invisible; a pure white discocellular streak; widening out at lower end: a white spot on median nervure below orbicular and touching antemedial line; terminal line dark brown, cilia reddish. Hindwings ochreous suffused with purplish brown; a diffused, broad, dark brown postmedial line; a lunular discocellular spot; the inner and outer margins broadly suffused with dark brown. Underside ochreous suffused with purplish brown; a broad diffused brown postmedial line; fine lunular subterminal and fine terminal lines; a dark discocellular spot.

Expanse 27 mm.

Hab. CASTRO, Paraná, Brazil.

Sub-fam. ERASTRIANAE.

Cydosia hyva, n. sp.

♀. Black, suffused with dark glossy green; palpi with white spot on second joint; some white on frons and a white spot on vertex; fore coxae and legs spotted with white; large white spot on tegulae; five white spots on thorax; patagia shot with purple, a coppery spot in centre, a few white scales in fringe; abdomen with three broad white bands beneath, anal tuft orange. Forewings: three small white spots at base; subbasal line represented by coppery spot on costal area; three white spots between subbasal and antemedial; antemedial line wavy, coppery suffused with purple; excurved on subcostal, incurved in cell, excurved below cell, angled inwards on submedian fold; a narrow diffused white streak on medial part of costa; a broad white streak on submedian fold; orbicular and reniform white, the latter distally excavated and followed by minute white spot beyond cell; postmedial line represented by coppery spot between veins 2 and 3 and followed by white band from vein 3 to 8 and a minute white spot on submedian fold; a broad coppery subterminal band, suffused with purple, very oblique at costa, then parallel with termen to near tornus, where it is slightly bent outwards; the band is followed by a series of white spots; cilia white, interrupted by black at tornus, below vein 2 and at veins 5 and 6. Hindwings: cilia black except at apex and above veins 2 and 3, where they are white. Underside black suffused with green; a white discocellular spot on forewings and a minute apical spot on hindwings.

Expanse 32 mm.

Hab. CASTRO, Paraná, Brazil.

Sub-fam. DELTOIDINAE.

Stellidia juno, n. sp.

♂. Palpi ochreous and fuscous; vertex of head ochreous; antennae shaft ochreous sprinkled with fuscous, the pectinations fuscous; body fuscous. Forewings fuscous; antemedial line wavy, pale yellowish brown; postmedial pale yellowish brown, fine, dentate, excurved from costa to vein 2, incurved on submedian fold, followed by series of rather large indistinct lunular spots; a light brown discocellular spot containing two fuscous spots; a curved brown spot on costa immediately above; four brown points on costa before apex; a terminal row of minute brown spots at ends of veins; cilia fuscous. Hindwings fuscous; a fine, wavy, dentate postmedial line, followed by diffused spots as in forewings; a discocellular spot containing two fuscous spots; terminal row of minute spots at ends of veins; cilia fuscous.

Expanse 32 mm.

Hab. CORCOVADO, Rio de Janeiro.

Stellidia estella, n. sp.

♂. Palpi dark fuscous brown, 3rd joint tipped with white; legs and frons dark brown; vertex brown with white band between antennae and two white spots behind; antennae ochreous speckled with brown, fuscous at base; tegulae brown edged with ochreous white; thorax brown irrorated with grey, a white dorsal spot on pro- and metathorax; abdomen light brown. Forewings dark brown; a white spot at base of costa; two white spots below median nervure; antemedial line of white spots; a white spot at base of cell and one in middle of cell; a cluster of four spots below origin of vein 2; two spots below origin of vein 3; two spots in end of cell, a spot on costa immediately above; white spots on discocellulars and a cluster of three spots beyond; a postmedial line of white spots; a subterminal line of white spots between the veins, incurved above vein 5; cilia fuscous, with white spot at ends of veins and submedian fold. Hindwings not so thickly scaled; indistinct postmedial and subterminal lines of white spots; cilia as in forewings. Underside ochreous irrorated with brown; postmedial pale line strongly angled inwards on vein 5 and outwards on vein 2; an indistinct pale terminal line.

Expanse 25 mm.

Hab. SÃO PAULO, S.E. Brazil.
Near *S. nivosita*, Schaus.

Fam. NOTODONTIDAE.

Phedosia riachuela, n. sp.

♀. Palpi and legs dark brown; frons dark brown with posterior white band; tuft on head, tegulae and thorax dark brown mixed with ochreous; antennae light brown; abdomen brown. Forewings brown; subbasal line dark brown, geminate from costa to median nervure, enclosing ochreous, forming dark shade in base of cell and below median nervure, followed by white point on costa; antemedial line dark brown followed by white point on subcostal, geminate from cell to inner margin, enclosing ochreous, with distinct spots on median nervure and vein 1; an indistinct, dark, diffused postmedial line; medial area from subcostal to vein 2 very dark, containing two creamy white spots below subcostal, a small one in cell distally excavated and forming streak below subcostal almost to a second and larger spot beyond cell from subcostal to cellular fold, with streak running to vein 8; a subterminal very wavy line of dark lunules; terminal line fine, dark, interrupted at veins; ochreous points on costa before apex; cilia brown. Hindwings brown; cilia lighter. Underside brown; forewings, an indistinct subterminal row of dark spots; ochreous points on costa before apex; cilia interrupted with ochreous at ends of veins in both wings.

Expanse 28 mm.

Hab. CURITYBA, Paraná, Brazil.

Poresta folia, n. sp.

♂. Palpi reddish brown; legs brown; frons ochreous; tufts on head pale stone green; tegulae brown mixed with ochreous and tinged with green; thorax brown mixed with ochreous; patagia pale stone green with posterior brown streak; abdomen brown, anal tuft greenish, underneath ochreous. Forewings ochreous suffused with green and irrorated with black and brown; base black with a few greenish hairs; antemedial line indistinct, broken into spots below median nervure, angled outwards in cell, thence straight and very oblique to inner margin, followed by dark shade from inner margin to cell, in which it forms a fuscous patch; a postmedial very dark shade from below vein 2 to near apex, very broad from vein 2 to 5 where it is violently reduced in width to apex, limited by very wavy line excurved on the veins; a subterminal line of short black lunules, preceded by light green shade; terminal line fine, dark, widening at ends of veins; three ochreous points on costa near apex; cilia brown tinged with green. Hindwings ochreous suffused with brown. Underside ochreous suffused with reddish brown: forewings, terminal area greyish, broadly at apex and narrowly at tornus.

Expanse 35 mm.

Hab. Corcovado, Rio de Janeiro.

Farigia curita, n. sp.

♂. Palpi ochreous grey, 2nd joint black above; legs ochreous grey; antennae shaft grey, pectinations brown; frons grey irrorated with brown; thorax thickly clothed with ochreous grey and dark brown hairs, ochreous beneath; abdomen ochreous grey; the dorsal tufts brown, ochreous beneath. Forewings creamy white thickly irrorated with black and pale stone green; very indistinct basal and antemedial lines; a more definite geminate lunular postmedial line, the lunules below veins 1 and 2 broadly black followed by dark green shade; a black streak on submedian fold projecting just beyond the lunule; the space enclosed by streak and postmedial line dark green near base shading into grey at postmedial; a terminal line of oblique lunules. Hindwings ochreous; the inner margin clothed with light brown hairs. Underneath ochreous, the costa of forewing suffused with brown.

Expanse 46 mm.

Hab. Curityba, Paraná, Brazil.

Symmerista corcova, n. sp.

♀. Palpi fawn-colour, whitish in front; head, tegulae, patagia and thorax fawn-colour mottled with ochreous; abdomen ochreous thickly mottled with fawn-colour. Forewings ochreous thickly mottled with red brown and suffused with lilacine; an indistinct, wavy, red brown, geminate subbasal line from costa to vein 1, forming dark point below base of cell; a red brown geminate antemedial line, the inner member being very dark, the outer lighter, nearly straight from costa to submedian fold, angled inwards on vein 1 where it encloses a whitish spot, preceded by brown shade suffused with violaceous and followed by brown shade, narrow at costa and broadening out in and below cell to tornus; postmedial line red brown, geminate, strongly dentate, enclosing light shade; some dark streaks between the veins on medial area, forming a V-shaped mark at end of cell; a subterminal row of dark red brown spots surrounded by lighter shade, the spots large and heavy above veins 3, 6, and 7; terminal line fine, red brown, preceded and followed by light shade between the veins; outer half of wings suffused with lilacine gloss; cilia dark brown with light shade at base. Hindwings ochreous suffused with reddish brown, darkest on costal and terminal areas. Underside: forewings ochreous centrally suffused with brown, costa and margins lighter; a well-defined brown terminal line; hindwings lighter.

Expanse 35 mm.

Hab. CORCOVADO, Rio de Janeiro.

Heterocampa nigriplaga, n. sp.

♂. Palpi ochreous and white, outwardly black; head ochreous and white; antennae brown; tegulae ochreous and white tinged with olivaceous; thorax olivaceous and white; ends of patagia dark brown; abdomen olivaceous and white. Forewings ochreous irrorated with olivaceous brown and black; a black discocellular spot; a dark subbasal line, excurved on subcostal and forming black spot below base of cell; antemedial line dark, geminate, slightly excurved; postmedial dark brown, geminate, sinuous, strongly excurved beyond cell and incurved at veins 2–3, followed by white spot on costa; a dark triangular shade on costa from postmedial to apex, terminating on vein 4; two short black strigae on the dark patch between veins 4 and 6; a subterminal series of diffused olivaceous spots; termen olivaceous interrupted at veins; cilia olivaceous and white interrupted by black and ochreous at veins; a large black patch at base from median nervure to vein 1; the space between veins 3 and 4 thickly irrorated with olivaceous. Hindwings ochreous irrorated with brown on veins and at costal and terminal areas; a diffused light brown, geminate postmedial line; the hairs on inner margin suffused with reddish brown; cilia ochreous suffused with brown.

Expanse 38 mm.

Hab. CASTRO, Paraná, Brazil.

Heterocampa viridiana, n. sp.

♂. Palpi olivaceous, laterally brown; legs, head and thorax olive green, a black band round middle of fore- and mid-tibiae; abdomen brown. Forewings yellowish olive green; base light brown; a wavy dark basal line; antemedial line wavy, black, geminate, filled in with light brown, the inner member heavier than the outer, angled outwards on subcostal, inwards below median nervure and on vein 1; a diffused narrow dark shade between basal and antemedial lines; postmedial line very wavy, double on costa and between veins 6 and 7, below vein 6 to inner margin single, dentate, angled outwards on the veins, followed by light brown shade; a narrow dark medial shade; a subterminal double row of black spots separated by grey between the veins, incurved from apex to vein 3, then straight to above tornus; termen olive green; cilia olive green with black spots at ends of veins. Hindwings ochreous, medially suffused with red, costally and terminally suffused with olive green; a broad, suffused brown subterminal band. Underside ochreous: forewings suffused with pale olive green on costa and apex and red on cellular area.

♀. Hindwings wholly suffused with red except the extreme margin. Underside uniformly suffused with red.

Expanse ♂ 38 mm.; ♀ 47 mm.

Hab. CASTRO, Paraná, Brazil.

Rifargia incurvata, n. sp.

♂. Palpi dark tawny, the 2nd joint tawny and white in front; head white and brown; antennae brown; tegulae and thorax tawny and white; patagia anteriorly tawny, posteriorly tawny and white with a dark streak; abdomen brown. Forewings white, irrorated with black and light brown; base ochreous thickly irrorated with black; subbasal line black, geminate, nearly straight from costa to inner margin; antemedial line fine, black, geminate, the inner member barely visible except at costa, wavy, excurved in cell, incurved below median nervure, excurved above vein 1 where it angles inwards, then strongly bent outwards and again inwards to inner margin; a faint diffused light brown medial shade; postmedial line black, geminate, the inner member heavy and distinct, the outer more diffused, evenly incurved from vein 7 to tornus, followed by reddish brown shade to subterminal line; a terminal series of fine black strigae at right angles to the ends of the veins from 1 to 4, then lunular to apex. Hindwings ochreous suffused with brown; a dark fascia of hairs above inner margin. Underside; forewings white, suffused with reddish brown below costa and at apex; hindwings suffused at costa and on inner margin.

Expanse 47 mm.

Hab. CORCOVADO, Rio de Janeiro.

Rifargia castrena, n. sp.

♀. Palpi and frons dark grey ; vertex and back of head black ; tegulae pale red brown with transverse black stripe ; thorax black with anterior light ochreous dorsal spot, and two posterior spots ; patagia black ; abdomen brown, the first segment dorsally black. Forewings ochreous, heavily suffused with reddish brown and fuscous ; a strongly excurved, dark, geminate antemedial line, the outer member much stronger than the inner, excurved below costa, strongly angled inwards on subcostal, excurved in cell, strongly angled inwards on median nervure at origin of vein 2, excurved below median and running horizontally to vein 1 near base where it is inwardly and again outwardly angled before reaching inner margin ; basal area to antemedial line suffused with reddish brown ; postmedial black, geminate, indistinct from costa to vein 4, well defined below vein 4, enclosing light shade, incurved between the veins ; a subterminal row of reddish brown lunular spots ; terminal line black, well defined between veins 2–4, the rest somewhat diffused ; cilia reddish brown at base, fuscous at tips ; a red brown space at end of cell, extending to postmedial from vein 4 to 6 ; crossed by strong black discocellular streak joining double dark medial shade on costa to very dark medial shade between veins 2 and 4 ; two black lunular spots preceding subterminal lunules between veins 2 and 4 ; outer half of wing heavily suffused with fuscous except below apex and at tornus ; veins on terminal area irrorated with black. Hindwings ochreous suffused with brown. Underside : forewings fuscous brown with suffusion of ochreous near apex : hindwings ochreous suffused and irrorated with fuscous brown.

Expanse 40 mm.

Hab. CASTRO, Paraná, Brazil.

Eunotela bipunctata, n. sp.

♂. Palpi brown, whitish in front and dark brown behind ; frons white ; vertex of head dark brown mixed with white ; antennae light brown, the shaft white ; tegulae dark brown ; thorax ochreous sprinkled with black ; patagia white, a dark streak in centre ; abdomen ochreous white, anal tuft light brown. Forewings ochreous white, the basal area suffused with pale yellowish brown, a slightly darker yellowish brown space beyond postmedial near apex ; a white spot at base of subcostal ; a dark basal line from costa to below median nervure ; antemedial line wavy, geminate, the inner member diffused light brown, the outer black ; a black streak on submedian fold from antemedial towards base ; a line of four spots in cell ; a triple postmedial line of black spots on the veins ; a dark discocellular streak ; a fine brown subterminal line throwing off internal spurs on veins 2 and 3, below vein 2 the line is preceded and followed by small diffused black spot, on vein 5 preceded by large black spot and followed by geminate spots above and below vein, a large black spot before line at apex ; cilia ochreous white with black spots between the veins. Hindwings ochreous, the veins, costa and termen brown ; cilia ochreous white.

Expanse 34 mm.

Hab. Corcovado, Rio de Janeiro.

Dylomia suavis, n. sp.

♀. Palpi, legs, head and antennae light yellowish brown ; tegulae light yellowish brown with fawn-coloured fringe; thorax darker brown ; abdomen reddish brown. Forewings light yellowish brown ; extreme costa fawn-colour; antemedial line narrow, oblique, slightly excurved, ending in a tuft of long scales on inner margin, inwardly brown shading to light fawn-colour outwardly; postmedial heavier than antemedial, nearly straight from near apex, approximating to antemedial and ending in a tuft of short scales on inner margin, inwardly pale fawn-colour, outwardly brown ; an indistinct subterminal row of diffused lunular dark spots ; terminal and apical areas slightly suffused with darker shade ; two discocellular dark spots, joined by fine line and surrounded by fawn-coloured scales ; cilia reddish brown, very heavy on inner margin. Hindwings slightly iridescent, ochreous, suffused with yellowish. Underside ochreous suffused with yellowish fawn-colour, heavier on costal and terminal areas.

Expanse 31 mm.

Hab. São Paulo, S.E. Brazil.

Fam. GEOMETRIDAE.

Azelina flora, n. sp.

♂. Body uniform grey; legs speckled with fuscous ; hind tibiae with a central band of black; an ochreous dorsal thoracic crest ; patagia with some scattered fuscous scales posteriorly. Forewings lilacine grey, slightly irrorated with fuscous ; a dark antemedial line from median nervure to inner margin ; a dark, oblique curved fascia from one third on costa to cell, shading to buff at discocellulars ; a round black discocellular spot suffused with lilacine; postmedial line very wavy, reddish brown, excurved between the veins, preceded by buff beyond the cell; on medial area the veins are buff speckled with brown and there is a buff patch between vein 1 and inner margin crossed by dark strigulae; an indistinct buff subterminal fascia from vein 3 to 6; a subterminal series of minute white points above veins 3 to 6; cilia buff suffused with brown. Hindwings pale ochreous grey, irrorated with fuscous, especially between vein 1 and inner margin; an indistinct, geminate postmedial line with some buff scales at inner margin; a diffused, dark discocellular spot; terminal area suffused with fuscous; cilia grey. Underside greyish white irrorated with fuscous; forewings with a brown postmedial line, well defined from costa to vein 4; medial area from vein 2 to 4 suffused with fuscous; a diffused black discocellular spot; hindwings with interrupted postmedial line and black discocellular spot.

Expanse 38 mm.

Hab. Castro, Paraná, Brazil.

Herbita pacondiaria, n. sp.

♂. This species is very close to *H. capnodiata*, Gn., but differs from that species in the absence of black surrounding the grey discocellular spot on the forewings and in the costal apical spots on the underside being white instead of black. The differences being so slight led to examination of the male ancillary appendages, which at once separated the species, the juxta in *capnodiata* being V-shaped, while in the present species the arms are vertical and parallel, with pointed spatulate ends.

Expanse 48 mm.

Hab. Castro, Paraná, Brazil.

Fam. COSSIDAE.

Langsdorfia tessellata, n. sp.

♂. Palpi reddish brown; legs ochreous, barred with reddish brown; tegulae light brown; thorax ochreous; patagia ochreous with transverse brown bars; abdomen brownish ochreous, dorsally brown. Forewings light brown, pale, covered with dark purplish brown spots surrounded by ochreous white, the spots on costal area and in cell small and very dark, a group of large spots beyond cell between veins 4 and 6, two of them confluent above vein 5; termen brown; cilia light brown. Hindwings ochreous, traces of indistinct spots between the veins. Underside ochreous: forewings indistinctly as on upperside; hindwings the spots well defined on costa above vein 8 and more distinct than on upperside on rest of wing.

Expanse 35 mm.

Hab. CASTRO, Paraná, Brazil.

Fam. LASIOCAMPIDAE.

Echedorus medialis, n. sp.

♀. Palpi brown; legs, head and antennae reddish brown; tegulae and patagia ferruginous; abdomen brown, dorsally ferruginous: the terminal tuft of down black with longitudinal white stripes. Forewings light brown; a darker antemedial line angled outwards on the veins, followed by light shade; an indistinct dark subterminal line; termen crenulate, pale; cilia dark brown, interrupted at veins; medial area suffused with dark brown, centrally thinly scaled, black, a central light space on costal area; apex black above vein 8. Hindwings dark brown; a diffused fuscous medial shade, followed by grey; termen grey; cilia brown.

Expanse 63 mm.

Hab. CASTRO, Paraná, Brazil.

Titya suffusa, n. sp.

♀. Palpi and legs dark brown; head, thorax and abdomen dark grey, suffused with brown. Forewings dark grey; basal third lightly and terminal third heavily suffused with brown; a broad somewhat diffused dark brown postmedial band angled outwards below costa; indistinct, wavy, dark subterminal shade and dark discocellular spot; cilia dark brown. Hindwings brown; base grey; cilia dark brown.

Expanse 58 mm.

Hab. CASTRO, Paraná, Brazil.

Titya serralta, n. sp.

♀. Brownish grey. Antennae dark brown; legs fuscous; anal segment of abdomen golden brown. Forewings brownish grey; a rather broad light grey antemedial line; a dark discocellular spot; postmedial line light grey, narrow, wavy, broader at costa, excurved at vein 8, incurved on cellular fold, excurved below vein 4, incurved above vein 2; a diffused light grey, wavy subterminal line;

termen dark grey; cilia dark brown. Hindwings dark brownish grey: an indistinct pale medial band; a pale subterminal band; termen and cilia dark brown.

Expanse 64 mm.

Hab. Alto da Serra, Santos, Brazil.

Near *T. undulosa*, Walker, but differs from it in the colour of legs, antennae and the anal segment of the abdomen, the position and form of the postmedial line, and in the absence of the dark shades following the antemedial and preceding the postmedial lines.

Titya castralia, n. sp.

♂. Body very dark purplish brown; a few whitish hairs mixed with the dark brown on frons and patagia; antennae tawny. Forewings thinly scaled, black, suffused with tawny shade darker at costa; a trace of a pale antemedial line at costa and in cell; postmedial line wavy, whitish, straight from costa to vein 6, where it curves inwards to vein 4, outwards below 4 and inwards on vein 2; a diffused black discocellular spot; a very slight indication of a subterminal light shade; termen dark interrupted at the ends of the veins by whitish points; cilia dark. Hindwings: a slight indication of lighter postmedial band; a dark diffused discocellular spot. Underside paler than upper; costal area and cell of forewings very dark; hindwings darker on basal half; a diffused dark discocellular spot; a pale postmedial band.

♀. Body and wings pale greyish brown; legs and palpi much darker; antennae tawny; head, tegulae and base of abdomen slightly darker; anal segment very dark purplish brown, almost black. Forewings, basal and medial areas light grey; a slightly excurved, diffused dark antemedial line; a large black discocellular spot; postmedial line wavy, diffused, dark, the curves as in male, followed by about the same width of grey and a rather obscure dark shade, more distinct towards apex; terminal area greyish brown; cilia dark brown. Hindwings with indication of darker ante- and postmedial bands.

Expanse ♂ 39 mm., ♀ 62 mm.

Hab. Castro, Paraná, Brazil.

Sphinta schausiana, n. sp.

♂. Palpi and pectus dark brown; legs ochreous grey; frons ochreous; vertex grey; antennae ochreous; tegulae grey, suffused with brown posteriorly; patagia grey suffused with brown; a black dorsal stripe from back of head to base of abdomen ; abdomen dark brown, base black, anal tuft grey ; beneath ochreous. Forewings white, the veins brown ; costal area and cell dark brown thickly clothed with greenish grey hairs and scales ; a diffused dark brown streak below median nervure from vein 1 to vein 4, and below this three elongate dark brown lunules below veins 2, 3, and 4 ; a diffused dark streak between veins 5 and 6 and three dark subterminal spots below apex ; termen ochreous white ; cilia dark brown. Hindwings white suffused with pale brown on costa and inner margin ; a diffused brown spot at tornus; cilia white.

Expanse 43 mm.

Hab. CURITYBA, Paraná, Brazil.

Fam. PEROPHORIDAE.

Perophora albescens, n. sp.

♂. Head, palpi and antennae ochreous ; legs ochreous irrorated with black ; a white tuft at base of antennae ; tegulae white with some ochreous and a few scattered black scales, thorax white suffused with ochreous and irrorated with black ; abdomen dorsally white suffused with ochreous and irrorated with black ; dark dorsal tufts on segments 4, 5 and 6 ; ventrally ochreous and white. Forewings white, sparsely irrorated with black ; costa ochreous ; a diffused ochreous, wavy antemedial line, more distinct from vein 2 to inner margin ; an irregular diffused postmedial line, ochreous from inner margin to just below vein 3, then reddish brown to costa, a projection at veins 7 and 8 ; preceded by ochreous suffusion which fills the medial area below vein 2, with the exception of triangular space between origin of vein 2 and antemedial line ; terminal area suffused with ochreo-fuscous with the exception of narrow line following postmedial ; a darker lunular patch beyond postmedial from veins 3 to 5 ; a fuscous patch on costa close to apex ; discocellular ochreous ; cilia ochreous white. Hindwings white, outwardly suffused with ochreous and irrorated with black ; a very indistinct diffused ochreous antemedial line, heavily suffused with reddish brown at inner margin and at veins 3 and 4. Underside ochreous white irrorated with black : postmedial line on both wings distinct ; terminal area paler.

Expanse 30 mm.

Hab. SÃO PAULO, S.E. Brazil.

Perophora fenestrata, n. sp.

♂. Palpi brown; legs light ochreous brown sprinkled with black, fore tibiae pinkish; frons and tegulae creamy pink; antennae ochreous; thorax and abdomen pale brown sprinkled with black scales and slightly tinged with pinkish. Forewings light brown, slightly irrorated with black and suffused with a pink shade; costa tawny; a diffused, indistinct, double, dark medial shade from costa through end of cell to inner margin; trace of postmedial dark shade, forming diffused spot above vein 8; a dark discocellular bar, followed by minute hyaline spots above and below vein 5; a small pink subterminal suffusion between veins 6 and 8; cilia dark brown. Hindwings similar to the forewings, but the medial dark shade is beyond the cell and becomes a single line from vein 2 to inner margin; dark discocellular bar and hyaline spots larger than on the forewing. Underside: forewings light brown suffused with pink and irrorated with black; veins, cell and subapical patch heavily suffused with red; a narrow, dark brown, diffused postmedial shade; dark discocellular bar; hindwings with the red suffusion on the veins only; dark postmedial shade and dark discocellular bar.

Expanse 46 mm.

Hab. CASTRO, Paraná, Brazil.

Perophora jaruga, n. sp.

♂. Palpi red-brown shaded with fuscous; frons and antennae yellowish brown; tegulae centrally paler; anal tuft fuscous at tip. Forewings: a very indistinct fuscous antemedial line well defined, black, oblique from costa to vein 7, thence nearly straight to middle of inner margin, followed by narrow light shade and broad, black suffusion forming large triangular space at tornus from inner margin to vein 4 crossed by pale band from inner margin to vein 3, straight from vein 4 to near termen on vein 8, above vein 8 reaching apex; a pale discocellular bar, slightly defined by fuscous; termen pale; cilia dark. Hindwings: a black medial band and obscure subterminal shade. Both wings and abdomen are sparsely sprinkled with white scales tipped with black.

Expanse 60 mm.

Hab. GUARUJÁ, Santos, S.E. Brazil.

Fam. MEGALOPYGIDAE.

Megalopyge nivosa, n. sp.

♂. Frons, pectus and inner side of fore and middle femora and tibiae dark brown; outer side white; hindlegs brown; all tarsi brown; antennae ochreous, shaft white; vertex of head white; tegulae dark brown; thorax brown; a large white spot on front of patagia, some white subdorsal hairs on metathorax; abdomen brown, underside ochreous and brown. Forewings white; base of costa, veins and medial area below median nervure brown; terminal area suffused with brown; a group of dark brown spots at base; two dark brown streaks in cell; a brown fascia on median nervure, broadening at end of cell from vein 3 to 5; a triangular dark brown spot on discocellulars; a small brown mark at origin of vein 8; a diffused brown terminal line; cilia brown. Hindwings ochreous; veins and hairs on inner area brown. Underside ochreous white, suffused with brown on costal area; veins brown.

Expanse 36 mm.

Hab. CASTRO, Paraná, Brazil.
Near *M. albicollis*, Walker.

Megalopyge lanocrispa, n. sp.

♂. Frons and pectus dark brown; tarsi fuscous brown banded with ochreous; vertex of head ochreous; back of head light brown; antennae dark ochreous; tegulae ochreous in front, brown behind; thorax ochreous and light brown; abdomen light brown. Forewings ochreous white; costa and inner margin ochreous; veins light brown; a diffused dark discocellular spot; a postmedial brown band followed by lighter shade, excurved from vein 9 to vein 2, where it is slightly bent outwards and straight to vein 1b; five wavy black fasciae from base, one on subcostal nervure, two in cell, the lower one reaching to above origin of vein 2, one slightly shorter just below median nervure and one above 1b; a short dark streak at each side of veins on terminal area: a brown terminal line, broken at the veins; cilia similar. Hindwings ochreous; veins and inner area suffused with yellowish brown. Underside ochreous; forewings, costa and veins suffused with brown; hindwings, basal half and veins suffused with brown.

Expanse 40 mm.

Hab. CASTRO, Paraná, Brazil.
Allied to *M. fieldia*, Schaus.

Edibessa ferugina, n. sp.

♂. Head and body bright orange tawny; frons and antennae dark fuscous; a pinkish white dorsal spot on prothorax; patagia inwardly fringed with pinkish white; two pinkish white spots merging into patagia. Forewings fuscous; base pinkish white followed by suffused band of orange rapidly fading into fuscous; costal area orange at base, shading to yellowish grey at apex ; an orange fascia through lower half of cell, extending to apex, diffused beyond cell ; a dark space on terminal area below apex ; termen narrowly dark cream-colour from near tornus to vein 5 ; inner margin suffused with orange; cilia cream-colour suffused with fuscous. Hindwings fuscous ; base rose pink ; inner half of wing, costa and inner margin orange ; cilia cream-colour suffused with fuscous. Underside : forewings the same as upper, excepting that the fascia in the cell does not extend beyond it ; the base of both wings rose pink.

♀. The colours are paler and there is no fuscous on frons.

Expanse, ♂ 37 mm, ♀ 50 mm.

Hab. CORCOVADO, Rio de Janeiro.

Edibessa placida, n. sp.

♂. Head, pectus and thorax dull orange ; frons heavily suffused with fuscous ; legs fuscous, the tarsi white at extremities of joints ; antennae dark fuscous ; tegulae and patagia fringed with pinkish white ; two large black subdorsal spots on metathorax ; abdomen dark fuscous. Forewings light fuscous ; base pinkish white followed by suffused fuscous shade, more defined at base of cell ; costa dark fuscous at base fading to pale fuscous at apex ; subcostal area creamy white ; termen narrowly creamy white from tornus to vein 5 ; cilia creamy white, suffused with fuscous below apex. Hindwings pale fuscous ; costal area creamy. Underside the same as upper, except that the costa of forewing is creamy.

Expanse 30 mm.

Hab. CORCOVADO, Rio de Janeiro.

Edibessa rufa, n. sp.

♂. Body bright brick red ; frons brick red ; vertex of head red brown ; antennae brown, shaft dark ; tegulae red brown tinged with brick red anteriorly ; thorax red brown ; abdomen bright brick red, anal tuft brown. Forewings red brown thinly scaled ; a postmedial diffused fuscous band, broad beyond cell, more defined and broken into three spots near inner margin ; cilia fuscous. Hindwings bright brick red. Underside uniform brick red.

Expanse 28 mm.

Hab. SÃO PAULO, S.E. Brazil.

Edibessa rubrivena, n. sp.

♀. Head, pectus and legs bright red ; tarsi fuscous ; antennae fuscous ; thorax light brown with two anterior tufts of red ; patagia light brown, outwardly red ; abdomen bright red ; anal segment light greyish brown. Forewings light brown, thinly scaled; costa and veins, with the exception of subcostal nervure and submedian veins, red; cilia red; a postmedial row of fuscous spots angled outwards beyond cell between veins 4 and 5, thence incurved to middle of inner margin. Hindwings rose pink; cilia red. Underside uniform red.

Expanse 30 mm.

Hab. CASTRO, Paraná, Brazil.

Possibly this may be the female of the preceding species.

Norape undulata, n. sp.

♂. Pure white; frons, pectus and upper side of forelegs fuscous; antennae shaft white, pectinations buff; abdomen indistinctly banded with buff. Forewings: basal third of costa fuscous; a geminate fuscous spot in end of cell; a subterminal row of fuscous spots above veins 2–5; an antemedial bar of raised scales from cell to inner margin; a similar medial bar and postmedial band, the latter reaching indistinctly to costa. Hindwings pure white.

♀. Antennae white with the pectinations slightly ochreous; abdomen more distinctly banded than in male. Forewings: costa entirely white; the fuscous spots as in male but much fainter.

Expanse ♂ 27 mm., ♀ 33 mm.

Hab. CASTRO, Paraná, Brazil.

Fam. LIMACODIDAE.

Asbolia chica, n. sp.

♂. Pale yellowish brown; palpi, fore tibiae, antennae and patagia tawny. Forewings tawny, slightly suffused with grey on costa; a whitish line from base below median nervure to apex, where it is joined by a similar subterminal line; a dark shade above the white from base to origin of vein 2; just before vein 2 the white line throws off a spur towards tornus; beyond the spur the space between the white lines is fuscous, from base to spur tawny; on costal area at apex a patch of reddish tawny, diffused on inner side; cilia tawny. Hindwings ochreous; a fine tawny terminal line; cilia ochreous yellow.

Expanse 31 mm.

Hab. CASTRO, Paraná, Brazil.

This species is very close to *A. cicur*, Schaus; but differs from it in the more definite fuscous shade between the white lines and in the form of the scales on costal area, which are broad and lustrous in *A. cicur* and dull and hair-like in this species.

Fam. PYRALIDAE.

Sub-fam. Chrysauginae.

Chrysauge aurantia, n. sp.

Palpi black ; frons brown in front and black behind ; legs and antennae dark brown ; tegulae black with anterior line of orange ; thorax and abdomen black ; wings black. Forewings with broad orange band from costa near base, following above vein 1 to tornus, where it is violently curved backwards to meet costa at two-thirds from base. Hindwings with broad orange space from base, including lower half of cell. Underside the same as upper.

Expanse 35 mm.

Hab. Castro, Paraná, Brazil.

Acrodegmia gigantalis, n. sp.

♀. Palpi, legs and abdomen dark brown ; head, thorax and antennae a lighter shade. Forewings light yellowish brown ; antemedial line geminate, diffused, ferruginous, enclosing lighter shade, oblique across cell, angled outwards on median nervure, slightly incurved to vein 1, scarcely visible on costa and inner margin, preceded by broadly diffused ferruginous ; postmedial line similar to antemedial, outwardly oblique from costa to vein 8, strongly excurved to vein 2, then incurved to inner margin, followed by ferruginous shade fading to yellowish brown at termen ; a rufous fascia on inner margin from near base to a little beyond postmedial ; cilia rufous. Hindwings brown with diffused darker medial shade. Underside brown ; a fuscous patch at costa beyond cell of forewings ; a diffused, geminate postmedial line, the inner member broad and the outer narrow.

Expanse 76 mm.

Hab. São Pavlo, S.E. Brazil.

The type is somewhat faded, being originally inclined to olivaceous on the forewings.

Eurypta flammalis, n. sp.

♂. Palpi, legs and antennae dark brown ; head, thorax and abdomen black. Forewings bright orange, the base, costa, apex and termen black ; a narrow black fascia from below middle of cell to tornus. Hindwings black.

Expanse 18 mm.

Hab. Castro, Paraná, Brazil.

Tosale lugubris, n. sp.

♀. Head, thorax and abdomen brown. Forewings greyish brown suffused and irrorated with dark brown ; base greyish brown ; antemedial line dark brown, geminate, strongly excurved, filled in with greyish brown ; the outer half of inner area thickly irrorated with dark brown ; postmedial diffused, dark brown, followed by ochreous, strongly excurved from costa to vein 2, where it bends violently outwards to tornus, forming acute angle on vein 2, the ochreous line broken into dots on veins 2–6 ; outer half of medial and inner half of terminal areas olivaceous with slight metallic sheen ; an indistinct subterminal row of dark points ; cilia dark brown Hindwings brown ; an indistinct ochreous postmedial line, more defined from vein 2 to tornus. Underside brown ; an indistinct, diffused, geminate postmedial line filled in with ochreous.

Expanse 23 mm.

Hab. Castro, Paraná, Brazil.

Axamora pyrochroma, n. sp.

♀. Head, palpi, legs and thorax purplish brown ; abdomen brown. Forewings rich chestnut brown, veins and lines dark purple brown ; base purplish brown ; antemedial line dark purplish brown followed by pure white line broadening out to white spot on costa; postmedial line incurved from costa to vein 7, then strongly excurved to vein 4 from which it runs straight to inner margin ; a triangular white spot on costa beyond postmedial ; an indistinct, broken subterminal line, more distinct from veins 4–7 ; a dark terminal line ; a dark medial shade suffused with purplish white in and below cell to near inner margin ; cilia dark purplish brown, pale at base, a few white scales at apex and below vein 2. Hindwings golden yellow suffused with brown on costal and apical areas ; very indistinct postmedial and subterminal lines ; terminal line brown, cilia paler than in forewings.

Expanse 22 mm.

Hab. Castro, Paraná, Brazil.

Sub-fam. Epipaschianae.

Stericta basalis, n. sp.

♀. Proboscis, fore and middle femora and tibiae and head pale reddish brown mixed with ochreous ; palpi pale reddish brown, 2nd joint ochreous in front, 3rd joint black ; antennae grey ; tegulae pale reddish brown; thorax black with some ochreous scales; patagia ochreous; abdomen ochreous irrorated with black, anal tuft black; underneath, 1st segment white. Forewings ochreous white irrorated with black; basal third pale reddish brown, heavily shaded with black on inner margin and before antemedial line; antemedial line black, geminate, enclosing white band, inner member heavy, outer finer and diffused, angled inwards on vein 1; an indistinct diffused black medial shade, the medial area being lighter within and darker beyond the shade; subterminal line black, dentate, followed by ochreous white, oblique from costa to vein 4, then bent inwards to vein 2 and outwards to inner margin; termen black; cilia ochreous, suffused with brown, a dark brown band near base. Hindwings ochreous; veins, costa, apex and termen suffused with brown; cilia ochreous with brown band.

Expanse 26 mm.

Hab. Castro, Paraná, Brazil.

Deuterollyta francesca, n. sp.

♂. Antennal processes black; palpi 1st joint white, 2nd joint white with a few tawny scales at base and black at end, 3rd joint black with minute white tip; pectus white; fore-femora olivaceous with white at base and extremity; tarsi fuscous ringed with white; mid- and hind-femora white with olivaceous patch on outer side; head ochreous white; thorax ochreous with some black dorsal scales; abdomen ochreous anteriorly irrorated with brown, some black scales underneath. Forewings ochreous; costa, base and medial area from costa to a little beyond median nervure pale olive green; a white point at base of costa; a white band from one-third on costa crossing cell and fusing with white streak above median nervure; a patch of raised white scales below cell; beyond this a smaller white patch crossed by black striga; a white fascia from middle of costa to near apex, crossed by olive green band near the end; the olive green and white space surrounded by black irroration, narrow from base to vein 3, where it broadens out to subterminal line as far as vein 7; from above vein 7 to apex black; terminal area from 7 to 4 white, from 4 to tornus ochreous slightly tinged with green; a triangular black point at lower angle of discocellulars; termen black, broken at veins; cilia white. Hindwings iridescent white, some fuscous irroration at apex.

Expanse 23 mm.

Hab. Castro, Paraná, Brazil.

Macalla sinualis, n. sp.

♂. Proboscis, palpi, fore-femora and head fawn-colour with some white scales intermixed; fore- and middle-tibiae fawn with black band round middle; antennae dark brown, a few whitish scales on the shaft; antennal processes fawn-colour with some white and a few black scales, the middle portion of brush very dark grey; tegulae fawn with some black scales; thorax ochreous and fawn, two large black subdorsal, posterior spots; patagia fawn, white and very dark grey; abdomen ochreous, two large black subdorsal spots on 1st segment; a dorsal and two lateral black spots on 2nd segment, the remainder heavily suffused and irrorated with black and a few fawn scales, underneath ochreous. Forewings creamy white, suffused and irrorated with fawn and black; base black, followed by fawn irrorated with black; a black triangular patch before antemedial line below median nervure; antemedial line black, sinuous, angled outwards on subcostal, inwards below median nervure, followed by white below median nervure; postmedial black, incurved below costa, excurved on veins 4–5, incurved on vein 2 followed by white below costa; medial area centrally suffused with bright fawn-colour, a few black irrorations on costa, beyond and below cell, and an inner margin; a round black discocellular spot; terminal area suffused with fawn and irrorated with black; a heavy dark shade before apex from costa to below vein 5, a smaller dark shade below veins 2 and 3; a terminal row of dark spots between the veins; cilia ochreous interrupted by dark points at veins. Hindwings opalescent, creamy white; apex broadly black; small fuscous spots at tornus and at end of vein 2.

Expanse 34 mm.

Hab. Castro, Paraná, Brazil.

Macalla regalis, n. sp.

♂. Proboscis, palpi, pectus and femora reddish brown; tibiae dark brown mixed with whitish; tarsi fuscous ringed with ochreous, antennae grey; antennal processes reddish brown, the base of the brush with long fuscous scales, top of brush reddish brown; head, tegulae and abdomen reddish brown mixed with ochreous; thorax anteriorly ochreous, posteriorly fuscous; patagia reddish brown and fuscous; abdomen ventrally ochreous, anal tuft light brown tipped with fuscous. Forewings white; basal third reddish brown heavily suffused and irrorated with black; terminal third suffused with reddish brown, a very dark circular patch below apex: antemedial line black, sinuous, excurved on subcostal, incurved below median nervure, angled outwards on vein 1, followed by white ; postmedial brown, wavy, wide at costa, excurved at veins 5–3 ; a patch of raised white scales on discocellulars, with a few black scales on median nervure ; medial area centrally lightly suffused with light brown, costa and subcostal irrorated with dark brown, the other veins with light brown ; a terminal line of brown spots between the veins ; cilia ochreous with central dark line, red-brown at tornus and dark brown at apex, outwardly brown opposite the veins. Hindwings white, the margins dark fuscous, broad at apex, narrow at tornus and inner margin ; cilia fuscous with dark central line. Underside : forewings, base black ; medial area white ; terminal area black ; a black discocellular streak ; hindwings, base of costal area black, medial costal area ochreous irrorated with fuscous ; terminal area black, wide at apex, narrow at tornus ; a short black streak on upper portion of discocellulars.

Expanse 35 mm.

Hab. Castro, Paraná, Brazil.

IX. *The study of mimicry (Batesian and Müllerian) by temperature experiments on two* Tropical butterflies. By Lieut.-Colonel N. Manders, R.A.M.C., F.Z.S., F.E.S.

[Read February 7th, 1912.]

Plate XLI.

These experiments were undertaken when I was becoming impressed with the conviction that Natural Selection was not the prime factor in causing those remarkable resemblances among certain tropical butterflies which are usually classed as instances of Batesian or Müllerian mimicry.

They are not so numerous as I could wish, but as I am unlikely to be able to continue them, I bring them forward as they may be of assistance to others in future work in what I believe to be a fruitful field.

The insects dealt with form the best known case of mimicry among butterflies; the classical example of Batesian mimicry, viz. *Danais chrysippus* (model), and its two forms *dorippus* and *alcippus*, and *Hypolimnas misippus* (mimic) with its trimorphic female resembling *D. chrysippus*, *dorippus*, and *alcippus* respectively.

I have chosen these two butterflies as they are almost universally known to entomologists; they are not subject in any way to seasonal dimorphism; and they were common at Colombo where these experiments were carried out. The material of these experiments has been presented to the Hope Department of the Oxford University Museum, where it will be accessible to all naturalists.

It will be as well to devote a few words to the life-history of these butterflies as I have observed them in Ceylon.

Danais chrysippus.

Though the natural enemies of the perfect insect are few in number it is by no means exempt from destruction in its earlier stages. It is difficult to estimate the pressure of enemies during the egg stage, but I believe there is a gradual decrease of mortality from egg to imago in all butterflies—from birth to maturity—thus following the general law among living beings.

The parasitic Hymenopteron *Trichogramma evanescens* is excessively common, and large numbers of eggs are found parasitised. Ants destroy them largely, more especially when fresh laid, and from these two causes alone I am inclined to consider that the damage to the *chrysippus* population is greater than in the succeeding stage. The larva which, on account of its striking appearance, is frequently selected as an example of aposematic or warning coloration, has at least two parasites; a Tachinid and a species of ichneumon (*Apanteles?*), both these are very common. They are preyed on also by a small green spider and ants, but these latter do not readily molest them unless they have been previously injured. The larvae themselves are addicted to cannibalism if overcrowded or there is a deficiency of food. In its early stages it secretes itself beneath the leaves of its most usual food-plant, *Calotropis gigantea*, eating out circular holes which readily disclose its proximity. Whether it occupies the under surface for concealment or because this is more easily masticated is uncertain, probably both factors combine; when half-grown and thence onwards it feeds exposed, and is then a conspicuous object when on the leaves, but it matches well with the purplish-green flowers on which it readily feeds. As a pupa it has fewer foes, though undoubtedly immediately after the larval skin has been cast and before it hardens it is liable to be attacked by ants and also by larvae of its own species; but otherwise it is apparently immune. It is dichroic, some being pale apple-green, the colour of the leaves, and others pale pink. The colour is not wholly susceptible to its environment as it is not unusual to find a pink pupa conspicuously suspended beneath a green leaf of the food-plant. The perfect insect has few enemies, as far as my own observations extend; lizards of the genus *Calotes* prey upon them, as they do upon any species of butterfly, and they are liable to be eaten by birds when injured.

It is one of the most widely distributed tropical butterflies and has two well-marked forms: *D. dorippus*, in which the white subapical band and black apex are replaced by the same red colour as the rest of the wing, and *D. alcippus* with its sub-form *alcippoides* in which the hindwing is more or less white.

Inspection of this series brings out the following points—

First.—The crippled condition of many of the specimens. This is due no doubt to the weakening effects of the abnormal conditions to which the pupae were subjected; the mortality varied from one in four to over fifty per cent.

Secondly.—The large number with more or less red on the apex of the forewing, which is normally black. No selection of any kind has been made, all the specimens bred, whether normal or otherwise, are represented.

Thirdly.—The marked increase of red in those treated with excessive dry heat. The ♀♀s, as in all cases, are more affected than the ♂♂s.

Fourthly.—The conspicuous red apex of two specimens treated with dry heat at 90° F., a temperature common at Colombo, where, however, the atmosphere is humid.

Fifthly.—The slight but still perceptible red on one specimen treated with dry cold.

It is probable that if as great a shock could be produced by cold as by heat the same changes would occur, showing that such are due to internal conditions rather than external causes. There is no approach, except very slightly in two specimens, to the form *alcippoides*, it is all towards *dorippus*. Two females (No. 26, No. 28) which were subjected to moist heat show an inclination to the deep dull red which is so characteristic of the species in the hot, damp climate of Sumatra and Java.

Comparing these butterflies with a large representative collection, such as the National Collection at South Kensington, one is at once struck with the almost total absence in the latter of specimens which I may call intermediate, that is, between the type *chrysippus* and the form *dorippus*. In the very large series at South Kensington I could only find two or three, though the breadth of the white subapical bar and the number and size of the white spots on the forewing is greater than in my series, and in China they are developed to such an extent as to form a well-marked local race named by Moore *Danais bowringii*. Out of the hundreds of Ceylon specimens that have passed through my hands, I have only seen one that has any red scaling on the apex, and this one I captured myself at Colombo after a long drought. Professor Poulton writes, "This variety (*dorippus*) is sharply cut off from the type form. Although faint traces of a former white bar can be made out in *dorippus*, I have never seen, among thousands of individuals, the material out of which a good transitional series between it and *chrysippus* could be constructed" ("Essays on Evolution," p. 70).

As to the factor which produced these intermediates, Professor Poulton, in a letter to me, writes, "The species (*chrysippus*) has a double constitution A and B, developed from internal causes (viz. within itself, and hereditary), but they are not so far crystallised out but what some effect in the direction of A or B may be produced by external causes; but not apparently the whole effect—at least so far as you have gone." And again, "I do not change my view that the ultimate cause is internal and not external. That the internal condition can be modified to some extent your experiments certainly seem to show; although you do not produce the full *dorippus* effect, whatever you do. The full *dorippus* form is a dominant one on Kilimanjaro, with all its mountain moisture, showing, I think, that it is not heat and dryness that produce it. The same conclusion is supported by the fact that *dorippus* is extremely rare south of the Zambesi, although there are vast tracts of land that are dry, hot, and desert, for a large part of the year. Hence, although the germ-plasm seems certainly alterable by heat, that does not seem to be the way that usually works in nature. It may be so in the desert area of Ceylon, accounting for the isolated individuals that occur there of *dorippus*. *Inaria* is even more clearly independent of climatic causes, for its proportion is considerable all over Africa; yet the climate varies immensely. It is a common form on the West Coast."

I quite agree that the cause is internal and hereditary, but rather consider that the constitution is simple and that an external cause such as shock to the developing pupa throws it back to an earlier form of its internal development. That external conditions have in themselves power to produce some effect is indicated by the approach to the Sumatra form by the agency of moist heat, and Mr. Merrifield has shown by his experiments on *Chrysophanus phloeas*, that that butterfly is ready to assume a different colouring according to the temperature at which the larva is reared. But in the present state of our knowledge it is frequently impossible to say what is due to internal causes and what to the pressure of external conditions.

The question arises which is the ancestral form, *chrysippus* or *dorippus*? Most entomologists, I believe, consider the former to be the older, chiefly on the grounds that the latter is widely different in appearance from any now existing member of the group, and that in certain specimens the remains of a former bar are more or less visible. I do not know that either of these objections is insuperable, but if so, I can only assume that the germ-plasm has now become so fixed by inheritance that no form of shock can throw it backwards to an earlier type, but only disturbs it to such an extent as to cause it to produce the easiest variation of which it is now capable.

On the other hand, all experimenters on the earlier stages of European *Lepidoptera*, Weismann, Merrifield, Standfuss, and others, lay great stress on the fact that shock tends to throw the insect towards the ancestral type, and I certainly know of no detailed experiments to the contrary. It is scarcely reasonable that the same agent would throw one insect back to the type, and another to the form towards which it is tending. There is one fact recently brought to my notice by Mr. Doncaster of great importance. He tells me that he has received from Coimbatore, in the Madras Presidency, a brood of bred *chrysippus* in which were a considerable number of *dorippus*, the parent being the type. This is the first instance of such an occurrence, and it is the more interesting as *dorippus* has never to my knowledge ever been taken in Madras. I regard these *dorippus* as a throw-back to the ancestral form. We shall see that we shall be confronted with precisely the same difficulty when dealing with *Hypolimnas misippus.* It is, however, clear that neither form is a sudden mutation, but has been formed gradually the one from the other.

Hypolimnas misippus.

Few remarks are needed regarding its life-history, but I give the following from my note-book to show the rapid growth of the larvae, and the remarkably short time during which Natural Selection can have any influence on the mature butterfly. It will be noticed that the female lays the whole of her eggs in about ten days.

"17.10.09. Captured *diocippus* ♀ in cabinet condition.

20.10.09. Noticed a considerable number of eggs laid.

24.10.09. Several larvae are hatched and evidently a day or two old, if not older. Transferred ♀ to another cage.

29.10.09. Many of the larvae are half-grown. She is still ovipositing. To-day I collected over 100 eggs, laid since the 24th. Transferred to another cage.

2.11.09. No more eggs laid.

4.11.09. Found dead, apparently from natural causes. Two larvae pupated to-day; the pupation of larvae from eggs first laid is practically coincident with the length of oviposition."

It only appears in Ceylon directly after the rain, at the burst of the North-East Monsoon, and dies out with it. It has occurred the last four years with extraordinary regularity; in 1908 early in October; 1909 on October 12th; 1910 on October 12th; 1911 on October 7th. They always appear in considerable numbers and in the finest condition, and are no doubt bred on the spot. It flies commonly in November, gets scarce towards the end of December, by which time the females have mostly disappeared, and the last few males die out towards the end of January, not to be seen again until the following October. Males and females are equally numerous, the males frequenting flowering shrubs, and the females more open ground in the neighbourhood of the food-plant, *Portulaca oleracea*. It is in such country that its presumed model, *D. chrysippus*, occurs, and it is not uncommon for the *chrysippus* ♂ to mistake the *misippus* ♀ for one of its own species. Butterflies recognise each other by sight as well as by scent; the smell of a crushed *misippus* is very different from that of *chrysippus*. It is not rare for *misippus* ♂ to court for a few moments *D. chrysippus*.

The form of female which represents *D. chrysippus*, form *dorippus*, known as *inaria*, Cram., is distinctly rarer than the female of the type *diocippus*, Cram., which resembles *chrysippus*. In Colombo, in eight years, I have not seen a dozen specimens; but Mr. Ormiston tells me that in his part of the country at 4,500 ft., the proportion is about one of *inaria* to six of the type. Intermediates are rare; I picked out one in a collector's box which had the white apical bar thickly covered with reddish scales, but have never taken one myself or known of one taken by others.

It was advisable to ascertain the normal number of *inaria* in a batch of eggs laid by *diocippus* and *vice versa*, but unfortunately I was unable to find a single specimen of *inaria*. In October 1909 from a normal *diocippus* ♀ I obtained 250 eggs; there were 50 deaths from one cause or other and 197 resulting butterflies, 110 ♂♂s and 87 ♀♀s, all without exception of the *diocippus* form. In October of the following year I bred 225 from another female of the same form; the result was 84 ♂♂s and 76 ♀♀s, all typical *diocippus*, except five which were slightly speckled with red on the three small apical spots on the forewing; the remainder of the brood, 65 in number, I experimented with. (C1, C1a, etc.)

These results contrast in a most remarkable manner with those of the Rev. St. Aubyn Rogers in East Africa. He writes to me, "From an intermediate between the type and *inaria* form, but on the whole nearer the former, I obtained about 50 ♂♂s and 49 ♀♀s, but all *inaria*, some slightly *alcippoides*. In the following year an *inaria* laid 100 eggs, resulting in 60 ♂♂s and 36 ♀♀s, the whole *diocippus*! Weather dry." He added, "If *inaria* is the dry weather form (as I had surmised it being so uncommon in damp Ceylon), the offspring should be *inaria*." *

Mr. G. F. Leigh in Natal obtained from an intermediate female 8 ♂♂s, 5 *diocippus* and 3 *inaria*.

These results probably have a Mendelian interpretation, but they throw no light on the origin of these two forms.

Turning now to the results obtained; the butterflies exhibited are labelled A, B, C, C1a, etc.

Those labelled A, consisting of 9 ♂♂s and 55 ♀♀s, the parent of which is also shown, form *diocippus*, are part of the brood of 197 bred in October 1909, and show the normal appearance of the species as it occurs in Ceylon. They are in no way selected.

Those labelled B were from a similar parent to A, and only a few eggs were laid. They were all treated artificially, but as it was open to any one to say that they might have produced these abnormal forms under natural conditions, I took a third brood C, which I divided into two. One half was reared under natural conditions and produced all normal ♂♂s and *diocippus* ♀♀s; the other half I again divided into two, treating one portion artificially in the

* In a subsequent letter dated 23.11.1911 he writes, "I got a ♀ of the type form from which I bred 73 ♂♂s and 56 ♀♀s, of which 38 were of the type form and 18 of the *inaria* form and *no* intermediates." See Proc. Ent. Soc., 1911, p. xliv, and also 1912, p. lxxiii.

early stage of pupal life, and the other in the later stage. I should say the parent was of the type form. The whole of the abnormal specimens can be treated collectively.

The first noticeable point is the large number of cripples and malformed individuals. The mortality among those artificially treated was very high. *Misippus* is very hardy, and easy to breed, and there is no difficulty in obtaining large numbers of normal butterflies, but abnormal conditions have a great effect on them. The difference between the two was very marked, the latter often dying just before emergence, or with very little power of breaking through the pupa case; their movements after emergence were excessively feeble compared with the others. Taking the females first, the number of intermediates, *i.e.* with the apices and white band of the forewing speckled with red, is very large. Though such are not unknown in East Africa, it is significant of their rarity that in the National Collection I could only find one from Aden, one from Muscat, and one from Berhampore. In this series there is a gradual increase of red, from a few scattered scales in the black apex, to a complete change from one form to the other. I would also call attention to the character of the subapical band. Normally it is a slight curve from the costa to the outer margin, and is composed of separate spots divided by the black veins, but in these it is distinctly broader, longer, and more circular, and the spots are united into one continuous band. This is the normal appearance of the ♀ in certain areas of its distribution, for instance, at Port Darwin, the Cocos Keeling Islands, Java, and Sumatra, and in the latter islands the forewings are often of the same deep red colour as *D. chrysippus.* There are three noticeable features in the males. First, the appearance of a small white spot in the cell of the forewings, and in two or three specimens there is a second. These are extremely rare in the normal butterfly, which is exceedingly constant in colouring. Secondly, the rather more prominent and extensive lunular subterminal lines on the upper side of the hindwings. Thirdly, the less intense black of the tornus in the forewing underside, which in one specimen is distinctly red. In none is there any red on the forewing.

Comparing these males with those in the South Kensington Museum, I find a solitary specimen from the Silaki Valley, British East Africa, with a small amount of red at the base of the forewing upperside, and the lunules well marked on the hindwing. From the island of Formosa there are two males like the above, and the tornus beneath is red. Whether this is the usual form of the insect in that island I am unable to say. In constructing the ancestral type, we should probably be on safe ground by assuming that it had more white and a certain amount of red on the forewing, a lunulated band completely round the outer margin of the hindwing, and more red on the underwing. Anything beyond this is conjectural.

Referring for a moment to the females, it will be seen that in the forced specimens there are in the blue costal margin of the cell, two spots, sometimes red, sometimes white, in precisely the same position as the two white spots in the cell of the males. These are absent, or nearly so, in normal specimens, and we may conclude that, at one time in its history, the female had more white on the forewing than it has at present. This would rather incline us to the view that *diocippus* is the earlier form, but, as in *chrysippus*, we are confronted with the difficulty that shock throws back the insect to the earlier stage, in which case, judging by these intermediates, *inaria* is the more ancient type, and we must account for these additional spots by the not improbable conjecture that the evolution of such a variable butterfly has not been uniform.

The study of the closely allied species *Hypolimnas bolina* may help us in our determination of this question. It is difficult in a few words to give a brief, and at the same time lucid, account of the innumerable variations of this protean butterfly. The male, throughout its immense range, is very fairly constant, being very similar in general appearance to that of *H. misippus.* In Fiji the spots are very small, and a very deep blue. The females in their western area do not vary greatly, being generally plain brown and slightly blue on the costa, with a variable number of marginal yellow spots. In Formosa the colour is also plain brown, sometimes tinted with blue, and with a white band as in *misippus.* Further east, in the Loochoo Islands, the brown is replaced with glistening blue. But it is in Australia and the Fiji Islands that the butterfly reaches its maximum development both of size and variability. In the Godman-Salvin Collection, now in South Kensington, there is a series of some two dozen females, taken at Suva, Fiji, on the same day and on the same flower bed. All are different, and vary from plain brown, or plain brown with yellow or white discal band, to others with bluish white discal spots, and red on the forewing. In Australia, very much the same sequence is observed. It varies from a plain brown butterfly with slight blue on the costa and disc, to a highly variegated metallic red, white, and blue butterfly. We can, in this extensive series, trace the gradual change from a few scattered red scales, to a well-developed red band or patch.

There is an intimate relation between the colours brown and blue in all butterflies. So far as my own knowledge extends, there is no blue butterfly in the world that, in one or the other sex, has not some traces of brown. Blue, if I may so express it, is a later colour than brown. It is well exemplified in the European *Lycaenidae*. This being so, we may consider ourselves justified in assuming that the plain uniformly brown female represents the oldest known form of that sex of *bolina* at present existing. It seems a natural conclusion that the uniformly coloured *inaria* is also an older form, from which the more variegated *diocippus* has been evolved. As in the case of *D. chrysippus*, it is clear that it is not a sudden mutation.

Now as to the factor which has caused the resemblance between the two species; is it Natural Selection, or what?

The argument for the former, that is, Mimicry, has been elaborated by Prof. Poulton, in his well-known work, "Essays on Evolution," and it is unnecessary to recapitulate or to discuss whether this is a case of Müllerian or Batesian mimicry. But further, there are the two forms *dorippus* and *alcippus*, which are also held to be due to Natural Selection, and I will consider them first.

Danais chrysippus form *dorippus*.

In the above Essays (p. 320), Prof. Poulton has put forward the view that *dorippus* has been evolved from *chrysippus* as a form of cryptic defence; that is, though it is an unpalatable insect, the struggle for existence is so great in the desert areas in which it is usually found, that it has been necessary for its survival to discard the conspicuous white band and black apex, and make itself as near as may be to the colour of its environment.

I am doubtful as to this interpretation. In the extremely hot dry weather of the desert, the butterfly, like the majority of other insects, altogether disappears; birds shift their quarters; and reptiles and predatory insects become scarce. During the short rainy season, or, for that matter, after a few showers, insect and other life becomes very abundant for a short time, during which I doubt there being a greater struggle for existence than in other places where the type is found. Insects, though few in species, are particularly numerous in individuals, the members of the genus *Teracolus,* for instance, are frequently excessively common.

If *dorippus* is a desert form particularly fitted for such a life, we should expect it to be dominant in the Punjab,* Bikanir, and Rajputana deserts, where, if it occurs at all in the latter places, it is exceedingly rare, though the type is common enough. We should also expect it to be common on the hot dry plains of Mashonaland and other similar localities south of the Zambesi, but on the contrary, it is very rare, though the type is abundant.

Again, presuming that it is a later form, it is difficult to account for the absence of intermediates. The accepted interpretation would be, I presume, that they are not so fitted for a desert life. If this be so, we must assume an æsthetic eye for small differences in colour and pattern, on the part of birds and other enemies, for which the evidence is at present deficient.

I hold the view that the sporadic character of much of its distribution, the production by artificial means of intermediates, and that it has been bred from *chrysippus,* clearly show that it is the ancestral form; and though we are ignorant as to its origin, and the nature of its evolution, the proof that it has been guided by Natural Selection has not been satisfactorily demonstrated.

D. chrysippus form *alcippus.*

Prof. Poulton, in the above mentioned work, considers that the white hindwings of the form *alcippus* have been developed on the West Coast of Africa, where in some localities it is dominant, to give it greater conspicuousness where there is abundance of food, and thus warn

* Colonel Yerbury took two or three specimens at Campbellpore, in the north of the Punjab. They are now in the National Collection.

off a possible enemy; in other words, it comes under that form of mimicry known as aposematic or warning coloration.

There are, however, certain features in its area of distribution, which, to my mind, render this doubtful. I certainly found it, or its sub-form *alcippoides*, commonly in North-East Sumatra, where rain falls every week in the year, and it is also common and very variable in the Andaman Islands, where the general conditions are also like those on the West Coast. But it is absent from a similar environment in Ceylon, yet is found, though rarely, in the arid northern district of the island. *Alcippoides* is by no means uncommon in the bare plains of the Deccan and Madras, where the country is totally different from the West Coast.

The view that an aposematic colouring is necessary in one region and a cryptic colouring in another, both produced by the same factor, is complicated and not easy to understand, and I know of no direct evidence to support such a conclusion. The necessity for it in an insect so unpalatable, as *chrysippus* is generally held to be, is not lessened when we remember that the cryptic form is not uncommon in Bombay, and the conspicuous one is common in the adjoining Presidency of Madras, where the local conditions are almost identical.

These experiments throw little light on the origin of this form, though there is one specimen which shows an approach to it; *dorippus* also sometimes shows white on the hindwings, and it is possible, though this is a little more than conjecture, that it is the earliest form from which *chrysippus* has branched off in one direction and the white winged forms in another. The evidence that either has been influenced by Natural Selection is at present, to my mind, unconvincing.

Finally, as to the main question; the relationship of these two butterflies to each other; whether they have arrived at their present appearance by any form of mimicry; or whether their resemblance can be otherwise accounted for.

There is in this case, as in all similar examples of mimicry, the primary difficulty of understanding how small variations of colour or pattern in one butterfly could be so elaborated by the attacks of birds as to resemble the colour or pattern of another unrelated to it. In the example before us, remembering the short ten days in which Natural Selection has to act, and presuming that in some time past the *misippus* ♀ was somewhat similar to the ancient type of the ♂, we may ask, how could a specimen, or specimens, with a few red scales scattered over the wing, be noticed and subsequently avoided by birds, by any lesson they may have previously learnt from the capture of *Danais chrysippus*?

On the assumption that this is a case of Batesian mimicry, a bird tasting a red speckled specimen, would ascertain at once that it was palatable, and the red scales in others would not save them from destruction. The likeness towards *chrysippus*, therefore, could not progress.

If it is a case of Müllerian mimicry, where both species are unpalatable, a red speckled unpalatable one, as also its unspeckled companions, after a few experiments, would be left severely alone and nothing would be gained, for if the bird could discriminate it would neglect them, and if it could not, both would equally suffer.

Lastly, if the resemblance is due to the experimental attacks of young birds, the emergence of the butterflies should coincide with the time that tasting experiments are taking place, but in Ceylon it so happens that the young birds are off the nest and foraging for themselves in May, and *misippus* is not on the wing until October.

We could the more readily understand the process if the mutation was sudden and large, but the specimens exhibited negative such a supposition.

Some supporters of the mimicry theory, among others Mr. Pocock and Prof. Poulton, consider "that the first steps towards a mimetic likeness are not caused by a few differently coloured scales," but "by a large colour variation which was enough to produce a rough resemblance, and that Natural Selection gradually produced out of this a detailed resemblance." At first sight this looks like mutation pure and simple, but it is not necessarily so.

The evolution of the species is internal, and the large variation Prof. Poulton speaks of may be the cumulative effects of an increasing number of differently coloured scales in many generations. We have only to assume the disappearance of such intermediates to arrive at a "large colour variation."

I see nothing that prevents our believing that if internal evolution can produce a large variation, a continuance of the same process would in the course of time produce a butterfly quite unlike the type from which it arose. This may be so in the case of these two butterflies, but the evidence here produced rather supports the conclusion that the changes in them have been caused by the gradual accumulation of small variations; this being so there would seem to be no necessity for bringing in the complicated theory of mimicry to account for the resemblance between these two species of butterfly.

I have recently published a paper * on Batesian and Müllerian Mimicry, in which I examined the subject from the point of view of my own personal knowledge of certain tropical countries. I can only say here, and as briefly as possible, that I was unable to throw anything but a negative light on the premises on which those theories are based, and that some of the conclusions I arrived at were, that though butterflies are more generally eaten by birds than was generally believed, yet no discrimination was shown in their capture; that the presumed unpalatable Danaines were as readily eaten as other species of butterfly, and that the few species of birds I could experiment on in a wild state eat *Danais chrysippus* as readily as *Hypolimnas misippus*.

The circumstance that in life the ♀ *misippus* frequently consorts with *chrysippus*, and may thus lead one predisposed to believe in mimicry that he had before him a Müllerian combination, is explained by the fact that the food-plants of both butterflies grow together in the same sandy soil. Should any observer watch them in such situations, as I have done for hours at a time during the last three years, he will find that they are practically unmolested by birds, young or adult.

I conclude that *dorippus* and *inaria* are the older forms from which have descended *chrysippus* and *diocippus* respectively. Both survive to the present day, practically all over the wide distribution of the species, because like their descendants they are for the time being almost exempt from the struggle for existence. If it were possible to dissect a pupa in the same way as we can the embryo of a mammal, we should find traces of these intermediates and regard them as the remains of a stage beyond which the species has now progressed.

* Proc. Zool. Soc. Lond., May 1911.

Explanation of Plate XLI.

All the figures are about $\frac{3}{4}$ natural size.

Fig.

1. *Danais chrysippus*, ♂.
2. *D. chrysippus*, ♂ form *dorippus*.
3. *Hypolimnas misippus*, ♀ form *diocippus*.
4. *H. misippus*, ♀ form *inaria*.
5. *Danais chrysippus*, ♀, No. 87 intermediate.

   The apex of forewing is red, the white spots are diminished in size and the costa is lighter than normal.
6. *Hypolimnas misippus*, ♀, No. 19 intermediate, or reversion. The white subapical band and apex of forewing are thickly covered with red scales.
7. *Hypolimnas misippus*, ♂.

7*a*. *H. misippus*, ♂, No. 1, C 1.

The specimen shows a white spot in cell of forewing, increased size of white spots in both wings with lunular band in hindwing. A reversion to older type?

8. *H. misippus*, ♀, No. 4, C 1*a*.

   The specimen shows an uninterrupted white lunular band and a white spot in cell of forewing; the apex is thickly covered with red scales. A reversion to older type?

Photo, A. Robinson. *C. Hentschel.*

DANAIS CHRYSIPPUS AND HYPOLIMNAS MISIPPUS

Exposed to heat in the pupal stage (Figs. 5, 6, 7a, 8) compared with examples bred under natural conditions (Figs. 1, 2, 3, 4, 7).

Conclusions.

1. *D. dorippus* and *H. inaria* are the older forms of *D. chrysippus* and *H. misippus* (*diocippus*) respectively.

2. That the latter have been produced by the gradual accumulation of small variations.

3. That these small variations (intermediates) have now largely died out as being no longer required.

4. That they can be reproduced by shock (heat and cold) to the pupa.

5. That there is nothing to show any interdependence, or anything in common between the two species.

6. That though this is so with these two species it is difficult to believe that such is the case with all instances of mimetic resemblance.

7. That though no doubt the mimetic theory gives a logical explanation of them, the premises on which it rests have not been proved, but rather the contrary.

Explanation of Plate XLI.

[*See Explanation facing the Plate.*]

EXPERIMENTS WITH *DANAIS CHRYSIPPUS*.

"Dry Cold." (Placed under normal atmospheric conditions after removal.)

No.	Placed in.	Date.	Date of removal.	Date of emergence.	Remarks.
1*a*	58° F.	4. 12. 08	6. 12. 08	?	♂. Normal.
2*a*	,,	5. 12. 08	,,	6. 12. 08	♂. ,,
3*a*	,,	,,	,,	,,	♂. ,,
4*a*	,,	26. 12. 08	28. 12. 08	4. 1. 09	♀. ,,
5*a*	Full fed larva.	19. 12. 08	21. 12. 08	8. 1. 09	♀. ,,
9	Pupa. 50° F.	18. 6. 09	21. 6. 09	27. 6. 09	♀. Apex slightly reddish, not black.
10	,,	,,	,,	,,	♂. Normal.
11	,,	,,	,,	,,	♀. ,,
12	,,	,,	,,	,,	♂. ,,
15	,,	,,	,,	28. 6. 09	♀. ,,
16	,,	,,	,,	,,	♂. ,,
17	,,	17. 6. 09	,,	,,	♂. ,,
18	,,	,,	,,	,,	♀. Spot beyond cell duplicated.
19	,,	18. 6. 09	21. 6. 09	,,	♂. Normal.
20	,,	17. 6. 09	,,	,,	♂. ,,
21	,,	18. 6. 09	,,	,,	♀. Black on margin of hindwing broader than usual.
22	,,	17. 6. 09	,,	,,	♀. Normal.
23	,,	,,	,,	,,	♀. ,,
24	,,	15. 6. 09	,,	,,	♂. Spot beyond cell duplicated, hind margin more extensively black.
25	,,	,,	,,	,,	♀. Normal.
13	,,	,,	,,	27. 6. 09	♀. ,,
14	,,	17. 6. 09	,,	,,	♀. Spot beyond cell duplicated.

"MOIST COLD." (Placed under normal atmospheric conditions after removal.)

NO.	PLACED IN.	DATE.	DATE OF REMOVAL.	DATE OF EMERGENCE.	REMARKS.
26	50° F.	21. 6. 09	26. 6. 09	30. 6. 09	♀. Very faint trace of red along the nervures at lower portion of black apical patch.
27	"	"	"	"	♂. Normal.
28	"	22. 6. 09	"	1. 7. 09.	♀. "
29	"	"	"	"	♀. "

"Dry Heat." (Placed under normal atmospheric conditions after removal.)

No.	Placed in.	Date.	Date of removal.	Date of emergence.	Remarks.
30	113° F.	13. 7. 09	14. 7. 09	21. 7. 09	♂. Normal. Temp. doubtful.
31	110° F.	12. 8. 09	14. 8. 09		Died.
32	"	13. 8. 09	"		"
33	"	"	"		"
38	"	"	"		"
39	"	"	"		"
1	90° F.—95° F.	19. 6. 09	21. 6. 09	24. 6. 09	♂. Normal.
2	"	"	"	25. 6. 09	♂. "
3	"	"	"	"	♀. Black of apex partially replaced by red.
4	"	"	"	26. 6. 09	♂. Black apical patch distinctly red along the nervures. Ground-colour rather paler than normal.
5	"	"	"	"	♀. As No. 3, but red at apex brighter. Pale colour of base and disc extends into lower half of cell. Margin of hindwings almost entirely black.
6	"	20. 6. 09	21. 6. 09	"	♀. Normal, except a slight indication of red along apical veins.
7	"	"	"	"	♀. As No. 5.
8	"	"	"	"	♂. Normal.
34	96° F.	1. 9. 09	3. 9. 09	7. 9. 09	♀. Upper portion of apex very slightly, lower portion slightly red.
90	100° F.	5. 8.	7. 8.	11. 8.	♂. Apex distinctly red. Hind margin of secondaries almost entirely black.
91	"	"	"	12. 8.	♂. Normal. Hind margin of secondaries narrowly black, no white.
94	"	"	"	14. 8.	♀. Normal.
54	102° F.	3. 3. 10	5. 3. 10	9. 3. 10	♂. Apex distinctly red.

55	102° F.	7. 3. 10	9. 3. 10	12. 3. 10	♀. Apex bright red.
56	,,	6. 3. 10	,,	8. 3. 10	♀. ,, reddish.
57	,,	3. 3. 10	5. 3. 10	,,	♀. ,, very slightly red.
58	,,	,,	,,	9. 3. 10	♂. ,, ,, ,,
59	,,	7. 3. 10	9. 3. 10	13. 3. 10	♂. ,, very bright red.
60	,,	3. 3. 10	5. 3. 10	12. 3. 10	♂. ,, red.
61	,,	,,	,,	8. 3. 10	♀. ,, slightly red.
62	,,	3. 3. 10	5. 3. 10	8. 3. 10	♂. ,, very slightly red.
63	,,	,,	,,	11. 3. 10	♂. ,, bright red.
64	,,	4. 3. 10	6. 3. 10	12. 3. 10	♀. ,, ,,
65	,,	3. 3. 10	5. 3. 10	9. 3. 10	♂. Normal.
66	,,	,,	,,	,,	♂. Apex slightly red.
67	,,	4. 3. 10	6. 3. 10	11. 3. 10	♂. ,, distinctly red.
68	,,	3. 3. 10	5. 3. 10	9. 3. 10	♂. ,, ,, ,,
69	,,	4. 3. 10	6. 3. 10	10. 3. 10	♀. ,, slightly red.
70	,,	3. 3. 10	5. 3. 10	8. 3. 10	♀. ,, ,,
71	,,	,,	,,	12. 3. 10	♀. ,, bright red.
72	,,	4. 3. 10	6. 3. 10	11. 3. 10	♀. ,, ,,
73	,,	3. 3. 10	,,	,,	♂. ,, ,,
74	,,	,,	,,	10. 3. 10	♂. ,, ,,
75	,,	,,	,,	8. 3. 10	♀. Normal.
76	,,	,,	,,	9. 3. 10	♂. ,,
77	,,	,,	,,	10. 3. 10	♂. Apex distinctly red.
78	,,	4. 3. 10	,,	12. 3. 10	♂. ,, ,,
35	105° F.	4. 9. 10	6. 9. 10	13. 9. 10	♀. Almost entire replacement of black at apex by bright fulvous. All white spots diminished, fulvous interval in subapical band, submarginal spots below absent.
36	,,	5. 9. 10	7. 9. 10	,,	♀. ,, ,, ,, ,,
37	,,	,,	,,	14. 9. 10	♂. Very similar to above: spots at apex obsolescent.

"MOIST HEAT." (Placed under normal atmospheric conditions after removal.)

NO.	PLACED IN.	DATE.	DATE OF REMOVAL.	DATE OF EMERGENCE.	REMARKS.
88	102° F.	24. 7. 10	26. 7. 10	1. 8. 10	♀. Normal.
89	"	"	"	"	Died.
92	101° F.	5. 8. 10	9. 8. 10	12. 8. 10	♂. Normal, but hind margin of secondaries narrowly black, no white.
93	"	"	"	"	♂. Apex reddish.
95	"	12. 8. 10	16. 8. 10	17. 8. 10	♂. Normal.
96	"	"	"	18. 8. 10	♂. "
97	"	"	"	"	♀. "
98	"	"	"	"	♂. "

"VARYING CONDITIONS." (Placed under normal atmospheric conditions after removal.)

NO.	PLACED IN.	DATE.	DATE OF REMOVAL.	DATE OF EMERGENCE.	REMARKS.
40	{ 2 hours. 60° F. / ,, 108° F. }	28. 9. 10	28. 9. 10		Died.
44	{ 4 hours. 60° F. / 3 ,, 105° F. }	13. 10. 10	13. 10. 10	20. 10. 10	♀. Normal.
45	,,	,,	,,	,,	♂. ,,
46	,,	,,	,,	,,	♀. ,, but two spots beyond cell, upper very small.
47	,,	,,	,,	,,	♂. ,,
48	,,	,,	,,	,,	♂. ,,
49	{ 3 hours. 60° F. / 7 ,, 110° F. }	15. 10. 10	15. 10. 10	,,	Died.
50	,,	,,	,,	22. 10. 10	♀. Normal.
51	4 hours. 110° F.	18. 10. 10	18. 10. 10	,,	Died.
52	,,	,,	,,		,,
53	,,	,,	,,		,,
79	{ 24 hours. 58° F. / 24 ,, 102° F. }	19. 7. 10		30. 7. 10	♂. Normal.
80	,,	,,		,,	♀. ,,
81	,,	,,		,,	♀. ,,
82	{ 48 hours. 102° F. / 24 hours normal. }	23. 7. 10		,,	♂. Apex slightly red.
83	48 hours. 102° F.	,,		,,	♀. ,, ,, ,,
84	,,	,,		,,	♀. Apex well marked with red, subapical white band also reddish.
85	,,	,,		31. 7. 10	♂. Apex slightly red.
86	,,	,,		,,	♂. ,, ,, ,,
87	,,	,,		,,	♀. Apex almost entirely red, subapical white band reduced; ground-colour of wings paler, especially to inner side of white band; indication of white along veins of hindwings approaching *alcippoides*.
41	{ 2 hours. 60° F. / 2 ,, 108° F. }	28. 9. 10	28. 9. 10	6. 10. 10	♂. Apex slightly red.
42	,,	2. 10. 10	2. 10. 10	8. 10. 10	♂. ,, ,, ,,
43	,,	,,	,,		Died.

EXPERIMENTS WITH *HYPOLIMNAS MISIPPUS.*

"DRY" normal (77° F.) air. Parent *diocippus.*

NO.	PLACED IN.	DATE.	DATE OF REMOVAL.	DATE OF EMERGENCE.	REMARKS.
1	77° F.	21. 11. 08		29. 11. 08	♂. Normal.
2	,,	,,		,,	♂. ,,
3	,,	,,		,,	♀. *inaria.*
4	,,	,,		28. 11. 08	♂. Normal.
5	,,	27 ,,		8. 12. 08	♀. Type.
6	,,	29 ,,		4. ,,	♂. Normal.
7	,,	29 ,,		4. ,,	♀. Type.

"DRY COLD." B. Parent *diocippus.*

NO.	PLACED IN.	DATE.	DATE OF REMOVAL.	DATE OF EMERGENCE.	REMARKS.
8	25° F.	1. 12. 08	2 12. 08. to 60° F.	12. 12. 08	♂. Distinct extension of the blue-white discal spot on to costa of forewing.
9	60° F.	2. ,,	6. 12. 08.	13 ,,	♂. Similar to above but not so distinct.
10	,,	,,	,,	,,	♀. Type, rather small and dark.

"DRY HEAT." Dry bulb 99° F., wet 84°. (Outside air dry bulb 83° F., wet 79°.)

NO.	PLACED IN.	DATE.	DATE OF REMOVAL.	DATE OF EMERGENCE.	REMARKS.
1	As above.	10. 11. 09	11. 11. 09	17. 11. 09	♂. Normal.
2	"	11. "	13. "	Died.	
3	"	11. "	13. "	18. 11. 09	♂. Normal.
4	"	12. "	15. "	19. "	♂. "
5	"	13. "	18. "	20. "	♂. Small white spot centre of cell, forewing.
6	"	13. "	"	"	♀. Cripple; apical white band broader and continuous, *i. e.* veins white not black.
7	"	13. "	"	"	♀. Apical band as above, extreme apex reddish.
8	"	13. "	"	"	♀. Apical band reddish, apex reddish; the two red spots in black costal band.
9	"	13. "	"	"	♀. As No. 7.
10	"	14. "	17. "	19. "	♂. As No. 5.
11	"	14. "	"	21. "	♂. "
12	"	14. "	"	"	♂. "
13	"	15. "	19. "	22. "	♂. "
14	"	15. "	"	"	♀. Apical band reddish white, considerable red scaling at apex; black area between band and disc much diminished.
15	"	15. "	"	Died.	

C1. Parent *diocippus*. "Dry Heat." 101° F. 24 hours after pupal change.

No.	Placed in.	Date.	Date of removal.	Date of emergence.	Remarks.
1	As above.	7. 11. 10	10. 11. 10	14. 11. 10	♂. Upperside forewing, two bluish white spots in cell, the inner smaller; upperside hindwing, blue scaling at tornus more extensive and distinct indication of lunular line as in ♀. Underside hindwing, central band yellowish, not pure white with black scaling, basal and subterminal bands decidedly light red.
2	,,	,,	,,	,,	♂. One small spot in cell; cripple.
3	,,	,,	,,	,,	♀. Type. White band more dentate on inner side and curved inwards at lower extremity; not straight.
4	,,	,,	,,	,,	♀. ,, Cripple.
5	,,	,,	,,	,,	♀. Well marked intermediate; band rufous, shape as No. 3. Apex speckled with red.
6	,,	,,	,,	,,	♀. As No. 3.
7	,,	,,	,,	,,	♂. Small bluish white spot in cell.
8	,,	,,	,,	,,	♂. ,, ,,
9	,,	,,	,,	,,	♂. ,, ,,
10	,,	,,	,,	,,	♂. ,, ,,
11	,,	,,	,,	,,	♀. As No. 5.
12	,,	,,	,,	,,	♂. As No. 2.
13	,,	,,	,,	,,	♂. ,,
14	,,	,,	,,	,,	Cripple.
15	,,	,,	,,	,,	♂. As No. 2.
16	,,	12. ,,	15. ,,	19. ,,	♂. As No. 1, but only one spot in cell.
17	,,	,,	,,	,,	♂. As No. 1, but underside of tornus forewing red not black, and more black on underside of hindwing.
18	,,	,,	,,	,,	♀. Band thickly speckled red upper part, red scales in black apex.
19	,,	,,	,,	,,	♀. Apical band and apical spots almost entirely red—a well-marked intermediate.
		13. ,,	17. ,,	20. ,,	23 ♂. 18 ♀ normal, except one ♀ slightly speckled red on apical white spots.
		14. ,,	,,	21. ,,	
	Remainder ♂♂ and ♀♀ normal or died.				Total 34 ♂♂. 25 ♀♀.

C1*a*. "Dry Heat." 101° F. 3 days before emergence.

No.	Placed in.	Date.	Date of removal.	Date of emergence.	Remarks.
1	As above.	18. 11. 10	21. 11. 10	22. 11. 10	♀. Apical band snow white, broader, longer and much more circular than normal, in two specimens thickly covered with red scales. The two spots in black costal band in cell very distinct, the outer larger and whitish; normally these are bluish, or indicated by blue scaling.
2	"				♀. (as 1)
3	"				♀. (as 1)
4	"				♀. (as 1)
5	"				♂. Cripple. Two spots in cell.
6	"				♀. As above.
	Remainder about 40 normal or died.				

X. *On the genera* Liothrips *and* Hoodia. By Dr. H. KARNY of Elbogen, Austria. Translated by G. A. ELLIOTT, F.Z.S., F.E.S. Communicated by R. S. BAGNALL, F.E.S., F.L.S.

[Read February 7th, 1912.]

IN my work on the *Thrips*-galls and the Gall-*Thripidae** I mentioned incidentally that Uzel's genus *Liothrips* could not be so sharply separated from the *Cryptothrips* group as is frequently assumed. In the *Cryptothrips* group, s. str., I include the genera *Mesothrips*, Zimmermann; *Smerinthothrips*, Schmutz; *Gynaikothrips*, Zimmermann; *Hoodia*, Karny; *Cryptothrips*, Uzel; and *Dermothrips*, Bagnall. All the above-named genera have the wings of equal width throughout, and are thus distinguished from the otherwise similar *Leptothrips*, Hood, and *Androthrips*, Karny, in which the wings are somewhat constricted near the middle.

According to Uzel's synoptic table, the essential difference between *Liothrips* and *Cryptothrips* lies in the formation of the mouth. In *Liothrips* the mouth-cone is "narrowed towards the apex and pointed"; in *Cryptothrips* and the allied genera it is "apically broadly rounded." These contrasts may, indeed, be easily recognised in extreme cases, but there are many intermediate types. Compare the three figures of *Gynaikothrips uzeli*, *G. chavicae* and *Mesothrips jordani*.† All three certainly have the mouth-cone "apically rounded," yet they show (especially in *Mesothrips*) a decided approach to the pointed type. It is evident that, in such cases, it is often difficult to define any distinct boundary between *Liothrips* and the *Cryptothrips* group.

Of all the European genera, *Hoodia*, Karny, is, in my opinion, undoubtedly the most closely allied to *Liothrips*, Uzel; I will therefore say a few words as to these two genera. The special inducement to this is found in the publication by R. S. Bagnall of an English species as *Liothrips hradecensis*,‡ whereas I consider it to be a new

* Centralbl. f. Bakteriol. Parasit. u. Infektionskr., ii, Abt. xxx, 1911, pp. 556–572.

† *l.c.* p. 562.

‡ Ent. Mo. Mag., ii Ser., vol. xxi, 1910, p. 256; Journ. Econ. Biol., vi, 1911, p. 11.

species, belonging to the genus *Hoodia.* I will first give a tabular view of all the known species of both genera, and then add a few remarks upon them.

Revision of the known species of Liothrips.*

1. Fore tarsi toothed in both sexes.
2. Third to fifth joints of antennae yellow; the latter often centrally brownish; sixth basally yellow; thence brown; seventh entirely brown. Tarsal tooth small, pointed, only visible in one position of the tarsus. *L. seticollis,* nov. spec. (Paraguay).
2′. Third to sixth joints of antennae entirely, seventh mostly yellowish. Tarsal tooth blunt, stout.
1. *L. tarsidens,* Trybom (Madagascar).
1′. Fore tarsi without tooth in female.
2. Wings entirely wanting. 2. *Liothrips,* sp. Trybom (Madagascar).
2′. Wings present.
3. Basal half of forewings black or light brown.
3. *L. umbripennis,* Hood (North America).
3′. Forewings, at most, brown at extreme base, then hyaline, or with only a central dark stripe.
4. Antennae yellow; at most, joints, one, two and eight dark.
5. Eighth joint of antennae yellow.
4. *L. citricornis,* Hood (North America).
5′. Eighth joint of antennae dark.
6. Fore tibiae dark . . . 5. *L. major,* Buffa (Erithraea).
6′. Fore tibiae yellow . . 6. *L. setinodis,* Reuter (Europe).
4′. Seventh joint of antennae also entirely and at least the apical half of sixth dark.
5. First and second joints of antennae dark, third to fifth yellow, the sixth basally yellow, apically dark, seventh and eighth dark.
6. Fore tibiae entirely yellow; intermediate and hind tibiae black, apically suddenly yellow.
7. *L. hradecensis,* Uzel (Central Europe).
6′. All tibiae uniform dark brown.
8. *L. seticollis,* nov. spec.† (Paraguay).
5′ Sixth joint of antennae entirely dark.
6. Fourth and fifth joints of antennae at least partly yellow.

* When this table was written I did not yet know the description of *Liothrips glycinicola,* Okanoto, from Japan.

† I have again inserted this species because the tarsal tooth is not visible in the normal position of the tarsus.

7. Third and fourth joints of antennae entirely and basal half of fifth yellow ; all the other joints brown.
9. *L. mcconellii*, Crawford (Mexico).

7′. Third joint of antennae entirely yellow, fourth and fifth only centrally yellow ; all the other joints dark brown.
10. *L. ocellatus*, Hood (North America).

6′. Antennae dark, only third or also second joint yellow.

7. Cheeks divergent posteriorly.
11. *L. fasciculatus*, Crawford (California).

7′. Cheeks parallel or convergent posteriorly.

8. Cheeks almost parallel, or only constricted at the extreme base. All the prothoracic bristles present.

9. Two large stout bristles in front of the eyes.
12. *L. intermedius*, Bagnall (Venezuela).

9′. No bristles in front of eyes . 13. *L. similis*, Bagnall (Venezuela).

8′. Cheeks distinctly convergent posteriorly. Prothorax with bristles only on the posterior angles and hind margin.
14. *L. elongatus*, Bagnall (Venezuela).

Revision of the known species of Hoodia.

1. Sides of head parallel, or slightly divergent posteriorly. Antennae yellow, except the two first joints; the last two joints are dark only in the exceptionally dark-coloured individuals. Mouth-cone at first almost rectangularly convergent, apically broadly rounded. . . . 1. *H. austriaca*, Karny (Austria).

2′. Sides of head distinctly convergent posteriorly. The last two joints of the antennae dark brown. Mouth-cone laterally acute-angularly convergent, but apically distinctly rounded.
2. *H. bagnalli*, nov. spec. (England).

Remarks.

Liothrips bakeri, Crawford, does not belong to *Liothrips*, but probably either to *Mesothrips* or *Smerinthothrips*. The fore tarsi are armed with a large setigerous tooth as in *Mesothrips*; it agrees with the Javanese genus also in its mode of life, living in the leaf-galls of *Ficus*. On the other hand, the formation of the fore-femora inclines to *Smerinthothrips*.

Hoodia bagnalli, nov. spec.

Syn. *Liothrips hradecensis*, Bagnall, Ent. Mo. Mag., ii Ser., vol. xxi, 1910, p. 256; Journ. Econ. Biol., vi, 1911, p. 11 (nec Uzel, 1895).

Liothrips hradecensis, Bagnall, Journ. Econ. Biol., vi, 1911, p. 1 (*vitio typog.*).

Length of body in ♂ 2′7–3 mm.; in ♀ 3′3–3′8 mm.

Black-brown to black. Only the fore tibiae and the apices of the intermediate and hind tibiae and all tarsi yellow. Antennae yellow, only the two first, the two last, and often also the apices of fifth and sixth joints dark.

Head about half as long again as broad. Cheeks distinctly convergent posteriorly, very finely granulate and with several short, fine hairs; a long, stout bristle on each side behind the eyes, no such bristle in front. Mouth-cone rather long, reaching beyond the middle of the prosternum, at first laterally acute-angularly convergent, but apically distinctly rounded. Antennae about twice as long as the head; third joint as long as the first and second together; fourth joint as long as the third; all the following each shorter than the preceding one; eighth joint as long as the first.

Prothorax about half as long as the head, half as broad again as long, distinctly widened backwards; all bristles present and fully developed. Fore femora scarcely thickened. Fore tarsi without tooth. Pterothorax scarcely longer than broad. Wings extending to the apex of the sixth abdominal segment, of equal breadth throughout, the median vein often brownish. Forewings at the extreme base brownish and there furnished with three long, stout bristles; on the distal part of the hind margin 15–20 cilia are duplicated.

Wing retaining spines on second to sixth segments slender and weak, those on seventh still weaker and shorter than on the preceding; two on each side of each segment, the anterior very small and weak, about the middle of the segment, the posterior quite close to the hind margin; laterally from each of these a long, stout bristle, and then another, rather shorter and straight. Tube rather longer than the prothorax; its basal breadth is about one-third of its length and almost twice its apical breadth; the adjacent scale basally apparently withered (♂).

Piercebridge, near Darlington, and Gibside, co. Durham, England. On leaves of elm. Bagnall *leg.*

The colour of the antennae and of the legs in *Hoodia bagnalli* is similar to that of *Liothrips hradecensis.* The shape of the head is the same as in *Liothrips seticollis*;* it is laterally distinctly convergent posteriorly, but in *L. hradecensis* (also in *Hoodia austriaca*) almost parallel,

* The detailed description of this new species is reserved for future publication.

very slightly divergent posteriorly. On the basal third of the third to sixth joints of the antennae there is in *L. hradecensis* a transverse raised line, which is wanting in all the other species of *Liothrips* and *Hoodia* known to me. *H. bagnalli* has, in common with most of the allied species, a long bristle behind the eyes, which is wanting in *L. hradecensis.*

The arrangement of the prothoracic bristles is the same as in most species of *Liothrips* (e.g. *citricornis, ocellatus, seticollis*); in *L. hradecensis,* on the contrary, bristles are present only on the posterior angles. In *L. seticollis* all the wings are characterised by a distinct brown median longitudinal streak; in *H. bagnalli* this is ill-defined and indistinct; in *L. hradecensis* it is entirely wanting.

The duplication of the cilia on the posterior margin of the forewing, as far as known to me, is characterised by the following figures:—

Species.	Number of interpolated Cilia.
Hoodia austriaca	14–23 (coll. mea).
,, *bagnalli*	15–20 (coll. mea).
Liothrips seticollis . . .	14–20 (Mus. Berol.).
,, *setinodis* . . .	12–14 (Agram, coll. mea).
,, ,, *pragensis* . .	15 (Bohemia, Mus. Vindob.).
,, *ocellatus* . . .	14 (teste Hood).
,, *tarsidens* . . .	15 (teste Trybom).
,, *umbripennis* . . .	13 (teste Hood).
,, *mcconellii* . . .	7 (teste Crawford).

I was unable to ascertain this with respect to *L. hradecensis* without endangering the unique specimen in the Vienna Hofmuseum.

Turning now to the generic character—the shape of the mouth-cone—it is to be noted first that *Liothrips* agrees in this respect with *Hoplothrips* and *Phloeothrips,* having therefore an apically pointed mouth-cone, as is apparent from Uzel's generic diagnosis. On the other hand, we find in *Hoodia* forms of the mouth-cone which occur also in *Gynaikothrips* and *Mesothrips*; the lateral margins of the cone first converge rectangularly or acute-angularly, but are then apically rounded. In this point the two species of *Hoodia* differ from all true *Liothrips.** But

* It has been already pointed out that *Liothrips bakeri,* Crawford, has a differently formed mouth-cone, and therefore does not belong to *Liothrips.*

these two differ also considerably from each other in the shape of the mouth-cones. I have already briefly described this difference in the table, and think I can best visualise it by saying that, in this respect, *Hoodia austriaca* recalls *Gynaikothrips uzeli*, whereas *Hoodia bagnalli* recalls *Mesothrips jordani.**

I believe that I have now demonstrated that *Liothrips hradecensis*, Bagnall, is not identical with Uzel's species, but represents a new species, which can be clearly differentiated from all known species of *Liothrips*, and is most closely allied to my *Hoodia austriaca.* I have allowed myself the pleasure of naming this interesting new species after its discoverer.

* Compare the figures Centralbl. f. Bakerteriol., Parasit. u. Infektionskr. ii, in Abt. xxx, 1911, p. 562.

Oct. 4, 1912.

XI. *The comparative anatomy of the male genital tube in* Coleoptera. By D. Sharp, M.A., F.R.S., and F. Muir, F.E.S.

[Read February 7th, 1912.]

Plates XLII–LXXVIII.

ARRANGEMENT OF MEMOIR.

I. INTRODUCTORY.

The object of this memoir is to review the structure of the male genital tube throughout the Order Coleoptera. This is not equivalent to a review of the male copulatory organs. The modifications of the abdomen itself are extremely extensive and varied, but we have perforce omitted them, because the time at our disposal was scarcely adequate for the accomplishment of the work, the results of which are here presented.

Mr. F. Muir, having returned to England for a year's vacation in order to recruit his health after a long period of arduous entomological work in the tropics, joined the senior author at Brockenhurst, and the two combined their efforts for the production of this memoir.

A work of the kind is almost indispensable in the present state of Coleopterology, and the authors hope that it will be received as a much needed contribution to a great subject. A subject too as to which, notwithstanding its slight advancement, great misconception is prevalent.

The work has nearly all been carried out in the little laboratory attached to the residence of the senior author at Brockenhurst, and in a period of little more than twelve months. Each of the authors has devoted some independent work to it since Mr. Muir's departure for Honolulu, and it is hoped that this fact will be accepted as some excuse for certain inconsistencies that may be discovered by a severe critic.

The drawings that form so important a part of the work have all been made by the junior author, and consequently on him has fallen the difficult task of deciding as to the ventral and dorsal aspects of the structures. This is far from easy; it is, in fact, beset with sources of deception, as may be seen from the note (as to a discovery made by the junior author) placed in front of our descriptions of the family *Scarabaeidae*.

A primary object of the authors being to make a review extending over all the Order, they could only hope, in the too short time at their disposal, to get together the necessary material by the aid of their friends. Appeals were therefore issued with this object, and met with the most obliging responses; and we naturally desire to tender our warmest thanks to all those who have helped us in this and in other ways. We must mention first of all Mr. G. J. Arrow of the British Museum of Natural History; the only limit to whose kindness has been the reluctance we felt as to taking his attention from more important duties.

Mr. Antwerp E. Pratt made over to us a considerable collection of Coleoptera from New Guinea. This enabled us to examine a number of specimens in the case of certain species, and has been most useful, though, for our purpose, it has been subject to the drawback of several of the forms being new or little-known species.

Mr. J. C. Moulton of Sarawak, Mr. T. Bainbrigge Fletcher of Pusa, Mr. Arthur M. Lea of Tasmania, Mr. W. W. Froggatt of Sydney, sent us useful material. Herr Edmund Reitter of Paskau was so good as to select from his stores and send to us several forms we specially needed. In our own country Commander Walker and Mr. G. A. K. Marshall provided important material. Mr. Geo. Lewis has given us a few interesting forms. Mr. Ford of Bournemouth, and Mr. Janson of London gave themselves considerable trouble in the selection of speci-

mens for us. Mr. Hugh Scott of Cambridge University assisted us in every way that we asked.

Mr. G. C. Champion and Mr. C. J. Gahan have been very good by helping us in the disagreeable task of naming our heterogeneous material.

As regards the taxonomical and phylogenetic portions of the memoir it is desirable that we should say that they are drawn up to display the part that a knowledge of the fertilising structures should have in these two departments of Coleopterology. The senior author has for many years taken an interest in the taxonomy and phylogeny of *Coleoptera*, and it would therefore be absurd to pretend that, apart from consideration as to the sexual organs, he is in complete ignorance as to the bearings of other branches of anatomy, of physiology, of ethology and of ontogeny on the two departments mentioned. But the junior author is comparatively a recent student of these departments; and the senior author, therefore, gave him a free hand in drawing up the tables, and has modified them but little. They represent, therefore, fairly well the results that may be obtained in taxonomy and phylogeny from a preliminary study of the male genital tube. We hope that we have made it clear, in other parts of the paper, that our work is only a very imperfect introduction to this comparatively narrow field of inquiry. But we believe the subject will prove to be of great importance when combined with the results derived through other lines of investigation. There is one point, however, in the memoir that has not been based on study of the aedeagus, viz. the families we have made use of. Though we shall have in the course of this memoir to propose several changes as to the families of Coleoptera, it must not be supposed that the families here dealt with have been decided on from the point of view of the structure of the genital tube. The forms studied were selected in the first instance simply by our desire to study these structures throughout the whole Order. We may, however, say that though certain changes will have to be made, yet our impression is that most of the families at present in use in Coleopterology will have their validity substantiated by a continuance of this study.

The second part of our morphological section deals with the nature of the male organs; and under the heading *Phytophagoidea* in the section phylogeny some more speculative opinions on the same subject are given; but a brief elementary statement on this point will probably be found useful here. Two simple diagrams (figs. 239 and 239*a*) have been made with the same object. They are really diagrammatic and do not represent any particular form.

Let a glove be taken, a hole pierced in the tip of one of its fingers, a slender tube attached around this hole, this tube being placed inside the finger and prolonged into the hand-part of the glove: and we have before us a rough model of the genital tube.

This structure lends itself to modification in the readiest manner. By traction on the slender tube the finger of the glove can be entirely drawn into the hand, with the result that the distal orifice becomes proximal. Let the glove finger be restored to its natural position and some hard patches be put on it, and the operation of invagination be again repeated, and it will be noted how protean this simple arrangement can become. Further make some small folds on the finger, and suppose these to grow out (after the fashion of the horns and processes on the heads of Lamellicorn beetles) and the reader will then have a general idea of the structures we are about to consider.

The finger of the glove can be made by some folds to collapse in several layers, like a shut-up nautical telescope, and this telescopic arrangement can be carried to such an extent that Straus-Durckheim (*Melolontha vulgaris*, pl. vi, f. 1) shows in a section of the telescopically collapsed tube no less than eleven superposed layers.

We scarcely need to remark that the retraction and eversion of the genital tube are not brought about by force applied to the duct.

We have had considerable difficulty in arranging our matter in a comprehensible sequence, and the different sections of the memoir are not conformable in this respect. We have endeavoured to diminish the inconvenience resulting from this by means of an alphabetical index of the names of families and groups placed immediately before the explanation of the figures.

In the course of this memoir we have occasion to refer the reader to a passage of the historian Gibbon, relating to the Empress Theodora, the consort of the Emperor who rebuilt the great cathedral of Saint Sophia at Constantinople. We may fittingly close our introductory remarks by a quotation from the same chapter of this immortal author. He says, "A magnificent temple is a laudable monument of national taste and religion, and the enthusiast who entered the dome of St. Sophia might be tempted to suppose that it was the residence, or even the workmanship of the Deity. Yet how dull is the artifice, how insignificant is the labour, if it be compared with the formation of the vilest insect that crawls upon the surface of the temple!"—Gibbon, "Decline and Fall of the Roman Empire," chap. xl.

II. ORISMOLOGY AND TECHNIQUE.

The following is a list of some of the terms we have applied to parts of the male genital tube, and we add a few synonyms used by other writers. The letters in brackets are those made use of in the plates.

This section is concluded by some critical remarks.

AEDEAGUS. The median lobe and tegmen together. It is the Edeagophore of Blaisdell.

AZYGOS, or the azygotic portion of the male genital tube. It comprises all the unpaired portion of the tube from the body wall to the divergence of the seminal ducts, where the zygotic portion, or efferent ducts, ends (*b–d* and 5–1, fig. 239).

BASAL-PIECE (*bp*). The basal part of the tegmen. It is the "basale" (Blaisdell); external lobes (Packard); basalplatte (Verhoeff); tambour (Straus-Durckheim).

EJACULATORY DUCT (*ej*) or stenazygos is the slender portion of the genital tube from the seminal ducts to the internal sac or eurazygos.

EURAZYGOS (*c–d* and 5–1, fig. 239). The enlarged portion of the genital tube.

FIRST CONNECTING MEMBRANE ((*cm*1). The membrane connecting the median lobe to the tegmen.

INTERNAL SAC (*is*). The enlarged portion of the azygos which is more or less evaginated during copulation. It is the sac interne (Jeannel); praeputialsack (Verhoeff), and forms part of the ejaculatory duct of most writers.

LATERAL LOBES (*ll*). The distal portion of the tegmen. In the generalised trilobe type they form two free processes lateral of the median lobe and often enveloping it. They are the "deux branches de la pince" (Straus-Durckheim); mesostili in *Procrustes*, ipofallo in *Lucanus* and perifallo in *Dytiscus* (Berlese); apicale (Blaisdell), lateral lobes (Packard), Parameren (Verhoeff).

MEDIAN FORAMEN (*mf*). The aperture, or lumen, at the base of the median lobe through which the ejaculatory duct passes.

MEDIAN LOBE (*ml*). The central portion of the aedeagus upon which the median orifice is situate. It is the penis of Straus-Durckheim, Verhoeff, Packard and many other writers, Körper (Lindemann), body (Hopkins), ipofallo in *Procrustes* etc., and penis in *Oryctes* (Berlese).

MEDIAN ORIFICE (*mo*). The opening, or area, on the median lobe through which the internal sac is evaginated. It is the "Mundung ductus ejaculatorius" (Verhoeff), fornix edeagi (Blaisdell) and apical opening (Hopkins).

MEDIAN STRUT (*ms*). A single strut, or a pair of struts, proceeding from the basal part of the median lobe. In some cases they are articulated to the median lobe, in other cases they actually form part of the median lobe without articulation or line of demarcation.

POINT OF ARTICULATION (*pa*). The point on the median lobe to which the lateral lobes are attached. In many cases the median lobe and tegmen are connected by intervening membrane and there is no point of articulation.

SECOND CONNECTING MEMBRANE (*cm*2). The membrane connecting the tegmen to the termination of the abdomen. It is the prepuce of Straus-Durckheim (*Melolontha vulgaris*).

SPICULE (*sp* fig. 224*a*). A sclerite attached by one end to the second connecting membrane. In many cases it is Y- or T-shaped. It is the Stengel (Lindemann), spiculum gastrale (Verhoeff), rod or fork (Hopkins), and is considered by some as being the last sternite. It is not infrequently similar in shape to another sclerite that pertains to another layer of the genital tube.

STENAZYGOS. Is the stenazygotic or slender portion of the azygos (*b*–*c*, fig. 239).

TEGMEN (*tg*). The term applied to the lateral lobes and basal-piece together. It is the ring (Hopkins), Gabel (Lindemann).

VENTRAL PLATE (*vp*, fig. 19, etc.). A sclerite on the anterior ventral surface of the basal-piece in some Lamellicorns. In some cases the lateral lobes are consolidated to its anterior edge. The chitinisation of this part varies much.

ZYGOS. Zygotic portion of the male genital tube; and is formed by the two seminal ducts (*a–b*, fig. 239) proceeding from the testes.

METHOD EMPLOYED.

In preparing this memoir it was necessary to make use of a great deal of dried material, some of it fifty and sixty years old, as our time was limited and we could not procure fresher specimens. In such cases we found the following methods acted very well and, if care was used, did not destroy the specimen. The dried specimens were placed in water and allowed to soak for a time according to the size and condition of the specimen, the water being heated if necessary; when thoroughly relaxed the aedeagus was dissected out, either through the opening between the last dorsal and ventral plates, or the last segment was taken off, or the abdomen was taken off at the base, the aedeagus extracted through the basal foramen and, when necessary, the abdomen stuck on to the thorax again. The aedeagus was then placed in weak caustic potash for a time when the muscles would swell up and could then be dissected; in cases where it was necessary to clear off all the muscles the caustic potash was used very strong. To get the internal sac evaginated was a more difficult matter; but with care it was possible to do this by the use of localised pressure, and with the aid of a very finely pointed syringe. By inserting the fine point into the median foramen and gently applying pressure the internal sac can be forced out in a manner, if not quite natural at least near enough to study its shape and structure.

With fresh material it was a much easier matter, especially with bulbous forms such as are found among the Staphylinidae; by placing the aedeagus in water and gently pressing upon the bulb the internal sac can be made to evaginate in a perfectly natural manner.

To study the position taken up by the internal sac within the uterus during copulation it was necessary to take the beetles in copula, kill them in a strong killing-bottle and then dissect out the whole female organ with the internal sac of the male still in situ.

We may here emphasise the great importance of extracting the structures without injury to the basal parts. It is necessary to give this caution because it too often happens that the dissections of these parts that exist in various collections have been made only with a view to examining the apical portions of the structures. Hence the basal parts are often found to have suffered serious injury.

As there can be no doubt that the nature of the genitalia is destined to play a prominent part in the systematic study of Entomology, the terms to be used in it should be carefully considered. At present great confusion prevails. This is not a matter for surprise when the difficulties that exist are grasped. The male structures form parts and accessories of a genital conduit of which the female genitalia are the continuation and completion. Hence the male parts are really only comprehensible when studied in connection with the female parts; and this, moreover, when the two are functioning. The parts, in fact, have to be restored to the condition they are in during copula.

The terms used in this memoir were of necessity selected soon after the commencement of our work, and we consider it advisable here to state how they appear to us at the conclusion of our undertaking.

AEDEAGUS. This is a most convenient and useful term for the combination of sclerites in the two adjacent layers of the male tube. The term was, we believe, introduced by M. A. C. M. E. Foudras (Altisides, 1859, p. 32). It is probably derived from the Greek *τὰ αἰδοῖα*, signifying the genitals. The use of the Greek word may be seen in the notorious passage of Procopius quoted by Gibbon in footnote 24 of chap. xl of "The Decline and Fall." We doubt whether a better term could be found for this middle complex of male sclerites, and we expect that a word will have to be invented for the corresponding (if not homologous) female sclerites.

MEDIAN LOBE. This term is not free from serious objections, but it is far superior to that of "penis," which applied to Insecta is totally fallacious. The part in

Insecta that most nearly approximates to the Vertebrate penis is the internal sac, the knowledge of which has been almost nothing until its recent inauguration by Jeannel. The median lobe appears to be sometimes a complex or amalgamation of more or less individualised sclerites. (Cf. *Hydrophilus.*)

LATERAL LOBES. Though a very suitable term for the parts in the various trilobe forms, it is inappropriate in cases where the projections (if homologous at all) are medianly situate. Paramere is quite as good as lateral lobes. Cornua (meaning cornua tegminis) is also not free from objection, and accessory process is rather cumbersome. Tegminal lobes might do if the term tegmen be itself accepted.

BASAL-PIECE. Perhaps this term may stand till more is known about the cases in which it is two pieces, and those in which it appears to be absent.

INTERNAL SAC. Probably the term Vesica might be preferable. But this part of the conduit is so protean in form and development that it might be better to invent a term indicating a structure that is predominantly membranous.

TEGMEN. This term seems convenient and adequate for the layer of sclerites external to the median lobe. The elytra of grasshoppers are frequently called tegmina, but we do not think this objection to our use of the term a serious one.

CONNECTING MEMBRANES. This term cannot be commended. It gives the idea that the sclerites are the important structures. But the tube may exist without sclerites and is it then a connecting membrane?

Other terms (such as Prepuce) that have been used for various parts are totally unsuitable. We consider that it is premature to endeavour to establish permanent terms for the parts of the complex genitalia of Insects till the various Orders have been more thoroughly examined and compared.

III. MORPHOLOGY.

A. Special Anatomy.

Family CICINDELIDAE.

Forms examined: *Manticora tuberculata* Deg., S. Africa. *Omus californicus* Esch., N. America. *Cicindela tortuosa* Dej., N. America. *Therates labiatus* Fabr., New Guinea. *Tricondyla aptera* Ol., New Guinea.
Figs. 29–31 of Pl. XLVII.

Manticora tuberculata (Pl. XLVII figs. 31, 31*a*, 31*b*).

Median lobe curved, tubular; median orifice at distal end on ventral side, about one-fifth the length of lobe; median foramen at basal end, as large as circumference of lobe; dorsal edge forming a projection to which lateral lobes are articulated. Lateral lobes broad at base, with slender, free tips. Basal-piece shield-shape, connected to lateral lobes by a curved band broader in middle; the lateral lobes are slightly asymmetrical and the distal end of each lobe lies on the left side of the median lobe. The internal sac is nearly as long as the median lobe; at the point where the ejaculatory duct enters the sac there is a small chamber with chitinous walls (fig. 31*b*) drawn out into a long, slender flagellum, with the external opening at its tip. Only the baso-dorsal part of the sac is evaginated, as a tongue, with the lateral edges turned down to form a groove, along which the flagellum passes (fig. 31*a*); the rest of the sac is crushed up like a concertina and the flagellum is pushed out.

Omus californicus.

Median lobe as in *Cicindela* but irregular in outline; basal half of lateral lobes wider than in *Cicindela*, distal half tapering to a point. Basal-piece forming a thin V-piece on ventral side of median lobe. Internal sac well developed, a thin, long, curved chitinous spine rising from the apex.

Cicindela tortuosa (Pl. XLVII fig. 30).

Median lobe curved, tubular, swollen along the distal two-thirds; median orifice forming a slit along ventral side of the distal fourth of lobe; median foramen at basal end. Lateral lobes slender, two-thirds as long as median lobe. Basal-piece V-shaped, connected to lateral lobes about one-third from their base. Internal sac large, and, when invaginated, coiled up, with a long, slender flagellum arising from apex with external opening of duct at tip (not shown in figure).

Therates labiatus (Pl. XLVII fig. 29).

Median lobe tubular, curved, thick, smaller and slightly flattened perpendicularly at base, median orifice at distal end, median foramen at basal end. Tegmen consisting of a pair of thin symmetrical lateral lobes, reaching to near tip of median lobe, and a wide V-shape basal-piece. Internal sac large with chitinous plates and two chitinous spines on sac, one curved and thin, the other short, thick and straight; the duct enters at apex but not through spine (*i. e.* the spine is not of the nature of a flagellum).

Tricondyla aptera.

Median lobe curved, and tubular as in *Manticora.* The tegmen consisting of slender lateral arms and V-shaped basal-piece, as in *C. tortuosa.* Internal sac median size with large diverticula near apex and a large, strong bent spine on sac which is not traversed by the duct, the duct opening on apex of a small membranous tongue at the tip of the sac.

Obs.—The Cicindelid *aedeagus* is similar to that of *Carabidae* in structure ; but is distinguished from all the Carabid types we are acquainted with by the presence of a basal-piece in the form of a sclerite on the ventral side of the median lobe. In this respect they resemble other Coleoptera more than the Carabidae do ; but in the development of the internal sac with spines and a long flagellum they are more highly specialised. A great number of the Carabids are asymmetrical, whilst the Cicindelids are generally symmetrical or nearly so. The diagnostic of the family is the same as that of the other families of the Caraboid series, except as regards the basal sclerite, which appears to be various in the series.

Family CARABIDAE.

Forms examined: *Carabus violaceus* L., Brockenhurst. *Cychrus ventricosus* (teste Leconte), California. *Metrius contractus* Esch., California. *Blethisa multipunctata* L., England. *Nebria brevicollis* Fabr., Brockenhurst. *Mormolyce phyllodes* Hag., loc. ? *Pheropsophus agnatus* Chd., China. *Clivina fossor* L., Brockenhurst. *Anthia sexgut-*

tata Fabr., India. *Tefflus difficilis* Sternberg, Nyasaland. *Pterostichus niger* Sch., and *oblongopunctatus* Fabr., Brockenhurst. *Ophonus sabulicola* Panz., Southsea. *Laemosthenes complanatus* Dej., Southsea. *Bembidium biguttatum* Fabr., Brockenhurst.

Figs. 32–35 of Pls. XLVII and XLVIII relate to Carabidae.

Carabus violaceus (Pl. XLVII figs. 32 and 32*a*).

Median lobe long, tubular and well chitinised; median orifice extending about one-third along ventral side, the chitin of lobe thinning out into membrane of sac; median foramen running across basal end of lobe, the edge of which projects on dorsal side for attachment of lateral lobes. Lateral lobes thin, especially at distal end, nearly reaching to tip of median lobe. Internal sac well developed, covered with short dark spines on basal half; folds of membrane around opening of duct (*od*) complex (Fig. 32*a*). The figure shows a depression along the dorsal side which under fluid pressure becomes everted.

Cychrus ventricosus.

Somewhat like *C. violaceus* but median lobe more curved, especially at base. Lateral lobes stouter and developed more perfectly, with tips slender and bearing a few hairs. Internal sac short (about one-third the length of median lobe) with long thread-like diverticula immediately ventral of opening of duct; surface of sac studded with minute papillae.

Nebria brevicollis (Pl. XLVII fig. 34).

Median lobe curved cone-shape, the median orifice being situated at the small distal end, the median foramen at the large basal end. Lateral lobes attached to dorsal edge of median foramen, left lobe broad, flat, reaching to tip of median lobe, right lobe broad and flat, reaching about two-thirds along median lobe. Internal sac small and undifferentiated.

Metrius contractus

Median lobe short, deep, flattened; the distal end produced into a curved blunt spine; median orifice narrow, running along one-fourth of ventral side of lobe, near distal end; median foramen on basal end somewhat dorsal. Left lateral lobe narrow, spatulate at end, with fringe of long hairs along dorsal side, a little longer than median lobe; right lobe shorter, broader and produced to point, without hairs along edge. Internal sac large and complex.

Blethisa multipunctata.

The aedeagus of this species is remarkable by the small area of the median lobe that is chitinised, the larger part of the lobe being membranous. This species has also a very peculiar feature, inasmuch as a long strut extends forwards. This strut appears to be a process of the internal sac, and has nothing in common with the strut of Dytiscidae that at first sight appears to be similarly placed. It is unfortunately too late to add a drawing of this interesting structure to our plates.

Mormolyce phyllodes (Pl. XLVII figs. 33 and 33*a*).

Median lobe very short, stout, and funnel shaped ; median orifice large, across distal end, the edge of left side being drawn out into a narrow tongue; median foramen large, across base of lobe, with lateral lobes attached to edge on dorsal side. Left lateral lobe small and flattened, right lobe double the size of left. Internal sac when evaginated twice as long as median lobe, with blunt short diverticula near apex and the apical part granulated. It is possible that the sac as figured is not entirely evaginated near apex.

In this paradoxical insect, the articulation between the lateral lobes and the median seems to be imperfect, but our preparation is from an immature example.

Pheropsophus agnatus (Pl. XLVIII fig. 35).

Median lobe short, pointed ; median orifice occupying median portion on ventral side of lobe ; median foramen basal. Lateral lobes small, irregular and sub-equal. Internal sac large, with blunt, short diverticula near base and on ventral side.

Anthia sexguttata.

Median lobe forming an irregular tube, abruptly bent up dorsally near base ; median orifice a narrow slip along one-fourth of tube on ventral side near apex, continuing as a depression to near bend at base ; median foramen at basal end. Lateral lobes small, thick and irregular, right larger than left.

Tefflus difficilis.

Very solid tubular median lobe, somewhat asymmetrical, with short thick lateral lobes attached to its dorsal basal point, the right lateral lobe larger than the left; median orifice at distal end, median foramen at basal end, slightly dorsal. Internal sac large, complex, covered with chitinous granulations.

The Carabid aedeagus consists of a more or less asymmetrical median lobe, with small but very varied lateral lobes attached to the dorsal side of the base of the median lobe, often very asymmetrical and often very much reduced. The basal piece absent, or rather not to be distinguished from the second connecting membrane. Internal sac often complex and well developed, contained in median lobe when invaginated (not passing through median foramen). When withdrawn into abdomen the aedeagus lies on its side.

The absence of a basal sclerite separates this family from the Cicindelidae.

Family PAUSSIDAE.

The form examined appears to be the S. African *Orthopterus smithi* Macl. Our specimen has no locality label. Fig. 41 Pl. XLIX.

Orthopterus smithi (Pl. XLIX fig. 41).

Median lobe a chitinous curved tube, thinner at distal end than at base ; median foramen as large as the lobe, with the lateral lobes attached to its dorsal edge ; median orifice formed by an asymmetrical slit at distal end, the right edge being produced into a small curved knob, the left into a curved flattened point. Right lateral lobe broad, and flattened, reaching to near apex of median lobe, left lateral lobe narrow and slightly shorter ; a small thin sclerite is attached to connecting membrane between the lateral lobes on ventral side (not shown in figure) and appears to be homologous to the basal-piece in *Dytiscus*. Internal sac fairly large and when evaginated funnel shape.

This aedeagus is distinctly Caraboid and strongly reminds one of *Nebria*. If we may judge from a single dissection the family differs from Carabidae by the possession of a scleritic basal-piece.

Family RHYSODIDAE.

Form examined is a species from Queensland, not contained in the British Museum Collection. It is a large form somewhat resembling the European *R. sulcatus*. Fig. 36 Pl. XLVIII.

Rhysodes sp. ? (Fig. 36).

Median lobe a strongly chitinised, curved tube, with median orifice on ventral side of apex and median foramen at basal end. Lateral lobes asymmetrical, the right large, flat and subtriangular, the left small and irregularly oval. Internal sac well developed, a large lobe arising from the apex armed with patches of hairs and chitin plates.

This is a characteristic Caraboid type and must be placed near that family.

Family PELOBIIDAE.

Pelobius tardus Herbst, from Brockenhurst has been examined.
Fig. 40 Pl. XLIX.

Pelobius tardus (Pl. XLIX fig. 40).

Median lobe strong, curved, somewhat flattened, produced into blunt barb at tip, with a shallow groove along the ventral side (or the lateral edges turned down ventrally), a membranous tongue (*a*) covers the basal four-fifths of the groove, the median orifice being covered by this tongue. Lateral lobes large, produced into filament at apex ; articulated to median lobe on dorsal side of base. Basal-piece forming a T-shape sclerite, with a large head. No differentiated sac.

Family HALIPLIDAE.

The form examined is the common European *H. fulvus* Fabr.
Fig. 39 Pl. XLVIII.

Haliplus fulvus (Pl. XLVIII fig. 39).

Median lobe a flattened curved body, deeply grooved along the ventral side, with a membranous tongue (*a*) covering the basal three-fourths of groove ; the basal part expanded, with lateral lobes articulated to dorsal edge. Lateral lobes asymmetrical, left one short and broad, with hairs on inner surface near distal end ; right lobe longer and narrower, with slender tip, inner surface covered with long fine hairs. Basal-piece forming a wide V-shape sclerite joining lateral lobes across the ventral side. No differentiated sac.

Family DYTISCIDAE.

Forms examined: *Dytiscus punctulatus* Fabr., and *D. marginalis* L., England. *Ilybius aenescens* Th., England. Figs. 37 and 38 Pl. XLVIII.

Dytiscus punctulatus (Pl. XLVIII figs. 37 and 37*a*).

Basal half of median lobe forms a tube, the distal half projecting as four prongs, the dorsal one chitinous, the ventral and lateral ones membranous (fig. 37*a*, *a. b. b.*). The dorsal half of lobe forming a strong chitinous plate, broader and turned down in the middle (*c*) and bearing hairs at the apex, the basal part being curved upward and expanded; the ventral half is membranous (*m*). Lateral lobes large and broad, bearing hairs at the tip and attached to the base of the median lobe on the dorsal side (*pa*). A thin strut (*bp*) broad at the end where it supports the membrane between the bases of the lateral lobe, on the ventral side, represents the basal-piece. This functions as a lever to which the muscles for turning the aedeagus are attached. When invaginated the aedeagus rests on its side, but when evaginated it takes a turn and the dorsal becomes ventral. Our figure shows it in its true dorso-ventral position. Sac undifferentiated.

Dytiscus marginalis.

This only differs in details from *D. punctulatus*, the median lobe is expanded into a small flattened disc at apex; the lateral lobes are longer.

Ilybius aenescens (Pl. XLVIII fig. 38).

Median lobe consisting of a strong, curved, thin sclerite, broadened at the base and turned down to form a short groove, the ventral side of this groove being covered by a membranous tongue (*a*), thus forming a very short tube where the undifferentiated sac opens. Lateral lobes broad at base, flattened and slightly twisted at tips and attached on dorsal side of the base; the inner dorsal surface being studded with short stout sense-hairs, the rest of inner surface with long fine hairs. Basal-piece (*bp*) broad at the end where it partly surrounds the base of the median lobe but narrow beyond.

This appears to be a more perfect structure than the aedeagus of *Dytiscus*.

The three families, Dytiscidae, Haliplidae, and Pelobiidae, are closely allied as to the aedeagus, the median lobe being on the same plan, and differing from Carabidae and Cicindelidae. In the latter two families the median lobe is a more or less perfect tube with the median orifice at or near the distal end, and the median foramen at the basal end; in the three other families it forms a chitinous organ, grooved along the ventral surface (or the lateral margin turned down), with a membranous tongue covering the basal part of the groove. There being no differentiated sac it is impossible to say how much of the ejaculatory duct is evaginated during coition.*

Unfortunately the only Amphizoidae we could procure were females.

Family GYRINIDAE.

Forms examined: *Enhydrus* sp. n., aff. *E. atrati*, Lita, 4000 ft. *Gyrinus natator* and *urinator*, England. *Orectochilus dispar* Walker, Ceylon.

Figs. 42, 43 and 43*a* Pl. XLIX.

Gyrinus natator (Pl. XLIX fig. 42).

Median lobe slightly flattened and curved; tip truncate; dorsal and lateral parts chitinous; median orifice forming a narrow slit on the membranous ventral side near tip; median foramen at base. Lateral lobes flattened horizontally, narrow at base and gradually widening to truncate apex, which bears long hairs; consolidated along ventral basal half and near base on dorsal side. Median lobe articulated to base of lateral lobes on dorsal side. Basal-piece large, forming a large chitinous plate on ventral and lateral sides; membranous on dorsal side; membrane connecting it to lateral lobes large and allowing great movements of parts. No differentiated internal sac.

Enhydrus, sp.

This is the same type as *G. natator*, the median lobe being pointed and the lateral lobes pointed on the inner side of a widened tip. Basal-piece large, but connecting membrane not so large as in *G. natator*, and not allowing so much movement between basal-piece and lateral lobes. No differentiated internal sac.

Oretochilus dispar (Pl. XLIX figs. 43 and 43*a*).

Median lobe tubular, drawn to a point on the ventral side of the apex; median orifice situated on dorsal side of apex; median fora-

* F. Netolitzky (Deut. Ent. Zeitschr., 1911, p. 271) has discussed the Adephaga from the point of view of the lateral lobes.

men at base. Lateral lobes narrow and bluntly pointed, the distal half bearing fine hairs along edge. Basal-piece long and narrow. No differentiated internal sac.

The aedeagus of the Gyrinidae is of the trilobe type with well-developed basal-piece, and they should not be placed with the Dytiscidae, but near to the Hydrophilidae. The comparatively simple trilobe form and undifferentiated internal sac indicate a form of low specialisation (accompanied by extreme adaptive characters of the body). Information as to the mode of fertilisation in this family is very desirable.

Family HYDROPHILIDAE.

Forms examined: *Hydrophilus* (*Hydrous* of recent authors) *piceus* L., Europe; *H. ater* Fabr., Paraguay. *Anacaena ovata* Reiche, England. *Berosus luridus* L., and *B. signaticollis* Charp., Brockenhurst. *Laccobius ytenensis* Sharp, Brockenhurst. *Helophorus aquaticus* L., Brockenhurst. *Dactylosternum subdepressum* Cast., Panama.
Figs. 44–46*a* Pl. XLIX.

Hydrophilus piceus (Pl. XLIX fig. 44).

The aedeagus of this insect is the best known of any, as it has been figured and described by many writers. See especially Escherich, Zeitschr. Wiss. Zool. lvii. The median lobe is well developed, membranous, strengthened by three sclerites. A ring-like one (*a*) supports the median orifice, a thin rod-like one runs down the ventral surface, and a large one (*b*) covers the dorsal surface; the latter is narrow at the tip and broadens out basally, where it extends into a pair of median struts (*ms*), a keel runs down the centre, bifurcates about the middle and the keels continue on to the median struts. The lateral lobes are broad at the base, where they meet both dorsally and ventrally and embrace the base of the median lobe; from the base they taper off to a point at the apex. The basal-piece is formed by a large, shield-shaped sclerite (*bp*) with its lateral edges turned up, the dorsal side being membranous. When the muscles acting upon the median struts force the median lobe outwards, the fact of it being articulated to lateral lobes (at the point of articulation *pa*) causes it to turn dorsally upon that point, this at the same time forces the lateral lobes apart. This appears to be the action of all the trilobe types in which the lateral arms are free (not consolidated together) and the median lobe is articulated to the lateral lobes. We have not examined one of these forms during copulation, but it is most likely that the lateral lobes are used to keep open the external orifice of the female. The internal sac is undifferentiated.

Laccobius ytenensis (Pl. XLIX fig. 45).

This is a trilobe form. Median lobe chitinous on dorsal side, membranous on ventral side whereon the median orifice is situate. Lateral arms curved, surrounding median lobe. Basal-piece large, membranous on dorsal side. Internal sac undifferentiated.

Berosus signaticollis (Pl. XLIX fig. 47).

Median lobe thin, tubular, slightly curved and pointed at apex; median orifice on ventral side of apex; median foramen at base; basal edge continued into two curved median struts (*ms*). Lateral lobes large, consolidated into one piece on the ventral side, forming a flattened trough into which the median lobe falls when at rest; point of articulation at base. Basal-piece large, forming a flattened trough into which the lateral lobes fall when at rest, the distal edge of the basal-piece being articulated to the middle of the ventral part of the lateral lobes. Internal sac undifferentiated.

In *B. luridus* the median lobe is slender and long, the lateral lobes slender and long and quite free. Basal-piece small and jointed to the lateral lobes in normal manner. Internal sac undifferentiated. The profound difference between these two otherwise allied species is of great interest.

Helophorus aquaticus.

The median lobe is short, broad at base and bluntly pointed at tip, where the median orifice is situate. Lateral lobes about same length as median lobe, broad at base and bluntly pointed at apex. Basal-piece longer than median lobe, shield-shaped, membranous on dorsal, chitinous on ventral side. Internal sac undifferentiated.

Dactylosternum subdepressum (Pl. XLIX figs. 46, 46*a*).

Median lobe flattened, broad at base, pointed at apex, the dorsal aspect being chitinous, the ventral membranous; the median orifice towards the base on ventral aspect (*mo*). Lateral lobes meeting together at base on ventral face, but wide apart on dorsal; tapering to a point at apex. Basal-piece small, chitinous all round, but narrow on dorsal aspect, and extending basally on ventral side, there somewhat shield-shaped. Internal sac undifferentiated.

The Hydrophilidae possess an aedeagus of the trilobe form, with well-developed median and lateral lobes and basal-piece, but with undifferentiated internal sac. This is a generalised type. *Berosus* departs from it furthest in *B. signaticollis.*

Family STAPHYLINIDAE.

Forms examined: *Gyrophaena pulchella* Heer, England. *Homalota londinensis* Sh.; *H. elongatula* Gr., and *H. pavens* Er., Brockenhurst. *Tachinus subterraneus* L., Brockenhurst. *Tachinoderus grossulus* Lec. (? North America, no locality ticket). *Ocypus cupreus* Rossi, Brockenhurst. *Staphylinus caesareus* L., Brockenhurst. *Philonthus* and *Gabrius,* numerous species. *Creophilus erythrocephalus* Fabr., Australia. *Quedius ventralis* Ar., Brockenhurst. *Pinophilus rectus* Sh., and *P. mimus* Sh., Amazons. *Platyprosopus* sp., India. *Othius fulvipennis* Fabr., and *O. melanocephalus* Grav., Brockenhurst. *Xantholinus glabratus* Grav., Brockenhurst, and *X. phoenicopterus* Er., Australia. *X.* (*Eulissus*) *chalybeus* Mann, Brazil. *Paederus riparius* L., Brockenhurst. *Lathrobium brunnipes* Fabr., *L. fulvipenne* Grav., and *L. boreale* Hochh., Brockenhurst. *Stenus speculator* Lac., Brockenhurst. *Osorius* sp. near *ater* Perty, Trinidad. *Nodynus leucofasciatus* Lew., Japan. *Olophrum piceum* Gyll., Brockenhurst. *Leptochirus edax ?* loc. dub. *Zirophorus bicornis* Ol., Amazons. *Micropeplus fulvus* Er., England.

Figs. 61–74 of Plates LII, LIII and LIV are devoted to Staphylinidae.

Gyrophaena pulchella (Pl. LII figs 61, 61*a*).

Median lobe chitinous, tubular, flattened near tip and twisted and swollen slightly at base; median orifice narrow, on ventral side near apex; median foramen at base small. There are two pairs of spines on ventral side close behind median orifice. Lateral lobes large, broad and flattened; inner surface membranous, outer chitinous, and divided into several large sclerites; near apex there is a small articulated lobe bearing two stout hairs. The lateral lobes are attached to median lobe near base on ventral side of median foramen (*pa*). Internal sac medium size with a long flagellum (*fg*) arising from apex of sac and passing through median orifice.

This is a highly developed form of the Aleocharid type. The structure is very large in comparison with the size of the insect.

Homalota londinensis.

Median lobe broad and flattened; tip on ventral aspect curved downward, and drawn out into a fine point, tipped with a fine pin-head knob. Lateral lobes large and broad; on the lower margin, near base, arises a long curved flattened spine. Sac not examined.

Homalota elongatula.

Median lobe bulbous at base, membranous on dorsal side, chitinous on ventral, the distal chitinous edge prolonged into a laterally compressed curved tip. The lateral lobes large, flat, and rounded at apex.

Homalota pavens.

Median lobe swollen at base, chitinous on ventral side, membranous on dorsal, distal end not twisted. Lateral lobes large. Sac not examined.

Tachinus subterraneus (Pl. LII figs. 61, 61*a*).

Median lobe short and bulbous, the ventral aspect formed by a chitinous sclerite jointed at apex, the dorsal by a circular sclerite, with a semi-membranous connection between (*m*). The median orifice has a dorso-distal position and the median foramen is small with a ventro-medial position. The lateral lobes joined together to near tips, attached to median lobe near median foramen on posterior (ventral) side. Internal sac large and complex, with a flexible, chitinous sclerite (*a*) supporting each side; at the distal end there is a large egg-shaped chitinous body (*b*) with a short tube on one side on which the ejaculatory duct opens. The use of this hollow egg-shaped body we are unable to conjecture.

Tachinoderus grossulus.

Distal half of median lobe tubular, basal half bulbous; median orifice distal; median foramen on ventral aspect in median position; semi-membranous around middle portion of bulbous base. Lateral lobes small, amalgamated to near tip. Internal sac large, with bilobed diverticulum on ventral face, and small chitinous process at apex where the ejaculatory duct opens.

Ocypus cupreus (Pl. LII figs. 63, 63*a*, 63*b*).

In this form the median lobe is a strong, chitinous tube with a bulbous base, a semi-chitinous band (*m*) running round the bulb; the median orifice is distal; the median foramen small and ventral, at the junction of bulb and tube. The lateral lobes are amalgamated and form a broad, slightly-curved plate on the ventral aspect of the median lobe, the tip being slightly cleft. The internal sac large, with four large, round diverticula near base, covered with curved spines; the dorsal side covered with long strong hairs, the ventral with large curved spines, similar to those on the diverticula; the apex is drawn out thinner and has two constrictions near the end and the opening of the ejaculatory duct (*o*) near the tip on the ventral side is supported by two flat chitin sclerites; a small spine rises just beyond it. The sac shown in the figure is drawn from a specimen taken in copula; it had the position figured.

Creophilus erythrocephalus, has a median lobe somewhat like *O. cupreus*, but the lateral lobes form a single broad prong on the ventral face. Internal sac medium size with a short curved flagellum arising from apex.

Quedius; has a similar form of median lobe to *Ocypus*, and the lateral lobes form a single piece on its ventral side. In *Q. ventralis* (Pl. LII fig. 64) the internal sac is figured evaginated. In *Q. brevicollis* the internal sac has a pair of small diverticula near apex and the opening of the ejaculatory duct below them, also a larger pointed pair on the dorso-lateral part of the middle, and a round diverticulum on the ventral side near base, covered with semi-chitinous pegs.

Q. vexans (of our British collections) has median and lateral lobes of the same type, the internal sac being swollen at base and thin for the distal two-thirds; a pair of blunt diverticula arise from the side near the middle, and a backward-pointing one nearer the base on a median-ventral line.

Pinophilus rectus (Pl. LIV figs. 71, 71*a*).

Median lobe large, bulbous at base, with semi-membranous strip (*m*) running across to near apex; apex with dorsal edge projecting beyond ventral; median orifice on ventral side of apex; median foramen small, on ventral side about one-fourth from base. Lateral lobes thin narrow strips, articulated to median lobe on ventral edge of median foramen. Internal sac about 15 mm. long, thin, tubular, coiled up in median lobe when invaginated. Arising from apex of sac is a fine chitinous flagellum as long as the sac, with the opening of the ejaculatory duct at its tip. At the base of the sac are three irregular chitin plates (*b*) with a narrow strip of chitin (*a*) running some way along the sac. These appear to form guides for the flagellum.

P. mimus has a similar sac and flagellum which make ten complete coils in the median lobe, like a coil of rope, and measure 20 mm.

In *Pinophilus* where there is an enormously long sac and flagellum, coiled up within the median lobe, it is not likely that the sac is evaginated, but the flagellum is thrust out and the basal part of the sac folded up like a concertina bellows; nor is it likely that the whole of the long flagellum is everted, but the muscles acting upon the coils cause it to operate like a coiled spring, the distal end being thus thrust out and retracted when the muscular pressure is relaxed.

Othius fulvipennis (Pl. LIII fig. 65).

Medium lobe bulbous with ventral distal edge projecting; median orifice dorso-distal, median foramen small, ventro-medianal; a semi-membranous band running round bulbous part of median lobe. Lateral lobes thin, separate, attached to median lobe on ventral edge of median foramen. Internal sac large, apex forming two diverticula; on the larger diverticulum the ejaculatory duct opens; a small bilobed diverticulum on dorsal side and a pair of large diverticula on ventral side; between these last processes and the base are two pairs of curved chitinous spines.

Othius melanocephalus (Pl. LIII fig. 66).

Very much like *O. fulvipennis*, but the internal sac differs greatly; on each side near apex is a fine long diverticulum (*a*).

Xantholinus glabratus (Pl. LIII figs. 67, 67*a*, 67*b*).

In this species the bulbous median lobe is of an extreme form, being egg-shape, with a small membranous distal portion to which the greatly reduced lateral lobes are attached. The median lobe is formed of dorsal and ventral sclerites, round, and connected by a semi-membranous band (*m*); the median orifice (*mo*) is at the distal end, and the median foramen (*mf*) slightly in front (or basal) on the ventral face. These two openings are separated only by a chitinous plate (*a*) formed by the basal part of the lateral lobes which are extremely reduced. The internal sac is three times the length of the median lobe, tubular, and studded with large teeth, curved basally.

A less modified form is found in *Xantholinus* (*Eulissus*) *chalybeus* (Pl. LIII figs. 68, 68*a*) from Brazil ; in which the distal end of the median lobe is short and tubular, drawn out into a point on the ventral side, the median foramen being situate in the ventral chitinous sclerite at the base of the short tubular distal end.

X. phoenicopterus is also less modified than *X. glabratus*, the lateral lobe being much larger and the median foramen on the ventral sclerite.

Paederus riparius (Pl. LIII figs. 69, 69*a*).

The median lobe broad, slightly flattened and slightly bulbous at base, the dorsal distal margin projecting beyond the ventral, the median orifice being on ventral face beneath this projection ; the median foramen small, near base slightly dorsal. The lateral lobes broad, flattened, with curved pointed apices projecting beyond end of median lobe, closely applied to sides of it, and attached to it near the ventral edge of median foramen. Internal sac with large curved spine (*a*) at base. Apex of sac not examined.

Lathrobium brunnipes.

The median lobe bulbous and membranous, except on the ventral basal part which is chitinous ; median orifice at tip ; median foramen small, about the middle. Lateral lobes consolidated into a single body, broad at base and narrow at apex where there are two small points ; a groove runs along the ventral side. They form the strongest part of the aedeagus and are consolidated to the ventral face of the median lobe from the edge of the median foramen to the tip. Internal sac not examined.

L. fulvipenne is of the same type as *L. brunnipes*, but the left lateral lobe appears to be absent and the right is large and projects as a curved spine ; there is also a chitinous support on the dorsal side of the median orifice.

L. boreale.

The same type as *L. brunnipes*, the lateral lobes being consolidated into a single piece, the tip being pointed and turned down like a small hook, the median ventral line being keeled, not grooved. The dorsal margin of the median orifice is supported by a small chitin plate and a strong chitin piece with two hooks at the end projects from the basal part of the internal sac. On each side of the internal sac, near the base, is a patch of chitinous flat scales, prolonged into prongs on the basal edge. When the sac is evaginated the two-hooked piece on the dorsal side of the base turns over and points basally. The aedeagus in *Lathrobium* is extremely irregular and asymmetrical in structure.

Stenus speculator (Pl. III figs. 70, 70*a*).

Median and lateral lobes on same plan as *Paederus riparius.* Internal sac large, with two chitin strips (*a*). These chitin strips are continuations of the chitin of the ventral surface of the median lobe.

Osorius sp. (Pl. LIV fig. 72) from Trinidad, apparently has the lateral arms entirely missing, or reduced to a narrow, small band slightly distal of the median foramen on the ventral side (*ll*). The median lobe is bulbous with the dorsal side semi-membranous and the ventral distal edge pointed. The internal sac is large with two diverticula near base, one bearing short hairs on the tip, and a large curved diverticulum at end, ventral of the opening of ejaculatory duct.

Nodynus leucofasciatus.

Median lobe bulbous at base, chitinous on ventral side and drawn out distally to a point, the dorsal side being membranous ; median orifice at distal end on dorsal side ; the median foramen small, on ventral side and about the middle. Lateral lobes fairly broad, pressed against sides of the median lobe and projecting slightly beyond tip, attached to median lobe on ventral side of edge of median foramen. Internal sac without chitinous armature.

This is very Silphid-like, but the absence of the basal-piece separates it from that group.

Olophrum piceum is very like *Nodynus*, the lateral lobes being flattened and curved. Internal sac long, flattened and coiled up in the median lobe ; its surface covered with hair-like scales.

Leptochirus, sp.

Median lobe tubular, curved ventrally near the base ; semichitinous on dorso-basal part. Median orifice on dorsal side of tip ; median foramen small, near base on ventral isde. Lateral lobes small, about one-fifth the length of the median lobe. Internal sac large, but not examined.

Zirophorus bicornis (Pl. LIV fig. 73).

Has a thin, slightly flattened median lobe, strongly chitinised and curved at the base, and semichitinous along the dorsal basal part (*m*). The lateral lobes are articulated to the curved base and consist of narrow lobes free along their whole length. Median orifice at distal end, median foramen at base. Internal sac short and without armature.

Micropeplus fulvus (Pl. LIV fig. 74).

This is a Staphylinid type, the median lobe being large and bulbous at the base ; the median orifice at the apex large, the median foramen small and one-fourth from base on ventral side. The lateral lobes are so completely amalgamated to the median lobe that it is very difficult to distinguish them, but they are of fair size and lie along the ventro-lateral portion of the median lobe. The internal sac is large, complex, covered with small chitinous spines and supported by chitinous patches.

It is among the Staphylinidae that we have found the greatest modification of a single type. In this family the internal sac reaches a high state of specialisation and the modification of the median lobe for the evagination of the sac by blood-pressure is carried to perfection. This is brought about by modifying the tubular median lobe into a bulb having chitinisations on the dorsal and ventral aspects, with a band of membrane between, so that the dorsal and ventral sclerites can be brought together by muscular contractions and so exert pressure of a fluid on the sac and turn it out.

The Staphylinidae are distinguished from the Silphidae by the absence of a basal-piece. Since our paper was written Dr. L. Weber of Cassel has published a very valuable paper on the male genitalia of Staphylinidae (Festschr. Ver. Cassel, 1911). We are, however, not prepared to accept his interpretation of the very abnormal genus *Habrocerus*, as to which he himself speaks with considerable diffidence.

Family SILPHIDAE (= families *Silphidae*, *Liodidae*, and *Clambidae*, Reitter).

Forms examined: *Silpha* (*Phosphuga*) *atrata* L., England. *S. obscura* L., England. *S. japonica* Motsch., Japan. *S.* ? *analis* Chevr., Panama. *Necrodes osculans* Vig., Woodlark Island. *Necrophorus mortuorum* Fabr., England. *Astagobius angustatus* Schm., Carniola. *Bathyscia* (sp. not in Brit. Mus.), Piedmont. *Liodes* (*Anisotoma* of certain authors) *humeralis* Fabr., England. *Clambus minutus* St., England.

Figs. 48–54, Plates XLIX and L, are devoted to this group.

Silpha atrata (Pl. XLIX fig. 48).

Median lobe flattened, broad, with ventral side chitinous and dorsal membranous ; median orifice at distal end ; median foramen small, situate in the basal part of the ventral chitinous plate. Lateral lobes broad at base, tapering to rounded point at apex. A thin ring of chitin runs over the base of median lobe (*bp*) and joins the bases of the lateral lobes ; this represents the basal-piece. Internal sac large, rounded at the apex, with three large, round diverticula at base (*b*), covered with long, fine hairs, thickest on the dorso-basal surface.

The median lobe is not consolidated to the basal-piece and can be dissected away.

The figure shows the apex of sac collapsed, the broken lines (*c*) show the more normal shape.

Silpha obscura (Pl. L figs. 49, 49*a*).

Median lobe large, extending beyond the basal-piece ; the ventral and lateral faces of the distal half chitinous, the dorsal side and all the basal half membranous, except a small strip of chitin (*a*) extending from the median foramen (*mf*) towards the base. The median orifice on dorsal side of tip ; the median foramen small, placed about middle of ventral side. Lateral lobes fairly broad, curved at tips and bearing a small knob, they are pressed closely to the latero-ventral surface of the distal half of the median lobe. The basal-piece is ringlike (*bp*). Internal sac large ; details not examined.

Silpha japonica.

Of the same type as *S. atrata.* The internal sac is flattened horizontally and constricted in the middle, the dorsal surface is covered with long, silky hairs.

Silpha analis (Pl. L fig. 50).

Though probably a different genus this is similar to the various species we have already remarked on. The basal-piece is of rather larger extent. Internal sac large with a large curved prong (*a*) on each side near the base, basal part covered with short hairs, distal part with granulated surface.

Necrodes osculans.

The aedeagus is of the *Silpha obscura* type. The median lobe broad, with distal half chitinous, especially on the ventral aspect, the ventral half membranous ; the median orifice dorso-distal, and the median foramen ventro-medial. The lateral lobes each broad at base, the apex slightly curved. The basal-piece consists of two small narrow sclerites, attached to the base of the lateral lobes, but they do not meet on the dorsal side.

Necrophorus mortuorum (Pl. L fig. 51).

Median lobe chitinous on ventral and lateral aspects, membranous on dorsal aspect; median orifice large, on dorsal aspect of apex; median foramen small, on ventral aspect about one-fourth from base. Lateral lobes broad at base, tapering to blunt point, bearing several hairs. Basal-piece (*bp*) slender and ring-shaped. Internal sac large, but details not examined.

Astagobius angustatus.

The median lobe large, slightly flattened and curved; the median orifice on the ventral face of apex, the dorsal edge being pointed; median foramen large, at base. Lateral lobes long and thin; basal-piece formed by a small curved sclerite on ventral face, but not meeting on dorsal. Internal sac large, armature not observed.

Bathyscia, sp. (Pl. L figs. 52, 52*a*).

Median lobe tubular, slightly flattened towards apex on dorsal face where it graduates to a point; median orifice at apex on dorsal face; median foramen (*mf*) at base, as large as the diameter of the median lobe, the edge being strengthened by a thickening of the chitin (*a*). The tegmen consists of a broad ring-shaped basal-piece (*bp*) with a pair of thin lateral lobes lying along each side of the median lobe, the basal-piece being slightly posterior of the base of the median lobe. Internal sac large, extending through the median foramen. Arising from the apex of the sac is a short, stout flagellum (*c*), along which the ejaculatory duct continues and opens at its tip. The dorsal face of this flagellum is chitinous (*a*) and broadened at the base where the corners articulate with a Y-shaped (*y*) support (Jeannel's Y-piece); the ventral face of the flagellum is membranous, except at the tip where the chitin forms a short fine tube.* Fig. 52*a* represents the internal flagellum (*c* of fig. 52) on a much higher scale of magnification.

Liodes humeralis (Pl. L figs. 53, 53*a*, 53*b*) is of the same type as *Bathyscia*. The median lobe is chitinous, strongly bent at the basal third, swollen at base and pointed at apex; the median orifice is at apex on ventral face; the median foramen at base, and as large as the enlarged base of median lobe. The tegmen consists of a

* On this group reference may be made to an important memoir by Jeannel, Arch. Zool. exp. v, 1910.

ring-like basal-piece, broader on dorsal than on ventral aspect, with a pair of narrow, pointed lateral lobes pressed close to the sides of the median lobe. The internal sac not large, but with complex armature at apex (53*a*, 53*b*). A flat, curved median chitin-piece (*b*) is attached to the internal sac by a large chitin knob (*c*) through which the ejaculatory duct runs and opens on the end of the median piece; a chitin plate (*d*) with a second chitin knob (*e*) gives it greater support. To each side of the chitin knob (*c*) is attached a flattened pointed process, thickened at its base at the point of attachment, one is slightly longer than the other.

Clambus minutus (Pl. L fig. 54).

Median lobe a thin, partly flattened, tube, with the dorsal distal part drawn out into a curved process hooked at the tip, the ventral distal part into a semi-membranous tongue. The lateral lobes are amalgamated for two-thirds of their length and form a broad shallow plate with the distal third forming unequal points, bearing a couple of stout spines. The basal-piece ring-shape (*bp*). Internal sac not examined.

Among the Silphidae s. l. that we have examined there are three distinct types of aedeagus. The first is represented by *Silpha*, in which the median foramen is small, the median lobe collapsible on the dorsal aspect and forms a collapsible bulb by means of which the internal sac is evaginated by fluid-pressure, and the sac bears no chitinous armature. In the second the median foramen is large, and the median lobe is not collapsible and does not function as a bulb for the evagination of the sac, and the sac bears chitinous armatures.

The third type has the lateral lobes amalgamated together to form one piece, and the median lobe is tubular and not collapsible.

These characters do not quite agree with the divisions into families of the Silphid allies. As, however, the recent authorities are not in accord on this point, and as we have studied a very small percentage of the known forms, we have treated the assemblage as one family. But we hope our doing this will not be interpreted as supporting either one view or the other.

The Silphid type approaches the Staphylinid type, but the presence of a reduced basal-piece serves to distinguish the two.

Family LEPTINIDAE.

Form examined: *Leptinus testaceus* Müll., Brockenhurst.

L. testaceus (Pl. LI figs. 55, 55*a*).

Median lobe large, chitinous on dorsal aspect, where it is drawn out into a point and on the sides, semi-membranous on the ventral aspect; median orifice on the ventral aspect of the distal end (*mo*); median foramen large at basal end, and proceeding somewhat along dorsal side (*b*). Lateral lobes thin narrow bodies lying along the dorso-lateral parts of the median lobe and projecting somewhat beyond its tip. Basal-piece well developed, forming a ring through the base of which the median lobe passes and projects beyond, basally. Point of articulation on dorsal side. This basal-piece is distinct but of a semi-chitinous nature. Internal sac large, projecting through the median foramen; it bears a patch of hairs near its apex, and about the middle a long slender chitin rod (*a*) attached to the sac by a broad square base; the ejaculatory duct does not pass through it. This differs but little from certain Silphidae.

Family PLATYPSYLLIDAE.

Form examined: *Platypsylla castoris* Rits., N. America.

P. castoris (Pl. LXXVII fig. 229).

This comes near to *Leptinus* from which it differs only in details. Median lobe tubular, pointed at apex and greatly enlarged on basal two-fifths; median orifice on ventral face near apex; median foramen large at base. Tegmen consisting of a basal-piece surrounding the median lobe anterior to the basal enlargement, and a pair of narrow lateral lobes situate on the dorsal face. Internal sac smaller than in *Leptinus* and not passing through the median foramen when at rest, covered with hairs and flattened pointed scales; a thin flagellum arises from the apex.

We are indebted to Mr. E. A. Schwarz for the opportunity of examining this interesting species.

Family SCAPHIDIIDAE.

Form examined: *Scaphidium quadrimaculatum* Ol., Brockenhurst.

S. quadrimaculatum (Pl. LIV fig. 76).

This is a characteristic Staphylinid type. Median lobe with distal half forming a wide tube, basal half bulbous, with a membranous band round the bulb (*m*) ; median orifice large, at distal end, with ventral edge projecting beyond dorsal; median foramen small on ventral face, about one-third from base. Lateral lobes attached to median lobe on ventral aspect, at the ventral edge of the median foramen. Internal sac large, with patches of short hairs ; details not studied.

Family TRICHOPTERYGIDAE.

Form examined: *Trichopteryx grandicollis* Mann., England, and some others.

T. grandicollis (Pl. LXXVII figs. 231 and 231*a*).

The aedeagus consists of a short tube with a pair of hooked struts on the ventral side of the base, the median orifice large, with the ventral edge produced into a blunt point. Internal sac large, bearing small spines and a small chitin-plate (*a*) on the dorsal face and some chitinisation on the ventral (*b*) which we have not definitely made out. The position of the opening of the duct on the sac was not observed.

We could find no trace of tegmen. A small plate with a central strut exists below the aedeagus, but it appears to be a body sclerite and not the tegmen.

At present we are unable to associate this with any other form.

Euryptilium marginatum has the organ longer, with the ventral margin of the median orifice projecting, pointed, and turned down.

Mr. H. Britten has submitted to us for examination dissections of *T. grandicollis, T. thorica, T. bovina, T. brevis, Euryptilium marginatum, Ptiliolum spencei* and an unidentified species. These are each and all easily recognised by the aedeagus.

Family CORYLOPHIDAE.

Forms examined: *Sacium politum* (coll. Matthews), hab. ? *Corylophus cassidioides* Marsh., England.
Fig. 75 Pl. LIV.

Sacium politum (Pl. LIV figs. 75, 75*a*).

Median lobe a large flattened tube, the median orifice at the distal end, the ventral edge extending beyond the dorsal and pointed; the median foramen very small at the basal end. Tegmen forming a "ring-piece," the cap (*a*) or lateral lobes forming a wide curved plate slightly emarginate; the basal-piece forming a large shield-shaped plate with a deep keel down the centre (*b*). Internal sac large, with complex armature.

Corylophus cassidioides is of the same type. At present we cannot directly connect this to any other type; the small median foramen with the internal sac contained in the median lobe is unique among the "ring" forms, where it is the rule to have a large median foramen and the internal sac passing through it, when not evaginated.

Family SCYDMAENIDAE.

Forms examined: *Stenichnus collaris* Müll., England. *Eumicrus* (recently *Scydmaenus*) *tarsatus* Müll., England. *Leptomastax coquereli* Fairm., Corfu.

Figs. 56, 56*a*, *b* and *c*, 57 Pl. LI.

Stenichnus collaris (Pl. LI figs. 56, 56*a*, 56*b*, 56*c*).

The distal portion of the median lobe forms a short thick irregular tube; the basal part being curved under and prolonged into a flattened narrow process (*f*), a band of membrane (*m*) connecting the two portions; the median orifice is large, at the distal end; the median foramen small, situate on the dorsal face about two-thirds down the tubular distal end of the median lobe. Lateral lobes narrow flat processes, attached to the median lobe at the dorsal edge of the median foramen. Internal sac short but very complex (56*c*). On the dorsal face there is a membranous surface bearing a pair of keels studded with chitinous teeth (*g*) which converge together in the centre above the opening of the ejaculatory duct; on the ventral half is a broad chitinous plate somewhat shoe-shaped in lateral view (*a* and *b*), bearing a pair of small toothed processes (*h*).

We would like to call attention to the great importance of recognising the mobility of the internal sac and concomitantly the variation in the position of the sac armature, especially when it closes the median orifice. Unless this is understood the shape of the aedeagus will appear to vary greatly in certain species. In the figures we give, fig. 56 shows a side view with sac invaginated, 56*b* shows the sac partly evaginated, and 56*c* with it entirely evaginated, or nearly so; 56*a* gives a ventral view of 56*b*.

Eumicrus tarsatus (Pl. LVII fig. 57).

Median lobe tubular, slightly curved, with large median orifice at distal end and small median foramen at base. Lateral lobes large, broad and closely pressed to sides of median lobe; they extend beyond the end of the median lobe where the tips are consolidated into a single point, entirely enveloping the ventro-apical portion of the median lobe. Although the lateral lobes are pressed very closely to the median lobe, yet they are not consolidated thereto, and can be parted without damage. Internal sac small with a curved chitinous process (*a*) bearing the opening of the ejaculatory duct at its tip.

Leptomastax coquereli.

Median lobe similar to *Eumicrus tarsatus;* the lateral lobes are broad and flat but do not meet and become consolidated at their tips. Internal sac small, with a chitinous process ending in a short flagellum on which the ejaculatory duct opens.

The family Scydmaenidae exhibit a great diversity of form, but all appear to be of one type. Median lobe more or less tubular with a large median orifice and a small median foramen more or less inclined to the dorsal face. The lateral lobes articulated to the base of the median lobe on the dorsal face of the median foramen. Internal sac bearing armature. The point of articulation being on the dorsal side of the median foramen distinguishes this family from the Staphylinidae wherein the point of articulation is on the ventral side.

The distinguished French entomologist, M. de Peyerimhoff, has published a memoir on the male structures of Scydmaenidae, in which he expresses the opinion that the structures are in some species variable. We would point to our remarks under *Stenichnus collaris* as possibly explaining the discrepancies he remarks on.

Family PSELAPHIDAE.

Forms examined: *Sagola* sp. (not in Brit. Mus.), New Zealand. *Trichonyx sulcicollis* Reich., Brockenhurst. *Bryaxis impressa* Panz., and *B. juncorum* Leach, Brockenhurst. *Physa inflata* Sharp, New Zealand. *Palimbolus* sp. (not in Brit. Mus.), New South Wales.

Figs. 58, 59, 60 and 230 Pls. LI and LII.

Sagola sp. (Pl. LII fig. 59).

Median lobe long, slender, tubular and slightly curved, the median orifice at apex, the ventral edge projecting beyond the dorsal. Lateral lobes large, flattened laterally and lying on each side of median lobe, with their base in intimate union with the base of the median lobe. The piece we call basal-piece (*bp*) appears to belong to the lateral lobes and not to be a true basal-piece, but this point is obscure. Internal sac undifferentiated.

Trichonyx sulcicollis.

Median lobe bulbous with circular, membranous patch on dorsal face; median orifice at distal end, closed by a chitin plate which is attached at the base of the internal sac; this plate moves when the sac is evaginated; median foramen small, about two-thirds from base. Lateral lobes short, flattened, applied closely to the ventral face of the distal end of the median lobe. Internal sac large, armed with strong chitinous plates.

Bryaxis impressa (Pl. LXXVII figs. 230, 230*a* and *b*).

This appears to be much on the same plan as *Sagola*, but the lateral lobes in their basal part are consolidated to the sides of the median lobe, and their more median portions apparently meet, while their outer portions remain free, divergent and pointed. If a section be taken through the middle of the aedeagus it should include three lumens, in the middle that of the median lobe (*d* of fig. 230*b*) and another on each side, *c*, the lumen of the lateral lobe. Internal sac undifferentiated. There is considerable difficulty in the interpretation and delineation of this structure, as regards the distal portions of the median strips of the lateral lobe. In the figures 230 and 230*a* it is assumed that they pass beyond the median orifice and then meet at the point *a*.

Bryaxis juncorum.

The aedeagus is on the same plan as *B. impressa*, but is shorter and more bulbous; the lateral lobes are consolidated to the median lobe.

Physa inflata (Pl. LI fig. 58).

Median lobe bulbous, ventral and dorsal walls chitinous with a membranous band (*m*) around the middle, median foramen small, ventral and nearly median. The lateral lobes hard to distinguish from median lobe but appear to be the two pointed sclerites on each side of median orifice (*ll*), but it is possible that the median sclerite (*a*) on the ventral distal part of the median lobe represents the consolidated and reduced lateral lobes. Internal sac large, swollen towards the apex where it is produced into two small diverticula, between which the ejaculatory duct opens, the apical dorsal part bearing spines, and a large spine on each side a third from the base.

Palimbolus sp. (Pl. LII fig. 60).

Median lobe bulbous with right edge of median orifice prolonged into point; except for a batch of membrane on dorsal side (*m*) the median lobe is chitinous; median foramen small, on ventral face. Lateral lobes small, subcircular bodies applied closely to median lobe slightly posterior of the median foramen. Internal sac well developed with two chitin rods (*a*) supporting the ventral surface and forming two rounded projections beneath the opening of the ejaculatory duct.

The few forms of Pselaphidae that we have examined show very interesting differences which future investigation will probably show to be characteristic of distinct groups, unless connecting forms should be found. The type is closely allied to the Staphylinid. The possibility of *Bryaxis* having a true basal-piece included in the aedeagus requires investigation, as the possession of such a structure would prevent their being regarded as direct offshoots of the Staphylinidae.

Family SPHAERITIDAE.

Form examined: *Sphaerites glabratus* Fabr., Scotland. Fig. 78 Pl. LV.

Sphaerites glabratus (Pl. LV figs. 78, 78*a*).

Median lobe thin, only the tip visible; median orifice at tip. Lateral lobes large, consolidated together for the greater part of their length on the ventral, and for half their length on the dorsal face, thus forming a tube in which the median lobe lies. Basal-piece small and asymmetrical, the chitinisation forming a broad circular band. Internal sac undifferentiated. This is very like *Syntelia*.

Family SYNTELIIDAE.

Form examined: *Syntelia histeroides*, Japan.

Syntelia histeroides (Pl. LV figs. 77, 77*a*).

Median lobe well developed, long, curved, tubular, with a pair of median struts. Lateral lobes very long and curved towards their pointed apices, consolidated together for the greater part of their length. Basal-piece small, symmetrical, with the opening on the ventral (?) face.

This comes near to *Sphaerites*.

Family NIPONIIDAE.

Form examined: *Niponius canalicollis*, Japan.
Fig. 82 Pl. LV.

Niponius canalicollis (Pl. LV figs. 82, 82*a*).

Median lobe tubular, slender and long; lateral lobes longer than median lobe and enveloping them. Basal-piece forming a long tube, constricted near its base and bent. Internal sac undifferentiated.

This form of aedeagus is nearest to *Syntelia* but differs in having the tubular basal-piece long, a character in itself not of family importance.

Family HISTERIDAE.

Forms examined: *Hister cadaverinus* Hoffm., England. *Pachylister chinensis* Quens., China. *Macrolister maximus* Ol., Africa. *Oxysternus maximus* L., Guiana. *Hololepta elongata* Er., Andaman Islands. *H. areifera* Mars., Cameroons. *Saprinus nitidulus* Fabr., England. *Teretriosoma stebbingi* Lewis, India.
Figs. 79, 80 and 81, Pl. LV, relate to *Histeridae*.

Hister cadaverinus (Pl. LV figs. 79, 79*a*).

Median lobe well developed, chitinous, slightly curved, with a large flange running round the lateral and distal edges of the apical half (*a*), forming a cavity in which the apical armature lies when the median lobe is at rest. This median armature is a pair of two-pronged structures, amalgamated at their bases and articulated to the base of the median lobe; when the median lobe is withdrawn between the lateral lobes at rest, the armature lies in the cavity, but when it is thrust out the armature turns back. There is a pair of short median struts. Tegmen consisting of a small basal-piece with very large lateral lobes amalgamated on their ventral side to the tip, and on the dorsal side along the basal half. Internal sac undifferentiated.

Macrolister maximus.

A figure is given of this with the median lobe erected (Pl. LV fig. 80).

Oxysternus maximus.

Median lobe rod-like, dilated at the tip into a cleaver-shaped process. Basal-piece moderately long, slightly asymmetrical, with a large membranous area on one aspect, just anterior to its junction with the lateral lobes. Lateral lobes very long, coalesced on their basal portions to form a very hard tube, the apical two-fifths forming a half tube, or trough, at the basal portion of which is the articulation of the median lobe. The rod-like, very hard median lobe renders it pretty certain that the sac remains undifferentiated. The aedeagus is here a beautiful structure with very solid chitinisation.

Hololepta elongata (Pl. LV figs. 81, 81*a*).

The aedeagus is flattened and thin, the basal-piece more than two-thirds the length of the lateral lobes; the lateral lobes amalgamated along the dorsal surface to the tip and along the ventral surface for the basal two-thirds. The median lobe is greatly reduced.

Saprinus nitidulus.

Median lobe small, only the tip visible. Lateral lobes very large, consolidated together along their entire length, with the tips slightly flattened and turned down; this forms a complete tube with an opening at the tip on the dorsal side. Basal-piece very small, asymmetrical. Internal sac small, apparently not differentiated.

Teretriosoma stebbingi. We are indebted to Mr. Lewis for the opportunity of examining this rare and interesting Histerid. The individual was in a very decayed condition and the preparation was not very successful, but it shows that this form departs from the other Histeridae we have examined by the shape of the lateral lobes, which are flattened divergent laminae. Their conjunction with the basal-piece seems to be more intimate than usual.

The four families *Histeridae*, *Synteliidae*, *Sphaeritidae* and *Niponiidae* are so closely related by the aedeagus, that they might form one family, in which the Histeridae would include the higher developments. Its characteristics are the existence of a basal sclerite having no power of movement over the median lobe, and extremely large lateral lobes more or less amalgamated to form a tube. The type is extremely different from Staphylinidae. But the approximation to the Byrrhidae is clear.

Family PHALACRIDAE.

Forms examined: *Phalacrus grossus* Er., Spain. *Litolibrus obesus* Sharp, Panama. *Olibrus corticalis* Panz., England.

Figs. 83 and 84 Pl. LVI are Phalacridae.

Phalacrus grossus (Pl. LXI figs. 83, 83*a*).

Median lobe broad and flattened; median orifice on dorsal face at apex; median foramen large. Tegmen forming a ring-piece. The "cap-piece" formed of the two flattened lateral lobes consolidated on the dorsal side to near their apices, and a large flat plate, turned down along the lateral edges, the basal corners meeting together on the ventral side of the median lobe, where the ring is asymmetrical. Internal sac large and complex. There is a pair of long tubular glands which open on the apex of the sac, one on each side of the opening of the ejaculatory duct. As our specimens were dried we could not examine the testes to see if these glands were extra, or if there were the usual ones having an abnormal opening. In *Olibrus corticalis* these glands are not present in this position.

Litolibrus obesus (Pl. LVI fig. 84).

Median lobe broad and flattened, slightly bent near the base where a flange (*a*) runs along the dorsal face; median orifice on dorsal aspect at tip; median foramen large, on ventral side of base. Tegmen forming ring-piece. Lateral lobes small, consolidated together and forming a pointed, flattened plate bearing a pair of small curved hooks; basal-piece long and narrow on dorsal side, broadened at the base where it encircles the median lobe, having two deep emarginations causing the median central portion (*b*) to project as a tongue. Internal sac large, bearing a pair of double claws and a pair of small plates, as armature.

Family MONOTOMIDAE.

Form examined: *Monotoma conicicollis* Guér., England. Fig. 85 Pl. LVI.

Monotoma conicicollis (Pl. LVI figs. 85, 85*a*).

Median lobe short, broad, flattened, and slightly curved; median orifice at tip, the dorsal edge projecting beyond the ventral and pointed; median foramen at base and of large size. From the ventral edge of the median foramen proceed two long struts (*ms*).

Tegmen (fig. 85*a*) forming a ring-piece, the dorsal part being a hood-shaped body, with a thin piece proceeding from each basal corner and consolidating on ventral side of median lobe. Internal sac very large, bearing armature near base (*b*) and towards apex (*a*).

Family NITIDULIDAE.

Forms examined: *Psilotus atratus* Reitt., Chiriqui. *Cychramus luteus* Fabr., England. *Ips* (*Glischrochilus* of various authors) *japonius* Motsch., Japan.
Figs. 87 and 88 Pl. LVI.

Psilotus atratus (Pl. LVI fig. 87).

Median lobe tubular, broad and flat, with single median strut. Tegmen forming a large broad curved plate or hood, on dorsal face, with a small dorsal median projection (*a*) from base, the basal corners meeting and consolidating on ventral side of median lobe. Internal sac large, the opening of ejaculatory duct at apex, where it is supported by two chitin rods consolidated together at tip (*b*) round the duct opening.

Ips japonius (Pl. LVI fig. 88)

is of the same type as *P. atratus*; and so is *Cychramus*, the "hood" being much larger than the median lobe.

The family Monotomidae comes near to these forms, as also does Helotidae. On the other hand, *Rhizophagus* does not belong to Nitidulidae. Whether it can be satisfactorily placed in *Cucujidae* (where we have treated of it, cf. fig. 101), can only be determined by a much more extensive survey of the Cucujidae than we have made.

Family BYTURIDAE.

Form examined: *Byturus tomentosus* Fabr., England.
Fig. 86 Pl. LVI.

Byturus tomentosus (Pl. LVI fig. 86).

Median lobe long, slender, and pointed; median orifice at tip on dorsal face; median foramen at base. Tegmen forming a close-fitting sheath, the distal half chitinous, the basal half membranous, with a strip of chitin supporting each side (*a*); and a **Y**-piece with a long stalk (*b*) supporting the ventral aspect. Internal sac undifferentiated.

This type is similar to Trogositidae.

Family TROGOSITIDAE (or *Ostomidae*, or *Temnochilidae*).

Forms examined: *Temnochila virescens* Fabr., Mexico. *Alindria grandis* Serv., Africa. *Leperina*, sp. n.? aff. *adustae* Pasc., Australia. *Thymalus limbatus* Fabr., Brockenhurst.

Figs. 89 and 90 Pls. LVI and LVII.

Temnochila virescens (Pl. LVI figs. 89, 89*a*).

Median lobe long, flattened laterally, formed by a trough-shaped chitin plate (*a*) on ventral aspect and membrane on dorsal aspect (*b*), with a chitin strut round median orifice at distal end (*c*). Tegmen formed into a sheath; lateral lobes distinct and only amalgamated at base; basal-piece large and tubular, chitinous on dorsal and ventral aspects, membranous on sides. Internal sac undifferentiated.

Alindria grandis is of the same type, but the division between lateral lobes and the basal-piece is obliterated.

Thymalus limbatus (Pl. LVII figs. 90, 90*a*).

Median lobe long, straight, flattened laterally. Tegmen forming a sheath with lateral lobes consolidated together on the *ventral* aspect, basal-piece long, tubular, with a strong strut on the dorsal aspect at base (*a*).

Leperina aff. *adustae* is of the same type but has the lateral lobes free.

It is possible that this type is a development of a trilobe type through such a form as *Aulonium*. *Byturus* belongs near this family.

Family COLYDIIDAE.

Forms examined: *Enarsus bakewelli* Pasc., New Zealand. *Tarphiomimus indentatus* Woll., New Zealand. *Aulonium bidentatum* Fabr., Guatemala. *Deretaphrus ignavus* Pasc., Australia. *Cerylon histeroides* Fabr., England.

Figs. 91–95 of Pl. LVII relate to the above-named forms.

Enarsus bakewelli (Pl. LVII figs. 92, 92*a*, 92*b*).

Median lobe nearly as long as tegmen, chitinous on dorsal and lateral aspects, membranous on ventral (*a*); median orifice on ventral aspect near apex. Tegmen consists of a large basal-piece formed of a ventrally-placed sclerite, the dorsal aspect membranous, and a pair of lateral lobes joined together on their ventral aspects and forming a large plate ; the median distal portion of the plate projecting between the distal ends of the lateral lobes as a free process, truncate at tip (*b*). No differentiated internal sac.

In this species there is a distinct abdominal plate between the anus and aedeagus (*lv*), which we think must be the last ventral sclerite of the body.

Tarphiomimus indentatus is of a similar type (Pl. LVII fig. 93).

Aulonium bidentatum (Pl. LVII figs. 91, 91*a*).

Median lobe large, somewhat flattened ; median orifice near tip on ventral face. Tegmen formed of a large basal-piece, chitinous on ventral and membranous on dorsal aspect, and a large piece, formed of the lateral lobes consolidated together to near their tips, on the ventral face.

Deretaphrus ignavus (Pl. LVII figs. 94, 94*a*).

Median lobe long, slender and tubular, with median orifice at tip on dorsal side, median foramen at base, which is slightly swollen. Tegmen consisting of two short, broad lateral lobes, rounded at tip and bearing a strong curved spine at base, between which the median lobe passes. Basal-piece short, projecting as two short struts (*a*) at base. Internal sac undifferentiated.

Some other species (which cannot be determined but are not *D. piceus*, the type of the genus) are of the same construction with slight difference in details.

Cerylon histeroides (Pl. LVII fig. 95).

The aedeagus consists of a long, tubular median lobe, swollen at its apex, across which is the median orifice ; and a small ring-shaped tegmen articulated at the base of the median lobe. Internal sac complex.

Obs.—There is great diversity among the few forms of Colydiidae we have examined.

We might perhaps associate *Enarsus* and *Aulonium*, though there is much difference between them. *Enarsus* is one of the connecting links of the trilobe aedeagus with the sheath-forms (Trogositidae, etc.) that we have at present placed in Cucujoidea. We have therefore in our table also given this genus a place in Byrrhoidea. *Aulonium* is more definitely Trogositoid.

Deretaphrus is not thoroughly elucidated. There may be an affinity with *Rhizophagus*. It is very different from the trilobe form.

Cerylon is extremely difficult. If the ring at the base of the long tubular median lobe be really the tegmen as we have assumed, the genus might be said to be a trilobe form with tegmen greatly reduced, with concomitant great development of the median lobe in the tubular form. This in fact would then be a form of development in some respects parallel with what we find in Chrysomelidae.

A thorough study of the forms at present associated in Colydiidae would probably lead to the dismemberment of the family, and would in addition throw a considerable light on Coleopterous taxonomy.

Family CUCUJIDAE.

Forms examined: *Passandra fasciata* Gray, Central America. *Hectarthrum cylindricum* Sm., Queensland. *Cucujus mniszechi* Grouv., Japan. *Brontopriscus pleuralis* and *B. sinuatus* Sharp, New Zealand. *Brontes lucius* Pasc., Queensland. *Diagrypnodes wakefieldi* Wat., New Zealand. *Chaetosoma scaritides* Westw. (?), New Zealand. *Rhizophagus depressus* Fabr., England.

Figs. 96–101 Pl. LVIII relate to these forms.

Passandra fasciata (Pl. LVIII figs. 96, 96*a*).

Median lobe short and fairly broad, with the median orifice at tip, on dorsal aspect; the basal dorsal edge is continued as a broad strut (*a*), which suddenly narrows and continues as a long fine strut (*b*). The tegmen forms a ring, the dorsal side is formed by a pair of long lateral lobes, wide at their base, where they are consolidated together into a plate, and narrow for the distal three-fourths where they are free; the ventral portion of the ring is formed by a broad plate attached to the outer basal corners of the lateral lobes. Internal sac very long and narrow, except at its base where it is complex; the basal complex part of the sac evaginates easily and then forms a cross-shape body (fig. 96*a*); the distal portion (*c*) has the opening at its apex and forms a semi-chitinous trough; the lateral portions (*d*) are semi-chitinous; two small diverticula (*e*) turn basally, and basad of these are two more that bear hairs. The rest of the long internal sac is narrow. At the apex of the sac there is a semi-chitinous tongue (*f*) through which the ejaculatory duct passes. The enlarged part of the ejaculatory duct forms a chitinous tube. It is possible that this part of the duct passes through to apex of the sac and forms a flagellum.

Hectarthrum cylindricum

is on a similar plan, but the consolidated basal part of the lateral lobes is constricted off from the free portion and forms a distinct plate.

From certain specimens that we have examined it appears probable that the chitinous ejaculatory duct forms a flagellum, and is capable of being thrust right through the tongue at apex, and entirely up the internal sac.

This type (*Passandra* and *Hectarthrum*) differs from the rest of the Cucujidae we have examined in having a large plate on the ventral side of the ring-piece instead of the consolidated tegminal struts (*tg*).

Cucujus mniszechi (Pl. LVIII fig. 97).

Median lobe well developed, cylindrical, slightly flattened laterally; median orifice on dorsal aspect near apex, the ventral edge continued into a small point; dorsal basal edge continued into large median strut (*ms*). Tegmen forming slender ring-piece, with small cap-piece, bearing small lateral lobes. Internal sac very long, with long, slender flagellum arising from the apex, at the tip of which the ejaculatory duct opens.

Brontopriscus sinuatus (Pl. LVIII fig. 100).

Median lobe small, tubular, with median orifice at tip, the basal part continued as a large flat strut, narrowing in middle and spatulate at the end (*a*). Tegmen consisting of a ring piece with dorsal cap, the cap being formed by a curved plate produced into two flattish lateral lobes; there is no line of division between the plate and the lateral lobes. Internal sac very long, with a long fine flagellum rising from the apex; about the middle the sac is swollen and its surface studded with fine, short spikes.

In *Brontopriscus pleuralis* the aedeagus is very similar, but the flagellum is longer, and there are four broad, short spines on the sac about a third from its base.

Brontes lucius is very near to *Brontopriscus*, but the median strut is longer and more slender; the middle of the internal sac slightly dilated and covered with long strong hairs and the rest of the sac sparsely covered with stout hairs.

Diagrypnodes wakefieldi (Pl. LVIII figs. 99, 99*a*).

Median lobe slender, curved and membranous, with a thin chitin-rod on each side to support it; median orifice on ventral aspect near tip. The tegmen forms on dorsal aspect a large cap, which is formed by two pieces articulated together, the distal one bearing two small lateral lobes. It is possible that the distal piece is the basal part of the lateral lobes, and the basal plate is the basal piece. The basal corners of this basal plate meet under the median lobe. No differentiated internal sac.

Chaetosoma scaritides (Pl. LVIII fig. 98).

Median lobe slender, chitinous on ventral aspect, membranous on dorsal; median orifice on dorsal aspect of tip, ventral edge pointed and projecting beyond dorsal edge. Tegmen forming a ring, with large dorsal cap-piece formed of a large curved plate with a pair of broad lateral lobes at apex; the ring is broad and continued as a strut (*tg*) on ventral side. Internal sac small, not differentiated.

There are probably more than one species of *Chaetosoma* in New Zealand, and if so the one here dealt with is not the *C. scaritides* of Westw. Ours is a comparatively large, black form, found by Commander J. J. Walker at Wellington.

Rhizophagus depressus (Pl. LVIII fig. 101).

Median lobe large, tubular and slightly curved; median orifice at apex, the base prolonged into a long dorsal strut. Tegmen forming a slender ring round the median lobe, the dorsal part slightly enlarged into a very small cap-piece. Internal sac large, with stout, twisted flagellum arising from apex.

This differs from Nitidulidae by the large, exposed median lobe, the cap-piece of the tegmen reduced so as not to cover the lobe.

This family is of great interest and requires much greater investigation than we have given it before any definite conclusions can be arrived at. It will eventually have to be divided. Whether or not certain divisions that have already been proposed are adequate we cannot say. *Chaetosoma* is of interest as it shows a probable transition from the sheath type (Trogositidae) to the true ring type. In *Diagrypnodes* we have a type nearer to Pythidae than to *Cucujus*. The degree of differentiation of the sac and the condition of the lateral lobes must be considered in adjusting the relationships in this family. Thus *Hectarthrum* has a more generalised tegmen than *Rhizophagus* wherein its reduction to a mere ring is very considerable. There are several other Cucujus-forms (*Prostomis*, etc.) that we have not been able to examine, although they are probably taxonomically important.

Family HELOTIDAE.

Form examined: *Helota gemmata* Gorh., Japan, and a second species from Assam.

Figs. 106, 106*a* and 106*b* Pl. LX.

Helota gemmata (Pl. LX figs. 106, 106*a*, 106*b*).

Median lobe broad, flattened; the ventral face forming a plate of which the lateral edges project slightly; the base prolonged into two broad struts; median orifice at distal end. The tegmen formed of a large "cap-piece" on the dorsal aspect and a Y-piece on the ventral. The edges of the cap-piece are turned in and form a groove in which the projecting edges of the median lobe run. Internal sac large with complex armature at apex. This armature (fig. 106*b*) consists of a stout chitinous block (*a*), on the end of which the ejaculatory duct opens; the ventral face of this piece forms a shallowly curved plate (*b*), on the dorsal aspect are two curved plates, both deeply cleft at the tips (*c*).

This type must be placed somewhere near the Nitidulidae. It is an instance—and far from a solitary one—of an aedeagus within an aedeagus.

Family OMMADIDAE.

Form examined: *Omma stanleyi* Newm., Australia.

Omma stanleyi (Pl. LIX figs. 102, 102*a*).

Median lobe well developed, tubular with median orifice on the smaller distal end and the median foramen at the larger basal end; two short median struts; point of articulation on dorsal face. Lateral lobes large, concave on the inner surface, where this envelops the median lobe to near its tip, the basal part of the lateral lobes consolidated together. No defined basal-piece. The internal sac is simple and of medium size.

In this species the anus opens at the end of a chitinous tube (*a*) which either represents the last segment (tergite and sternite) or a chitinisation of the rectum, more probably the former.

Family CUPEDIDAE.

Form examined: *Cupes clathratus* Motsch., Japan. Figs. 103, 103*a*, 104, 104*a*, 104*b* Pl. LIX.

Cupes clathratus (Pl. LIX figs. 103, 103*a*, 104, 104*a*, 104*b*).

Median lobe small with median orifice on ventral aspect, forming a longitudinal opening along the distal two-thirds. Tegmen complex without distinct division between the basal-piece and lateral lobes. On the dorsal side there is a plate (*a*) bilobed at tip, which covers the median lobe. A pair of large lateral lobes with complex tips, and from near their bases, on the ventral face, two long, slender spines (*b*) are given off. Internal sac undifferentiated.

There is a unique structure pertaining to the dorsal plate of the last visible abdominal segment (104, 104*a*, 104*b*). As in *Omma* the anus opens at the end of a chitinous tube (*c*), from below it there rises a pair of flattened chitinous processes (*d*). The last visible dorsal plate is deeply cleft at its distal margin, its basal part continues into the abdomen, curves under and ends in a point, a hole (*e*) being left just before the bend, through which the gut passes.

Obs.—As regards *Omma* and *Cupes;* though very peculiar they are by no means closely allied, and form two families more naturally than a single one. It is by no means impossible that the peculiarities of these two Coleoptera are indications of an old relationship with Insects of another Order (perhaps something that preceded the existing Sialidae). We really, however, know very little about the creatures and generalisation is premature. We find that their wings even have been but imperfectly studied.

Family CRYPTOPHAGIDAE.

Form examined: *Antherophagus nigricornis* Fabr., England.
Fig. 105 Pl. LIX.

A. nigricornis (Pl. LIX fig. 105).

Median lobe short and broad, the dorsal basal edge being continued as a broad, long, strut (*a*); median orifice forming a dorsolateral slit across the apex. Tegmen forming a ring with a large dorsal cap; the cap formed of a pair of broad, triangular lateral lobes and a basal plate with the basal angles produced into struts (*b*) which embrace the side, but are not consolidated together on the ventral aspect, of the median lobe. Internal sac long (the apex broken and not examined).

This type approaches the Phalacridae and also the Erotylidae.

Family EROTYLIDAE.

Forms examined: *Megalodacne* sp., New Guinea; *M. grandis* Fabr., Natal. *Cypherotylus onagga* var. Lac., S. America. *Cryptodacne vittata* Broun, New Zealand. *Camptocarpus prolongatus* Crotch, Chiriqui. *Doubledaya* sp., Siam.

Figs. 107 and 108, and 108*a* Pl. LX.

Megalodaene sp., New Guinea.

Has a tubular, curved median lobe, a very large cap-piece bearing very small lobes. Internal sac more than twice as long as the median lobe with chitinous flagellum half as long as sac.

Megalodacne grandis, Natal, is similar to the above but with internal sac only a little longer than median lobe and flagellum nearly as long as the sac.

Cryptodaene vittata (Pl. LX figs. 108, 108*a*).

Median lobe short, wide and slightly flattened; median orifice at tip; median foramen large, at base, with long strut from the dorsal edge of median foramen. Tegmen forming a ring, with large cap on dorsal aspect from the apex of which rise two short lobes. Internal sac large with armature at apex; this armature consists of a curved process, chitinous on ventral and membranous on dorsal (*b*) aspect, with the opening at the tip; dorsal of this process is another consisting of a brush-like organ (*c*).

Camptocarpus prolongatus (Pl. LX fig. 107).

Median lobe long, thin, tubular, and curved near the base; median orifice at apex, the ventral edge produced into a point; median foramen at base; from the dorsal edge of the median foramen proceeds a long strut (*ms*) bifurcate at end. Internal sac long with a chitinous flagellum rising from apex nearly half as long as the sac.

Doubledaya, sp. ? (Siam) has the terminal lobes of the cap short (shorter than in *Cryptodacne vittata*, fig. 108) but the cap itself is rather longer. Internal sac not examined.

Family DISCOLOMIDAE.

Form examined: *Notiophygus* sp. (not named in Brit. Mus.), S. Africa.

Notiophygus aff. *nigropunctati* (Pl. LX figs. 109, 109*a*).

Median lobe strong and strongly chitinised, forming a short tube with the ventral edge of the median orifice pointed and projecting long beyond the dorsal edge, the median foramen occupying a basal ventral position with its ventral edge produced into a strong process (*pa*) by which it is articulated to the tegmen. Tegmen forming a strongly chitinised cap-piece, enveloping the median lobe, which plays through an orifice on the ventral face, the distal edge of this orifice is beset with stout short hairs (*a*). Internal sac well developed, with two small plates (*b*) as armature.

The best position we can suggest for this form at present is near to Nitidulidae or Monotomidae, but if there is any relation it is a very distant one.

Family COCCINELLIDAE.

Forms examined: *Lasia globosa* Schn.; *Mysia oblongo-guttata* L.; *Coccidula rufa*, Herbst.; all abundant European forms. Also *Leis 22-maculata* F., S. Africa.
Figs. 111, 112 Pl. LXI.

Lasia globosa (=*Subcoccinella 24-punctata*, recently) (Pl. LXI fig. 111).

Median lobe in form of a long, curved, chitinous tube, with the median orifice at apex, the lip of which is turned back on the dorsal aspect and likewise projects as a thick spine on the ventral face; median foramen at base, where the tube is flattish and expanded laterally. Tegmen forming a ring round the median lobe, the dorsal part consisting of two large lateral lobes, between which is a large curved sclerite, pointed at apex and fastened at each basal corner to the large strut on the ventral face. This strut is thick and expanded at its end, and fits into the expanded end of the median lobe (*b* and *c*) to which it is attached by muscles. Internal sac undifferentiated.

Mysia oblongo-guttata (Pl. LXI fig. 112).

The median lobe is very long, thin and curved, the first connecting membrane is also very long and allows the median lobe to be withdrawn into the body cavity. The tegmen is similar to *Lasia*, but more slender, the strut being fastened at its end to the expanded base of the median lobe. Internal sac undifferentiated and opening at apex of median lobe.

In *Coccidula rufa* the median lobe is also very thin and long and withdrawn into the abdomen.

In *Leis 22-maculata* the median lobe is shorter and thicker than in *M. oblongo-guttata* and *Coccidula*, but not so stout as in *Lasia*.

This interpretation differs from Verhoeff's. He considers our median lobe as a siphon (equal to our flagellum in *Camptocarpus* and many other forms), and a part of our tegmen (*a*) as the penis, or median lobe. *Lasia globosa* supports our view. But even if Verhoeff's interpretation should prove to be correct it would not justify the placing of this family apart from all other Coleoptera; the "siphon" would merely be a structure analogous with our flagellum in so many families.

Weise has given some figures of the aedeagus of Coccinellidae (Deutsche ent. Zeitschr. 1896 Taf. i p. 368). According to our observations there is a duct within the part he figures as being the duct.

From observation of the copula of two or three species of Coccinellidae we find that the lateral lobes occupy a purely external position on the venter of the female.

Family ENDOMYCHIDAE.

Forms examined: *Endomychus coccineus* L., England. *Eumorphus* aff. *profani* (Brit. Mus. Coll.) and *E.* aff. *tetraspiloti* Hope, both from Borneo. Also *Trochoideus desjardinsi* Guér., Malay Arch., which is usually, though we think erroneously, placed in *Endomychidae*.

Figs. 113, 114, Pl. LXI; 185, 185*a*, Pl. LXX. And *Trochoideus*, figs. 184, 184*a*, Pl. LXX.

Endomychus coccineus (Pl. LXX fig. 185).

Median lobe well chitinised, tubular, curved and slightly twisted laterally, the ventral edge of the lobe projecting far beyond the dorsal edge, thus making the median orifice on the dorsal face at apex. Internal sac short, the basal part generally protruding through the orifice, with a stout flagellum arising (*fg*) from the apex. Tegmen in form of a small cap-piece (*a*) on dorsal aspect of median lobe, with a broad irregular strut (*b*) on ventral face.

Eumorphus, sp. aff. *profani* (Pl. LXI fig. 113).

Median lobe a strongly chitinised, irregular tube with the median orifice at apex and the median foramen at base. On the ventral face of median orifice project two large spines, the smaller one nearer the orifice; the orifice is closed by the folding over of a part of the side of the internal sac. Tegmen consists of an irregular, chitinous ring-piece in which there is no division between basal-piece and lateral lobes. Internal sac complex, consisting of a large bilobed process at the base of the sac, bearing several tufts of short, stout hairs, and a small, tubular, invaginate portion, also bearing stout hairs.

In *Eumorphus*, sp. aff. *tetraspiloti*, the process (*a*) is trilobed and is shown expanded in fig. 114 Pl. LXI, the tubular portion (*c*) being still invaginated and the armature at apex (*b*) is membranous. In this species there is only one spine on median lobe, but the projection of the lip is subspinose.

Trochoideus desjardinsii (Pl. LXX figs. 184, 184*a*).

Median lobe tubular with median orifice at apex and median foramen at base, the ventral edge of the median orifice projecting beyond the dorsal edge; a deep constriction about one-third from the base. Internal sac small, armature not examined. Tegmen forming a large, nearly parallel-sided cap-piece on the dorsal aspect, the lateral edges curving dorsally, enveloping the sides of the median lobe, on the ventral face is a thin curved strut. On each side of the cap-piece, about one-third from its apex arise a bunch of curved hairs which cling together and have the appearance of being free lateral lobes.

This form does not fit in with the typical Endomychids, and should not be associated with them.

The Endomychidae, through *Endomychus coccineus*, show some affinity to such forms as *Mycetaca*, there being a tendency towards the reduction of the tegmen to an irregular ring-piece at the base of the median lobe, and to a strong chitinisation of the irregular median lobe; but there is room for much discussion as to these Endomychid forms.

Family MYCETAEIDAE.

Form examined: *Mycetaca hirta* Marsh., England. Fig. 115 Pl. LXI.

M. hirta (fig. 115).

Median lobe irregularly curved, laterally flattened and expanded at apex, where the median orifice is situate; median foramen at base. Tegmen forming a ring-piece, the dorsal cap being broad, short and bilobed at apex, the ventral portion of the ring being produced into a strut. Internal sac undifferentiated.

This type approaches the more generalised Coccinellidae and Endomychidae.

Family LATHRIDIIDAE.

Forms examined: *Lathridius lardarius* Deg., England. *Corticaria pubescens* Gyll., England.
Figs. 116 and 117 Pl. LXI.

Lathridius lardarius (Pl. LXI figs. 116, 116*a*).

Median lobe small with median orifice at tip and median foramen at base. Tegmen forming a large cap-piece, the distal part formed of the consolidated lateral lobes, curved and pointed. The basal-piece large, curved, and the basal corners produced into two short struts (*s*). Internal sac undifferentiated.

Corticaria pubescens (Pl. LXI figs. 117, 117*a*).

Median lobe short, with large median orifice which nearly divides it into a dorsal and a ventral plate, a median strut (*ms*) proceeds from the dorso-basal edge. Tegmen forming a small ring with a large strut (*tg*) on the ventral side. Internal sac large, covered with stout chitinous hairs.

We cannot place this type near to any other in the present defective state of our information. *Corticaria* and *Lathridius* are so distinct that they can hardly be retained in one family.

Family ADIMERIDAE.

Form examined: *Adimerus crispatus* Sh., St. Vincent.
Fig. 118 Pl. LXII.

A. crispatus ? (fig. 118).

This is a trilobe form with well developed median lobe with median orifice at apex; lateral lobes embracing the sides of the median lobe; a large basal-piece, chitinous on ventral side. Internal sac undifferentiated. It approaches the Mycetophagidae and the *Enarsus* portion of the Colydiidae. The organ is very minute.

Family AGLYCYDERIDAE.

Forms examined: *Aglycyderes setifer* Woll., Canary Islands. *A. wollastoni* Sharp, New Zealand.
Fig. 119 Pl. LXII.

A. setifer (Pl. LXII fig. 119).

Median lobe tubular, slightly curved and twisted; median orifice at tip, the edge membranous without demarcation between it and base of internal sac; median foramen at base, the lateral edges being produced into two median struts (*ms*). Tegmen forming ring round median lobe, the dorsal part being in form of a large, nearly parallel-sided cap, blunt at apex; on the ventral face the ring is produced into a single terminal strut (*tg*). Internal sac short and with what appears to be a spine on its base (*a*).

In *A. wollastoni* the median lobe is shorter and stouter, the median orifice forming a narrow horizontal slit across apex. The tegmen is more slender at the base of the cap and the ring and ventral strut curved.

Family PROTERHINIDAE.

Forms examined: *Proterhinus validus*, *P. ferrugineus*, and *P. gigas*, Hawaiian Islands.
Fig. 120 Pl. LXII.

P. validus (Pl. LXII fig. 120).

Median lobe tubular and very slightly curved, the membrane at the median orifice extending basally nearly dividing the chitinous part into a dorsal and a ventral sclerite, the edges of the orifice produced into a dorsal and a ventral point, the ventral one being the longer and curved; median foramen at base, the lateral edges prolonged into two long median struts (*ms*). Tegmen forming a ring round the median lobe, the dorsal cap being large, nearly parallel-sided and blunt at apex. Internal sac small.

P. ferrugineus is similar to *P. validus*, but the ventral edge of the median orifice is produced into a longer and narrower point.

The families Proterhinidae and Aglycyderidae are hard to separate. In both cases there are only three joints to the tarsi, the third one having a small piece constricted off at the base, but it is not a true joint. The "beak" in the female *Proterhinus* varies in the different species and the head of *A. setifer* and *A. wollastoni* differ. The presence of wings in *Aglycyderus* but not in *Proterhinus* is the only distinct difference we can point to at present.

Family MYCETOPHAGIDAE.

Form examined: *Mycetophagus quadripustulatus* L., England.
Fig. 110 Pl. LX.

M. 4-pustulatus (Pl. LX fig. 110).

Median lobe large, flattened and pointed at tip, the basal angles being prolonged into a pair of median struts, median orifice at tip on ventral face. Lateral lobes large, flattened, enveloping the basal part of median lobe. Basal-piece large, chitinous on ventral face, membranous on dorsal. Internal sac undifferentiated.

Apparently a trilobe form with mobile median lobe. Cf. Dermestidae, and *Thymalus* in Trogositidae.

Family DERMESTIDAE.

Forms examined: *Dermestes murinus* L., England. *Anthrenus claviger* Er., England.
Fig. 121 Pl. LXII.

D. murinus (Pl. LXII fig. 121).

A modified trilobe form, with long, slender median and lateral lobes, the median orifice near tip on ventral face, and the median foramen at base, where the edge is extended on each side into a short median strut (*ms*); the point of articulation is on the dorsal aspect. Basal-piece small, and fitting over the base of lateral and median lobes. Internal sac undifferentiated.

Anthrenus claviger.

Has a thin curved median lobe with two median struts, with broad lateral lobes, rounded at tips, much longer than the median lobe. Basal-piece somewhat as in *D. murinus*.

This is a trilobe form, and may carry with it *Ectrephes* and *Ptinus* qq. v.

Family BYRRHIDAE.

Form examined: *Byrrhus gigas* Fabr., Alps.

B. gigas.

Of the simple trilobe type. Median lobe chitinous along the dorsal aspect, the apex of which is cleft, each point flattened and slightly twisted; struts at base very short; median orifice supported by a very attenuated chitinous ring, the ventral margin prolonged into a sharp-pointed lobe, supported on the ventral face by a narrow chitin plate. Lateral lobes well developed, their bases meeting on dorsal and ventral aspects, and thus enveloping the median lobe, their apices pointed; point of articulation on the dorsal aspect. Basal-piece triangular. Internal sac undifferentiated.

This is very like *Hydrophilus.*

Family CHELONARIIDAE.

Form examined: *Chelonarium zapotense* Sharp, Guatemala, and *C. errans* Sh.

Chelonarium zapotense (Pl. LXII figs. 122, 122*a*).

This is a highly specialised trilobe form. Median lobe short, stout, highly chitinised; the ventral side being drawn out into two long median struts. To the ends of these struts is articulated a median process, bilobed at the base, slender in the middle and divided into two long, slender, flat, bent, distal processes (*a*). Lateral lobes small, rounded at apex and curved. Basal-piece formed by a large sclerite on the ventral aspect, with lateral and basal edges curved up; dorsal side membranous. Internal sac undifferentiated.

C. errans is exactly the same type, but some details are different (*i. e.* the slender process (*a*) from the ventral aspect is single).

Family CYATHOCERIDAE.

Form examined: *Cyathocerus horni* Sh., Central America. Figs. 123 and 123*a* Pl. LXII.

C. horni (Pl. XLII figs. 123, 123*a*).

Median lobe long, thin and crooked, with median orifice at apex and median foramen at base on dorsal aspect. Tegmen forming sheath with the distal end cleft along the dorsal aspect, but without division between lateral lobes and basal-piece. Internal sac undifferentiated.

The tegmen of this comes near to the Trogositidae, but the median lobe is quite unique so far as we have observed.

Family GEORYSSIDAE.

Form examined: *Georyssus pygmaeus* Fabr., England. Fig. 124 Pl. LXII.

G. pygmaeus (Pl. LXII fig. 124).

Trilobe form, flattened horizontally. Median lobe flattened, pointed at tip. Lateral lobes flattened, rounded at apex, concave along the inner edge so that the median lobe can fit into the concavity, and so become nearly hidden. Basal-piece large, chitinous on ventral face, membranous on dorsal. Sac not examined.

This is a trilobe form, and reminds one of some of the Gyrinidae. It cannot be placed with *Cyathocerus*.

Family HETEROCERIDAE.

Form examined: *Heterocerus flexuosus* Steph., England. Figs. 125 and 125*a* Pl. LXIII.

H. flexuosus (figs. 125, 125*a*).

Median lobe large, chitinous on ventral and lateral faces, membranous on dorsal, produced into short bilobe strut (*ms*) at base, the apical point slightly turned aside. The internal sac appears to be permanently everted and, when at rest, twisted up on the dorsal face of the median lobe. Tegmen forming a large cap on dorsal aspect of median lobe, produced into a broad strut at base, slightly emarginate at apex, and the lateral edges turned down and enveloping the side of the median lobe, but only connected by membrane (*m*) on the ventral aspect.

Family PARNIDAE (= Dryopidae of some).

Forms examined: *Pelonomus palpalis* Sh., Central America. *Parnus luridus* and other species, England. Figs. 126 and 127 Pl. LXIII.

P. palpalis (Pl. LXIII fig. 126).

Median lobe long, slender and slightly curved, the median orifice on ventral aspect near tip, base articulated to base of lateral lobe on dorsal aspect (*pa*). Lateral lobes large, pointed at tips, and slightly curved, the bases meeting on dorsal and ventral sides. Basal-piece, forming a large sclerite on ventral face, with its edges turned up along sides and base, meeting together where lateral lobes are articulated. Internal sac undifferentiated.

In the genus *Parnus* the lateral and median lobes are very small, the basal-piece large, and forming a long chitinous and slightly curved tube. The internal sac undifferentiated. Figs. 127 and 127*a* Pl. LXIII, are of *P. luridus*. It has a curved chitinous spine (*c*) on the ventral aspect of the median orifice.

Family DERODONTIDAE.

Form examined: *Laricobius erichsoni* Ros., Macugnaga. Fig. 128 Pl. LXIII.

Laricobius erichsoni (Pl. LXIII fig. 128).

Trilobe form. Median lobe large, fairly wide, and pointed at tip, formed of a large chitinous sclerite on dorsal aspect, membranous on ventral face; median orifice on ventral aspect before tip. Lateral lobes large, round at tips, excavate at base on inner side where they envelop the base of the median lobe. Basal-piece large, formed by a shield shape sclerite on ventral aspect, emarginate at base, and membranous on dorsal face. Internal sac undifferentiated. Closely allied to *Mycetophagus* q.v.

Family CIOIDAE.

Forms examined: *Cis boleti* L. and *C. nitidus* Herbst. England.
Figs. 129 and 129*a* Pl. LXIII.

Cis boleti (Pl. LXIII figs. 129, 129*a*).

Median lobe long, slender and tubular, with median orifice at apex. Lateral lobes of tegmen forming a large plate on the ventral aspect, turned up along the lateral edges, and the distal end flattened and slightly expanded, forming a median, emarginated process and a rounded process on each side of it; basal-piece small, chitinous on the ventral aspect. Internal sac not dissected out, but apparently not differentiated.

C. nitidus is on the same plan, but the large plate formed by the tegmen is cleft down the distal half.

The ventral aspect of the tegmen is an important feature of this family.

Family SPHINDIDAE.

Forms examined: *Sphindus dubius* Gyll., Brockenhurst. *Aspidiphorus orbiculatus* Gyll., Brockenhurst.
Fig. 130 Pl. LXIII.

Aspidiphorus orbiculatus (Pl. LXIII fig. 130).

Median lobe large, cylindrical and curved, the base drawn out on dorsal face into a wide strut (*ms*), bifurcate at end; median orifice at apex on dorsal face. Tegmen forming a ring with large cap on dorsal face; cap curved and pointed at apex. Internal sac small, with armature at apex.

In *Sphindus dubius* the tegmen forms a ring with a large cap-piece; the median lobe is produced at the base on dorsal face into a wide strut, bifurcate at end. Internal sac complex at apex.

At present we can only place this form near Phalacridae, etc., but the association is a forced one.

Family BOSTRICHIDAE.

Forms examined: *Apate terebrans* Pall., Africa. *Schistoceros cornutus* Pall. (= *Bostrichus migrator* Sharp, teste Lesne), Hawaiia.

Apate terebrans (Pl. LXIII fig. 131).

Median lobe large and flattened horizontally with two struts at the base (*ms*) turned up and pointing distally; median orifice near tip on ventral aspect; membranous (*m*) at the tip on dorsal face along the sides, and ventrally along the middle, except round the median orifice. Tegmen forming a small curved plate on ventral aspect, with the distal corners produced into strong curved hooks (*a*) which grip the edges of the median lobe and act as a guide through which it moves; basally they are produced into a pair of strong struts (*s*). Internal sac undifferentiated.

Schistoceros cornutus appears to be more simple (no description has however been made of it).

Family LYCTIDAE.

Forms examined: *Lyctus canaliculatus* Fabr., England. *L.* (*Minthea*) *rugicollis* Walk., Manila. *Tristaria grouvellei* Reitt., Australia.
Figs. 132 and 132*a* Pl. LXIII.

Lyctus canaliculatus (Pl. LXIII figs. 132, 132*a*).

This appears to be a trilobe form, with a long, thin median lobe pointed at apex, and long lateral lobes, flattened laterally, the basal part of the median lobe is curved upwards and is articulated to the base of the lateral lobe. The basal-piece consists of a thin chitinous plate encircling the base of the lateral lobes, very narrow dorsally and wider ventrally. Internal sac undifferentiated.

Lyctus rugicollis.

In this the aedeagus is much shorter as regards the lateral and median lobes, but the basal-piece is longer and more pointed.

Tristaria grouvellei is quite of the same type as *Lyctus.*

Obs.—The Lyctidae forms are of great importance, as they may not improbably show an alliance with the Colydiidae group. There may even be an approximation to the Caraboidea. An examination of a larger series of Bostrichidae is required before coming to a conclusion as to these forms. At present *Lyctus* appears very different from *Apate.*

Family PTINIDAE.

Forms examined: *Ptinus fur* L., England. *Ptilinus vectinicornis* L. and *Ernobius mollis* L., England.

Figs. 133, 134 and 134*a* Pl. LXIV.

Ptinus fur (Pl. LXIV fig. 133).

Median lobe long, thin and curved at the base with the point of articulation on the dorsal aspect; median orifice near tip on ventral face; median foramen at base. Lateral lobes long, narrow and asymmetrical, the right one being broadened out at tip, the left one more acute, basal-piece forming a small sclerite at the base of the lateral lobes, on the ventral side, its distal margin being deeply emarginate. Internal sac undifferentiated.

This type approximates to *Lyctus.* Note the peculiar connection of the bases of the lateral and median lobes.

Ernobius mollis (Pl. LXIV figs. 134 and 134*a*).

Median lobe asymmetrical, curved, tubular, flattened at apex and expanded and strongly curved at base dorsally, where it articulates with the bases of the lateral lobes. Lateral lobes asymmetrical, the left one is twisted and the point acute, with a narrow base running along the edge of the basal-piece; the right one has a rounded apex with a point below the apex, on the inner side, and the base is broad.

Basal-piece curved, and, together with the basal parts of the lateral lobes, forming a bulb enveloping the base of the median lobe. Internal sac very little differentiated, without armature.

Ptilinus pectinicornis is on the same type as *Ernobius*, but the median lobe is slender and symmetrical and has a slender rod-like piece arising from the base and along the dorsal face (as if there were two median lobes). Lateral lobes also slender and more symmetrical. Basal-piece forming, with the bases of the lateral lobes, a bulb which covers the base of the median lobe. Along the ventral side of the aedeagus lies a narrow sclerite, bilobed at tip; this appears to pertain to the body segments, and arises from the membrane connecting the aedeagus to the chitinous body wall (second connecting membrane).

These two are greatly modified trilobe forms, and their connection with such a form as *Ptinus fur* is easily conceivable.

Family ECTREPHIDAE.

Form examined: *Polyplocotes longicollis* Westw., Australia.

Fig. 135 Pl. LXIV.

This is a trilobe form. Median lobe long, slender and tubular; median orifice near apex; median foramen at base, where the edge turns up dorsally and articulates to base of lateral lobes. Lateral lobes long and thin, the rounded tips bearing hairs; the bases of the lobes touch both dorsally and ventrally; the inner side excavated and enveloping the base of the median lobe. Basal-piece small, forming a ring round the bases of the lateral and median lobes, the ring being widest on the ventral face. Internal sac undifferentiated.

This type approaches the *Dermestidae*; but note the intimate connection of the sclerites basally at one point.

Family MALACODERMIDAE. (s. l.).

Forms examined: *Dictyopterus* (or *Eros*) *aurora* Herbst., Scotland. *Lycostomus gestroi* Bourg., Sarawak.? *Metriorrhynchus thoracicus* F., New Guinea. *Cratomorphus diaphanus* F., Brazil. *Lampyris noctiluca* L., England. *Luciola vespertina* F., Pusa. *Phaenolis ochraceus* Gorh., Centr. America. *Drilus flavescens* Geoffr., England. Gen. n.? aff. *Chauliognathus*, New Guinea. *Silis ruficollis* Fabr., England. *Telephorus nigricans* Müll., *T.* (*Rhagonycha*) *limbatus* Th., and *testaceus* L., England. *Malachius bipus-*

tulatus L., England. *Anthocomus sanguinolentus* Fabr., England. *Balanophorus mastersi* Macl., Australia. *Danacaea denticollis* Baudi, Piedmont. *Melyris abdominalis* F., Africa. *Henicopus armatus* ? Lucas, Reynosa. *Psilothrix cyaneus* Ol., England. *Astylus fasciatus* Germ., Brazil. *Phlocophilus edwardsi* Steph., England.

Figs. 136–146 Pls. LXIV and LXV, also Fig. 186 Pl. LXXI relate to these forms.

Dictyopterus aurora.

Median lobe thin, flattened laterally and curved slightly upwards, there is a small spine on the dorsal face near the base. Lateral lobes broad, nearly as long as the median lobe, consolidated together for their basal three-fourths on dorsal face. Basal-piece shorter than the lateral lobes, chitinous on the ventral aspect only ; and there with a large emargination so that it articulates with the lateral lobes by two slender projections. Internal sac undifferentiated. This is a trilobe type with the lateral lobes consolidated and forming a cover on the dorsal aspect of the median lobe. The lateral lobes apparently exhibit great diversity in the Lycid division of the Malacoderms.

Lycostomus gestroi (Pl. LXIV fig. 136).

Median lobe long, thin, tubular, slightly dilated before tip ; median orifice at tip, the dorsal edge prolonged as a curved spine. Lateral lobes very small, firmly attached to base of median lobe. Basal-piece comparatively small. Internal sac undifferentiated.

Metriorrhynchus thoracicus (or an allied species) (Pl. LXXI fig. 186).

Median lobe long and slender, consisting of a narrow chitinous sclerite on the dorsal face, widened slightly on the distal half and coming to a blunt point, the sides slightly curved downward ; membranous on the ventral face. Median orifice on the ventral aspect near apex. Internal sac large and complex, stiffened by a narrow chitinous sclerite (*a*) along one side and bearing several large spines ; this sac is only partly invaginated in repose, the greater part being folded under and held flat against the ventral face of the median lobe. Lateral lobes forming two large globular and membranous pads with a comparatively small basal-piece.

Cratomorphus diaphanus (Pl. LXIV fig. 137).

Median lobe large, complex ; chitinous on the dorsal aspect and along the distal half, developed into a flange (*a*) on each side ; the basal part is turned up at a right angle (*b*), and articulated to the base of the lateral lobes (*pa*); the ventral face is membranous. Lateral lobes large, subtriangular, with a constriction dividing the apical third off from the rest; their base meeting on dorsal aspect at point of articulation ; there is a short spine (*c*) on the inner side of each of the lateral lobes. Basal-piece forming an asymmetrical ring-like sclerite, the sides of which do not meet on the dorsal aspect. Internal sac undifferentiated.

Lampyris noctiluca.

This is the same type as *Cratomorphus* and very similar to it in details.

Luciola vespertina.

In this the lateral lobes are consolidated to near their tips on the dorsal aspect ; the basal-piece is symmetrical, of the *Lampyris* type ; median lobe slightly bulbous at base. This comes somewhat near to *Drilus*, though more complex and specialised.

Phaenolis ochraceus.

This is the same type as *Cratomorphus*, but the flanges near the apex of the median lobe are not so large, and the bent basal part is shorter ; the lateral lobes are smaller, truncate, and have no constricted apical portion; the basal-piece is more slender and more asymmetrical. Internal sac undifferentiated.

Drilus flavescens (Pl. LXIV fig. 138).

Median lobe well developed ; the dorsal face chitinous, apex bluntly pointed ; a little before the apex there is a broad spine directed basally (*b*) ; base broader where it is articulated to the lateral lobes; the whole organ, basally of the spine *b*, evenly curved ; ventral face membranous, supported by a thin chitin strip along its whole length. Lateral lobes broad and truncate, consolidated together at their base on the dorsal aspect, widely apart on the ventral face. Basal-piece forming a wide chitinous piece extending from one lateral lobe to the other, the central part of the ventral face being membranous (*m*). Internal sac undifferentiated.

This is comparatively a very simple form, departing but little from the general trilobe type. In our figure (138) the lines marking the incision between the lateral lobes should extend further forwards, so as to indicate the point of articulation shown in 138*a*.

Chauliognathus? (Pl. LXIV fig. 139).

The median lobe formed of a chitinous plate on the dorsal aspect and membranous on the ventral, slightly curved. The tegmen consists of two asymmetrical curved, pointed lateral lobes, and a small basal-piece connecting them. Internal sac a simple dilatation of the ejaculatory duct.

The undifferentiated sac separates this from the other *Telephorus* forms; in this, as well as in the form of the aedeagus it reminds us of Lampyrid forms. There is nothing like this insect in the British Museum Collection. It is quite *Telephorus*-like in shape, but has a large, ivory-like area on the pronotum, reminding one of the pallid spaces of the luminous organs of *Lampyridae*, etc., but we have no reason for supposing it to be luminous.

Silis ruficollis (Pl. LXIV fig. 140).

Median lobe short, wide, somewhat cone-shaped, broader at the distal than at the basal end. Tegmen complex, being in the form of a shallow cup-like piece produced on dorsal aspect as two broad, truncate lobes (*ll*) which appear to represent the lateral lobes, and the dorsal edge prolonged as a ridge (*a*). Internal sac large and complex, with two diverticula at base on dorsal aspect studded with minute spines, and with long chitinous spines at apex. The basal part of the sac is not invaginated, only the apical portion.

Telephorus (*Rhagonycha*) *limbatus* (Pl. LXV fig. 141, 141*a*).

Median lobe well developed, bulbous in form, with the median orifice at distal end and a small median foramen at base. The tegmen is of a complex nature and forms a complete cover for the median lobe. There is a well developed basal-piece (*bp*) with two large, truncate lateral lobes, meeting together on the ventral aspect (*ll*); on the dorsal aspect is a large plate (*a*) projecting as a bilobed piece a little beyond the median lobe; this appears to be a development of the lateral lobes. The lateral edges of this plate are consolidated to the latero-dorsal portion of the median lobe; on each side is a second lobe which is connected with the dorsal plate (*a*) at its base. The median lobe thus has no movement apart from the tegmen. Internal sac large and complex.

Telephorus (*Rhagonycha*) *testaceus* belongs to the same type as *T. limbatus*.

Telephorus (*Rhagonycha*) *fulva* (Pl. LXXVIII figs. 237, 237*a*).

These two figures are intended to give an idea of the internal sac of the male, and its relation to the female parts during copula. A portion of the sac (*a*) bears small spines. *ut.* wall of female passage; *od.* oviduct.

Telephorus nigricans.

Of the type of *T. limbatus.* Median lobe slightly bulbous at base. Tegmen, forming a cover for median lobe, consisting of a plate slightly emarginate at the distal edge, with a pair of side lobes which are narrow; this appears to be formed by the lateral lobes and a well developed basal-piece. Internal sac large and complex.

Fig. 236 Pl. LXXVIII, was made to show the relations of the parts of the sexes in *Telephorus* during copula, and was probably made from this species, but the pair from which it was taken is unfortunately not to be found at present.

Malthinus.

Figs. 235 and 238 Pl. LXXVIII have been made to give an idea of the structures during copula. They were probably drawn from *M. flaveolus*: the pair has unfortunately been mislaid.

Malachius bipustulatus (Pl. LXV fig. 142).

Median lobe long tubular, slightly enlarged on the basal half where it is membranous on the ventral face. Tegmen consisting of a cap-piece on the dorsal face, the basal angles meeting together beneath the median lobe; the central part of the cap-piece (*m*) is membranous. The tegmen thus forms a ring-piece through which the median lobe passes. Internal sac not examined.

Anthocomus sanguinolentus is the same type as *M. bipustulatus.*

Balanophorus mastersi (Pl. LXV fig. 143).

This is a most abnormal type in which the tegmen appears to be reduced to a minimum; at present we cannot connect it with any other Malacoderm.

Median lobe large, the distal part tubular, the basal part bulbous. The dorsal and ventral faces are chitinous, with large membrane (*m*) between: the median orifice is at the distal end, and the median foramen small and situate on the ventral face of the basal end. The tegmen consists of a pair of very small lateral lobes situate on the ventral face of the median foramen. Internal sac large.

This perhaps functions in the same manner as so many Staphylinids in which the median lobe is bulbous; but we have only one specimen, and another examination of this and allied forms is desirable. A specimen of another brachelytrous Malacoderm from Larat (*Helcogaster*?) indicates that this form may prove to be connected with Telephorinae.

Danacaea denticollis (Pl. LXV fig. 145).

Median lobe tubular and curved; the median orifice at apex, its dorsal edge being drawn out into a point far beyond the ventral edge; median foramen at base, its ventral margin being emarginate, forming a cavity into which the base of the tegmen fits. Tegmen forming a "ring-piece," the dorsal part forming a small, truncate lobe or cap (the lateral lobes) bearing a few hairs; a thin strip proceeds from each basal angle of the cap-piece and the two strips meet together on the ventral side of the median lobe, thus forming a ring round the median lobe. The ventral (or basal) part of the ring-piece is raised into a knob which fits into the emargination at the base of the median lobe and is attached thereto by muscles, and the median lobe turns upon it when it is moved through the ring-piece. Internal sac large and complex.

Melyris abdominalis.

Median lobe tubular and slightly curved; the median orifice is at the distal end and extends some way along the tube as a narrow slit; median foramen at base. Tegmen forming a ring-piece, the cap being very slightly emarginate at tip and bearing a few long hairs. Internal sac large and complex.

Henicopus armatus?

Median lobe short, tubular, the basal part slightly enlarged, emarginate on dorsal face of median foramen where the tegmen is attached. The median orifice at distal end, the ventral edge produced into a point beyond the dorsal edge. Tegmen forming a strong ring-piece, the cap produced into two short lobes bearing hairs. Internal sac large, studded with long, strong, chitinous spines.

Psilothrix cyaneus (Pl. LXV fig. 146).

Is of the same type as *Henicopus*, the median lobe being thick, and produced into a short point on the ventral edge of the median orifice, the cap of the ring-piece is slightly bilobed. Internal sac large, studded with short chitinous spines.

Astylus fasciatus.

Has a long, slender, tubular median lobe, dilated a base where the tegmen is attached, the ventral edge of median orifice produced into a point. Tegmen long and narrow, the cap-piece being long and narrow, bilobed at tip. Internal sac long.

Phlocophilus edwardsi (Pl. XLV fig. 144).

Median lobe long, thin, slightly flattened, with two short median struts. Tegmen forming a ring with a large, flattish plate, extending basally on the dorsal side (*a*). This is an abnormal type and at present we cannot fit it in to any of the Malacoderm group.

The Malacodermidae consist certainly of more than one family, but as our review of them does not enable us to speak of the number or composition of the families, we have used the old, vague term. Some additional remarks on the subject will be found under the heading "Taxonomy."

Family CLERIDAE.

Forms examined: *Natalis porcata* Fabr., Australia. *Trogodendron fasciculatum* Schr., Australia. *Cylidrus* sp., New Guinea.

Figs. 147, 148 and 148*a* Pls. LXV and LXXVI.

Natalis porcata (Pl. LXV fig. 147).

Median lobe long, slender and membranous, supported by a chitinous strip down each side. These are prolonged into a pair of median struts. Tegmen sheath-shape, the division between lateral lobes and basal-piece obliterated. Internal sac undifferentiated.

Cylidrus sp., New Guinea.

Median lobe short, prolonged into a pair of long median struts. Tegmen sheath-shape without division between lateral lobes and basal-piece. Internal sac undifferentiated.

Trogodendron fasciculatum (Pl. LXVI figs. 148 and 148*a*).

Median lobe well developed, the median orifice at tip on ventral face; a pair of median struts expanded at their ends. Tegmen large and forming a sheath, deeply cleft on dorsal, and slightly on ventral face, but no line of demarcation between lateral lobes and basal-piece. Internal sac undifferentiated.

This type approaches Trogositidae.

Family LYMEXYLONIDAE.

Forms examined: *Atractocerus valdiviensis?* Ph., Chile. *A. africanus* Boh., Madagascar.
Figs. 149 and 150 Pl. LXVI.

Atractocerus valdiviensis? (Pl. LXVI fig. 149).

Median lobe short and bulbous, drawn out to a short point at apex where the median orifice is situate, base produced into two short median struts; median foramen at base. Tegmen forming a shallow concavity in which the median lobe rests, and consisting of two sclerites; a distal bilobed (lateral lobes) piece, with two struts encircling the median lobe and a curved basal-piece connected to the lateral lobes by a membrane (*cm* 1). The internal sac appears to be simple, which is exceptional when the median lobe is bulbous.

We speak with much hesitation as to this and the following owing to the bad preservation of the two individuals. The specimens of this genus are too often found to be in a disastrous state in collections.

Atractocerus africanus (Pl. LXVI, figs. 150, 150*a*).

Median lobe long and slender with orifice at apex and foramen at base. Lateral lobes complex, forming a pair of large complex lobes joined together on the ventral aspect where they form a medial square plate (*a*) deeply emarginate in the middle, and on the dorsal face continue as two flat sclerites which join together at their bases where the median lobes articulate (*pa*). The basal-piece forms a large shield-shaped plate on the ventral face, the distal corners prolonged into a pair of obtusely rounded projections. Internal sac undifferentiated.

The anus of this species opens at the end of a large tube, which lies over the aedeagus.

These two types differ from one another and do not approach to any of the other trilobe forms. We anticipate that they will prove to be of important bearing.

Family DASCILLIDAE.

Forms examined: *Ptilodactyla* sp., Brazil. *Dascillus cervinus* L., England.
Figs. 151 and 152 Pl. LXVI.

Ptilodactyla (not named in Brit. Mus.) (Pl. LXVI fig. 151).

A trilobe form. Median lobe well developed, tapering to a fine point at apex; median orifice on ventral aspect, forming a long slit along the basal half; two well developed median struts. Lateral lobes large, meeting at their bases both ventrally and dorsally, excavate on inner side so that they envelop the median lobe (in figure they are shown apart so as to expose the median lobe). Basal-piece large shield-shape, membranous on the dorsal aspect. Internal sac undifferentiated.

Dascillus cervinus (Pl. LXVI fig. 152).

Median lobe complex, consisting of two parts ; dorsally a large flat sclerite, bluntly rounded at tip with the sides turned down (*a*), with two short struts at base ; ventrally a smaller sclerite pointed and curved downward at tip (*b*) with a pair of basal struts and a strong raised piece in the centre at base (*c*); the ejaculatory duct opens at the base of these two sclerites. Lateral lobes large, curved, nearly meeting at their bases on ventral aspect, where they are articulated to the central raised piece (*c*) of the median lobe, but somewhat apart on the dorsal aspect, where they are articulated to the edges of the dorsal plate (*a*) near its base. Basal-piece well developed on the ventral aspect. Internal sac undifferentiated. When the median lobe is thrust forward during copulation the lateral lobes open laterally, the dorsal plate of the median lobe turns up dorsally, and the ventral piece turns ventrally, the median orifice then lies at the bottom of these organs.

The Dascillid male is a trilobe type and at present we cannot connect it with the Malacodermidae further than by the approximation that occurs in simple forms (cf. *Drilus* and *Dictyopterus*).

Family CYPHONIDAE.

Forms examined : *Microcara* (or *Helodes*) *livida* Fabr., England. *Cyphon coarctatus* Payk., England.
Figs. 187 and 188 Pl. LXXI.

Microcara livida (Pl. LXXI fig. 187).

When the aedeagus is extended there are nine distinct tergites, the anus lying below the ninth tergite ; the first two sternites are obscure and lie beneath the last coxae, the third being the first visible segment ; the eighth and ninth are distinct. The aedeagus comprises all the structures that lie between the anus and the ninth sternite. Basally the aedeagus consists of a large bilobed plate on the dorsal side, continued on the ventral side as a membrane (the tegmen) (*tg*) ; this ensheathes the median portion, which consists of a trilobed body, two lobes having dorso-lateral positions and the third a ventro-median one, this lobe is continued as a narrow, thin plate having a narrow edge of chitin ; the end of the ejaculatory duct (or undifferentiated internal sac) lies on this plate and has a wide opening on a membrane between the two dorso-lateral lobes.

This median portion we consider is the median lobe. In certain of the Dascillidae (i. e. *Dascillus cervinus*) the median lobe is represented by a pair of processes rising from the edge of the median orifice. The tegminal fold is quite distinct, separating the median or distal portion from the basal and outer portion, and it is highly probable that it is homologous to the same fold in other types.

Cyphon coarctatus (Pl. LXXI fig. 188).

When the aedeagus is fully drawn out the 8th and 9th abdominal segments are distinct, the tergites plain, and well chitinised with a strut from each posterior corner. The sternites not so well defined. The anus lies beneath the ninth tergite, and the structure between the anus and the ninth sternite is the aedeagus. This structure consists of a membranous tube with a very large orifice (median orifice), the opening of the ejaculatory duct or undifferentiated internal sac. On the dorsal side this tube is supported by a chitinous V or Y piece, on the ventral edge there are two curved chitinous hooks which are extended inwardly as a broad thin plate.

The homologies of this structure are difficult to make out, as owing to the absence of a distinct tegminal fold there is no guide. *Helodes* is the nearest type to which we can refer it. Considering the opening of the ejaculatory duct as homologous in these two forms then the curved hooks and plate would be equivalent to the lobes and plate of *Microcara* (*Helodes*) and the tegmen would not be represented at all. Until more Dascillid and allied forms have been studied this is the best explanation we can give, but we fully recognise its weakness.

By the structure of the undifferentiated internal sac, etc., we had considered it probable that copula did not take place in the usual manner in this form, but that it was possible that the female "ovipositor" was inserted into the large median orifice. An observation of the senior author adds strength to this supposition, but it needs more confirmation; any observations of the copulation of Dascillids, Cyphonids and their allies will be of interest, especially as to the part played by the "internal sac."

We hope that one of us may be able to elucidate this abnormal family by the aid of some of the larger and less delicate exotic forms, of which we should be very glad to receive examples.

Family RHIPICERIDAE.

Form examined: *Callirrhipis philiberti*, Seychelles.
Fig. 153 Pl. LXVI.

Callirrhipis philiberti (figs. 153, 153*a*).

Median lobe large, formed by a large sclerite (*a*) on dorsal face, narrow at apex which is slightly cleft, widening towards the base, which is continued into two median struts, and a slender chitin rod (*b*) on the ventral face, the sides being membranous. Lateral lobes large, pointed at apex, and widening at base where they consolidate together on the ventral face and just touch on the dorsal. Basal-piece large membranous on dorsal aspect and in the centre of ventral aspect and with a chitinous support round the ventral. Internal sac undifferentiated, but the duct is greatly enlarged just beyond the aedeagus (*ej*).

This is an Elaterid type.

Family ELATERIDAE.

Forms examined: *Agrypnus* sp. ? New Guinea. *Anisomerus hacquarti*, Mashonaland. *Chalcolepidius albertisi* Cand., Honolulu.
Figs. 154, 155 and 156 Pls. LXVI and LXVII.

Agrypnus sp. ? (Pl. LXVI fig. 154).

Median lobe formed by a broad sclerite (*a*) on dorsal face pointed at tip, and with two struts at base, and a small chitin rod (*b*) on ventral face, the sides membranous; median orifice large, on ventral aspect near tip. Lateral lobes large, enveloping the median lobe. Basal-piece well developed, membranous on dorsal face, and in centre on ventral face (*m*) with chitin (*bp*) round the edges. Internal sac undifferentiated, with dilated duct basal to aedeagus.

Anisomerus hacquarti (Pl. LXVII figs. 155 and 155*a*).

Asymmetrical trilobe form. Median lobe small, with median orifice at tip and two small struts at base. Lateral lobes large, the right longer and broader than left, consolidated at their basal part into a tube. Basal-piece very small. Internal sac undifferentiated, the duct dilated basal to the aedeagus.

Chalcolepidius albertisi (Pl. LXVII fig. 156).

Median lobe slender, chitinous above and on sides, membranous on ventral face; median orifice near tip on ventral face, base produced into two long median struts. Lateral lobes a little shorter than the median lobe, flattened horizontally and deeply cleft on outer edge about half way down (*a*) nearly dividing them into two pieces; their bases meeting on the dorsal aspect. Basal-piece very long and divided into two sclerites, one long V-shape (*b*), a more basally placed piece running round the basal edge (*c*); dorsal aspect membranous. Internal sac undifferentiated.

The aedeagus in Elateridae is as a rule a generalised trilobe type, becoming compressed and asymmetrical in *Anisomerus*. The division of the lateral lobes and basal-piece into two in *Chalcolepidius* is interesting. It is a more differentiated form of the family, which seems to be on the whole rather monotonous and uninteresting.

Family THROSCIDAE.

Forms examined: *Throscus dermestoides* L., England. *Lissomus bicolor* Chevr., Mexico.
Figs. 157 and 158 Pl. LXVII.

The aedeagus of this family is a tri-lobed form near to Elateridae. In *T. dermestoides*, fig. 157, the median orifice is on the ventral aspect near to the base and the basal-piece is large and well developed. In *Lissomus bicolor* (Pl. LXVII figs. 158, 158*a*) the basal piece is membranous (*m*) in the centre on the ventral aspect, and the chitin forms a ring; the median orifice is on a membrane on the ventral aspect of the broad, flattened median lobe. The internal sac is undifferentiated.

Family EUCNEMIDAE.

Form examined: *Hemiopsida mastersi* Macl., Australia.
Fig. 159 Pl. LXVII.

Median lobe short, forming a pointed, chitinous plate on the dorsal aspect, prolonged into two long median struts. Lateral lobes large, consolidated together at the base to form a tube, the distal ends spatulate and twisted. Basal-piece very small, forming a round sclerite on the ventral aspect. Fig. 159 shows the internal sac (*is*) partly protruding.

Near to the Elaterid type, but the detached, small basal-piece may prove to be distinctive.

Family BUPRESTIDAE.

Forms examined: *Euchroma goliath* Lap., Panama. *Chrysodema aurofoveata* Guér., New Guinea. *Cyphogastra* spp. ? New Guinea. *Polybothris quadricollis*, Madagascar. *Acmaeodera flavofasciata* P. and M., Pyrenees. *Stigmodera macularia* Don., Australia. *Belionota walkeri* Wat., New Guinea.

Figs. 160, 161 and 161*a* Pl. LXVII.

Chrysodema aurofoveata (Pl. LXVII fig. 160).

The median lobe consists of a strong chitinous dorsal plate, flat, almost parallel-sided, and pointed at apex, with a deep groove (*a*) running down each side of the ventral aspect; this ventral face is membranous, with the median opening some distance from the apex, and the base prolonged into two short median struts. Tegmen strong, highly chitinised and flattened horizontally, with the lateral lobes and basal-piece consolidated into one piece. Lateral lobes consolidated for a short distance from their base on dorsal aspect, and for some distance on the ventral aspect; long, nearly parallel-sided, their rather slender tips rounded, and bearing short spines and a couple of hairs. Along the inner sides of the lateral lobes runs a chitinous projection which fits into the groove (*a*) on the median lobe and acts as a guide when this moves in and out of the tegmen. Internal sac undifferentiated.

In fig. 160 the free apices of the lateral lobes are made to appear too short and blunt, and this defect is exaggerated by the exsertion of the median lobe.

Polybothris quadricollis (Pl. LXVII figs. 161 and 161*a*).

This is the same type as the last. Median lobe consisting of a flat dorsal plate, widest at the base and graduating to a point at apex, with a pair of median struts at base; median orifice on ventral aspect near tip. A little behind the median orifice there is a slender chitin rod attached to the ventral membrane, and projecting into the lumen of the median lobe, to which muscles are attached. Lateral lobes flattened, curving up to a point on the inner side of the apex, with basal-piece consolidated to lateral lobes. The coadaptation between lateral and median lobes is not so complete as in *Chrysodema*. Internal sac undifferentiated.

The Buprestidae differ from the Elateridae by the consolidation of the basal-piece to the lateral lobes and by the beautiful coadaptation between the lateral and median lobes to allow of median lobe being extended beyond the tips of the lateral lobes (fig. 160); and there is no point of articulation. At present the family appears to be well isolated.

The consolidation of the lateral lobes into one piece, with the inner faces beautifully coadapted to the sides of the median lobe is found in a high state of perfection in *Euchroma*.

Family TENEBRIONIDAE.

Forms examined: *Eleodes dentipes* Esch., California. *Chiroscelis digitata* Fabr., W. Africa. *Blaps similis* Latr., England. *Zopherosis georgii* White, Australia. *Stenosis angustata* Herbst., Corsica. *Cossyphus insularis* Cast., Sicily. *Pediris* sp. ? (not in Brit. Mus.) and ? *P.* ? *sulcigera* Boisd., New Guinea.

Figs. 162–170 Pl. LXVIII and LXIX, relate to Tenebrionidae; fig. 164 being that of a female structure observed in *Eleodes dentipes*.

Eleodes dentipes (Pl. LXVIII figs. 163, 163*a*).

Median lobe short with two large median struts; median orifice forming a longitudinal slit from apex to middle on the dorsal face. Lateral lobes consolidated together along their dorsal edges and forming a triangular plate with its edges turned under. Basal-piece forming a large sclerite on dorsal aspect, pointed at the base. Internal sac undifferentiated.

There is a structure in the female which is at present unique as far as our knowledge goes (fig. 164). The basal part of the oviduct is greatly dilated (*a*), a duct (*b*) which we take to be the duct of the spermatheca enters this dilatation and continues as a free coiled chitinous tube (*c*) which reaches the vulvular opening.

Blaisdell has described and figured both male and female organs of many of the American Eleodiini (Smithsonian Inst. U.S.N.M. Bull. 63, 1909).

Chiroscelis digitata (Pl. XVIII figs. 165, 165*a*).

Tegmen of the usual Tenebrionid type. Lateral lobes small, consolidated into a small triangular plate on dorsal aspect. Basal-piece large, curved, chitinous on dorsal, membranous on ventral, aspect. Median lobe small but distinct, with two median struts. Internal sac undifferentiated.

Blaps similis.

Is of the same type, the median lobe being small but distinct, the lateral lobes small, consolidated along the basal half, thus forming a triangular dorsal plate, split from the apex to half way to the base.

Cossyphus insularis (Pl. LXVIII figs. 166, 166*a*).

Of the usual Tenebrionid type, but the median lobe greatly reduced and forming a small membranous lobe on which the median orifice is situated. No differentiated sac.

Stenosis angustata (Pl. LXVIII fig. 167).

Median lobe well developed, with two median struts. Lateral lobes consolidated and forming a long, narrow, nearly parallel-sided ventral trough in which the median lobe lies, truncate and slightly curved at tip. Basal-piece forming a ventral trough-shaped sclerite, membranous on dorsal aspect.

The fact that the tegmen lies on the ventral aspect of the median lobe seems to differentiate this type from the former, but we here repeat that we have several times remarked as to the difficulty attending the orientation of the dorsal and ventral aspects of the aedeagus.

Zopherosis georgii (Pl. LXVIII fig. 168).

Median lobe long and narrow, chitinous at tip and along the sides, membranous along the median dorsal and ventral portions; median orifice near tip on dorsal aspect. Tegmen forming a large, nearly parallel-sided trough in which the median lobe lies, the distal half formed of the consolidated lateral lobes, truncate at tip and bearing fine hairs, the basal half formed of the basal-piece. Internal sac undifferentiated.

This type appears to come near to *Stenosis.*

Pediris sp.? (Pl. LXVIII fig. 162).

Median lobe thin and pointed, the tip curved slightly downward, the median orifice on dorsal face near base. Lateral lobes long, slender, studded with small spines along the distal half with the tips spatulate. The lobes are quite free but their lateral edges touch on the dorsal face (in fig. 162 they are parted to show their freedom). Basal-piece large, forming a ventral sclerite with its lateral edges turned in, the dorsal face is membranous (*m*), there are two sclerites in the middle of the membrane (*a*) whose distal ends are articulated to the base of the lateral lobe.

In a similar species from the same region (Geelvink Bay) the lateral lobes are short, consolidated together along their dorsal margins, and form a triangular plate in the characteristic Tenebrionid fashion.

Family RHYSOPAUSIDAE.

Form examined: ? *Rhysopaussus* sp. (not in Brit. Mus.) Australia.

Figs. 169, 169*a* Pl. LXVIII.

Tegmen of the Tenebrionid type. Lateral lobes consolidated along their dorsal edges, forming a triangular plate on the dorsal face with the lateral edges turned under. Basal-piece large, forming a large curved sclerite on the dorsal face, membranous on the ventral face. The median lobe is reduced to a mere small membrane on which the ejaculatory duct opens.

Family CISTELIDAE (Alleculidae of some).

Forms examined: *Omophlus lepturoides* Fabr., Rome. *Prostenus dejeani* Sol., Brazil. *Chromomaea* sp.? Australia.

Figs. 170, 171 and 171*a* Pl. LXIX.

Omophlus lepturoides (Pl. LXIX fig. 170).

This aedeagus is of the Tenebrionid type. Lateral lobes very small, consolidated into a small dorsal plate, pointed at tip and curved. Basal-piece very long and narrow, enlarged at base, chitinous on dorsal and membranous on ventral faces. Median lobe reduced to a small membrane on which the ejaculatory duct opens, at ventral edge there is a small two-toothed chitinous lobe with two long struts (*a*). Internal sac larger than the ejaculatory duct, but not highly differentiated.

Prostenus dejeani (Pl. LXIX figs. 171, 171*a*).

A regular Tenebrionid type; the median lobe is reduced to a mere membranous tongue on which the ejaculatory duct opens.

Chromomaea sp.

Is of the Tenebrionid type. Lateral lobes small consolidated into a small dorsal plate, expanded at tip, and beset with small spines pointing basally. Basal-piece long and curved. Median lobe very small.

In many members of this family the terminal body segments are highly modified to form claspers (*vide* Biologia Centrali-Americana, Champion, Vol. IV. pt. 1 pls. 17–20. On Pl. LXXVIII figs. 234 and 234*a* we have represented the abdominal structure of *Cistela atra*.

Family LAGRIIDAE.

Forms examined: *Lagria hirta* L., England. *L. grandis* Gyll., Australia.

L. hirta.

Of the Tenebrionid type. Lateral lobes consolidated, forming a very small triangular plate. Basal-piece long, narrow and curved, enlarged at the base. Median lobe reduced to a small membranous tongue.

Family OTHNIIDAE.

Form examined: *Othnius lyncea* Pasc., Ceylon.
Figs. 172 and 172*a* Pl. LXIX.

O. lyncea (Pl. LXIX figs. 172, 172*a*).

Median lobe short, pointed, with broad, curved strut (*ms*) from the dorsal, basal edge. Lateral lobes consolidated into a large pointed cap-piece, with its lateral edges turned under. Basal-piece large and curved. We are in doubt as to the dorsal and ventral aspects.

We meet here with a departure from the Tenebrionidae. The basal-piece is not preponderant, but the lateral lobes are large, and include the median lobe as a cap-piece rather than as a sheath. The structures in our specimen are very feebly chitinised and somewhat difficult to make out. The position the family occupies in the Munich Catalogue is better than one near Tenebrionidae. *Othnius* cannot go in the trilobe forms because of the hooding of the median by the lateral lobes. So that at present it appears least ill-placed in the loosely connected complex we have called Cucujoidea.

Family AEGIALITIDAE.

Form examined: *Aegialites debilis* Mann., Vancouver.
Fig. 173 Pl. LXIX.

Median lobe long, slender, tubular and membranous, supported along each side by a chitinous rod (*a*) which widens out at the base and forms a ring round the median foramen (*b*). Tegmen forming a large dorsal cap composed of two large sclerites, the distal one (lateral lobes) broad, curved and coming to a point at apex, bearing a pair of small lobes near its base, its basal angles are produced into struts which are attached to the base of the median lobe; the basal-piece of the cap consists of a large sclerite, broader at the base where it curves round the sides of the median lobe. Internal sac apparently elongate.

This type is near to *Pytho*.

Family MONOMMIDAE.

Forms examined: *Monomma giganteum* Guér., Angola; and sp., Penang.

Figs. 174 and 174*a* Pl. LXIX.

M. giganteum.

Median lobe long, thin and tubular; chitinous round the tip (*a*), with dorsal and ventral face supported by chitin strips. Internal sac undifferentiated. Lateral lobes large, joined together on the ventral aspect by a semi-chitinous connection, the tips truncate. Basal-piece half as long as the lateral lobes, forming a curved sclerite on ventral aspect. Fig. 174 is rather too broad.

M., sp. ?, Penang, is similar to *M. giganteum.*

We place this type with *Stenosis* and *Zopherosis* on account of the ventral orientation of the tegmen.

Family MELANDRYIDAE.

Forms examined: *Orchesia micans* Panz., England. *Phloeotrya rufipes* Gyll., England. *Melandrya caraboides* L., England.

Figs. 175, 176, and 177 Pl. LXIX.

Orchesia micans (Pl. LXIX fig. 175).

Median lobe long, thin, straight and membranous, supported by a chitin rod on each side, which flattens out at base and forms a pair of struts (*ms*). Tegmen consisting of a well-developed basal-piece produced to a long point in front (*a*), with a pair of long, thin lateral lobes. Internal sac undifferentiated.

Phloeotrya rufipes (Pl. LXIX fig. 176).

Median lobe very long and thin, supported along each side by a thin chitinous rod (*a*), these project at base as two struts (*ms*); median orifice at apex. Tegmen forming a short sheath, open at apical two-thirds (*b*) on ventral face, and produced into a long, narrow, parallel-sided, basal sclerite on dorsal face. Internal sac undifferentiated.

Melandrya caraboides (Pl. LXIX fig. 177).

Median lobe fairly short, membranous, supported on each side by a chitinous rod (*a*); median orifice at apex. Tegmen forming a sheath, chitinous above and membranous below. Internal sac undifferentiated.

It is impossible to place these with any satisfaction at present. The Melandryidae appear to be a family of transition; or it may be an unnatural association.

Family PYTHIDAE

Forms examined: *Pytho depressus* L., Scotland. *Rhinosimus ruficollis* L., England.
Fig. 178 Pl. LXX.

P. depressus (Pl. LXX fig. 178).

Median lobe long, slender and tubular, with basal third slightly enlarged. Tegmen forming large dorsal cap, as in *Aegialitidae*, the apical part being long, narrow and pointed at tip, the two lobes long and slender; the basal-piece convex. Internal sac undifferentiated.

Rhinosimus ruficollis.

Is of the same type; the median lobe being membranous and supported along each side by a chitin rod, the basal-piece is longer than in *P. depressus.* This species in some points approaches nearer to Aegialitidae.

Family PYROCHROIDAE.

Pyrochroa pectinicornis L., Scotland.
Fig. 179 Pl. LXX.

Median lobe long, somewhat flattened, produced into two struts at base (*ms*), with median orifice on dorsal side near apex. Tegmen consisting of consolidated lateral lobes (*ll*) on ventral face, meeting together on dorsal face at base, and a well-developed basal-piece. Internal sac undifferentiated.

The ventral aspect of the tegmen induces us to place this and *Trictenotoma* near together; and we associate them, as well as various other families of the "Heteromera," with Cucujoidea.

Family ANTHICIDAE.

Form examined: *Anthicus maritimus* Lec, California (named by Leconte with a query).
Fig. 180 Pl. LXX.

A. maritimus (Pl. LXX fig. 180).

Median lobe short, tubular, continued from the dorsal basal part as a single broad strut (*ms*) ; median orifice at apex, the chitinisation on the dorsal face (*b*) continuing on to the sac, ventral edge of orifice projecting beyond dorsal. Tegmen forming a large cap-piece pointed at apex with the basal lateral edges turned in to form a groove in which the median lobe plays ; from the base proceed a pair of divergent struts (*c*), consolidated at their bases. Internal sac undifferentiated.

The cap-piece without lobes and the undifferentiated internal sac induce us to place this also in Cucujoidea. The tegmen is however of peculiar form.

Family OEDEMERIDAE.

Forms examined : *Oncomera femorata* Fabr., England. *Copidita* (*Sessinia*) *punctum* Macl., Australia. *Dohrnia miranda* Newm., Australia.

Figs. 181, 182 and 183, Pl. LXX.

Oncomera femorata (Pl. LXX fig. 181).

Median lobe long, pointed and flattened laterally, bent up at the base, where the dorsal and ventral edges of the median foramen project, the ventral one being flattened out and serving for the attachment of muscles ; median orifice on ventral face near tip ; on each side near tip there is a stout, sharp spine. Tegmen consisting of a plate coming to two points at the distal end, and T-shape at base, the arms of the T curving up and embracing the median lobe ; the first connecting membrane attaching the median lobe to the T-shape piece of tegmen. Internal sac undifferentiated.

Copidita punctum (Pl. LXX fig. 182).

This is on the same plan as *Oncomera*, but the tegmen is round at the apex with a slight indentation at its tip and two small recurved spines a little before the tip, on the dorsal aspect.

Dohrnia miranda (Pl. LXX fig. 183).

Median lobe flattened laterally and pointed at apex, the median orifice being situate on the ventral aspect far from the apex Tegmen forming a large sheath, membranous or ventral (?) aspect and chitinous on dorsal (?). Internal sac undifferentiated. The position of the tegmen on the dorsal side of the median lobe does not agree with other Oedemeridae we have examined ; but this requires more detailed investigation.

The ventral aspect of the tegmen causes us to place this family on one side along with Pyrochroidae, etc. But we must recall our remark as to the difficulty of determining this point.

If it could be established that the tegmen is composed of a modified chrootic sternite, then this type might be the most primitive of the coleopterous aedeagi.

Family MORDELLIDAE.

Forms examined: *Anaspis frontalis* L., England. *Pelecotomoides conicollis* Cast., Australia. *Tomoxia biguttata* Gyll., New Forest.

Figs. 189, 190 and 191 Pl. LXXI.

Anaspis frontalis (Pl. LXXI fig. 189).

Median lobe slender, tubular and semi-chitinous, and with median orifice at tip. Tegmen consisting of a pair of pointed lateral lobes consolidated at their base, and a narrow, long basal-piece. The tegmen lies on the dorsal aspect of the median lobe, with a membranous connection on the ventral aspect. Internal sac undifferentiated.

This aedeagus does not approach either in structure or orientation the other forms we have examined among the Mordellidae. It is possible that it would find a better place near *Anthicidae.*

Pelecotomoides conicollis (Pl. LXXI fig. 190).

Median lobe long, slender and curved, median orifice near tip on ventral face. Tegmen consisting of a large, basal sclerite (*bp*) on the ventral aspect of the median lobe, with a pair of highly modified lateral lobes, in the form of crescents. Internal sac undifferentiated.

Tomoxia biguttata (Pl. LXXI, fig. 191).

Median lobe long, thin and membranous, supported by a chitinous rod along each side, which join together about the middle and continue as a single median sclerite. Tegmen consisting of a sheath-like sclerite and a flat sclerite bearing three irregular processes, the two sclerites being connected by a membrane. Internal sac undifferentiated.

We are not satisfied with our knowledge of this family and hope it will be shortly increased. The orientation of the tegmen causes us at present to put it, as exceptional, along with Oedemeridae.

Family RHIPIPHORIDAE.

Form examined : *Emenadia* sp. ? Australia.
Fig. 192 Pl. LXXI.

Median lobe long, slender, membranous, supported by a thin chitin rod on each side which meet together at the base. Tegmen of the Mordellid type. Internal sac undifferentiated.

This is the same type as Mordellidae (excl. *Anaspis*).

Family CANTHARIDAE = MELOIDAE.

Forms examined: *Tegrodera erosa* Lec., California. *Cissites* (*Horia*) *debyi* Fairm., Borneo. *Nemognatha* sp.*
Fig. 193 Pl. LXXI.

Horia (*Cissites*) *debyi* (Pl. LXXI fig. 193).

Median lobe large, flattened laterally, and bent nearly at right-angles one-third from base, the whole organ being pistol-shape; median orifice at apex, and median foramen occupying the ventral base of basal third. Tegmen consisting of a large "tambour" shaped basal-piece, and a single median piece, rounded at the apex, representing the lateral lobes. Internal sac undifferentiated.

Tegrodera erosa.

Median lobe tubular, flattened laterally, with the median orifice on dorsal aspect at tip and median foramen occupying the ventral aspect of the basal half; on the ventral aspect near tip are two spines, one in front of the other. Tegmen composed of a large rounded and curved basal-piece and a pair of lateral lobes consolidated at their base. Internal sac small with a strong curved spine at its base.

Nemognatha sp.

Median lobe tubular with a large median foramen occupying the ventral aspect of the basal half. Tegmen with lateral lobes consolidated to tip, which is roundly bilobed, basal-piece large. Internal sac well developed, but without armature.

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* This specimen has unfortunately been lost ; only the dissection now exists.

Family TRICTENOTOMIDAE.

Form examined: *Trictenotoma thomsoni* Deyr., hab. ? Figs. 194 and 194*a* Pl. LXXII.

Trictenotoma thomsoni (Pl. LXXII figs. 194, 194*a*).

Median lobe long, thin and curved upward at the base; the apex chitinous, continued as a chitin strip along the ventral face, at the base this chitinous strip is a curved bar (*b*) which connects with the tegmen. Tegmen consisting of a well-defined basal-piece (*bp*) with a large sclerite (*a*) on the ventral aspect of the median lobe; near the base of the sclerite (*a*) arise two long thin lobes, spatulate at tips and hairy. The bars (*b*) from the median lobe are connected with the lateral basal edges of the large sclerite and form a spring which brings the median lobe back into position when the muscles are relaxed. Internal sac undifferentiated. The large sclerite may represent the lateral lobes of other forms, as it is closely connected with the basal-piece; in that case the remarkably long lobes (*ll*), are secondary differentiations, or appendages of the conjoined lateral lobes.

This is a beautifully constructed organ. It is a little like *Pytho*, but the orientation of the tegmen is reversed and in that respect approaches Pyrochroidae.

Family BRUCHIDAE (Lariidae of some).

Forms examined: *Bruchus rufimanus* Boh., England. *Caryoborus nucleorum* Fabr., Brazil. *C.* sp.? (not named in Brit. Mus.), S. America.
Figs. 195, 196 and 197 Pl. LXXII.

Bruchus rufimanus (Pl. LXXII figs. 195, 195*a*).

Median lobe tubular, with the dorso-basal margin produced into a parallel-sided strut (*s*), the median orifice being at the apex. Tegmen forming a ring-piece with a pair of lateral lobes on the dorsal aspect and a wide strut on the ventral aspect. Internal sac large with armature at the base closing the orifice, consisting of a curved spine (*a*) on the ventral face and a chitinous plate (*b*) on the dorsal.

Caryoborus sp.? (Pl. LXXII fig. 196).

Median lobe a flattened tube, with the ventral and dorsal edges of the median orifice pointed, the ventral one produced beyond the dorsal one, thus giving the orifice a slit-like shape on the dorsal face; the dorso-basal edge is produced into a single dorsal strut, chitinous on the outer edges (*ms*) and membranous down the middle (*m*). Tegmen forming a ring, with a large dorsal cap-piece slightly emarginate at tip, and a keel-like strut on the ventral aspect.

Internal sac long with two small pads (*a*) of chitinous short spines.

Caryoborus nucleorum (Pl. LXXII fig. 197).

Median lobe large, the distal two-sevenths forming a flattened tube, with the ventral edge of the median orifice pointed and projecting beyond the dorsal edge, the basal five-sevenths forming a large sclerite on the dorsal aspect. Tegmen forming a ring, with lateral lobes consolidated together forming a cap-piece, slightly emarginate at tip; at the base of the lateral lobes and consolidated to them there is a large, inflated semi-chitinised membrane (*a*) which is consolidated to the median lobe; this may represent a chitinisation of the first connecting membrane. On the ventral side is a Y with a long strut (*b*). Internal sac long, without complex armature.

This family comes within the Chrysomelid group.

Family CHRYSOMELIDAE.

Forms examined: As this is one of the most extensive divisions of Coleoptera, we arrange the species specially studied in thirteen groups.

1. ORSODACNINAE. *Orsodacne nigriceps* Latr., England.

2. DONACIINAE. *Donacia* (*Plateumaris*) *sericea* L., and *comari* Suffr., *D. bidens* Ol., *semicuprea* Panz., and *lemnae* Fabr., England.

3. SAGRINAE. *Mecynodera balyi* Clark, Australia. *Carpophagus banksiae* Macl., Australia. *Diaphanops westermanni* Schönh., Fremantle, Australia. *Polyoptilus* sp. aff. *erichsonii* (not in Brit. Mus. Coll.), Australia. *Sagra amethystina* Guér. var., W. Africa. *Sagra nigra* Ol., Assam.

4. TIMARCHINAE. *Timarcha geniculata* Germ., Asturias. *T. tenebricosa* Fabr., England.

5. CRIOCERINAE. *Crioceris asparagi* L., England.

6. CLYTHRINAE. *Labidostomis longimana* L., Istria. *Clythra laeviuscula* Ratz., Pyrenees. *Lachnaea palmata* Lac.? Pyrenees. *Saxinis saucia* Lec., California.

7. CRYPTOCEPHALINAE. *Cryptocephalus aureolus* Suffr. England. *C. asturiensis* Heyd.? Asturias.

8. EUMOLPINAE. *Eumolpus surinamensis* F., S. America. *Chrysochus pretiosus* Fabr., Bohemia. *Glyptoscelis cuprascens* Lec., California.

9. CHRYSOMELINAE. *Orina elongata* Suffr., and *O. speciosa* L., Piedmont. *Chrysomela sharpi* Fowl., Scotland. *Gastrophysa raphani* Herbst., Scotland. *Paropsis variolosa* Marsh.?, Sydney. *Phytodecta 5-punctata* L., Piedmont. *Phyllodecta vitellinae* L., and *P. vulgatissima* L., England and Scotland.

10. GALERUCINAE. *Diabrotica soror* Lec., California. *Galerucella* spp., England.

11. HALTICINAE. *Haltica coryli* All., England.

12. HISPINAE. *Spilispa imperialis* Baly ?, Australia. *Cephaloleia* sp. aff. *nigropictae* Baly ?, S. America.

13. CASSIDINAE. *Mesomphalia pascoci* Baly, Ecuador. *Aspidomorpha 4-maculata* Ol., Nyasaland.

Figs. 198 to 216 Pls. LXXII, LXXIII, and LXXIV, relate to these forms.

Orsodacne nigriceps (Pl. LXXII fig. 198).

Distal half of the median lobe forming a flattened tube, with the ventral edge of median orifice slightly cleft at tip, and projecting beyond the dorsal edge, the basal half formed of two long struts on dorsal aspect. Tegmen forming a ring-piece with cap divided at tip. Internal sac long, projecting much beyond the median foramen. A slightly chitinised cone at the apex carries the opening of the ejaculatory duct.

The two struts of the median lobe and the long sac place this nearer to the Longicorn type than to other Chrysomelidae.

Donacia sericea (Pl. LXXII figs. 199, 199*a*, 199*b*).

Median lobe large, chitinous, tubular and curved, with the median orifice at apex and the median foramen large, occupying the ventral face of the basal half (*mf*). Tegmen forming a ring-piece; on the dorsal side the cap forms a slender lobe with hairs at the tip on the ventral face. The strut forms a large keel. Internal sac large with complex armature at its apex. This armature consists of a pair of lateral curved plates (*c*) and a median process (*b*) through which the ejaculatory duct passes and opens on its tip, a chitinous block (*d*) supports the structure at its junction with the membrane.

D. comari.

Is very like *D. sericea* but the cap is divided at the tip. The armature on the apex of the internal sac differs in details (Pl. LXXII figs. 200, 200*a*).

D. bidens and D. semicuprea.

Aedeagus very like *D. comari*, but the armature on the sac is totally different (Pl. LXXIII, figs. 201 and 202).

D. lemnae.

Has the cap long and thin. The armature on sac is distinct from those described above (Pl. LXXIII fig. 203).

Carpophagus banksiae (Pl. LXXIII figs. 204, 204*a*).

Median lobe large, chitinous, tubular and curved; the median orifice at apex, the median foramen occupying the ventral basal half. Tegmen forming a ring-piece, with a very long lobe as cap. Internal sac large with complex armature at apex (204*a*) consisting of a pair of complex side lobes (*c*) and a slender median process (*b*) through which the ejaculatory duct passes and opens on its apex.

Mecynodera balyi.

Median lobe well chitinised, curved and fairly short, forming a flattish tube; the ventral edge of the median orifice projecting beyond the dorsal edge: median foramen large, occupying the ventral portion of the basal half. Tegmen forming a ring-piece, with large cap apically deeply divided and furcate; the median strut or keel on the ventral aspect, of median size. Internal sac not extending through the median foramen. Armature at apex of sac consisting of a slender median process on which the ejaculatory duct opens, two chitinous plates embedded in the membrane below the median process, and a Y-piece above also embedded in the membrane.

Polyoptilus sp.

This is very like *Mecynodera* but the cap is less furcate at the tip.

Diaphanops westermanni.

This is very like *Polyoptilus* sp.?; the cap is differently shaped, being broader distally and bearing there a small emargination; the armature at the apex of the internal sac (Pl. LXXIII fig. 205) consists of a slender process on which the ejaculatory duct opens (*a*) protected by a stronger and broader process above it (*b*), a broad plate (*c*) grooved along the centre supports the membrane below and another and smaller plate (*d*) supports the membrane above. *N.B.*—In the figure, (*d*) and its pointing line are imperfect.

Sagra amethystina (Pl. LXXIII figs. 206, 206*a*).

Median lobe well developed, chitinised, tubular and curved ; the ventral edge of the median orifice projecting beyond the dorsal edge, pointed but not cleft. There is a very long prolongation of the tegmen dorsally, and this is grooved along the middle, and has a short, narrow division at tip. Internal sac not projecting beyond the median foramen, which is large and occupies the ventral portion of the basal half of the median lobe. Sac complex in shape, with two sclerites on each side of the base (*a*—*a*) to support it ; armature at apex consisting of a slender median process on which the ejaculatory duct opens, with another brush-like process above it and chitinous sclerites supporting its base.

Sagra nigrita.

Of the same type as *Sagra amethystina ;* the armature at apex of sac consisting of a slender process on which the ejaculatory duct opens, protected by a wider and curved process above, broadened at the base where it is attached to the sac ; on each side is a patch of stiff hairs.

Crioceris asparagi.

Median lobe well developed and chitinised, with the ventral lip of the median orifice projecting slightly beyond the dorsal edge ; the median foramen occupying the greater part of the ventral surface of the basal half. Tegmen consisting of a small Y-piece and a moderate-sized strut, or keel, on ventral aspect, dorsal part entirely membranous and without any trace of prolongation as cap. Internal sac short with a strong chitin-piece at apex on which the ejaculatory duct opens.

Labidostomis longimanus.

Median lobe forming a well chitinised, short, nearly straight tube, slightly flattened on dorsal side of distal half, with the ventral edge of the median orifice projecting beyond the dorsal edge ; median foramen large, occupying the ventral aspect of the basal half ; a slight constriction divides the basal and distal halves. Tegmen consisting of a small shield-shaped-piece, keeled along the middle on the inner side, on the ventral aspect of median lobe, without traces of lateral lobes. Internal sac short, with complex chitinous armature which closes the median orifice. Stenazygos excessively elongate, many times longer than the whole insect.

Clythra laeviuscula (Pl. LXXIII fig. 208).

Median lobe well developed and chitinised, forming a tube, the distal half flattened on the dorsal aspect and bearing three keels, a median and a pair of lateral; the ventral edge of the median orifice coming to a small point but not projecting far beyond the dorsal edge; slightly constricted about middle; median foramen occupying the ventral aspect of the basal half. Tegmen in form of a shield-shaped sclerite, with the corners not meeting on the dorsal face, and no trace of prolonged cap. Internal sac small with complex armature consisting of a long chitinous flagellum (*a*) and a pair of strong, curved, chitinous spines (*b*). Stenazygos not investigated.

Lachnaea palmata.

In this species the median lobe is well developed, curved near the apex, but straight beyond. The armature on sac consists of a small spine-like flagellum and a pair of large spines, with a complex process closing the median orifice consisting of a plate bearing a median curved tongue and a pair of lateral, rounded plates. The tegmen is Y-shaped, the strut being slender and bifurcate at end.

Saxinis saucia.

Median lobe very slightly curved, with the ventral edge of median orifice pointed and extending slightly beyond dorsal edge; the median orifice closed by the armature on the sac. Median foramen occupying the ventral portion of basal half. Tegmen V-shaped.

Cryptocephalus aureolus.

Median lobe well developed and chitinised, the distal half being considerably flattened; the ventral edge of medium orifice drawn out to a fine, flattened point, with the tip curved downward, projecting much beyond the dorsal edge; median foramen occupying the whole of the ventral side of the basal half. Tegmen shield-shaped, with a keel along the middle of the inner side. Armature on sac not examined.

Cryptocephalus asturiensis ?

Of the same type as *C. aureolus*, but the ventral edge of the median orifice drawn out into a blunt point and not turned downward. Armature on sac complex, that at the base closing the median foramen; at the apex there are two broad, bifurcated spines and a flattened median sclerite, but no flagellum.

Eumolpus surinamensis (Pl. LXXIII figs. 207, 207*a*).

The apical third of the median lobe strongly curved and slightly flattened, the ventral edge of the median orifice pointed and projecting far beyond the dorsal edge, the basal two-thirds consisting of a broad curved piece on the dorsal side, the ventral part being occupied by the median foramen; between the distal third and the basal two-thirds there is a strong constriction. The tegmen consists of a Y-piece, with a long strut on the ventral aspect and only membrane on the dorsal, and without trace of cap-piece. Internal sac long, with apical armature consisting of a twisted chitin plate (*a*) through which the ejaculatory duct runs, and opens on its apical edge (207*a*). Beyond (basally) the sac the duct forms a long chitinous tube, four times the length of the aedeagus, and then enlarges somewhat so as to become a slender chitinous chamber.

This is very remarkable on account of the extreme elongation of the stenazygos. Apparently this part, which is at least four or five times as long as the eurazygos, is also made as slender as possible. It is difficult to say whether it is not rather an altered part of the eurazygos than a specialisation of the duct.

It may possibly function as a flagellum, invaginated during inactivity. A thorough examination of this structure and its function in Eumolpidae would be very interesting. In *Chrysochus pretiosus* this stenazygos (or pseudostenazygos) is quite as slender as in *Eumolpus*.

Glyptoscelis cuprascens.

Median lobe well developed and chitinous, bent at right angles about middle, the distal half forming a flattened tube, with the ventral edge of the median orifice drawn out beyond the dorsal edge and pointed; the median foramen placed on the ventral aspect of the basal half. The dorsal face of the basal half cleft down the centre making it into two struts. Tegmen forming a broad shield-shaped sclerite, the apex of the shield being attached to the median lobe and the wide part extending ventrally, not meeting on dorsal side of median lobe and having no trace of cap-piece. Sac and stenazygos not examined.

Orina elongata (Pl. LXXIII fig. 209).

Median lobe well developed and chitinised, curved, tubular, with the ventral edge of the median orifice drawn out to a point greatly beyond the dorsal edge, thus placing the median orifice on the dorsal aspect; median foramen smaller than in Eumolpinae, etc., occupying only the basal sixth of the ventral aspect. Tegmen consisting of a small V-shaped sclerite, not meeting on dorsal aspect and showing no trace of cap-piece. Internal sac of moderate size, with a strongly chitinised flagellum on which the ejaculatory duct opens.

Orina speciosa.

Median lobe forming a long, fairly slender tube, slightly curved; ventral edge of median orifice bluntly pointed, turned downward and projecting slightly beyond the dorsal edge, which is rounded and turned upward; median foramen occupying the ventral face of the basal sixth. Tegmen forming a V-piece, not meeting on dorsal aspect and without any trace of cap-piece. Internal sac nearly as long as the median lobe with a fairly thick flagellum arising from the apex, and through which the ejaculatory duct passes, nearly as long as the sac.

Gastrophysa raphani.

Median lobe very short and broad; the ventral edge of median orifice pointed and projecting beyond the dorsal edge; the dorsal edge forming a flat fold, or lid, over the orifice, thus giving it a horse-shoe shape. Tegmen forming a V-shaped piece on ventral aspect of the median lobe. Sac not examined.

Chrysomela sharpi.

Median lobe well developed and chitinised, with the ventral edge produced somewhat beyond the dorsal edge and rounded, the median foramen occupying about one-sixth of the ventral basal portion. Tegmen forming a semi-ring without trace of cap-piece. Internal sac large, with a curved, slender flagellum on which the ejaculatory duct opens.

Paropsis variolosa ? (from Sydney) (Pl. LXXIV figs. 210, 210*a*).

Median lobe well developed and chitinised and flattened horizontally; the ventral margin of the median orifice bluntly pointed and produced far beyond the dorsal edge, thus placing the orifice in a dorsal position; median foramen occupying one-sixth of the basal ventral portion, which is slightly constricted off from the distal five-sixths. The chitinisation of the dorsal edge of the median orifice is continued on to the base of the internal sac as two short broad strips (*a*). Tegmen forming a slender semi-ring-piece, with only a minute strut (*s*) and not meeting on the dorsal aspect. Internal sac large, bearing a strong, curved flagellum on which the ejaculatory duct opens. This form comes near to *Orina*.

Phytodecta 5-punctata.

Median lobe tubular and slightly curved; the lateral edges of the median orifice produced into two flattened, curved spines which curve over the orifice; median foramen occupying the ventral basal third. Tegmen V-shape. Internal sac nearly as long as the median lobe, bearing at its apex a curved flagellum slightly longer than the sac.

Phytodecta olivacea.

Is near to *P.* 5-*punctata*, but the lateral spines at the edge of the median orifice are greatly flattened, meet on the median ventral line, and curve downward, and are asymmetrical, the right one being produced into a short point on the outer side and the left rounded. Internal sac bearing a flagellum.

Phyllodecta vitellinae (Pl. LXXIV figs. 212, 212*a*, 212*b*).

Median lobe stout, tubular, constricted one-fourth from the base; the ventral edge of median orifice produced beyond the dorsal edge and bluntly pointed; median foramen occupying the ventral aspect of the basal fourth, on the dorsal aspect of the base is a deep emargination. Tegmen forming nearly a complete ring, but not quite complete on the dorsal face, no trace of cap-piece. Internal sac short, bearing armature in the shape of a flat, curved spine on each side (*a*) and a median complex plate (*b*).

We have examined several of two varieties that go under this name, a blue variety from Forres sand-hills and a southern one, with a bronzy green form; in these we find a constant difference in the shape of the emargination on the dorsal edge of the base of the median lobe, the northern variety has a round emargination (fig. 212*a*) and the southern a nearly parallel-sided emargination (fig. 212*b*). More extended observations on this species are greatly to be desired. We think it possible that there may be two.

Phyllodecta vulgatissima.

This is near to *P. vitellinae*, but the distal end of the median lobe is more flattened horizontally, and the constriction near base is not so deep. The armature on sac is on the same plan, but more complex and lies inside the median orifice, and when the sac is slightly evaginated entirely alters the appearance of the orifice.

Timarcha geniculata (Pl. LXXIV fig. 211).

Median lobe well developed and chitinised, the ventral edge pointed and produced a little beyond the dorsal edge, the dorsal edge forming a pointed strip over the orifice; median foramen occupying the ventral aspect of the basal third, the dorsal face being cleft, thus making it into a pair of struts (*ms*). Tegmen forming a ring-piece with a curved plate, or cap, on dorsal aspect, shallowly emarginate at tip, on the ventral aspect the ring-piece projects as a long strut (*b*). Sac large, with a slender flagellum (*fg*) rising from the apex.

The basal part of the median lobe being divided into two pieces, and the complete ring-piece with a cap on the dorsal side separate this genus from the Chrysomelinae. *C. tenebricosa* is of the same type, but the cap-piece is smaller in proportion. Hence we propose Timarchinae as a distinct subfamily. As Donaciinae and Sagrinae approximate this structure, the Timarchinae should be placed between them and Chrysomelinae.

Diabrotica soror.

In this Galerucid the median lobe forms a long, curved tube: the basal foramen extends ventrally for one-third of the length of the tube: at the distal extremity there is a short acumen, and the dorsal face of the tube is membranous for nearly one-third of the length. The tegmen consists of a pair of slender, nearly parallel and nearly contiguous rods, these diverge very abruptly, and then converge again a little so as to partially embrace the median lobe, but they are unconnected by chitin on the dorsal aspect.

Galerucella spp.

Agree with the above in respect of the tegmen; but the basal part of the median lobe is very different, the tube being more complete at the base, and provided there with a pair of hooks. These hooks also exist in *Galeruca tanaceti* and in *Lochmaea*. In the last-mentioned genus the median lobe is of highly irregular form, and instead of forming a single curve, the two extremities of the organ are curved in opposite directions (as occurs less markedly in *Haltica*).

So far as we can form an opinion as to the Galerucinae from the few forms examined, it would appear that their chief characteristics are (1) the indefinite delimitation of the median orifice, entirely dorsally placed and unprotected; and (2) the small tegmen, forming only delicate rods.

Haltica coryli.

Median lobe straight, tubular, somewhat flattened, ventral edge of median orifice produced into a point, projecting beyond the dorsal edge ; chitinisation of the dorsal edge forming three strips which close the orifice; median foramen occupying the ventral portion of the basal fourth. Tegmen Y-shape without traces of cap-piece. Internal sac fair size with armature that appears to be comparatively simple.

Although the aedeagus in Halticinae is much used for discriminating the species, we have not met with any satisfactory account of it; the sac, with its armature, the base of the median lobe, and the foramen, as well as the condition of the tegmen, being in fact almost entirely neglected.

Spilispa imperialis (Pl. LXXIV fig. 213).

Median lobe well developed and chitinised, strongly bent at about two-thirds from apex, bent up at right angles at the curve, with the median foramen occupying the ventral portion ; median orifice with ventral edge rounded and produced beyond dorsal edge. Tegmen T-shaped, with the forks of the T embracing the median lobe.

Cephaloleia sp. ? (Pl. LXXIV fig. 214).

Median lobe tubular, strongly curved, with ventral edge of median orifice pointed and projecting far beyond the dorsal edge ; median foramen occupying the ventral portion of the basal third. Tegmen Y-shape. Internal sac long, passing through the median foramen ; nature of armature not observed.

Mesomphalia pascoei (Pl. LXXIV figs. 215, 215*a*).

Median lobe long, thin, tubular and flattened slightly, curved nearly at right angles about one-fourth from base and deeply constricted ; median foramen occupying the ventral portion of the basal fifth ; ventral edge of median orifice pointed and projecting well beyond dorsal edge. Tegmen Y-shaped. Internal sac not large, bearing at apex a flattened tube like flagellum (*fg*), on which the ejaculatory duct opens, and a plate embedded in the sac below (*a*). The ejaculatory duct in this species is semi-chitinous, and forty-eight millimetres long.

Aspidomorpha 4-maculata (Pl. LXXIV fig. 216).

Median lobe stout, tubular and bent at forty-five degrees two-fifths from base ; median orifice with ventral edge bluntly pointed and only produced a little beyond dorsal edge ; median foramen occupying ventral part of basal fifth. Tegmen Y-shape. Internal sac without armature.

The Chrysomelidae form an interesting series of groups which further research will perhaps separate into distinct families. The most primitive type is *Orsodacne*, which approaches *Parandra*. We find forms wherein the tegmen is not divided, though it has a comparatively large cap (*Timarcha*), and others in which the median lobe becomes tubular, *Orina*, etc. Apparently a still more modified form is that in which the tegmen is reduced to a delicate Y or V-shaped piece. An overwhelming majority of the existing species belong to the divisions in which the tegmen is thus reduced (*Chrysomelinae*, *Galerucinae*, *Halticinae*). The modifications of the tegmen will probably be found of considerable assistance in the classification of this enormous group of Coleoptera.

Family CERAMBYCIDAE

Forms specially examined: *Parandra* sp. n.? New Guinea. *Mallaspis xanthaspis* Guér. ?, ? Colombia. *Aromia moschata* L., England. *Chloridolum dorycum* Boisd., New Guinea. *Gnoma ctenostomoides* Th., New Guinea. *Monohammus longicornis* Th., New Guinea. *Macrochenus guerini* White, ? N. India. And various others not calling for special remark.

Figs. 217 to 221 Pls. LXXV and LXXVI.

Parandra sp.? (probably undescribed) (Pl. LXXV fig. 219).

Median lobe somewhat flattened horizontally with dorsal and ventral edges of median orifice pointed, the orifice extending back some distance on each side; from the dorso-lateral edges of the base two flat, narrow struts are given off. Tegmen forming a ring with a pair of pointed processes, separate to near their base, on the dorsal aspect, and a median strut (*cs*) on the ventral aspect. Internal sac large, without armature.

Aromia moschata.

In this well-known insect (Pl. LXXV fig. 217), the sac is largely developed, and bears a complex armature near the apex (*a*).

Chloridolum dorycum.

This is similar to *A. moschata*, but the armature of the sac is even more complex, and is shown in some detail in figs. 218 and 218*a* Pl. LXXV. There is a deeply cleft chitinous plate (*ab*) bearing hair at the two extremities (*ac*); a large chitinous plate (*d*) with the sides curved up, and another plate (*e*) below it, and this is produced into a blunt median keel (*f*); there is a large diverticulum (*g*) as in *Aromia*. A considerable part of the sac is beset with small, chitinous teeth.

Among the forms of this large family that we have examined there is a great uniformity of type, the median lobe having the orifice at the tip and extending along the side, the sclerites on the dorsal and ventral aspects being separated by a membrane running along each side, from orifice to foramen; the base of median lobe prolonged into two struts; tegmen ring-shaped, with a divided projecting process, the division generally very deep; internal sac long, projecting into the body forwards beyond the median foramen in the state of repose.

It is in the great development of the sac, and the diversities in its armature that we must seek the peculiarities of the family. *Parandra*, so far as the genital tube is concerned, appears to be the lowest form; in it we have found no specialisation of importance. A general resemblance between the tube of *Parandra* and that of Cucujoidea is evident at first sight (compare *Parandra*, fig. 219 with *Cucujus*, fig. 97, or *Passandra*, fig. 96). In the section phylogeny we have shown reasons for supposing that this general resemblance may be deceptive.

We have examined various other Cerambycidae without finding anything to make it necessary to increase the length of this memoir by including them. But there is one point we must mention briefly. Bordas has pointed out that in certain Cerambycidae there appear to be present two ejaculatory ducts. In other words that the stenazygos is wanting. We also have observed this fact in *Gnoma* (Pl. LXXV fig. 220) and in some species of *Monohammus* (Pl. LXXVI figs. 221 and 221*a*).

That this fact is of much morphological importance is not clear to us. It may perhaps be due to the great extension of the sac (or eurazygos). And in fact in another closely allied species of *Monohammus* we have found a distinct stenazygos. The structure as it has appeared to us in *Monohammus longicornis* is shown in Pl. LXXV fig. 221, and in 221*a* where the sac is everted. It is then seen to be studded with small spines, and bears two diverticula, thus acquiring a singular resemblance to the head of a dog; and it will be seen that there is a short tube (a) into which the two ducts lead. In the absence of knowledge as to the development it is not advisable to attempt an explanation of this form, but it appears to be not improbable that it may represent the stenazygos. The student will in looking at this figure recollect that the part of the sac that is the more anteriorly placed is really the apical part; the sac in Cerambycidae being completely inverted, the junction of the ducts with the sac is really the apical, or distal, portion of the genital tube.

Family ANTHRIBIDAE.

Form examined: *Phlocobius alternans* Wied., India. Figs. 225 and 225*a* Pl. LXXVI.

Phlocobius alternans (Pl. LXXVI figs. 225, 225*a*).

Median lobe forming a short, flattened tube ; the ventral and dorsal edges of median orifice pointed, the ventral projecting beyond the dorsal, the orifice thus forms a slit extending back along the sides ; at the base the median lobe is prolonged into a pair of long, thin struts (*ms*). Tegmen forming a ring with dorsal cap-piece and a ventral strut, the cap-piece having a ridge across where it becomes more strongly chitinised, and at the tip bearing long hairs. Internal sac large, having a large diverticulum, and at its apex a membranous flagellum-like organ.

The few other Anthribidae that we have examined are all on the same type although the details differ.

Family CURCULIONIDAE.

Forms examined : *Eupholus chevrolati* Guér., New Guinea. *Polycleis plumbeus* Guér., S. Africa. *Brachycerus apterus* L., S. Africa. *Belus bidentatus* Macl., Australia. *Mecocorynus loripes* Chevr., E. Africa. *Sphenophorus obscurus* Boisd., Hawaiia.
Figs. 222, 223 and 224 Pl. LXXVI.

Eupholus chevrolati (Pl. LXXVI figs. 222, 222*a*).

Median lobe a short flattened tube, with ventral edge of median orifice projecting beyond dorsal edge, and pointed ; from each side of base projects a long median strut (*ms*). Tegmen forming a ring-piece with a pair of delicate, but quite distinct prolongations on the dorsal aspect, and central strut on the ventral aspect. Internal sac long, reaching beyond the ends of the median struts, with a stout, curved, spine-like flagellum at the apex and a large diverticulum (*a*) below it.

Polycleis plumbeus.

Median lobe well chitinised, tubular, slightly flattened and curved ; ventral edge of median orifice projecting beyond dorsal edge and bluntly pointed ; median struts small and slender, only half as long as the median lobe. Tegmen forming a ring-piece with a pair of small delicate projecting lobes on dorsal aspect and a slender central strut on ventral aspect. Internal sac contained within median lobe.

With the increased chitinisation of the median lobe there is here a reduction of the median struts.

Brachycerus apterus.

Median lobe forming a short flattened tube, with the ventral edge of median orifice projecting beyond the dorsal edge and pointed ; median struts large. Tegmen forming a ring-piece with lateral lobes consolidated into a cap-piece on dorsal aspect ; central strut on ventral aspect large. Internal sac long with armature which we have not examined.

Belus bidentatus (Pl. LXXVI fig. 223).

Median lobe forming a straight chitinous tube, with a pair of short median struts ; median orifice at apex. Tegmen forming a wide ring-piece with a long narrow cap-piece ; central strut large. Internal sac long, projecting some way beyond the median struts. A fine chitinous tube (*a*) projects through the apex of the sac, and ends in a membranous flagellum (*fg*) ; the chitinous tube (*a*) appears to have the power of being moved through the apex of the sac. The apex of the sac is supported by two crescent-shaped sclerites (*b*), one on each side of the tube. The dorsal and ventral aspects of the internal sac are supported by two chitinous plates from near the apex to the base.

The long, slender sac with the flagellum at the apex recalls the highly specialised flagella and long sacs of the Brenthids.

Sphenophorus obscurus (Pl. LXXVI figs. 224, 224*a*).

Median lobe forming a semi-chitinous tube, supported along each side by a chitin strip (*a*), the median orifice is at the apex on the dorsal face and is supported by a chitinous ring. From the basal ends of the lateral chitin strips proceed two median struts (*ms*). Tegmen formed of a semi ring-piece with a very strong central strut on the ventral face. A long first connecting membrane (*cm* 1) connects the tegmen to the median lobe, and a very long second connecting membrane (*cm* 2) connects the tegmen to the body wall; the basal part of this second connecting membrane (*cm* 2) is chitinised and forms a tube around the aedeagus; on the right of it is attached the "spicule" (*sp*). Internal sac large, without armature.

Obs.—We have examined various other Curculionidae without finding distinctions of great importance. But the various specialisations will probably prove to be of much assistance in the classification of this enormous complex. Comparison of the cap-piece of the tegmen in Attelabini, Rhynchitini and Brachycerini with long-rostrum-forms (*i.e.* probably higher) like *Mecocorynus* is suggestive of this.

Family SCOLYTIDAE = (Ipidae of some).

Form examined: *Tomicus* (*Ips* of some) *laricis* Fabr., England.

Fig. 226 Pl. LXXVII.

The male organs of many of this family were carefully figured and described by Lindemann * and again by Verhoeff.† It is a Rhynchophorous type. We figure *Tomicus laricis* (Pl. LXXVII fig. 226). Median lobe short and tubular, with a pair of slender median struts. Tegmen ring-shaped with a central strut on ventral side (*a*). Internal sac fairly long, with a thin membranous flagellum arising from the apex, supported by a couple of thin chitin rods (*b*).

We must refer workers in this group to Lindemann's above-mentioned paper for details of the various species.

The evolution of the tegmen in this family appears to be from a ring-piece with well developed lateral lobes, to reduction of the lateral lobes, the ring-piece being correlatively reduced into a small Y-piece on the ventral side of the median lobe. Cf. remarks on Chrysomelidae.

Family PLATYPIDAE.

Form examined: *Platypus* (*sp.*), Honolulu. *Crossotarsus barbatus* Chap., New Guinea.

* Bull. Soc. Imp. Mosc., Vol. XLIX (1875) No. 1.

† Archiv f. Naturgesch. 1896.

Crossotarsus barbatus (Pl. LXXVII fig. 228).

Median lobe forming a strong chitinous tube with the median orifice at the apex and the median foramen occupying the ventral basal third. Tegmen forming a Y-piece. Internal sac not examined.

Family BRENTHIDAE.

Forms examined: *Baryrrhynchus miles* Boh., India. *Arrhenodes funebris* Sharp, Panama.
Fig. 227 Pl. LXXVII.

Baryrrhynchus miles Boh. (fig. 227).

Median lobe forming a tube for the apical two-fifths, chitinous on dorsal and ventral aspects; the dorsal sclerite prolonged into two wide struts at the base (*ms*). Tegmen forming a ring, with a pair of large, rounded lobes, forming one piece basally, on the dorsal aspect and a long strut-like basal-piece ventrally. Internal sac long, projecting beyond the base of the median lobe, and armed with a long, slender, chitinous flagellum (*fg*, fig. 227) about 12 mm. long, and ·006 mm. in diameter towards its tip; the opening of the ejaculatory duct is at the tip of the flagellum.

We have examined various other Brenthidae, and as far as we have observed, this family is very uniform, differing in the size and shape of the cap-piece, of the median lobe, flagellum, etc.; but all possess the flagellum, and the division of the cap-piece is never missing. In *Baryrrhynchus robustus* Jek., the lobes are slender rods, bearing hairs at the tip, but are quite distinct.

Family LUCANIDAE.

Forms examined: *Chiasognathus granti* Steph., Chile. *Neolamprima adolphinae* Gestro, New Guinea. *Lucanus cervus* L., England. *Systenus* (formerly *Platycerus*) *caraboides* L., Bosnia. *Figulus marginalis* Rits., Borneo. *F. striatus* Ol., Seychelles. *Syndesus cornutus* Fabr., Tasmania. *Ceratognathus niger* Westw., Tasmania. *Mitophyllus irroratus* Parry, and *M. parryi* Westw., New Zealand. *Aesalus scarabaeoides* Panz., Europe. *Nicagus obscurus* Lec., N. America. *Sinodendron cylindricum* L., Brockenhurst.
Figs. 5–10*a* Pls. XLII and XLIII.

Ceratognathus niger (Pl. XLII fig. 5).

The median lobe is long, tubular, with median orifice at tip and small median foramen at base. Lateral lobes as long as median lobe, the basal half of each embracing the side of the basal half of the median lobe, the distal half narrow and curved. Basal-piece very small. Internal sac small with a large patch of long brown hair but no armature.

Mitophyllus parryanus.

Closely allied to *Ceratognathus.* Median lobe well developed, cylindrical, slightly constricted near the tip and rounded at the base ; median orifice at the distal end, membranous round the orifice and from there graduating off to strong chitin on the rest of the lobe ; small median foramen at base ; point of articulation on dorsal side. Lateral lobes twice as long as the basal-piece, reaching to the end, and embracing the sides, of the median lobe. Basal-piece about one-third the length of the tegmen, with small basal opening. Internal sac small, covered with fine brown hairs, but no armature.

Mitophyllus irroratus.

The basal-piece has quite disappeared, the lateral and median lobes as in *Ceratognathus*, but the basal parts of the lateral lobes entirely envelop the basal part of the median lobe. Internal sac small witb very dense covering of chitinous, elongate, pointed scales ; the ejaculatory duct long and coiled up in the median lobe so as to allow enough slack when the sac is evaginated. An important difference exists between this species and *M. parryanus.*

In these forms the muscles for working the median lobe are attached to its base, there being no median struts.

Syndesus cornutus (Pl. XLIII figs. 6, 6*a*, and 6*b*).

The median lobe is well developed, bottle-shaped, with the median orifice at the distal end and the small median foramen at the base (*mf*), around which the chitin is much thicker and stronger and supports the point of articulation and the attachment of two median struts. Lateral lobes broad at the base and bluntly rounded at the tips which reach slightly beyond the tip of the median lobe ; the bases of the lateral lobes embrace the sides of the base of the median lobe. Basal-piece large and shield-shape, membranous on the dorsal side. The internal sac without armature but very long (21 mm.) and doubled up in the median lobe. The median foramen is very small and it is not likely that the ejaculatory duct passes through when the sac is evaginated, consequently only half the sac can be evaginated.

This is a very interesting form, in connection with the question of the function of the flagellum generally. Does the portion of the sac that can be evaginated (to the extent of at least 10 mm.) act in a similar way to the highly developed flagellum of *Lucanus*?

Systenus caraboides (Pl. XLIII figs. 7 and 7*a*).

The median lobe is formed of a strong bilobed plate on the ventral side, with a ridge across each lobe (*a*, fig. 7*a*), the one on the right being larger than the one on the left; the dorsal side is membranous, except at the base round the small median foramen, where there is a ridge for the point of articulation (*pa*) and the attachment of the median struts. The lateral lobes are broad, short and truncate and embrace the basal sides of the median lobe, but do not meet either on the dorsal or ventral faces. The basal-piece is large, shield-shaped, with the edges turned up; the dorsal side being membranous. The internal sac is large and complex and is permanently evaginated and bears a short flagellum (*fg*) through which the ejaculatory duct passes to the orifice at the tip. When at rest the sac collapses upon itself and lies on the dorsal side of the median lobe, but under blood pressure swells out (fig. 7*a*).

Lucanus cervus (Pl. XLIII fig. 8) and *Chiasognathus granti*.

Are on the same plan as *S. caraboides*, but the flagellum is very greatly elongated.

Figulus marginalis.

Median lobe small, tubular and curved, with a pair of median struts consolidated along their basal half, the internal sac is fairly large and appears to be permanently everted and has no flagellum. Lateral lobes small. Basal-piece about twice as long as the lateral lobes, forming a slightly flattened tube; from the distal edge of the ventral side there is a small curved tongue which covers and hides the median lobe.

F. striatus.

Is of the same type but ha s a long flagellum. The question of these two species remaining in the same genus is doubtful. This type approaches *Sinodendron*.

Neolamprima adolphinae (Pl. XLIV figs. 10 and 10*a*).

Has a long, strong, cylindrical basal-piece, with small lateral lobes. The median lobe is small, thin and cylindrical, with two short broad median struts, and from the base proceed two long, flattened supports (*a*) that connect it to the lateral lobes. No differentiated internal sac.

Aesalus scarabaeoides.

Has a long, tubular median lobe, slightly curved; median orifice at distal end and median foramen at base. Tegmen consisting of a small ring-shaped basal-piece with narrow (almost hair-like) lateral lobes about two-thirds as long as the median lobe, and closely appressed thereto; these are all amalgamated at base and show no articulation. Internal sac not observed. This distinct form is worthy of more investigation. We have had only one example at our disposal.

Nicagus obscurus.

Since our paper was written Mr. Schwarz has kindly given F. Muir an opportunity of dissecting this problematic form, and he finds that it is a Lucanid, not a Scarabaeid. The description and remarks on its affinities must be published elsewhere.

Sinodendron cylindricum (Pl. XLIII figs. 9 and 9*a*).

The median lobe is small, curved, tubular and highly chitinised; the median orifice at the distal end; the median foramen, a long narrow opening along the ventral basal aspect; a pair of large median struts are articulated to the base; the point of articulation has a dorso-basal position. The lateral lobes are small, concave across the inner side (*a*) where the median lobe lies. The basal piece forms a large, strongly chitinised tube. The internal sac undifferentiated, the basal part (*b*) is always protruding from the median orifice.

In the Lucanidae there are several types of aedeagus, but they all differ from the Scarabaeidae in having a well-developed chitinous, exposed median lobe, and the internal sac is never developed to so great an extent as in the Scarabaeidae, unless we consider the flagellum as a modified sac. In that case the sac in the forms of the two families may be said to be very different.

In our taxonomical table we have suggested a division of Lucanidae into three families, Lucanidae, Lamprimidae and Sinodendronidae. This seems necessary if Trogidae are separated from Lucanidae. The alternative is to unite the five divisions, Trogidae, Scarabaeidae, Lucanidae, Lamprimidae and Sinodendronidae into a single family.

The diversity of these forms is in striking contrast with the homogeneity of Caraboidea, Rhynchophora, Cerambycidae.

Family TROGIDAE (fam. nov.).

Forms examined: *Trox omacanthus* Har., Pusa; *T. scaber* L., Brockenhurst; *T. suberosus* Fabr., Brazil; *T. penicillatus* Fåhr., Hedjaz; *T.* sp., Queensland; *T.* sp., N. Australia (these two not named in Brit. Mus. Coll.). *Glaresis beckeri* Solsky, Transcaspian. Also the following forms classified with the family but not really belonging to it, viz. *Cloeotus rugiceps* Germ., Rio de Janeiro; *C. sinuatus* Bates, Guatemala; *Liparochrus timidus* Arrow, N. Australia; *Anaides laticollis* Har., Mexico; *A. simplicicollis* Bates, Costa Rica; *Nicagus obscurus* Lec., N. America.—For *Cloeotus, Liparochrus* and *Anaides* vide Coprini in Scarabaeidae; for *Nicagus* vide *Lucanidae.*

Figs. 1, 2, 2*a*, 3, 3*a*, 4, 4*a*, Pl. XLII.

Trox omacanthus (Pl. XLII figs. 2 and 2*a*).

Median lobe broad, flattened and rounded at tip, with a slight depression down the dorso-median line; median orifice across the ventral face of tip, the dorsal tip projecting some distance beyond it. Lateral lobes broad and short, nearly meeting at their bases on the dorsal side, but well separated on the ventral side; tips pointed. Basal-piece well developed, membranous along the middle on ventral face, chitinous on dorsal face. Internal sac large, covered with short brown hairs; no chitinous armature. The testes of this species consist of six long, simple, sausage-shaped glands, attached by very short stalks to the ends of the long vasa deferentia, which are not coiled up in a bunch as in *T. scaber*, q. v.

Trox scaber (Pl. XLII figs. 3 and 3*a*).

Median lobe well developed, broad, flattened and truncate at the tip; median orifice on ventral face near base (*mo*), two long median struts (fig. 3*a*, *ms*) are articulated to the lateral edges of the base of the median lobe; point of articulation on dorsal side. Lateral lobes slightly longer than median lobe; pointed at apex, their bases nearly meeting on dorsal side, far apart on ventral side. Basal-piece forms a broad, flattened, chitinous tube, bent near the base. No differentiated internal sac.

It is of interest to note that the testes of this species are of a simple form. The vasa deferentia are very long and the ends of them coiled up into balls as in the Carabidae; situate near their extremity are six small, simple, globular glands attached to the vasa deferentia by slender, short ducts. These globular glands are simple and have none of the complex structures of such forms as *Melolontha vulgaris.*

Trox penicillatus (Pl. XLII figs. 4 and 4*a*).

This is similar to *T. scaber*, but more complex, especially the median lobe. There is no differentiated sac.

Trox sp. ? 1, N. Australia (Pl. XLII fig. 1).

Median lobe broad, flattened, curved and pointed at tip, with a little ridge running down the middle of the dorsal side; median orifice across tip on ventral side. Lateral lobes well developed, embracing the lateral edges of median lobe nearly to the tip, not meeting together at base either on dorsal or ventral side. Internal sac small but distinct, without armature.

Trox sp. ? 2, N. Queensland.

This is of the same type as *T.* sp. ? 1; the median lobe is broad, flattened and pointed at the tip; the median orifice situated across the tip, the lower pointed lip of which turns down when the sac is evaginated. Lateral lobes only embracing the sides of the median lobe and not meeting on either side at their bases. Basal-piece small, membranous on dorsal side, large at the sides where the lateral lobes are articulated and a narrow chitinous strip on the ventral side. Internal sac short, with curved chitin plate as armature.

Trox suberosus.

Similar type to *Trox* sp. ? 2, but the basal-piece is longer. Internal sac short, covered with fine soft hair, and on the ventral side with a curved chitinous plate which projects beyond the sac when evaginated.

Glaresis beckeri.

Median lobe large, well developed, with pointed tip turning up dorsally; membranous on ventral side; median orifice on ventral side near tip; point of articulation on dorsal side. Lateral lobes slightly longer than median, nearly meeting at their base on dorsal face; concave on the inner side and embracing the dorso-lateral part of the median lobe; tips bluntly pointed. Basal-piece as long as the median lobe, forming a broad, flattened chitinous tube bent downward near the base. Internal sac small with fine hairs, but no chitinous armature.

Remarks on *Trogidae*.—The chitinous large median lobe and the comparatively simple internal sac separate the Trogidae from the Copridae *s. b.*; *Cloeotus sinuatus*, with its small but distinct median lobe comes near to them, but its sac is large and of a complex shape as in other Copridae.

Such a form as *Trox* sp. ? No. 1, approximates to *Mitophyllus* and other allied Lucanidae, while *T. omacanthus* leans a little to the Passalid aedeagus. *T. scaber* approaches a little to the Sinodendron type, but very little.

The small family Trogidae is of great importance as regards the classification of the Scarabaeoid series of Coleoptera, and should receive a thorough anatomical study. We allude to it again under the heading "Taxonomy."

Family PASSALIDAE.

Forms examined: *Proculus opacipennis* Th. and *P. mnizechi* ? Central America. *Eriocnemus* sp. not in Brit. Mus., Mysol. *Protomocoelus* (*Pelops*) *gestroi* Kirsch, New Guinea. *Labienus ptox* Kaup, New Guinea. *Neleus* sp., Amazons. *Leptaulacides planus* and *L. vicinus* (in Brit. Mus. Coll.), Sarawak. *Aulacocyclus edentulus* Macl., and *A. teres* Perch., Australia.

Figs. 11, 12, 13 and 13*a* Pl. XLIV.

Leptaulacides planus (Pl. XLIV fig. 11).

Median lobe short and round, with median orifice at end and median foramen at base. Lateral lobes large, rounded at their tips and consolidated together to their extremity on the dorsal side, but still showing the line of junction; on the ventral side they meet together at their base where it is chitinous, and for some little way up where it is membranous (*m*). Basal piece small chitinous all the way round. Internal sac large, twice as long as the aedeagus, with patches of brown hairs.

Labienus ptox (Pl. XLIV fig. 12).

Median lobe very large and round, with the median orifice on the dorsal aspect. The lateral lobes are consolidated on the ventral side and the basal-piece forms a small sclerite placed ventrally, being membranous on the dorsal aspect. Internal sac about twice as long as the aedeagus, covered with fine light spines.

Aulacocyclus edentulus (Pl. XLIV figs. 13 and 13*a*).

The median lobe is large and round, with the median orifice across the dorsal aspect. The tegmen (*tg*) forms a chitinous tube, narrower at the base than at the apex. The internal sac is a little longer than the aedeagus, the apex studded with light brown short hairs.

The forms that we have examined divide into two distinct groups, in one the tegmen consists of two distinct pieces, the basal-piece and the lateral lobes; in the other (*Aulacocyclus*) the basal-piece and the lateral lobes form one piece, either by consolidation or the suppression of the basal-piece. It is possible that this family is an offshoot of such a form of aedeagus as *Trox omacanthus*, but still more probable that it came from some form annectant with Trogidae and Dynastidae.

Family SCARABAEIDAE.

Forms examined: We have examined somewhat less than 100 forms of this enormous family of Coleoptera. Mr. G. J. Arrow has been so good as to suggest an arrangement of those that call for notice that will be convenient, and in accordance with his views (which, as he states, are to some extent conventional); and we place them under fourteen divisions, as follows:—

1. Coprinae. *Ateuchus* (or *Scarabaeus*) *cicatricosus* Luc., Spain. *Eucranium lacordairei*, S. America. *Phanaeus lugens* Nevinson, Venezuela. *Heliocopris mouhotus* Sharp, Malay penins. *Catharsius molossus* L., Asia trop. *Onthophagus fracticornis* Pr., Brockenhurst. *Oniticellus* (*Radama*) *marsyas* Ol. Madagascar.

2. Aphodiinae. *Aphodius punctato-sulcatus* St., Brockenhurst, and *A. senegalensis* Kl., Old Calabar. *Millingenia fossor* Sharp, Ismailia. This latter not correctly classified.

3. Acanthocerinae. *Cloeotus sinuatus* Bates, Guatemala, and *C. rugiceps* Germ., Rio de Janeiro.

4. Orphninae. *Orphnus* sp.

5. Hybosorinae. *Hybosorus orientalis* Westw., E. India. *Liparochrus timidus*, Arrow, N. Australia.

Anaides laticollis Har., Mexico, and *A. simplicollis*, Costa Rica. *Phaeochrous emarginatus* ? Castl., New Guinea.

6. Geotrupinae. *Geotrupes stercorarius* L., Britain; *G. mutator* Marsh., Britain; *G. pyrenaeus* Ch., var. Reynosa. *Typhoeus typhoeus* L., Brockenhurst.

7. Aclopinae. *Aclopus* sp., Rio de Janeiro.

8. Pachypodinae. *Pachypus cornutus* Ol., Europe.

9. Glaphyrinae. *Amphicoma vulpes* Fabr., Caucasus.

10. Melolonthinae. *Microplidius luctuosus*, Natal. *Pyronota edwardsi* Sh., New Zealand. *Hoplia coerulea* L., Pyrenees. *Diphucephala furcata* Guér., Australia. *Maechidius* spp., Australia. *Rhizotrogus solstitialis* L., Britain. *Anoxia orientalis* Kr., Europe. *Melolontha vulgaris* L., England.

11. Euchirinae. *Euchirus longimanus* L., Amboina.

12. Rutelinae. *Anisoplia floricola* Fabr., Gibraltar. *Phyllopertha horticola* L., Europe. *Spilota reginae* Newm., China. *Anomala assimilis* Boisd., New Guinea. *Mimela confucius* Hope, China. *Oryctomorphus variegatus* Guér., Chile. *Parastasia bimaculata* Guér., Nicobar Islands. *Pelidnota punctata* L., N. America. *Anoplognathus analis* Dalm., and *A. olivieri* Dalm., Australia. *Repsimus manicatus* Sw., Sydney. *Bolax westwoodi* Castl., Brazil. *Fruhstorferia javana* Kolbe, Java.

13. Dynastinae. *Hexodon unicolor* Ol., Madagascar. *Cyclocephala stictica* Burm., Mexico. *Ancognatha vulgaris* Arrow, Ecuador. *Phileurus didymus* Er., S. America. *Homophileurus 4-tuberculatus* Beauv., S. America. *Cryptodus* sp. ?, Australia. *Xylotrupes gideon* L., Asia, etc. *Oryctes boas* Fabr., Trop. Africa. *Diloboderus abderus* St., Brazil. *Augosoma centaurus* Fabr., Africa. *Eupatorus hardwicki* Hope, India. *Golofa eacus* Burm., S. America.

14. Cetoniinae. *Lomaptera xanthopus* Boisd., New Guinea, and *L.* sp. (not in Brit. Mus.), New Guinea. *Ischiopsopha bifasciata* Q. and G., New Guinea. *Macronota diardi* G. et. P. and *M. suturalis* Voll., Borneo. *Cetonia aurata* L., England. *Diaphonia dorsalis* Newm., Australia. *Inca pulverulentus* Ol., S. America.

Figs. 14 to 28 Pls. XLIV, XLV, and XLVI, also fig. 28 on Pl. XLVII, are devoted to Scarabaeidae.

N.B.—While this memoir is passing through the press, the junior author has been able to make an examination of the male genitalia in the pupa of a species of

Anomala, and he finds that the lateral lobes develop on the ventral aspect. *It follows from this that the orientation we have adopted in the following sketch of this family is incorrect* and should be reversed, at any rate as regards the terms dorsal and ventral applied to the aedeagus.

Ateuchus cicatricosus.

The aedeagus is of the same type as *Phanaeus* and *Heliocopris*, etc. It is however strongly chitinised and the lateral lobes are more complex and irregular in form. The internal sac is very remarkable ; it is large and complex in shape ; at the apex are two long, curved spines closely pressed against one another (looking like one) ; a little beyond is a small, curved bifurcate, spine-like, chitinous plate ; towards the base is a shallowly concave chitinous plate from the apical end of which arises a strong chitinous piece giving off a dozen thin, flattened, curved lamella-like spines which lie together like the lamellae of certain antennae.

Eucranium lacordairei.

Is similar to *Ateuchus cicatricosus* in type, but the sac has only chitinous plates for armature.

Phanaeus lugens.

Median lobe small with chitinous support at base, prolonged into two short, broad, median struts. Lateral lobes small, connected together by membrane to near their tips. Basal-piece large, strongly chitinous, tubular with a large basal opening. Internal sac large, complex, with chitinous structures, one being a broad, curved spine towards apex.

Catharsius molossus.

Median lobe small with a chitinous support continuing as two short median struts for the support of muscles. Lateral lobes large, fairly narrow and curved, joined together on dorsal and ventral side of membrane which folds in when lateral lobes are brought together; this forms a tube in which the median lobe is situated and hidden. Basal-piece large, forming a chitinous tube, slightly bent near base, with basal opening on ventral face. Internal sac large with complex armature; near the base there is a shallow wide diverticulum, about the middle a wide curved chitinous plate, and towards the apex two thin chitinous spines arising from near the opening of the ejaculatory duct ; a large spine-shape plate supports the membrane at the base of the two spines.

Heliocopris mouhotus.

Median lobe small, entirely hidden and embraced by the lateral lobes. Lateral lobes rather large, with a membranous connection to near their tips, which membrane folds together when the lateral lobes approximate. Basal-piece large, forming an irregular chitinous tube, curved and enlarged at the base, with a large basal opening. Internal sac large, with two blunt, flattened, chitinous spines near apex.

Onthophagus fracticornis.

Median lobe small, with small chitinous support at base projecting into basal-piece as two short, broad, rounded, median processes (cf. *Oniticellus*). Lateral lobes small, connected by membranes to near their tips. Basal-piece large, forming chitinous tube with large basal opening at base. Internal sac large, bearing complex, curved chitinous plates on the apical half.

Oniticellus marsyas.

Tambour cylindrical, basal portion short. Lateral lobes short and powerful, abruptly flexed, of irregular, complicated form ; their median aspects contiguous throughout. Median lobe entirely concealed, forming at the base a chitinised tray, basally split for two-fifths of its length and forming a secondary tambour within the normal one. Sac largely developed. This is a very remarkable and high form of Coprinae, though the affinity with *Onthophagus* is a close one.

Obs.—The Coprinae have the basal-piece rather completely tubular in form, owing to the shortening of the basal part of the "tambour." The basal part of the tambour (or great basal sclerite of the Scarabaeidae) is chitinous on one aspect, membranous on the other, and this basal portion being in Coprinae of small elongation in comparison with the distal portion, the tubular form of the distal portion is unusually conspicuous. The aedeagus of Coprinae is easy of recognition.

Aphodius punctato-sulcatus (Pl. XLV figs. 18 and 18*a*).

Median lobe small and membranous, supported on the dorsal edges by two chitin strips (*a*) which project into the basal-piece as two struts (*ms*) for the support of muscles ; median orifice occupying all the dorsal face. Lateral lobes large, a semi-chitinous extension along the dorsal edges (*b*) form two flanges which overlap and hide the median lobe. Basal-piece large, the distal half forming a tube, the dorsal part extending backwards, bent and slightly flattened. Internal sac large, its surface covered with chitinous spines, those in the middle being largest and pointed.

Aphodius senegalensis.

Differs but little from the foregoing.

Obs.—If the two *Aphodius* examined by us are characteristic of the group, it is distinguished from Coprinae by the more flat, less cylindric, base of the tambour.

Millingenia fossor.

Median lobe small but well chitinised, without median struts. Lateral lobes slightly longer and pointed, embracing the base of the median lobe but not entirely concealing it, meeting at their base on the dorsal side and connected by a thin strip of chitin on the ventral. The basal-piece large but mostly semi-chitinous. Internal sac medium size with a thin triangular chitinous plate on the dorsal side near base and a strong chitin knob on ventral side near base. This appears to be near to *Cloeotus*. Not correctly placed in Aphodiinae.

Cloeotus sinuatus (Pl. XLIV figs. 15 and 15*a*).

Median lobe small, of a semi-chitinous nature, but quite distinct; median orifice on ventral side near tip. Lateral lobes little longer than median lobe, not quite meeting together at their bases, embracing the basal-lateral portion of median lobe. Basal-piece very large, forming a curved chitinous sclerite on the ventral side, a large membrane (*m*) separating it from the lateral lobes, except at the lateral corners where the sclerite is prolonged to the lateral lobes (*a*). Internal sac very large and complex, bearing short hairs, but no chitinous armature.

The fact that the basal-piece forms a sclerite on the ventral side of the aedeagus appears to point to a difference between it and the Coprinae, but we must recall what we have previously said about the dorso-ventral aspect.

Cloeotus rugiceps.

Similar to *C. sinuatus*, but the median lobe is smaller, more membranous and more covered by the lateral lobes. Internal sac large and complex, bearing hairs that graduate in certain spots into short stout spines.

Cloeotus appears to form a connection between the Trogidae, in which the median lobe is well developed and the internal sac small or unspecialised, and the Coprinae, in which the median lobe is entirely hidden between the lateral lobes, much reduced in size and chitinisation, and the internal sac is greatly developed and complex.

Orphnus sp.

Appears to come nearer to *Inca* and *Euchirus* than to *Geotrupes*. The concealed median lobe is large and membranous, with chitinous support at base prolonged into median struts. Lateral lobes large, acutely pointed, curved downwards, and straight on the inner side, dilated near the tips on the outer side, consolidated at base on dorsal and ventral side. Basal-piece large of Melolonthine type, the ventral plate being very slightly chitinised. Internal sac large with short, stout spines about the middle.

Orphnus is very different from Coprinae.

Hybosorus orientalis.

Closely allied to *Phaeochrous*. Median lobe as long as lateral lobes, visible, well chitinised and asymmetrical; no median struts. Lateral lobes asymmetrical, the right being broad at base and bluntly rounded at tip; the left broad at base, the distal three-fourths being thin and narrow; the projection near base on dorsal edge forming a small prong; they do not join at base either on dorsal or ventral side. The basal-piece smaller in proportion than in *Phaeochrous* and not forming a tube, the ventral side being membranous. Internal sac large, studded with short brown chitinous spikes with a patch of dark hairs near middle.

Liparochrus timidus.

Median lobe small and membranous, the chitin forming two small supports (median supports) projecting into the "basal-piece" for the attachment of muscles. Lateral lobes large and square in shape; meeting at base both on dorsal and ventral sides and entirely covering the median lobe. Basal-piece a long curved sclerite on the dorsal side. Internal sac large and complex, but without chitinous armature.

Anaides laticollis.

Median lobe small, and membranous except for two small supporting sclerites, produced into the basal-piece as two long struts for the support of muscles; these are in close connection with the base of the lateral lobes. Lateral lobes well developed, bluntly pointed and meeting at base on dorsal and ventral faces. Basal-piece large and curved, situated on ventral (?) side. Internal sac large and complex; surface covered with very short spines with a patch of dark hairs towards the base.

A. simplicollis is very like *A. laticollis* but the sac bears a large curved chitinous plate near base, a patch of spine-like hairs about the middle and another near the apex, the rest of the surface covered with short spines.

In *Cloeotus, Millengenia, Anaides, Liparochrus, Hybosorus,* and *Geotrupes* the lateral lobes are free, or only connected together at their bases. In *Aphodius* the lateral lobes have membranous extension along their edges but they are not amalgamated together. In the Coprinae the lateral lobes are connected together by membranes and form a more or less complete tube which includes the median lobe.

Phaeochrous emarginatus (?) (Pl. XLV figs. 16 and 16*a*).

Median lobe small but well chitinised; median orifice on ventral side of tip; median foramen large and basally placed. Lateral lobes asymmetrical, the right shorter and broader than the other, concave on inner side at base for the reception of the median lobe; left curved, with projection near base on dorsal edge. Basal-piece large, forming a chitinous tube with a large opening on the ventro-basal part. Internal sac small and simple, covered with brown hair. When at rest the aedeagus lies on its side.

Typhoeus typhoeus (Pl. XLV figs. 17 and 17*a*).

Median lobe reduced to a small chitin ring (*ml*) projecting into the basal-piece as two median struts (*ms*). Lateral lobes small, but entirely concealing the median lobe. Basal-piece large, forming a chitinous lobe, bent downward near the base, the basal opening large, somewhat dorsal and the edges asymmetrical; the apical ventral margin (*a*) is produced beyond, and conceals, the base of the lateral lobes. Internal sac small, covered with brown hairs.

Geotrupes pyrenaeus, var. from Reynosa; is of the same type as *Typhoeus* but the ventral apical margin is produced as two broad plates which cover the ventral side of the lateral lobes.

In *G. stercorarius*, also the ventral distal edge of the basal-piece is produced into two spatulate lobes which cover the ventral side of the lateral lobe and the dorsal edge is produced into two broad lobes which cover the dorsal surface of the lateral lobes. The lateral lobes are small and asymmetrical. The median lobe is reduced to a membrane supported by the median struts consolidated into one slender rod, the distal chitinisation being continued on to the internal sac which is small. *G. mutator* is similar to this.

Obs.—*Geotrupes* is very remarkable and distinct. The tambour is very much closed, the basal portion of it is greatly reduced in size and the diameter there is considerably less than at the distal extremity, where the shape is very peculiar. The lateral lobes are of unusual form, and the distal chitinisation of the median lobe is strange, though it differs a good deal according to the species. *Typhoeus* is not so extraordinary as the other forms and may represent a distinct genus.

Aclopus sp.

Median lobe membranous. Lateral lobes long, thin and curved, basal half connected together by membrane. Basal-piece tambour-shape, much broader at base than at apex. The only specimen of this form at our disposal is so much damaged that we can say no more about it.

Pachypus cornutus.

Median lobe small, membranous; supported by a chitinous patch on each side, prolonged into long median struts. Lateral lobes fairly large, consolidated together for about one-third from their base on the dorsal side, and on the ventral side with membrane for about two-thirds from their base. Basal-piece large, tambour-shape, slightly flattened and asymmetrical. Internal sac large, covered with minute chitinous, pointed scales.

Amphicoma vulpes (Pl. XLIV fig. 14).

Median lobe small, visible, membranous except at base, with two median struts. Lateral lobes very small, free, their bases not touching on dorsal or ventral side. Basal-piece forming a long, thin, curved, chitinous tube, with basal opening at base on ventral side. Internal sac well developed and complex. It is difficult to distinguish the membranous median lobe from the sac as there is no line of demarcation.

The very long chitin tube formed in this insect by the basal-piece is highly remarkable. In fig. 14 this part is by a lapsus marked *ml* instead of *bp*; but the position of the median lobe is correctly indicated by the other *ml* near the tip.

Microplidius luctuosus (Pl. XLVI fig. 22).

Median lobe internal, fair size, membranous, except along base (*a*) where a chitinous strip runs along edge and projects as two median struts (*ms*). Lateral lobes large and curved near tips, their basal halves connected by membrane. Basal-piece tambour-shape broader at base than at apex. Internal sac well developed without chitinous armature.

Hoplia coerulea.

Basal plate large, broad, asymmetrical; forming a broad chitinous tray, very far from the tubular shape. Lateral lobes very long, their distal portions free; the free parts about as long as the parts connected by the membrane that forms the delicate cylinder through which the median lobe plays. The median lobe shaped like a long delicate finger; membranous, but at its base provided with a delicate, horse-shoe-shaped, semi-ring of chitin, and on the membrane basal to the ring, a pair of extremely fine chitin rods. Sac not observed. The median lobe is in this case extremely mobile and slips backwards and forwards to such an extent as to make it superficially either visible to a considerable extent, or apparently absent.

Diphucephala furcata (Pl. XLV figs. 21, 21*a*).

Median lobe internal, large, membranous, with a thin chitinous support along ventral side (*a*) and base, continued as median struts. Lateral lobes consolidated together for their basal half, the distal portions curved downward, asymmetrical and pressed near together, the right tip coming to a point, the left flattened, expanded, and produced into two short points. Internal sac large without chitinous armature. Basal-piece long and tambour-shape.

Maechidius sp.

Median lobe medium size fairly chitinised, not extending into median struts. Lateral lobes large, consolidated together for about one-fourth from their base. Basal-piece large, chitinous on dorsal (?) aspect entirely membranous on ventral, and as it is remarkably flat, offering no protection there to the softer parts. Internal sac fairly large, covered with fine hair; no chitinous armature.

Pyronota edwardsi.

Basal-piece large, feebly chitinised, on one aspect, and quite without chitinisation on the other. Lateral lobes elongate, bent almost at a right angle a little distance from their base, apically free as far as the bend, basally from that connected by a very narrow strip of membrane; their inner aspects flattened and adpressed. Median lobe apparently not passing between the lateral lobes.

This is very different from any other of the forms we have examined. The relationship of the median lobe and the lateral lobes would appear to be very unusual, but having only one specimen at our disposal this is not very clear.

Rhizotrogus solstitialis.

Of the same type as *Melolontha.* Median lobe medium size, membranous, supported by two thin sclerites. Lateral lobes large, broad, joined together to near their tips and forming a tube. Basal-piece not quite so long as the lateral lobes, chitinous on dorsal side but membranous on ventral. Internal sac large.

Anoxia orientalis.

Median lobe small, chitinous on each side, with two long median struts. Lateral lobes very large, long and curved at points; on ventral side they are consolidated for about one-fourth of their length near the base; on the dorsal side the basal three-fifths are consolidated together. Basal-piece tambour-like, somewhat shorter than the lateral lobes. Internal sac fair size, no chitinous armature.

Melolontha vulgaris.

Median lobe fair size but membranous, except for a narrow strip of chitin along each side, proceeding into basal-piece as two median struts. Lateral lobes long, narrow, and curved, with the tips slightly expanded; joined together at their base on ventral and dorsal sides with a membranous connection nearly to their tips. Basal-piece tambour-like, forming a large curved sclerite on dorsal side, the ventral side membranous. Internal sac large and complex, covered with small hairs but bearing no chitinous armature.

The student should refer to Straus-Durckheim's immortal work on *Melolontha.* It will give him a good idea of the genital tube in Coleoptera, as well as a knowledge of the details of this species. He uses the term "tambour" for the large basal-piece of the aedeagus, and we have used it also in the sense of a general resemblance to *Melolontha* in the form of this part. The tambour shape does not exist in *Trox*, and *Amphicoma* shows a very great modification of it.

Euchirus longimanus.

Median lobe small, supported by two thin chitin strips near base, continuing into the basal-piece as two median struts. Lateral lobes long, pointed, with the points strongly curved near tips and slightly flattened ; connected at base on dorsal and ventral side, otherwise free (no connecting membrane between them). Basal-piece tambour-shape. Internal sac large and complex, covered with short hair, but bearing no chitinous armour.

This curious insect shows no approach to *Amphicoma*; but apparently the aedeagus is but little different from *Aclopus*, and the forms placed early in the Melolonthine series.

Anisoplia floricola.

The lateral lobes are very long, touching for the greater part of their length, but not consolidated together. Basal-piece medium size, tambour-shape, with a small ventral plate. Basal piece and lateral lobes consolidated together, so that their real line of junction is difficult to distinguish. Internal sac without chitinous armature.

Phyllopertha horticola.

The aedeagus is short and broad, and the proportions generally similar to *Anomala ;* there appears to be a large chitinisation of the base of the median lobe.

Spilota regina (Pl. XLV figs. 20 and 20*a*).

Median lobe normal in shape and size, but the internal sac has a strong chitinous plate armed with spines near the apex (*b*), and has a pair of strong chitinous processes (*a*) on the apex ; this armature prevents the sac from being entirely evaginated, and makes it appear to be part of the median lobe. A similar thing takes place in *A. marginipennis*, where the plate bearing spines is very large and looks like the median lobe, and can only be understood by dissecting it away from the tegmen. In *S. regina* the lateral lobes are large and asymmetrical, the left being widened and curved at apex. Basal-piece tambour-shape, with a small ventral plate (*vp*).

Anomala assimilis (Pl. XLV fig. 19).

Median lobe small but distinct, the basal part being chitinised and prolonged into two median struts. Lateral lobes short and broad, meeting together at their bases on the dorsal side (but no consolidated together) and wide apart on the ventral side. Basal-piece tambour-shape with a chitinous plate (ventral plate, *vp*) on the ventral side at the base of the lateral lobes, to which these are attached by membrane. Internal sac very large and complex ; a chitinous plate (*b*) near apex, below it a small patch of hair, three large diverticula, one covered with hair and a slender long diverticulum above it. The opening of the duct (*a*) is on the ventral side.

Mimela confucius is of the same type ; the ventral plate of the basal-piece more complex, being curved, and the distal end bilobed (or deeply emarginate) and projecting between the lateral lobes.

Oryctomorphus variegatus.

This is of the same type as *Pelidnota*, the lateral lobes being consolidated on the dorsal side and the tip rounded.

Parastasia bimaculata.

Lateral lobes joined together on dorsal side somewhat as in *Oryctomorphus*, line of consolidation distinctly visible. Basal-piece large, tambour-shape, without a ventral plate.

Pelidnota punctata (Pl. XLVI fig. 23).

Median lobe fair size, membranous, with two small chitinous strips at sides prolonged into two long thin median struts. Lateral lobes consolidated together on the dorsal side, forming a flattened plate, broad at the base, with a bifurcate tip; the ventral edges, even at base, wide apart. Basal-piece broad, flattened, tambour-shape one-third of length; on the ventral side there is a large chitinous plate (ventral plate) covering the apical half of the ventral surface of the basal-piece. Internal sac very large, with five short, broad chitinous teeth about the middle, four being of equal size, the fifth much larger.

Anaplognathus analis and *A. olivieri.*

The *Anoplognathi* are recognised by the elongated lateral lobes, consolidated together on the dorsal side to near their tips, the ventral plate of the tegmen is also elongated and lies between the lateral lobes on the ventral side, thus forming a long tube. *Repsimus* is of the same type but not so specialised, the lateral lobes being shorter and only consolidated along their basal half.

Bolax westwoodi (Pl. XLVI fig. 24).

Median lobe long, thin and membranous, with semi-chitinous supports at the base (*a*). Lateral lobes very small, free, meeting at base on dorsal side but not on ventral, flattened and obtuse at apex. Basal-piece very large, forming a long tube, the dorsal part formed by a long, curved sclerite and the ventral surface by a long narrow one (*vp*). Internal sac long, thin at apex and supported by a chitin strip (b).

Fruhstorferia javana.

At the last moment we have received an example of this remarkable creature. The male structures are so extraordinary that they may be briefly described as having the appearance of being crippled or deformed. The example is however so perfectly developed as regards its external structure that there can be little doubt as to the "deformity" being natural.

The basal portion of the tambour is normal, but beyond this the part is twisted so that the orifice for the protrusion of the median lobe is placed laterally; one of the two lateral lobes forms a very hard, irregular tusk, while the other is membranous, and appears to be merely a useless appendage. The median lobe appears also to be twisted and deformed at the apex, which is slender. There appears to be no line of demarcation between median lobe and sac, and the part just described may be considered to be the everted sac. In that case the lobe is prolonged forwards into the body far beyond the tambour, and is of irregular shape; distally ample, then more slender, and in front of this rendered a little more broad by means of a large horse-shoe-shaped sclerite; in front of this it is again more slender, and contains some apparently semi-chitinised structures extending to the part where it is joined to the duct.

Obs.—The few Rutelina examined display forms that may be group characteristics. *Anisoplia, Phyllopertha* and *Anomala* have the lateral lobes free; and they are elongate in *Anisoplia*, short in *Anomala*. In the other forms (except *Bolax*) they are united either at the base or for their whole length. Anoplognathini have the cylinder formed by their conjunction elongated. The extraordinary Asiatic *Fruhstorferia* is quite abnormal by the distorted aedeagus. *Bolax* has a very long tubular basal-piece, with comparatively small, free lateral lobes, and should be compared with Glaphyrinae, though it is probable that the elongate, tubular form of the basal-piece may not be as important as it is remarkable.

Hexodon unicolor (Pl. XLVI figs. 25, 25*a*).

Median lobe large and membranous, with chitinous sclerites at base, prolonged into median struts (*ms*) consolidated for the greater part of their length. Lateral lobes large, symmetrical; consolidated on dorsal and ventral faces at base. Basal-piece large, tambour-shape with a ventral plate (*vp*) connected to the basal ventral edges of the lateral lobes by membrane, not consolidated to them. Internal sac large with four long thin diverticula at apex, covered with hairs, no armature.

We have examined several species of *Hexodon* and find they fall into two groups, one with symmetrical lateral lobes and four diverticula of sac; the other with asymmetrical lateral lobes and five diverticula.

Ancognatha vulgaris.

Median lobe moderate in size, membranous with chitinous support near base. (In some Scarabaeidae the chitinous support of the median lobe appears to appertain rather to the second connecting membrane, but we have described it as belonging to the median lobe as only a detailed study in many forms could elucidate this.) Basal-piece of the usual tambour-shape, its concave aspect membranous, its dorsal more feebly chitinised than in the normal Dynastinae; the sides of this sclerite prolonged distally so as to form a point on each side to which are articulated the very peculiar lateral lobes. These, viewed laterally form a sort of V, between the branches of which the distal point of the basal piece (as described above) penetrates. The lateral lobes are not in this species amalgamated by chitin but exist as two sclerites connected by membrane. Viewed on the convex aspect of the aedeagus in repose, the two sclerites become contiguous, their inner margins being nearly straight; each is a little truncate at the tip, and on the outer side has a small, sharp hook. On the concave aspect, the sclerite is larger than on the other aspect, but the inner margins are parallel here also. These lateral lobes are capable of divarication, and it appears that this permits the extrusion of the median lobe.

Internal sac large and complex, the apical half greatly enlarged, with two small diverticula near opening of ejaculatory duct at apex, and a long thin diverticulum opening near middle; no chitinous armature, but surface covered with short fine hair.

Cyclocephala stictica.

In this the lateral lobes are greatly abbreviated and form a ring at the end of the basal-piece. This ring, being placed at a right angle to the axis of the aedeagus, is articulated on each side to the distal point of the basal-piece; except at this spot the connection of the lateral lobes with the basal-piece is entirely membranous. As the ventral plate of the basal piece is to some extent elastic, the annular lateral lobes can, by it stretching, be brought into the same plane as the axis of the aedeagus.

The soldering together of the tips of the lateral lobes so as to form a perfect ring, make this very different from *Ancognatha.* The two forms have in common the unchitinised ventral plate of the basal-piece.

It should be noticed that in this form the consolidation of the lateral lobes into a ring takes place in an indirect manner. The apices of the lobes meet very nearly, but not quite, and a distinct narrow space is perceived between them; but basally to this small space the ventral plate penetrates between the lobes and is just there strongly chitinised, though elsewhere it is quite membranous.

This is a very interesting case. If we make use of a teleological mode of expression we may say that it appears that the tips of the lateral lobes are in process of becoming consolidated so as to form a structure normal in Dynastinae (compare with *X. gideon*). The functional difference between *Ancognatha* and *Cyclocephala* appears to be that in the latter the orifice is held open permanently by the ring-shaped lateral lobes; while in the more Melolonthoid structure of *Ancognatha* the lobes are mobile and the orifice opens or closes as the situation requires.

Cyclocephala would from this point of view appear to be related to *Xylotrupes,* while *Ancognatha* points to an affinity with *Diloboderus.*

Oryctes boas.

The distal portion of the tambour is elongate and cylindrical, the basal portion broad and short. The lateral lobes are long, placed at a right angle with the cylinder, the orifice between them viewed from behind is elongate and rather narrow. The structure at the base of the median lobe is rather perfect; the chitinisation of its anterior part on one aspect is met by a V-shaped prolongation from the other aspect, and by the conjunction of the two a complete ring-encasement is formed. We have already stated that we have not been able to decide as to the nature of this chitinisation.

Diloboderus abderus.

The aedeagus is here short, broad at the base, and gently narrowed to the tip so as to be somewhat conical in form viewed dorsally. The lateral lobes are articulated so as to admit of a beautiful movement of a limited nature. In repose they are brought near together, and their inner dorsal margins lie parallel though separated by a good space. If a little pressure be applied inside the aedeagus at the point where they meet dorsally, the two lobes separate by a partial rotation and then disclose a broad orifice such as we find to be the fixed position in *Xylotrupes gideon*. The specimen is in very bad condition, but we mention it because we have not observed a similar peculiarity in allied forms, though it may not improbably be found to exist elsewhere in the higher Dynastinae. The form and general proportions of the aedeagus are similar to those of *Oryctes boas*. Some special experiments made with that species show that the lateral lobes can be forced apart to a considerable extent by pressure, but there is no rotation whatever, and the parting is due to the elasticity of the ventral plate connecting the lobes.

Xylotrupes gideon (Pl. XLVI figs. 26, 26*a* and 26*b*).

Median lobe large, membranous, with chitinous ring at base for support, prolonged into a pair of median struts, consolidated at their base. Lateral lobes consolidated on dorsal and ventral side, short forming a short ring or tube which projects on the ventral side as two short, flattened and truncate points, which have a slightly outward turn. Though the lobes are thus separated at their distal part, they are united, in front of the free processes, to form a ring. Basal-piece large, tambour-shape, constricted about the middle, with a ventral plate (*vp*) which is only consolidated to the lateral lobes at the corners (*a*).* Internal sac large with two large, strong, curved spines about the middle.

We have examined several specimens of this well-known insect; they come from different localities, and there is slight variation in the aedeagus.

Three males from Koberi (N. Guinea, Pratt), one of them the fullest development of the species, the other two moderate, agree closely except that the largely developed example has the distal portion of the tambour more elongate, and the tusks of the lateral lobes less abruptly turned backwards.

A single specimen from "Australia" (old coll.), is of the broad, robust variety of the species, with broad thoracic horn, and the forks of the cephalic horn strongly developed; it has the aedeagus much as in the moderate Koberi form, but a little shorter and thicker, the

* In fig. 26 the point (*a*) appears to overlap the lateral lobe: this is not correct; "*a*" only reaches the margin of the lateral lobe, and is there conjoined with it.

tusks of the lateral lobes slightly shorter, and the consolidation of the two lobes where they meet in the middle behind the ventral plate very short.

One example (Cochin China, old coll.) of the same development as the two moderate Koberi forms, differs from them in having the ring of the lateral lobes considerably narrower, the tusks a little longer, and separated by an interval of rather different form. The difference from the Koberi high development male is even slighter.

One specimen from Amboina (F. Muir), a small development but not the smallest, has a decidedly different shape of the orifice, which may be described by saying that above it resembles a Gothic arch, while the forms previously mentioned are more like a Norman arch. Still more striking is the fact that the membrane above and in front of this arch is strongly chitinised, quite black, and the ventral plate is extensively chitinised.

One specimen ("Malasia," old coll.) of maximum development as regards cephalic and thoracic armature, but a rather small and slender individual, differs slightly from the Koberi moderate form in having the distal cylinder of the tambour more slender, and as a consequence the orifice between the lateral lobes more contracted; the tusks are a little longer, and the area between them is narrower and of slightly different form.

An individual ("Ter" [nate] Wallace I believe) is of almost the smallest development of the species, being with cephalic horn only about 30 mm. long; it approximates the Amboina individual, but entirely lacks the hard chitinisation of that specimen.

The sac, in these examples, has not been adequately examined, but in the specimen from Cochin China the curious pair of large spines on it appear to be more inequal in size than they are in the others.

Whether any racial distinctions are to be found in these male structures can be decided only by the examination of good series. We see no reason for supposing that any of the distinctions are of specific importance. The extreme chitinisation of the parts in the Amboina individual is remarkable. In it and in the Ternate example the two spines on the sac are nearly of one size.

Augosoma centaurus.

Very like *X. gideon* but the points of the lateral lobes are acute, and pressed together to their tips and turn downwards; the ventral plate of the basal-piece is consolidated to the lateral lobes; the internal sac is large and has no spines, but has at least one long diverticulum. The conjoined struts at the base of the median lobe have, attached to each one, a slender tendon, 10 mm. long, and elastic, like india-rubber.

Eupatorus hardwicki.

Is very like *A. centaurus*, but the points of the lateral lobes are longer and slightly spatulate at tips, the opening between the lateral lobes is much narrower. The chitinous developments are comparatively small, the ventral plate being feebly chitinised. We see no remarkable structures on the sac or median lobe, but the only individual at our disposal is in very bad preservation.

Golofa eacus.

Basal portion of tambour large and convex, the distal portion not quite so long as the basal, not cylindric but a good deal flattened. The lateral lobes very remarkable; strongly deflexed, each at the base on the dorsal side developed into a plate, meeting the other and so forming a roof over the base of the orifice; furnished at the apex each with two patches of hair one of which projects beyond the tip, while the other forms a large, very dense patch on the inner and ventral aspect. The ventral plate peculiar, very strongly chitinised, and prolonged as far backwards as the patch of hairs described above, and visible between the apical parts of the lateral lobes as a free edge. Sac elongate and of contorted form, but no armature has been detected.

The specimen was in very bad preservation. The prolonged fold of the ventral plate is remarkable; it limits and shapes the orifice through which the median lobe is protruded.

Homophileurus 4-tuberculatus.

Median lobe large, membranous, the chitinous support at base produced into median struts. Lateral lobes very long, turned downwards nearly at right angles to the basal-piece, the tips slightly curved and spatulate, the inner margins parallel, contiguous distally, slightly separated basally. Basal-piece large, tambour-shape, constricted near the middle, the basal part being greatly widened with a ventral plate moderately chitinised distally, to which the lateral lobes are fastened, but not consolidated. Internal sac large with several long diverticula at apex, covered with hair, but with no other armature.

Phileurus didymus.

This is strikingly different from *H. 4-tuberculatus.* The basal-piece is elongate, but it is subcylindric, and the lateral lobes are very complex and remarkable. Though they are free, they form a ring, the transverse diameter of which is broad, the free extremities are greatly dilated and one much overlaps the other; moreover each is provided at the base with a large free lobe, projecting in tongue-like shape. This is a very peculiar aedeagus.

Cryptodus sp. ?

Median lobe small, membranous. Lateral lobes large, curved and spatulate at tips, meeting together on dorsal side at base, but not on ventral side. Basal-piece tambour-shape, with a ventral plate consisting of two chitinous sclerites which are consolidated with the ventral edges of the base of the lateral lobes. Internal sac large bearing a complex chitinous armature near apex, of a symmetrical and beautiful shape.

Lomaptera xanthopus (Pl. XLVI fig. 27).

Median lobe well developed but with exceedingly small chitinous support and no median struts. Lateral lobes medium size, consolidated to their truncate tips on the ventral side, and at their base on the dorsal side. Articulated in a central position on the dorsal side of the consolidated lateral lobes is an elastic tongue (*a*) which rises and falls with the evagination and invagination of the internal sac. The basal-piece is large and of the tambour type but with the basal portion short; with a ventral plate (*vp*), rather broad, but not very hard, and not consolidated to the lateral lobes. Internal sac large, without armature; the opening of duct being situated at distal end on a small prominence, with a small papilla on each side (*c*).

In *Lomaptera* sp. ? (small sp. elytra yellow with strong green reflections; not in Brit. Mus. Coll.), the lateral lobes are more slender, pointed and turned down ventrally; the tongue is slender and not articulated at its base but forming a continuous piece with the lateral lobes.

Lomaptera sp. ? Arfak (chocolate elytra). In this species the tongue is broad, and is bifid at the apex. The ventral plate is very remarkable, being connected distally with the lateral lobes by a large, very hard chitinisation. There is a great deal of hair on the ventral aspect of the lateral lobes. We have this species named *L. ciocolatina* but do not know whether it has been described. It is one of the numerous species discovered by the Pratts.

Ischiopsopha bifasciata.

Differs very strongly from *Lomaptera.* The basal part of the tambour is still more reduced; there is no chitinisation of the ventral plate. The lateral lobes form a slender ring with a small notch in the tip at the middle, and there is no tongue. The absence of chitinisation on the ventral aspect appears in this form to be complete ; and the approximation to *Cyclocephala stictica* to be incontrovertible.

Diaphonia dorsalis.

The tambour is pretty much of the usual tambour-shape, the basal part being moderately large. The lateral lobes form two free, pointed tusks, and at the base between them there is a large, grooved, triangular process which is strongly chitinised. The chitinisation of the ventral plate is very feeble.

Macronota diardi and *M. suturalis.*

In these two species although the wall of the body is very hard, this is not the case with the aedeagus. The tambour is but little basket-like, and the chitinisation throughout allows the harder parts to be somewhat elastic.

In *M. suturalis* the tambour is remarkably flat, and is not broader at its front. The lateral lobes are short, broad and pointed, and can be brought together in the median line, then forming a roof without special orifice for the protrusion of the median lobe.

In *M. diardi* the tambour is greatly expanded in front, so that its angles descend and are very acute : only the lateral and anterior margins are strongly chitinised, the rest of the surface being feeble and transparent. The lateral lobes are large and complex, each terminating as a spinose process directed outwards, while near the base of each there is a smaller, hooked spine. The position of the two lobes is much the same as in *M. suturalis.* In both species the median lobe appears to be less developed than usual : but both the examples are in a very decayed state.

Cetonia aurata (Pl. XLVII fig. 28).

Tambour elongate but not highly developed, the basal part as long as the distal. Chitinisation of the ventral aspect poor and irregular, there being several patches of inferior chitinisation. The lateral lobes large but not quite so long as the basal-piece. They are placed dorsally with their median margins parallel, but not quite contiguous ; they are consolidated for more than half their length, the apical portions being free ; the deflexed tips bear each a small process abruptly turned outwards.

Inca pulverulentus.

Median lobe and internal sac not examined. Lateral lobe large, curved downwards, flattened and spatulate at tips; consolidated at base on dorsal and ventral side. Basal-piece slightly shorter than lateral lobes.

The specimen at our disposal is greatly destroyed by *Anthrenus*. The elongation of the lateral lobes is remarkable. Burmeister considered this form to be related to *Euchirus*, and there appears to be a great similarity in the aedeagus of the two, but we cannot say to what extent this is true of anything but the hard sclerites. The general shape of the aedeagus is one that is frequent in the Melolonthine series of genera.

Obs.—The aedeagus of Scarabaeidae is readily recognised (if Trogidae, Lucanidae and Passalidae are excluded) by the following definitions:—

Tegmen greatly developed, the basal-piece enormous, consisting of an anterior part unchitinised beneath, and a more distal tubular part to which are attached apically the varied lateral lobes (frequently called forceps or parameres); the median lobe drawn within the basal-piece, and thus concealed, membranous except at the extreme base where there are, more or less well developed, elastic chitinous supports; sac large, frequently provided with remarkable, varied chitinous structures.

The perfection attained varies greatly. There are higher and lower forms in each of the great divisions. The number of forms examined is not sufficient to enable us to follow up this remark profitably.

MORPHOLOGY.

B. General.

A brief statement of the anatomical terms we have used will be found in the early portion of the Memoir (Orismology, p. 481). The term genital tube is used because it conveys the idea of the chief characteristic of the parts. Whatever else they may be, however different they may appear, their combination to form a perfect tube without orifices, is remarkable: the one "orifice" that exists is not a real one. It arises from the invagination of the tube into itself. The genital tube is therefore a doubled tube, one end of which is a continuation of the body wall, while the other divides into a fork, of which one branch proceeds to each testis. In a peculiar structure of this kind it is evident that the homologisation of the parts is attended with some special difficulties. Extensibility and retractibility of the tube are carried to an extraordinary perfection, and the length of the tube is in some cases enormous compared with the size of the creature, and yet the "orifice" may in one position of the organ be placed near the distal, in another position near the proximal extremity. The same "orifice" is in fact at one moment of the creature's existence placed inside and quite near to the centre of the body, while at another moment it may be placed far away, at the extremity of the extended tube. The walls of this protean structure become in some places hard, and form sclerites. The study of these sclerites is one of the chief aids in our endeavour to understand the changes the tube may have undergone during its evolution.

The homologies of the various parts of the male genital tube are, within certain limits, very easy to follow, and even in some of the most extreme forms can be made out by anatomical comparison. But beyond the limits we have alluded to, the questions become very difficult, and will really only be settled by studies of the ontogeny that at present are not forthcoming. As misconception has been, and still is prevalent to a considerable extent, there are a few general points to which we must allude. According to our view the genital tube commences where the body wall ends. Anatomically it is not easy to decide where that spot is, because body wall and genital tube are continuous.

Embryologists consider with good reason that the stomodaeum and proctodaeum are the poles of the body wall, therefore all parts that have their origin on the dorsal aspect of these openings are tergal, and all parts on the ventral aspect are sternal. The genital tube, being ventral of the anus, can therefore contain no tergal parts; though one or more sternites may enter into its composition.

Hopkins * considers our tegmen in *Pissodes* as "representing the apodeme of the ninth tergite." Bugnion † considers that in *Cissites testaceus* the median lobe ("gouttière interne") is derived from the ninth segment, and the tegmen ("gouttière externe") from the tenth segment.

* U. S. Dept. Agr. Technical Series, No. 20, Part I, 1911.
† Bull. Soc. Ent. d'Egypte, 4me Fascicule, 1910.

We cannot agree with these interpretations without proof from studies of the development.

The question as to a sternite, or part of a sternite, being included in the male genital tube leads to the consideration of the number of abdominal segments, a subject beyond the scope of this memoir. The following points, however, bear upon it. In the majority of beetles the first tergite is often entirely membranous, and the first, second, and, sometimes, the third sternites are also membranous: beyond these the segments are distinct, and, in many cases, there appears to be one sternite missing.

In *Enarsus bakewelli* (fig. 92*b*) there is a distinct ventral plate between the anus and the aedeagus, and in *Cupes clathratus* (fig. 104–104*b*) there is a pair of sub-anal appendages. These facts seem to indicate that there exists in some cases a sternite between the anus and aedeagus although it is only represented by membrane in so many forms.

We have not been able to find the eleventh (Berlese) sternite in *Lucanus cervus*. In this species, as in a great number of others, the rectum is capable of being evaginated. In some cases the rectum has chitinous supports to facilitate this process. In the larvae of many of the Cassidae the rectum is quite telescopic, and is thrust out and turned up to enable the larva to fasten filaments of excrement to its back. If any part of the aedeagus is of chroötic (pertaining to the body wall *) origin it is the tegmen, which in that case is derived from one of the sternites. When a sclerite of the genital tube exterior to (or anterior to) the tegmen exists it may probably be of chroötic nature.

The only observation as to development that we can at present contribute to this discussion is a slight one on a Cistelid. In the larva of *Cistela* (*Eryx*) *atra* there are nine distinct tergites and sternites, the ninth sternite bearing a pair of small papilla-like processes; in the pupa there are also nine distinct tergites and sternites, and the ninth sternite bears the pair of papillae; in the female imago the genital styles are direct continuations of these papillae on the ninth sternite, and they lie within them at the end of the pupal stage.

* We have introduced this term because the more correct word, somatic, has already a wider meaning, as opposed to the germinal tissue or plasma.

Our limited material did not show us the development of the male parts; but in the imago there are nine distinct tergites and eight distinct sternites, the ninth sternite appearing to be represented by a Y-shaped sclerite (fig. 234). A large amount of dechitinisation has apparently taken place at the apex of the abdomen, as well as at the base, and it is possible that some part of the large membranes at the apex (*i.e.* at the base of the genital tube) may represent sternites.

We divide the genital tube into the following parts. A pair of seminal ducts leading from the testes forms the zygotic portion (fig. 239 *a–b*), and the long, single, highly irregular tube, folded back and joined to the body wall, forms the azygotic portion (fig. 239 *b–d*, 5–1). The paired, or zygotic portion (*a–b*), along with certain glands opening into it, is considered to be of mesodermic origin,* and the azygotic, along with certain glands, of ectodermic origin. Bordas † points out that very little is known as to the origin of these glands, and consequently objects to the terms ectadenia and mesodenia applied to them by Escherich, and calls them accessory, or annexed glands. We are not concerned with them here.

The first part of the azygotic portion of the genital tube (fig. 239 *b–c*) consists of a long, more or less slender, tube (the stenazygotic portion); beyond this the tube enlarges and forms the eurazygotic portion (*c–d* and 5–1). In many cases this enlargement of the azygotic portion of the tube takes place before it is reflected outwards to continue its course to join the body wall. We call that portion of the eurazygos that is usually not external (*c–d*), the "internal sac" ("sac interne" of Jeannel).

In all cases that we have observed the internal sac is evaginated during copulation, and forms a continuation of the external parts of the genital tube. In a great number of forms there is no demarcation between the stenazygotic and the eurazygotic portions of the tube before the outward reflection above mentioned; in such cases we say that the internal sac is undifferentiated. That portion of the tube that is reflected and thus forms the external portion of the organ we call phallic. But we

* On this subject see Escherich, Zeitschr. wiss. Zool. lvii, 1893, p. 620.

† Bordas, Ann. Soc. Ent. France, lxviii, 1899, p. 510.

must admit that the term is not a good one. The part in question is highly complex. It is in fact the layer, or layers, of the tube of which sclerites of the aedeagus form a large, or the larger, part.

The sclerites on the phallic portion of the genital tube form two groups. (1) Those situate on the distal portion of the tube (furthest from the body wall), which we call the median lobe (fig. 239, 5–4), and (2) those situate nearer the base, which we call the tegmen (3–2). The membrane between these two groups of sclerites we term the first connecting membrane (4–3), and the membrane at the base, joining on to the body wall, we term the second connecting membrane (2–1). The median lobe, together with the tegmen, we term the aedeagus.

The point where the genital tube is reversed (5–*d*) we call the median orifice, and the lumen at the base of the median lobe (4–to corresponding spot below) we call the median foramen. Similar terms could be applied to the tegmen, but we have not found them necessary for our descriptions.

Having thus given a description of the four parts of the tube, we now give remarks as to the structures of each of the four divisions.

The second connecting membrane (or prephallic portion of the tube) varies in extent according to the size and shape of the aedeagus. In certain cases (i. e. *Laccobius* and *Sphenophorus*) it is chitinised in part, and forms a covering round the aedeagus. At, or near, the base there is in many forms a chitinous rod with one or two prongs at the end, embedded in the membrane. This is the "Stengel" of Lindemann, "Rod" or "fork" of Hopkins, and "Spiculum gastrale" of Verhoeff. Hopkins considers it as representing the ninth sternite. A comparison of this in the various families would be of great interest, but would entail a study of the body segments, a task beyond the scope of this memoir. We have therefore left it out of consideration.

The phallic portion of the tube is the one that has chiefly attracted the attention of coleopterists. It consists partly of membrane, partly of sclerites, and there may be most extreme differences in the chitinisation of its different parts, excessively hard chitin being continuous with delicate membrane. We have already explained that we call the sclerites in question the aedeagus, and that this consists of two parts, viz. median lobe and tegmen.

In the vast majority of cases the median lobe is well developed and quite distinct from the tegmen. In the more generalised (or trilobe) form it is well developed, and more or less tubular, with the median orifice situate on the distal extremity, and the median foramen at the basal extremity. In many trilobe forms it is articulated to the lateral lobes by a more or less distinct condyle on the dorsal side of the median foramen; in such cases the first connecting membrane (*cm* 1) is short, and the median lobe can only turn upon its point of articulation (*pa*). A pair of median struts are often attached to the base of the median lobe to give support to the muscles that actuate it. In the Scarabaeidae the median lobe is comparatively reduced in chitinisation, and often in size, and in the more highly evoluted forms the tegmen entirely envelopes and conceals it. In the Tenebrionid type the reduction of the median lobe reaches its maximum; in some of their forms it is only represented by a small membrane on which the median orifice is placed. The line of evolution of the median lobe in the Staphylinidae is from a tubular form, with a basally placed median foramen, to a bulbous form, with the median foramen placed nearer to the median orifice. This reaches its maximum development in *Xantholinus.* In the Cucujoidea group and in the Phytophagoidea the median lobe is generally tubular (at any rate on the distal portion), and the first connecting membrane long, so as to allow the median lobe a large amount of play through the more or less ring-like tegmen.

The tegmen, in the more generalised groups, consists of two parts, the basal-piece, and a pair of lateral lobes. The chitinisation of the basal-piece then often forms a shield-shaped plate on the ventral aspect, the dorsal aspect being membranous. Unless the chitinisation forms a complete tube the membranous dorsal part and the second connecting membrane are indistinguishable. The lateral lobes in their generalised form consist of a pair of more or less pointed lateral organs, their outer surface being continuous with the basal-piece, their inner surface connecting to the base of the median lobe, and their position being that they lie one on each side of the median lobe.

In position, size and form the lateral lobes differ so much in various families that their true homology in the different groups will probably be only settled after tracing their modifications through long series of forms, and by studying their ontogeny. It will be noticed that they are paired, or longitudinal, in arrangement, whereas the other structures of the phallic part of the tube are single and transversely separated. This paired condition of the lateral lobes tempts one strongly to identify any paired processes on the phallic division of the tube (even when median) as being lateral lobes. And it is probable that we and others have too readily succumbed to this temptation.

It is in connection with this point that the term tegmen becomes very useful, for we can homologise the combination more certainly than we can the lateral lobes alone.

The difference in position of the lateral lobes may be accompanied by their partial (or complete ?) consolidation. If the chitinisation of the basal parts of the lobes extend towards the longitudinal middle line of the tube at the expense of the membranous creases that exist, the two lateral lobes can become joined, and it is possible that the conjunction may go so far as to obliterate their primitive duality. This consolidation can occur either dorsally or ventrally, and we must look on a distinction so established (as has been pointed out by Verhoeff) as of great importance. It creates a difficulty in adjusting the position of various forms of "Heteromera," Cioidae, etc.

Extension transversely of conjoined lateral lobes might lead to the formation of a tubular chitinous sheath such as we find in Trogositidae, Cleridae, Byturidae. Or such a sheath might be formed by unconjoined lobes extending both above and below, and if a sheath be formed, by abbreviation it may become a "ring." Or a ring may be formed by extension of the angles, or margins of the basal-piece. We can only briefly indicate some of the numerous modifications that are possible of these phallic sclerites.

In Staphylinidae the part of the tube wall that is in so many families chitinised to form the basal-piece, remains membranous, and in other families of the Staphylinoidea the basal-piece is small. In Tenebrionoidea the basal-piece is long, and usually forms the chief part of the aedeagus.

Some morphologists have supposed (as we have already said) that the lateral lobes are modified abdominal appendages; on the other hand it may be suggested that some Coleoptera have never possessed lateral lobes. This point is briefly discussed in the section of phylogeny.

The internal sac varies in size, shape and armature in the different groups, and even in allied species. In the Scarabaeidae it is nearly always excessively large, and is often produced into long diverticula (i. e. *Hexodon*, fig. 25a). In Lucanidae it is found in every stage, from a simple form, in which it is scarcely distinguishable from the stenazygos, to a form such as *Lucanus cervus* (fig. 8). In this species the internal sac is not drawn into the median lobe, but when at rest it is folded down on to the broad median lobe. The sac is produced into a long flagellum, supported on each side by a thin strip of chitin; the stenazygos* continues through the flagellum to its tip. To obtain a similar position of the orifice in Cerambycidae the great sac must be completely everted.

The phenomenon of the internal sac being permanently everted is not confined to the Lucanidae, but appears among the Scarabeidae, Heteroceridae and Lycidae. In *Spilota regina* (fig. 20) the armature of the sac consists of two strong chitinous projections from the apex, and a strong chitinous plate beset with stout spines, the basal part of the sac being membranous. A comparison with allied forms demonstrates that these structures are part of the internal sac, and that the median lobe is normal in shape and size. In *Metriorrhynchus* (fig. 186) there is no doubt as to the everted condition of the internal sac, and it may be doubted whether its invagination is possible in some of these cases.

The flagellum appears in various conditions, as to size, etc., in different families or portions of families. In the Brenthidae it reaches an enormous length and fineness, and at the base the stenazygos can be seen running into the flagellum, but further on they appear to amalgamate, as we cannot separate them. Among the Staphylinidae *Pinophilus rectus* has an enormous flagellum coiled up within the median lobe. The other forms of armature situated on the internal sac are very various, and have been described in many species in the special anatomical part of this memoir; cf. various species of *Donacia* (fig. 199), and *Carpophagus* (fig. 204a).

In another portion of this memoir we show that in many

* In the special anatomical portion of this memoir we have always spoken of this stenazygotic portion of the tube as the "ejaculatory duct," but this is a functional term, and by other writers is often applied to the internal sac; it would probably be well to abandon it.

of the types the internal sac is everted during copulation, and it is probable that this method is the usual one; though the Cerambycidae may be peculiar in their mode of eversion.

In a great many forms the line of demarcation between the internal sac and the median lobe is obscured, for in some cases the chitinisation of the median lobe is continued on to the internal sac, and in others the distal end of the median lobe is membranous. The fact that in many cases the basal portion of the sac, and in other cases the whole sac, is permanently evaginated prevents us from distinguishing the two portions by their positions when at rest.*

Of the zygotic portion of the genital tube we do not speak, as it is beyond the scope of this memoir. And the stenazygos only concerns us because in many forms it is impossible to sharply define it from the eurazygos, before the latter is reflected to form the phallic portion of the tube. In such forms we speak of the internal sac being undifferentiated (i. e. *Hydrophilus*). In cases were the internal sac is differentiated it is sharply defined from the stenazygos by its size, and often by chitinisations situate on the sac at the point of juncture of the two parts.

In *Eumolpus* and *Chrysochus* the stenazygos forms a very long slender structure like a flagellum.

Bordas† has pointed out the existence of two completely separated ejaculatory ducts in certain Longicorns (*Lamia*, *Batocera*, etc.). We have also observed this fact in some *Monohammus*, *Gnoma*, etc. Bordas considers that this furnishes an argument in favour of the theory that the terminal parts of the canal were primitively of paired origin. It is possible, however, that this feature is of secondary origin, brought about by the abbreviation and suppression of the stenazygos and the lengthening of the zygotic portions, thus causing the zygotic portions to open into the eurazygos; in some *Monohammus* there is a short stenazygos (fig. 221a).

* Since this was written one of the writers, F. Muir, has observed the development of the aedeagus in *Sphenophorus obscurus*. The median lobe and internal sac arise as a single tube which eventually differentiates into these two portions, the internal sac not being invaginated into the median lobe until the pupa is fully developed and ready to emerge. In many forms, as we have remarked, no distinct line of demarcation ever appears.

† C.R. Ass. franc. av. Sci., 1899, p. 540.

IV. FUNCTION.

Although a knowledge of the functions of the different parts of the male genitalia is essential to a comprehension of our subject, yet knowledge is at present so little advanced that we can here offer to the student only a general statement and a few suggestions.

The matter for the starting of a new generation is prepared in the centres of the bodies of two separate individuals, and it is necessary that the two essences should be brought together. This of course is effected in the Insecta by copula. During the copula an unobstructed road must exist. This is the genital conduit, and is formed in part by the genital tube of the male and in part by the genital tube of the female. These structures of two different individuals form functionally a single organ. The sex structures are unique in this respect. And they are not correlative with the life of the individuals, but with the life of the generations.

The importance of a correlative knowledge of the genital tube of the female is absolute, but from the point of view we take there is but little information.

The female Coleopteron is usually (possibly always) provided with a spermatheca—a special vessel for the reception of the matter transmitted along the male genital tube. It would appear that this spermatheca is generally placed near the base of the azygotic portion of the female genital tube.

The male structures are therefore directed to the object of placing the sperm in the spermatheca. The first question that arises is as to whether this is accomplished directly or indirectly. Must the sperm be deposited directly in the spermatheca ? Or is it sufficient that it be placed in some other part of the female tube ?

No positive answer can be given to this question at present. It appears from the vague remarks that one finds in literature that the general idea is that the placing of the sperm in any portion of the female tube is adequate. The opinion we ourselves entertain is, however, the reverse of this. We incline to the view that in a large number of cases, the male structures actually place the sperm in the spermatheca, however remote that structure may be from the orifice of the genital tube of the female. The flagellum appears to be an organ admirably adapted for this purpose, and its occurrence and reoccurrence in so many isolated forms is, to say the least, highly suggestive. Even in cases where there is no true flagellum, it may well be the case that the functional orifice of the male (not to be confounded with our "median orifice") is applied to the orifice of the spermatheca. See on this point our figures 58 and 63.

Certainty as to this point can only be obtained by repeated observations of the genital tube during its functional activity, and as to this we have been able to make but few observations.

In *Rhagonycha fulva* ♂ the sac is large and rounded, with three pairs of diverticula along the posterior surface, and a large patch of strong spines on the ventral side (fig. 237a, *a*); the duct opens between the most dorsal pair of diverticula. During copulation this sac distends the uterus to its own size, and the patch of spines covers the entrance to the oviducts. The abundance of this species would make it a convenient form to work out all the details of copulation on.

Unfortunately the process of killing the insects causes the muscles that actuate the internal sac to relax or contract, and so the exact relations of the sac and the female parts are never fully revealed. The shape of the female parts does not exactly correspond to the shape of the male sac and all its diverticula, etc., but there is a co-relationship between them, and apparently they always take up the same position in any one species. Besides the direct evidence as to the importance of the internal sac and its evagination during coition there is the great mass of indirect evidence afforded by the complex armatures that are developed upon them, especially at the apex. In *Pissodes* Hopkins * calls this armature the "seminal valve," but in the various examples of the different families that we have examined the armature does not function as a valve. In cases where there is no differentiated internal sac it is difficult to state how much of the duct is evaginated, but judging by observations made on certain Hydrophilidae a large amount is turned out. The evagination is done, at any rate in part, by blood pressure, and the invagination by the contraction of muscles attached to certain points on the internal sac and to the median lobe.

* U.S. Dept. Agr. Technical Series, No. 20, part I, 1911.

In certain forms the median lobe is specially contrived to effect this blood pressure. In *Xantholinus* the median lobe forms a chitinous egg-shaped chamber, having a membranous band round the middle; muscles pass from the dorsal chitinous portion to the ventral chitinous portion. The contraction of these muscles causes the chitinous portions to approach one another, and thus exert pressure on the fluid in the bulb which forces out the long internal sac. In the case of *Pinophilus* where the sac is exceedingly long, and lies coiled up, with a chitinous flagellum running right through it like a spring, it is not likely that the sac is evaginated ; in fact, the chitinisations on its base prevent such a thing. In this case muscular contraction round the coiled sac causes the distal end of the flagellum to be thrust out through the median orifice, the chitinisations on the base of the sac acting as a guide; upon the relaxation of the muscles the flagellum acts as a spring, the coils distend, and the distal end of the flagellum is retracted.

The action of the flagellum is obscure, but the fact that it appears in such diverse families denotes its great functional importance. It would be of great interest if some one would take any form in which this structure is greatly developed (e. g. *Lucanidae*, *Brenthidae*) and kill while in copula and dissect the female, to see if any part of the internal sac is evaginated, and to what part of the female genital tube the flagellum penetrates.*

In the Longicorns the capacious sac is very long, and it seems improbable that it is entirely evaginated, but only direct observation will decide this point.

The various spines and hairs that are found on the sac are generally pointed basally; this prevents the sac being withdrawn from the uterus of the female while the sac is distended. The various diverticula found on the sac do not appear to correspond to diverticula in the female, but they take up constant positions, and may serve as pads to

* Since writing the above one of the writers, F. Muir, has observed the copulation of *Cryptomorpha desjardinsi.* This is a Cucujus-type with a ring-shaped tegmen with a pair of lateral lobes, a long internal sac with a very long and slender flagellum. In this species the whole of the long internal sac is evaginated and enters the long female tube, the flagellum proceeding still further into the female genital tube. The spermatheca is small and attached to the uterus by a long slender duct. Whether the flagellum actually traverses this duct and penetrates the receptaculum he was not able to observe.

keep open certain spaces between the sac and the wall of the female tubes. Observations on the positions taken up by the sacs within the vagina during copulation are greatly to be desired.

The pressure necessary to drive the viscid fluid from the testes through the long slender ducts must be very great, and the thick coating of muscles surrounding the ducts serves to this end. The pressure behind such a flagellum as is found in *Baryrhynchus miles*, where it is 12 mm. long, and ·006 mm. in outside diameter toward the tips, must be well directed and considerable.

It is worthy of note that the armature of the sac of *Donacia sericea*, etc., recalls the parts of the aedeagus, there being a median lobe, through which the ejaculatory duct passes, and opens on its apex, and a pair of lateral lobes. There is, as it were, a secondary aedeagus within the aedeagus. To find out the action of these pieces during copulation would be of interest.

Whether the lateral lobes in such a trilobe form as *Ceratognathus* pass into the vagina and then diverge and thus hold the female, we are unable to say. In *Stenus speculator* (fig. 232) the lateral lobes are placed along the outside and hold the female. In Coccinellidae they are placed on the outside of the female venter, and appear to have no hold. In some of the Cistelidae the hind body-segment is developed into claspers to retain the female. In *Malthodes* (fig. 233) and *Malthinus* (fig. 235) the last abdominal segment is used as a clasper, and the last segments of the females have depressions into which the ends of the claspers fit to give them a firmer hold. In *Telephorus* and *Rhagonycha* the edge of the vagina is held between the tongue of the tegmen (fig. 236a) and the median lobe. In these species the aedeagus takes nearly a half turn during copulation (fig. 238). The twisting of the aedeagus during copulation is common to many forms, and in some it makes a complete half turn. This is the case in the Caraboid type. In such an one as *Dytiscus punctulatus* the aedeagus, when at rest and drawn into the abdomen, lies on its side, and when thrust out the median lobe curves downwards, but its true orientation is with the median lobe curved upward as we figure it (fig. 37).

It is probable that in many forms the female does not play an entirely passive part in the act of copulation; as to which see the remark made under *Cyphon*.

We may conclude these very fragmentary observations by pointing out that the diversity of the structures indicates a considerable variety of functional detail.

V. TAXONOMY AND PHYLOGENY.

Taxonomy.

It has been supposed that the copulatory structures are bad guides in classification, although they are generally admitted to be of the first importance for the discrimination of species. If, however, the extreme importance of the genital conduit be seized, it will appear that its structure must certainly be of very great assistance in taxonomy.

We have in this memoir considered the male portion only of the genital conduit, and that in a very imperfect manner. It seems possible that if the female part of the conduit were studied important distinctions would be found therein. The only considerable contribution to this subject we are acquainted with is the work of Stein (Mon. Geschl., Organe, etc.). This was published sixty years ago, and was not specially directed to the consideration of the conduit, but so far as we can form an opinion from it, and from our own limited observations and a few other memoirs, the probability of important differences in the female structures is confirmed.

Under these circumstances it will be suggested that we are not justified in making taxonomical generalisations on the subject of the genital conduit at present. With that suggestion we entirely concur. Nevertheless, as taxonomy has been carried on with little or no consideration of this important branch of anatomy, we think it important to introduce this subject, notwithstanding the very incomplete state of our knowledge.

The generalisations that follow are, it will be seen, imperfect and unsatisfactory. Possibly wider inquiry may bring to light important distinctions we have failed to appreciate, and it is also probable—we may say certain—that such inquiry would reveal the existence of annectant forms we are unacquainted with. As a further apology for the following generalisations we may ask that it shall be remembered that the other data of Coleopterous taxonomy are also very incomplete.

We have omitted from our tentative tables certain families that we have examined, e. g. Trichopterygidae and Discolomidae, but we have been somewhat inconsistent, inasmuch as we have inserted others that are perhaps quite as doubtful. Any one who will examine such forms as *Cerylon* will appreciate the difficulty as to making a correct conclusion as to the morphology of the aedeagus in these exceptional cases; the examination of a series of allied forms is often imperative before coming to a positive conclusion.

We must also reiterate here what we have said elsewhere as to the "Spicule." This is scarcely touched on by us, because it would have involved us in the consideration of the number of abdominal segments; but we recognise the importance of the subject. A comparative study of this sclerite, together with the terminal body segments, is necessary before a final decision can be reached for taxonomical purposes.

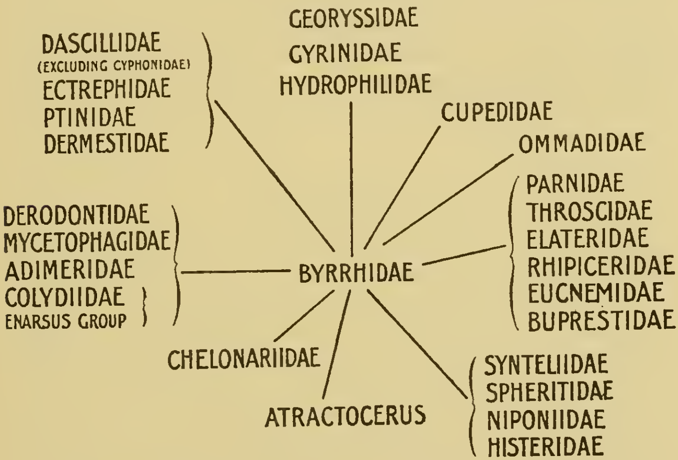
At present we are disposed to adopt eight series. We have considered the possible relations of these series in the section on phylogeny.

(1) Byrrhoidea.

Under this name we include twenty or thirty families. The complex is of considerable importance, as it is possible to consider that we are here in the presence of the more primitive of the conditions of the Coleopterous genital tube, so far as existing forms are concerned. We use this qualification because the structures are very far from being truly primitive. The peculiarities of this complex may be thus summarised, viz.: A median lobe, bearing (as in other cases) the orifice of the duct, and on each side of it a lateral lobe, the sclerites being intimately connected with a basal-piece. The tegmen is thus very complete, and the relation between it and the median lobe is one that allows of very little movement backwards and forwards of the median lobe independent of the tegmen. This distinguishes the families from the Cucujoidea. Moreover, the sac is never highly specialised, in many cases is scarcely differentiated from the duct.

The Buprestidae are peculiar, possessing a remarkable coadaptation between the inner aspects of the lateral lobes and the median lobe, which permits the median lobe to glide backwards and forwards in the slots of the lateral lobes. This coadaptation is carried to a most beautiful extent in *Euchroma*, but it is imperfect in some of the other forms, and, on the other hand, an imperfect condition of a similar kind obtains in Rhipiceridae.

The Byrrhidae are treated as on the whole the most central of the families. It is to be understood that the relations between the Byrrhoidea and some of the other series are very close, and that with greater knowledge some of the families will be found to be misplaced.



AFFINITIES OF THE BYRRHOID FAMILIES.

It will be noticed that we have placed *Cupes* and *Omma* in this division as separate families; they show no approximation to the Adephaga, nor are they at all closely allied inter se. Although *Omma* is clearly a "trilobe-form," it is not the simplest condition thereof; the adaptation of the inner sides of the lateral lobes to fit round the median lobe, and the presence of a distinctly enlarged internal sac (although destitute of armature) indicate in fact a fair amount of specialisation.

Cupes clathratus has a highly complex and peculiar organ, which, however, is of the trilobe form. It is also very remarkable by the structure of the last tergite and certain subanal appendages, but the consideration of the importance of these latter points does not come within the scope of our investigation.

We may also call attention to the fact that a portion of the Colydiidae (as accepted at present) is placed by us among the trilobe forms, while another part is placed in Cucujoidea; we need only add that the heterogeneous family Colydiidae requires a thorough investigation that would probably result in throwing an important light on Coleopterous taxonomy. Other forms placed in the following table near Colydiidae (Derodontidae, Mycetophagidae), should be also investigated with regard to a nearer relation to Trogositidae than is involved by our placing them in different series. Our suggestions as regards these points must be considered merely tentative, in view of the very imperfect state of knowledge on various points.

(2) Cucujoidea.

The families placed under this name are associated by us for the purposes of discussion. Exhibiting considerable diversity inter se, they approximate very closely to the Byrrhoidea, and possibly to the Phytophagoidea. The first of these affinities is chiefly due to Colydiidae, which in its present complex condition we have placed in the Byrrhoidea as well as in the Cucujoidea; the family, as we have previously stated, requires a very extensive investigation, which would probably result in its division. Cucujidae apparently approximates to the Phytophaga by means of *Parandra*, though as regards the male structures we may remark that *Cucujus* appears to be more specialised than *Parandra*. This question is considered in the phylogeny section. Trogositidae is placed in a very central position in this complex. In its normal forms (*Temnochila*, etc.) it approaches the Cucujidae by means of the perplexing *Chaetosoma*. In Cucujidae in the wide sense (for this family will certainly have to undergo division, as has already indeed been insisted on by certain taxonomists), the tegmen forms a less tubular sheath to the median lobe than it does in Trogositidae, while the sac is elongate and placed in repose as in Cerambycidae, and is protected by a strut, very elongate in certain forms and single in Cucujidae, (completely divided in Cerambycidae). As *Chaetosoma* does not display any of these characters it may, from our point of view, be more correctly placed in Trogositidae. *Thymalus* and *Leperina* depart from the more typical Trogositidae by the lateral lobes being ventrally brought together (completely conjoined in *Thymalus*, incompletely in *Leperina*). This point is of importance, because on account of it we have associated with the Cucujoidea certain families that have been usually associated in Heteromera. The tubular sheath formed by the tegmen in Trogositidae, is found in Cleridae, Byturidae, and in a somewhat different form in Cyathoceridae, and we have therefore placed the families in question in the Cucujid-Trogositid complex.

The curious genus *Diagrypnodes* of Cucujidae will have to be separated from the family; it approaches Pythidae. On the other hand no surprise will be felt at the association of Pythidae and Aegialitidae (which are pretty certainly but one family) with Cucujidae, when it is recollected that the Cucujidae include Heteromerous forms, and that certain genera, e. g. *Rhinomalus* and *Hemipeplus*, have for long been sources of perplexity, as to the distinctions between "Heteromera" and Cucujidae. *Anthicus*, Heteroceridae, Othniidae and *Lathridius* have but little specialisation of the sac; none of them show any special approximation to Cucujidae, but they appear to be less ill-placed in Cucujoidea than elsewhere. *Lathridius* is usually placed in one family with *Corticaria*, but the two have but little connection, and *Corticaria* will perhaps find a better position near Cryptophagidae, though it appears to be very aberrant.

We have no hesitation in placing Coccinellidae in this complex, although Verhoeff (in Arch. Naturges, 61, 1, 1895) has separated Coccinellidae as the equivalent of all other Coleoptera by the nature of the male structures, they possessing, according to his perception, within the "penis" (= our median lobe) a structure he calls the siphon. We do not take the same view of the structures as Verhoeff does. According to our view the siphon is the median lobe (penis of Verhoeff) and the part that hoods it (and that Verhoeff calls penis) is an unusual fold which is certainly a part of the tegmen, though we do not feel called on to decide as to its exact nature without a knowledge of the ontogeny. If this view of the structures be correct, Verhoeff's two divisions of Coleoptera, viz. Siphonophora (= Coccinellidae) and Asiphona (= all other

Coleoptera) is little better than ridiculous. Even if Verhoeff's view as to the outer fold being the median lobe be correct, his taxonomical conclusion cannot be maintained. For in that case the siphon is a secondary development within the median lobe, and secondary developments within the median lobe are frequent, and some of them quite as extraordinary as the Coccinellid siphon. (Cf. Flagellum in various groups, Brenthidae, Cucujidae, Lucanidae, etc.)

Sphindidae and Corylophidae come into the Cucujoidea, and are perhaps least ill-placed somewhere near Phalacridae. Corylophidae is really very different. The forms placed near Endomychidae are very inadequately known, and much more investigation is necessary. Coccinellidae are certainly aberrant, but far from extremely so if such forms as *Lasia* be examined. Certain Heteromerous forms (Oedemeridae, etc.) are placed in this division because of the amalgamation of the lateral lobes on the ventral aspect, a point we have alluded to in connection with *Thymalus* and *Leperina*, but a careful consideration of these forms in connection with those Tenebrionid forms (*Stenosis* and *Zopherosis*) in which the orientation of these parts is similar is desirable.

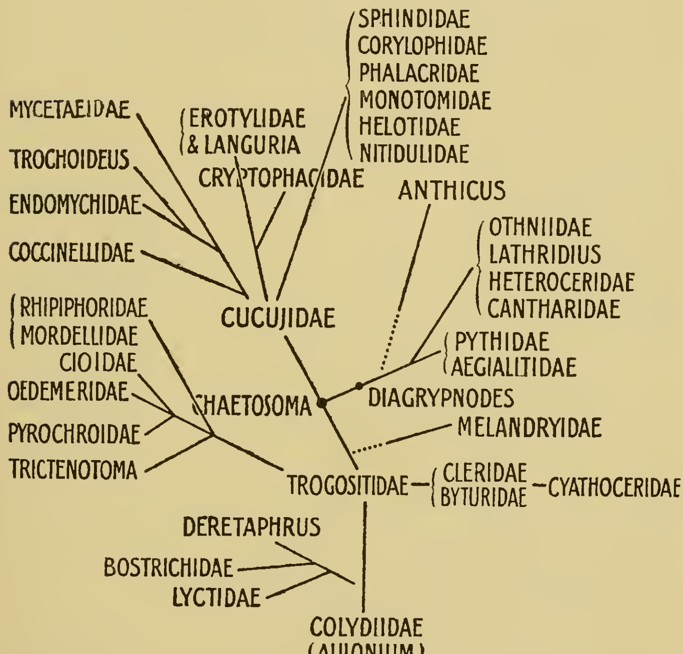
Cioidae is another form that is not very similar to anything else, but it has the orientation referred to.

Trictenotominae exhibits a most highly specialised and beautiful structure with the same orientation.

Melandryidae have the more usual (dorsal) orientation. Bostrychidae is most difficult to place; the aberrant *Deretaphrus* apparently really approaches it somewhat.

We must reiterate our opening remark on the Cucujoidea. Many of the families are merely placed in it for purposes of discussion. At present it is our impression that they are really more distantly related than we have made them to appear. But it must be remembered that we have examined but few forms, and that with further investigation connections we scarcely suspect may be forthcoming.

It may be well to elucidate the importance of these remarks by reference to a particular case. Say Thymalus (fig. 90). Here the parts identified as lateral lobes are basally conjoined but are apically divided. This form might be derived from an Elaterid (say) form by approximation of the two lobes on the ventral aspect and a concomitant obliteration of the anterior part of the partition separating them. If we take the view that the forms placed by us at present in Cucujoidea are derived from creatures that formerly possessed definitely distinguished lateral lobes, we must infer a transition more or less similar to the above. If on the other hand we admit that some forms may have originated and developed



AFFINITIES OF THE CUCUJOID FAMILIES

without having come into possession of lateral lobes, we might assign *Thymalus* to such a series; in which case the *ll* of our fig. 90 is merely tegmen, that has to some extent simulated the appearance of conjoined lateral lobes by becoming a little divided and emarginate at the tip. Which of the two theories is the more probable can only be decided by examination of a good series of Trogositidae, and by ascertaining if development throws any light on the subject.

(3) Phytophagoidea (or Rhynchophoro-Phytophagous Division).

We cannot point to any difference in plan of structure between the Rhynchophora and the Phytophaga. In Chrysomelidae and Curculionidae we find ourselves concerned with series of developments; and the Scolytidae within their comparatively narrow limits also exhibit a similar phenomenon.* Cerambycidae and Brenthidae are each so far as we have seen much more homogeneous. Of Anthribidae we have been able to examine but few forms, and these have not led us to suppose that any great diversity will be found within their limits; this family may well be studied in connection with *Belus* in the Curculionidae.

In this enormous complex the tegmen forms, in the more simple kinds, a ring around the median lobe, with a dorsally placed cap-piece, which is usually bilobed; the median lobe assumes the tubular condition in an abbreviated form only, the proximal part consisting of two dorsal struts; the first connecting membrane is large, and allows of a considerable movement of the median lobe within the tegmen; the internal sac is long, and extends through and beyond the median foramen. These conditions are displayed in *Parandra*, and we may remind the reader that they are those of a primitive (and suppositive) Cucujid. It is right to add here that we do not understand the phylogeny of the lateral lobes, because in this division it is specially obscure, and may be multiple, if they are represented at all.

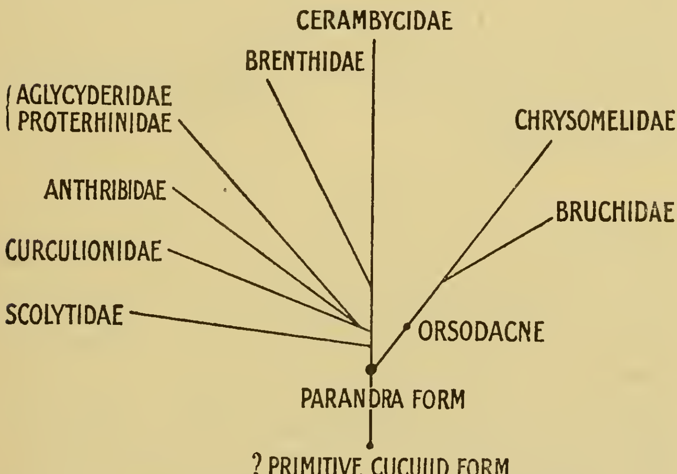
The characters are very persistent in Cerambycidae, and apparently also in Brenthidae; most of the specialisations being found in the sac and its armature. *Orsodacne* (usually placed in Chrysomelidae) is interesting, as possessing the simple conditions of the Cerambycid *Parandra*. *Timarcha* has no free lateral lobes but has a large dorsal portion of tegmen, and at the same time two well-developed median struts,—a somewhat anomalous form, therefore.† Specialisation in the Chrysomelidae occurs as

* This is not displayed in our illustrations, but is derived from Lindemann's excellent study of this family, mentioned under Scolytidae.

† Weise (Deutsche ent. Zeitschr. 1895, p. 26) has already called attention to the aberrance of *Orsodacne* from Chrysomelidae. If we

to two chief points; the reduction of the tegmen to a small Y- or V-shaped piece, concomitant with the development of the median lobe into a perfect, rigid tube (cf. *Orina*), enclosing the sac either entirely or to a large extent. The Bruchidae, as at present constituted, are scarcely distinct from the Chrysomelid *Sagra*. In the few Anthribidae we have examined there is no appearance of a division of the dorsal portion of the tegmen.

A development, parallel with that sketched in Chrysomelidae, occurs in Curculionidae and Scolytidae, so far



AFFINITIES OF THE PHYTOPHAGOIDEA.

as the reduction of the tegmen to a Y-piece is concerned. This character is strongly marked in *Platypus*, which may be treated as an extreme form of Scolytidae, though it is not included therein by Lindemann.

Aglycyderidae and Proterhinidae will probably prove not to be separable as distinct families. They are, however, a very interesting form. Though we have placed

rightly apprehend his meaning as to "Penisstütze" in connection with *Timarcha* we cannot in that case adopt his view; two separate median struts not only exist in *Timarcha*, but in *T. geniculata*, at any rate, are highly developed. Examine *Phyllodecta* to see a comparatively rudimentary, or vestigial, condition of the base of the median lobe.

them in this complex they might be placed equally as well with the Cucujoidea. Whichever view be adopted there appears to be no direct connection with any other family, and they can scarcely be viewed as primitive types. They do not approach the Byrrhoidea as there is no appearance of free lateral lobes.

As we have suggested (in speaking of *Parandra*) a connection of this series with Cucujoidea it is only fair to say that a different view may be taken. It might be considered that in this series there are primarily no free lateral lobes, those cases in which they appear to be present in a modified form being merely secondary developments of a single piece. This view would remove the series from any connection, direct or indirect, with the Byrrhoidea. The point is more fully discussed in the section phylogeny.

(4) Caraboidea or Adephaga.

In this type the median lobe is highly developed; the lateral lobes are largely and closely connected with the dorsal margin of the median foramen by means of a prominent condyle; the basal-piece is greatly reduced, or entirely membranous; in the less specialised forms the internal sac is undifferentiated, but in the more highly specialised forms it is large and complex. Pelobiidae, Dytiscidae, Haliplidae are the more generalised forms, and if the Adephagous type is to be connected with any other, these families should be specially studied. As to suggestions for this connection we must frankly say that we have not yet found anything to help us, but their differentiation from the Byrrhoid type is not great.*

It is just possible to consider the series as a modification of the Cucujoid type, the lateral lobes being displaced and fixed in a peculiar manner.

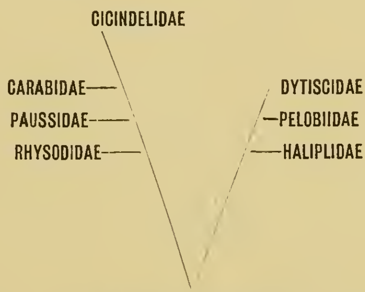
With the reduction of the basal-piece the median lobe becomes more tubular, and the sac more complex. In the Cicindelidae the basal piece is very much reduced, and in the Carabidae it is only represented by a membrane, as stated above.

* We greatly regret that we have not been able to examine the genus *Amphizoa*. The only male of the family that we have seen is the actual type of *A. josephi* Matth., now in the collection of the British Museum.

Taxonomically this is the simplest of all the series of Coleoptera if we limit it as is here done.

The structure of Gyrinidae is on a different plan from that of the Caraboidea. When it is remembered in addition to this that all the members of this family are highly specialised for a mode of life that is shared by no other Coleoptera, we are justified in concluding that this has always been an isolated family.

Cupes and *Omma* do not exhibit any approximation to the Caraboidea of direct nature.

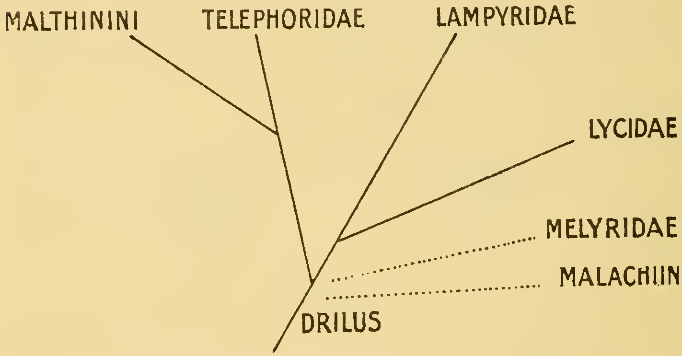


FAMILIES OF CARABOIDEA.

(5) Malacodermoidea.

In considering this complex we may commence by saying that we have rejected from it various families that were formerly included in it. The Dascillidae are, we consider, nearer to the "simple trilobe" forms we have called Byrrhoidea. The Cyphonidae we are obliged to omit as their aedeagus appears to be very peculiar, and we do not yet understand it.

This still leaves numerous forms as Malacoderms. As regards some of them taxonomists are not by any means agreed as to their family rank. We take *Drilus* as one of the simpler forms. This is a trilobed form modified as to the articulations between the median lobe and the lateral lobes, and between these and the basal-piece. The similarity between this and the more modified Lampyridae is evident. The Lycidae in their simpler forms (*Dictyopterus aurora*) also approach *Drilus*, and in more differentiated forms (*Lycostomus*, etc.) still have the same arrangement, though the median lobe may become elongate (to a remarkable extent), and the lateral lobes diminished. The Telephoridae (*Rhag. limbata*) exhibit a remarkable specialisation in the very bulbous form of the median lobe, but the New Guinea *Chauliognathus*? (fig.139) is much less remarkable, and departs to a comparatively slight extent from *Lampyris*. *Malthinus* and *Malthodes* appear to be modifications of the Telephorid plan.



AFFINITIES OF SOME OF THE MALACODERMID FAMILIES

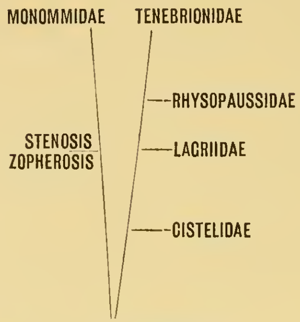
As regards "Melyridae" we fail to connect them satisfactorily with the Malacoderms, but as we cannot assign them any other place in a system we treat them here. In addition to this we may remark that the family will very likely have to be sundered in two or more. *Malachius*, however, may prove to be a form annectant to the highly specialised *Astylus* (Melyridae proper) and the aberrant *Balanophorus*. As regards the sac, the lower forms of the Malacoderms have it but little specialised, but in higher forms (those allied to *Telephorus* and the higher kinds of Lycidae) this structure becomes complex, as it is in all the Melyridae we have examined. *Phloeophilus* cannot be admitted to either the Malacoderms or the Melyrids till annectant forms are brought to light.

(6) Tenebrionoidea.

Under this name we can associate at present only a few families, because we are of the opinion that several of the families combined with Tenebrionidae to form the "Heteromera" must be separated. The comparatively small families, Cistelidae (Alleculidae of many recent writers), Lagriidae and Rhysopaussidae, are really allied to the huge group Tenebrionidae. Of this latter complex it will be noticed that we have examined but few forms. Taking *Pediris* as a central one we find the tegmen consisting of an elongate tubular basal-piece, chitinous on the dorsal aspect, with well marked and separate lateral lobes, making lateral and dorsal protection of the elongate median lobe. In the more specialised Tenebrionidae (e.g. *Eleodes* and *Blaps*) the lateral lobes are soldered together, and the median lobe is reduced in extent. In certain cases (*Cossyphus*) the median lobe is reduced to a nearly or quite membranous condition, and in Cistelidae and Lagriidae there is a similar reduction. In the type of the Nosoderma-group we have examined (*Zopherosis*) there exists a distinction from *Pediris* that we must treat as of considerable importance, inasmuch as the chitinisation of the tegmen occurs on the ventral aspect, the lateral lobes being united in that position. This suggests that a complete sundering of the Tenebrionidae will be found necessary. *Stenosis* agrees with *Zopherosis* in this respect. It would be well worth examining *Adelostoma* and allies to ascertain whether there is a real affinity between the *Stenosis* and *Zopherosis* forms, but we have not been able to carry our investigations of the Tenebrionid forms farther than the inadequate extent that will be found in our anatomical section.

As regards the families of "Heteromera" other than those mentioned above, we have already said that we have failed at present to connect them with the Tenebrionidae; and we have assigned them tentatively positions in the Cucujoidea. Whether the Tenebrionidae really link on as further differentiations thereof (cf. Melandryidae and Pythidae) we are not prepared to express an opinion. We have left Monommidae in the Tenebrionid division (along with the *Stenosis-Zopherosis* forms), but it appears to be really very isolated.

We may conclude our brief remarks on the Tenebrionidae alliance by referring the reader to what we have said elsewhere as to the "simple trilobed form of aedeagus," and adding that there is not here a great departure therefrom.



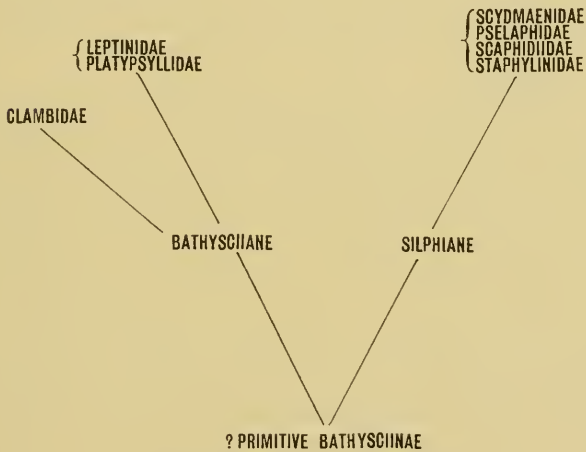
FAMILIES OF TENEBRIONOIDEA.

(7) Staphylinoidea, or Brachelytra.

In this division the family Staphylinidae is of the first importance, because of the great number and diversity of its forms. This family is characterised by the existence of a highly developed median lobe, by the absence of a basal sclerite, the lateral lobes being diversified in form. In the *Xantholinus* group we are in presence of one of the most highly specialised forms of Coleoptera. In the Omaliini we find an approximation to Silphidae. The Silphidae are in fact the most primitive of the families placed in this division.

The Silphidae proper differ much from the other forms of the family we have examined. In *Bathyscia* and *Liodes* (= *Anisotoma humeralis* of the European catalogue) there is a very large median foramen, basally placed, and a median lobe elongate and tubular in form; there is a basal-piece separated from the median lobe, and well marked lateral lobes closely connected with the basal-piece, and thus forming a well marked tegmen. But in Silphidae (*S. obscura*) the median lobe is bulbous, rather than tubular, with a small median foramen (often placed distally), a small basal-piece, with well marked lateral lobes forming thus a complete tegmen. This supports the division of Silphidae into two families.

The Silphinae show relationship with Staphylinidae; but if we consider Bathysciinae as more primitive than Silphinae, then the affinity of Staphylinidae with Silphidae s.l. is of an indirect nature. If, however, we consider (as is frequently done) Bathysciinae and Silphinae as one family (= Silphidae s. l.) then this is more primitive than Staphylinidae, and we may distinguish the two by the presence of a basal sclerite in Silphidae which is absent in Staphylinidae. Of the other families included in the Brachelytra, Leptinidae and Platypsyllidae approximate the Bathysciinae division of the Silphidae, while Pselaphidae, Scydmaenidae and Scaphidiidae approach Staphylinidae. Clambidae is highly specialised, but appears nearest to the Bathysciinae; it is, therefore, a family long separated from the most primitive form of the Brachelytra.



AFFINITIES OF THE STAPHYLINOIDEA.

(8) Scarabaeoidea, or Lamellicornia.

It is generally considered that this is one of the most distinct of the great divisions of the Coleoptera, and our investigations quite confirm this idea. At the same time much difference of opinion exists as to the families and their relations inter se, some naturalists considering Lucanidae and Scarabaeidae as incapable of distinction, while others maintain that they have but little affinity.* Probably the solution of the difficulty will be found by increasing the number of recognised families. Usually

* See Escherich, Wien. ent. Zeit. xii, 1893, p. 265.

these are three, viz. Passalidae, Lucanidae, Scarabaeidae. We will return to this point after touching on the peculiarities of the group.

The first of these is that in the enormous majority of the forms there is a great reduction of the scleritic parts of the median lobe. If the characters of a Lucanid and a Scarabaeid be examined, it would at first be supposed that but little real affinity exists between the two. On the other hand, if *Trox* (usually placed in Scarabaeidae) be added to the compared material, the difficulty becomes that of separating the two divisions, for *Trox* agrees better with Lucanidae than it does with Scarabaeidae. *Trox* is not only very important in this respect, but also because it throws some light on the very peculiar male structures of the Passalidae.

The Scarabaeidae, while exhibiting a reduction of the scleritic parts of the median lobe, display an enormous development of the basal-piece, which forms the "tambour" (Straus-Durckheim) of the organ. This tambour usually shows a constriction which might at first sight be supposed to separate it into two parts, in which case the proximal part only would be taken as the basal-piece, and the distal portion might be supposed to be part of the median lobe. This, however, is a most superficial observation; the constriction in question merely marks the attachment of the connecting membrane, the two portions of the tambour being one enormous basal-piece. The lateral lobes are most remarkable and are very diverse. They form what is usually, in this division, called the forceps. In some cases they are separate, not amalgamated, at their bases (*Spilota*, etc.); in another condition they are amalgamated on the dorsal aspect, forming an undivided piece (*Pelidnota*); while a third condition exists in *Lomaptera* (Cetoniinae), where the amalgamation of the lobes occurs on the ventral aspect. In *Ischiopsopha* by a modification of this they form a complete scleritic ring, as they do in *Xylotrupes*. The ventral surface of the basal-piece is usually membranous for a large area, but in some forms there is a chitinisation of this surface, to which we have applied a special name, the ventral-piece (fig. 19, *vp*). In some cases this ventral-piece becomes quite chitinously continuous with the lateral lobes (*Xylotrupes* e. g.), forming thus a very large irregularly shaped sclerite.

The sac in Scarabaeidae is usually largely developed in size, and also in form, showing lobes, or numerous diverticula (*Hexodon*), or even large peculiar sclerites (*Spilota regina*, Newm.).

(We have already alluded to the reduction of the median lobe in Scarabaeidae, but may here say that in our anatomical section we point out that no line of sharp demarcation can be drawn between median lobe and sac. The reduction of the median lobe in Scarabaeidae, compensated for—so to speak—by the remarkable developments of the sac is a matter worthy of special investigation.)

After these remarks on the Scarabaeidae, if we turn to the Lucanidae, we again find remarkable diversities, but of a totally different kind. The median lobe is well developed. In some cases there is a conspicuous fine terminal tube called the flagellum; this specialisation is more correctly described as a part of the sac. The sac in Lucanidae frequently is not invaginated, but is crumpled up, and the "flagellum" is merely a prolongation of that one of its lobes (or parts) on which the orifice of the duct is situated. The flagellum is clearly not of great morphological importance.

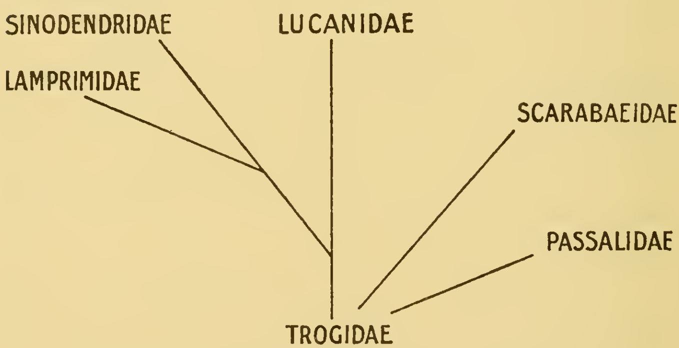
The basal piece in Lucanidae is very varied as regards size, being sometimes quite small (*Ceratognathus*), in other cases (*Neolamprima*) large and tubular, but we have not found any case in which it really approximates in shape to the "tambour" of the Scarabaeidae.

The lateral lobes of the Lucanidae are always well developed (though very slender in *Aesalus*), and they are never conjoined (we have pointed out that they are conjoined in three different ways in Scarabaeidae).

The genus *Trox* (s.l.) is usually placed in Scarabaeidae. In the recent Catalogue of European Coleoptera it immediately follows the Lucanidae. So far as regards the male structures it is impossible to look on *Trox* as a Scarabaeid. It might, on the ground of these structures, be placed in the Lucanidae, but if other considerations demand its separation therefrom, it must form a separate family, equivalent in import to each of the two families mentioned. The relation of *Cloeotus* and *Anaides* with *Trox* requires a careful examination.

This family Trogidae is of the first importance. It seems to offer the only inkling of a connection of the highly peculiar Passalidae with the other divisions of Scarabaeidae.

In the Passalidae the median lobe is large and globular, membranous around the median orifice, which is large; small median struts are sometimes attached to its base. The lateral lobes are consolidated, have not the character of lobes, but form a plate. The basal-piece is distinct, except in *Aulacocyclus* (fig. 13), where it is lost or entirely consolidated to the lateral lobes. The internal sac is large. All these characters are approached in *Trox omacanthus*, but in neither Lucanidae nor in Scarabaeidae do we find any suggestion of a direct connection with Passalidae.



AFFINITIES OF THE SCARABAEIOID FAMILIES

The great importance of the Trogidae in this division is evident, but becomes singularly significant when we realise that it also approximates greatly to the Byrrhoidea series.

In concluding our scattered remarks as to the Scarabaeoidea we may say that we think that the taxonomy of this division is still very imperfect. We greatly regret that we have not been able to examine some of its most enigmatic forms (e.g. *Nicagus*),* but we feel that it would

* Thanks to Mr. E. A. Schwarz, F. Muir has since been able to examine the long disputed *Nicagus*. It has a well defined median lobe, with median orifice on dorsal aspect of tip; well defined lateral lobes a little longer than the median lobe, broad at the base and gradually tapering to a pointed tip, the bases meeting on the ventral

even in that case have been highly improbable that we could have contributed much to the elucidation of the enormous complex. This would be of itself a considerable work.

PHYLOGENY.

In considerations as to phylogeny, palaeontology should be of the first importance. Unfortunately our knowledge as to this subject is dreadfully incomplete and is we fear likely to remain so for a very long period. In fact all we know is that no Coleoptera have yet been found earlier than the Triassic period; and that long anterior to that there existed many insects some of which it is reasonable to suppose were precoleopterous ancestors of the Order. Handlirsch suggests Blattoid or Sialoid ancestors. Only 18 of these ancestral Coleoptera are known in the Trias, and the whole of the subsequent mesozoic period only shows a total of 352 species. No information whatever exists as to the structure of the male genital tube of the fossil forms, so that palaeontology is of no assistance in our present special inquiry. All we can say is that with Handlirsch's plate 41 before us, in which the remains of the Liassic Coleoptera are figured, we may say that a considerable number of the forms are such as we should expect to find provided with a simple trilobe aedeagus or a Caraboid one. While in plate 39 fig. 4 we are inclined to consider *Pseudelateropsis* Handl. as a relative of *Cupes* or *Omma*. The condition of these fossil Coleoptera is, however, such that we really learn but little from them beyond the existence of a number of very distinct forms among the earliest Coleoptera.

In the absence of palaeontological guidance students of Coleopterous phylogeny have been driven to rely on other characters. The male genital tube has received no consideration in this respect, but we believe that it will be recognised as of great importance as elucidating phylogeny especially when it shall have been studied in conjunction with the female structures. There are in fact three main lines of inquiry as indicative of relationship, (1) the body and its appendages, (2) the genital conduit (*i. e.* the structure of the combined male and female parts), and

aspect but not on the dorsal; basal-piece well developed and chitinous on the ventral side; internal sac small and very little differentiated. This type is similar to *Trox* and some of the less specialised Lucanids.

(3) the ontogeny. To which may fall to be added as a fourth, the structure of the sexual glands.

We had at first decided not to write a phylogenetic section for our memoir, as our knowledge is so imperfect and is liable to correction in so many ways. Yet recalling the fact that the other departments are also but imperfectly known, so that there is but little agreement amongst phylogenists, we have concluded that a section on phylogeny of the genital tube, though somewhat premature, may be welcome nevertheless. It will at any rate exhibit the difficulties and complexity of the subject.

Our inquiry has led us to suggest the arrangement of Coleoptera in eight series. Remarks on these series appear in the section taxonomy. A connected account of their apparent relations, and an account of some of our reasons for the conclusions we have come to follow this, and the most important points will be found discussed under Phytophagoidea and Byrrhoidea.

1. *Byrrhoidea.*—The aedeagus appears to us to be in this series in its simplest condition, and at the same time to be the form most capable of modification to result in the structures we meet with in other groups, as we have already mentioned. The series itself is, however, far from being homogeneous and we shall not be surprised if some of its forms prove to be really separate series. *Cupes* and *Omma* may be mentioned. Also Gyrinidae. *Atractocerus* requires serious attention, and it may be doubted whether Buprestidae are really in phylogenetic accord with other Byrrhoidea.

We have frequently stated that we consider the trilobe form of aedeagus as it is exhibited by the Byrrhoidea to be the simplest, and probably the more primitive, of the existing forms. Our reasons for this are (1) that "low" forms of various divisions are found to possess the genital tube in a state but little different from the trilobe of the Byrrhoidea. (2) That in highly specialised groups of which there exist a sufficient variety of forms we have always been able to find in certain cases one or more points that form an apparent transition to the trilobe. This of course may be illusory (as indeed we shall argue when discussing under Phytophagoidea the questions connected with "lateral lobes"), but it shows that the modification of the trilobe is to the imagination easy, and we all know that in the absence of direct evidence phylogenists have only too frequently to resort to the use of the imagination. (3) The internal sac is found in its simplest condition among the trilobe forms, and attains its highest development amongst forms in which the aedeagus is very different from the simple trilobe. (4) In various females that we have examined the structures depart but little from the trilobe form. Thus in *Rhizophagus depressus* the female tube consists of a large basal piece with strong lateral lobes (*i. e.* there is a tegmen of the trilobe form). The median lobe is rather small, and its chitinisations are less compacted and coadapted than in the male aedeagus, the duct opens at the apex, and there are basal struts. In this species the male (fig. 101) departs considerably from the trilobe form.

2. *Caraboidea.*—This division, as limited by us, is remarkably homogeneous, and forms as regards the aedeagus one of the most satisfactory series of the Order. We have suggested that it might possibly be derived from Byrrhoidea. This would be accomplished by dragging the lateral lobes away from one aspect of the median lobe, and connecting them with a condyle on the other aspect. The basal-piece must become membranous (it is imperfectly chitinised in Cicindelidae), and completely ride over, or cloak the base of the median lobe. The last character being of a Cucujoid nature. We have no belief in such changes having occurred during the Coleopterous stage of the phylogeny.

3. *Cucujoidea.*—This is an assembly of many families, and will probably require much emendation and even division. The main points of distinction from Byrrhoidea are that the tegmen rides over the median lobe, and that the lateral lobes are differently placed. The question of deriving the series from Byrrhoid ancestors is discussed in our considerations as to series 8, Phytophagoidea.

4. *Staphylinoidea.*—In the higher forms this is a most distinct division, the aedeagus appearing to function by means of an aneurism of its basal part. We have associated Silphidae with Staphylinoidea because in the lower forms of the great family Staphylinidae (Omaliini and Piestini) the peculiar structure is much less perfect, so that we think it possible the Silphoid forms and the Staphylinoid forms may prove to be not separable by the male genital tube. The lateral lobes are extremely varied

in Staphylinidae, and assume different functions in the various divisions. The question of a relationship of the series with Byrrhoidea cannot be properly considered in the absence of a decision as to the relations of Staphylinidae and Silphidae, alluded to above.

5. *Malacodermoidea.*—Though the simpler forms of this series approach the Byrrhoid structure, yet we have not found any form that really connects the two. In the low Malacoderms the median lobe is insignificant in size compared with the lateral lobes, but the large development of the latter is on the basal parts, and the great distal development of these parts as found in Byrrhoidea does not occur in the Malacoderm forms we have examined, so that the relations of the parts appear to be different. In higher Malacodermidae the median lobe may be greatly developed, and the parts become so complex that a careful analysis is requisite for their comprehension. Under these circumstances we are not prepared to say more than that we shall not be surprised if a more thorough investigation should reveal annectants to the Byrrhoidea. As regards the Melyridae we have remarked in the taxonomical section that it presents special difficulties.

6. *Tenebrionoidea.*—As regards this series we have said in taxonomy the little that we are prepared to advance as to the phylogeny of the series. The difficulties arising from the orientation of some of the forms, alluded to under Taxonomy, is considerable. When lateral lobes, or when tegmen, are ventrally placed, are we justified in considering them homologous as regards origin with similar structures dorsally placed ? The answer to such a question if it concerned the chroötic tube would certainly be a negative one; but as regards the genital tube a positive answer cannot be given till the remakable cases of tortion and distortion that occur have received a more thorough consideration.

7. *Scarabaeoidea.*—This is a very distinct series, except that by means of Trogidae and certain Lucanidae it approaches the Byrrhoidea, to which therefore it may be linked. The Lucanidae appears to be a group of fragments, and, small as it is, offers a remarkable contrast to the huge family Scarabaeidae.

8. *Phytophagoidea.*—Under this series we have united all the great divisions of Rhynchophora as well as the Chrysomelidae and the Cerambycidae or Longicorns. We

have not found between Rhynchophora and Phytophaga any distinction that is valid throughout the two divisions, though it is not improbable that an extended study would reveal some important difference. At present the Phytophagoidea is by far the largest of the eight series.

The question as to the distinctness of the series depends largely on the view that is taken as regards "lateral lobes" in Coleoptera. To explain the view we are inclined to take, a digression of some length is necessary.

It has been suggested that lateral lobes may be modified appendages of the body. We have not found anything to support this view. Indeed if it were so they were doubtless modified in the precoleopterous stage of evolution and the point would therefore only indirectly concern us. But we incline to another view on this highly speculative point. We suggest that Coleoptera are descended from ancestors in which the efferent ducts from the sexual glands, either as a pair or singly, opened on a membrane connecting the 9th and 10th ventral plates of the abdomen, while the orifice of the alimentary canal was placed immediately above the 10th sternite, which thus separated the two great exits. By slight elongation of the membrane of orifice of the efferent ducts, they were in repose withdrawn within the body cavity; and a somewhat analogous phenomenon occurring with regard to the rectum, the genital tube and the apex of the rectum became, in the imago, placed inside the body cavity. The 10th sternite (between the two parts) shared their invagination so that the external body wall was terminated behind by the apposition of the hind margins of the 9th abdominal sternite with the 10th, or some other, tergite. This apposition, with of course considerable and in some cases very great modifications, has attained so great perfection that sometimes it is very difficult to see any opening at the posterior extremity of the body. According to this view the genital tube is merely an elongation of a connecting membrane between two ventral plates; the modified 10th sternite either entering into the composition of the tube or not, as the case may be. It may be well here to remark that for the purpose we have now in view, we are mentioning only the simplest aspect of the matter. For our purposes it does not signify how many abdominal segments there were originally, or whether more than one were indrawn either subsequently or concomitantly with the changes as to the invaginated genital tube.

The complete invagination of the male structure in the enormous majority of forms is a marked feature of Coleopterous anatomy. Another trait of the Order is the extraordinary extent to which chitinisation is carried. The external parts of Coleoptera are in some cases harder than bone, and in these cases the internal phragmas and apodemes may share in the hardness, as also the male genital tube. For instances we may mention the chitinisation of this structure in the Histeroid genus *Oxysternus*, and the Buprestoid *Euchroma*. A further development of the genital tube is exhibited by elongation, and by chitinisation. We have just mentioned examples of its perfect hardness, and as specimens of its elongation may mention the long flagella so frequently met with, and the remarkable elongation of the sac (or stenazygos) in *Eumolpus*, where it is about 1½ inches long. Turning now to the question of the origin of the sclerites of the tube, we know from the structure of the body wall that exposed large surfaces become very strongly chitinised while immediately contiguous parts remain delicate membrane. The chitinisation takes place by the intermediary of hypodermal cells, and it may well be that the reason for parts remaining membranous is due to creases preventing the proper development of hypodermal cells there, and, possibly, their extension in certain directions.

As the genital tube became elongated it would in the invaginated condition be crumpled and creased, and the formation of separated sclerites on it may probably have been to some extent determined by the nature of these foldings.

We make these suggestions with a view to getting the student to realise the probability that the development of the genital tube is due to factors that are on the whole similar to those that have determined the structures of other parts of the body. The factors are not really known. The phenomena of chitinisation are indeed specially obscure, and we are not aware that any one has offered an explanation of the fact that Histers are hard and Malacoderms soft. Neither do we pretend that there is a perfect co-relation between the chitinisation of the sclerites of the body wall and those of the genital tube: in fact we are well aware that in some cases the opposite is true.

We will now turn to the point for the elucidation of which this digression has been made, viz. the value of lateral lobes in the consideration of phylogenetic points.

The lateral lobes extend in the longitudinal direction, while the various invaginations are the result of transverse creasings. That lateral lobes can be much modified in their position is clear. There is no doubt that they can be brought more to the ventral surface or more to the dorsal surface, and there is no doubt that they can be approximated, made contiguous or even conjoined. These facile changes, whether great or small morphologically, have no doubt been actually limited, and when we recollect that there must always have been such an agreement between the male and the female parts of the genital conduit that good viability was invariably preserved, we must adopt the view that may be summed up in the words, "the less change the better."

Are lateral lobes present in all Coleoptera? And if they are not to be definitely seen in some forms is this to be attributed to original absence or to secondary modification?

In the Byrrhoidea lateral lobes are a conspicuous feature. So are they also in Caraboidea, with a slight difference in position. They are present in the Staphylinoidea in a variety of shapes and modifications of a very interesting character. They also exist in Malacodermoidea, in Tenebrionoidea and in the Scarabaeoidea.

In the Cucujoidea lateral lobes appear to be absent. But there are frequently present apically and on the middle of the tegmen two articulated processes that may be considered to be their homologues by process of a change to explain which we must make another brief digression.

If the reader will examine one of the typical Byrrhoidea, *e. g.* a large Elaterid, he will note that the tegmen is so attached to the median lobe as to permit of little or no independent movement of the two; they work, in fact, as a single layer. Let him then take a Cerambycid aedeagus (the members of which are all conformable as regards the point in question), and he will find the reverse condition displayed, the median lobe and tegmen being so arranged as to permit of a play of the former through the latter, the two parts function as two layers, one cloaking the other.

Returning then to the Elaterid he will notice that the change required to permit the tegmen in that form to ride over, or cloak, the median lobe consists in the first place of an elongation of the connecting membrane between them. If this take place and the liberated lateral lobes be approximated dorsally, we have in fact the essentials of the arrangement as we find it in Cucujidae. We might, then, conclude that it is permissible to derive the Cucujoidea from the Byrrhoidea. When, however, we turn to consider whether such a change has ever actually occurred, we must ask ourselves whether it is probable that an aedeagus that is functioning as an organ of one layer would change into a structure that functions as a two layer arrangement. We think the answer would be that in the early conditions of the genital tube such a change might occur, but that after the aedeagus had attained a considerable development nothing of the sort is at all probable.

We now return to the consideration of the Phytophagoidea. If a well-developed Cerambycid aedeagus (say one of Clytini) be compared with *Cucujus* it will be noticed that in the position occupied by the "lateral lobes" (if really such) of the latter there is in the *Clytus* a divided, or rather cleft, process resembling the *Cucujus* lobes, and it would appear therefore that if the *Cucujus* possesses lateral lobes so also may the *Clytus*.

A further examination of a variety of forms of the two series produces the gravest doubts. In the Cucujoidea the lateral lobes are either articulated at the apex of the tegmen, or if the articulation be absent, the single part has the appearance of being two parts combined (cf. *Helota*). But in Phytophagoidea (at any rate in Cerambycidae) there is never any articulation of the apical processes of the tegmen, and the comparison of a series of forms suggests that the bilobed state of the apex of the tegmen (or cap-piece) may be the result of progressive emargination of what was originally a single piece.* In that case the

* In the Cerambycidae (especially marked in genus *Phrissoma*), there is a ridge on the underface of the divided cap-piece giving an illusory appearance of articulation of the two lobes. In the Curculionidae the appearance is different: there are often two separated lobes (the "papilla" of Hopkins in *Pissodes*), and in *Eupholus* the lobes are widely separated (this point is not well shown in our fig. 222*a*), while in some other Rhynchophora there is a single median prolongation of the cap-piece. None of these cases is similar

Phytophagoidea have no lateral lobes and are different from the other great groups. It is then only possible to derive them from some primitive Cucujoid form unknown to us. The term primitive (suppositive), as here used, may probably be interpreted as implying that if a connection of Phytophagoidea with our other series ever existed it was in the precoleopterous phylogeny. Though we have not discovered any important distinction between Rhynchophora and Phytophaga as regards the aedeagus, we may point out that our investigation of these two enormous complexes is very far from exhaustive as to this point. Also that this memoir is not concerned with other distinctions.

We consider that the genital tube of the male is of great importance in the phylogeny of Coleoptera. And that its study makes it extremely difficult to accept less than eight primary divisions of the Order.

VI. ALPHABETICAL INDEX OF FAMILIES AND SERIES

to what we have found in the Cerambycidae. It is therefore possible that even the aedeagus may ultimately show the Rhynchophora to have an origin distinct from the Cerambycidae.

Explanation of Figures.

The figures are all original, and have been drawn with the aid of a camera lucida from our own dissections. The scale of magnification is varied. Although this point is not of great importance for our purposes, the scale is in most cases indicated by a line placed near the figure. When no number accompanies the line then the length of the line is 1 mm. and the magnification of the figure is indicated by that of the line. When a number accompanies the line, the number indicates the length of the line in millimetres or a fraction of one.

The connecting membranes between certain parts are only partially shown in the figures. To have invariably introduced them would have involved the use of shading; and much artistic ability would even then be required to distinguish the scleritic from the membranous parts. The student will recollect that these membranes always exist connecting the median lobe to the tegmen, and the tegmen to the body wall. Sometimes a part of one of the membranes is shown, and it is then indicated as such by the torn edge.

The position shown is very frequently not a true profile, but a partial one, thus allowing more of the parts to be seen and inferred. The drawings have all been made from specimens in a wet, or relaxed, state; and the student must not expect to find exactly the same appearances in dried and collapsed preparations.

The figures are as a rule uniform as regards their longitudinal position, the distal end being to the right so that a side-view shows the left side. In a few cases, in order to show certain structures, the right (not the left) side is figured; and in that case in order to make comparison more easy the figure is orientated so as to make the right side look as if it were the left one, and it is stated to be "reversed."

Broken lines indicate parts that are lying below the structures represented by unbroken lines. They are introduced to show the continuity of portions that are not actually seen in such a dissection as that figured. Where these concealed parts are the sac and the duct the broken lines are reduced to dots.

We use both single and double letters to indicate special parts. The double letters are used uniformly throughout the figures, and are explained below this, and more fully on pp. 481–483. The meaning of a single letter will be found by reference to that descriptive portion of the memoir to which the figure pertains.

Explanation of Double Letters.

aed = aedeagus.
an = anus.
bp = basal-piece.
cm 1 = first connecting membrane.

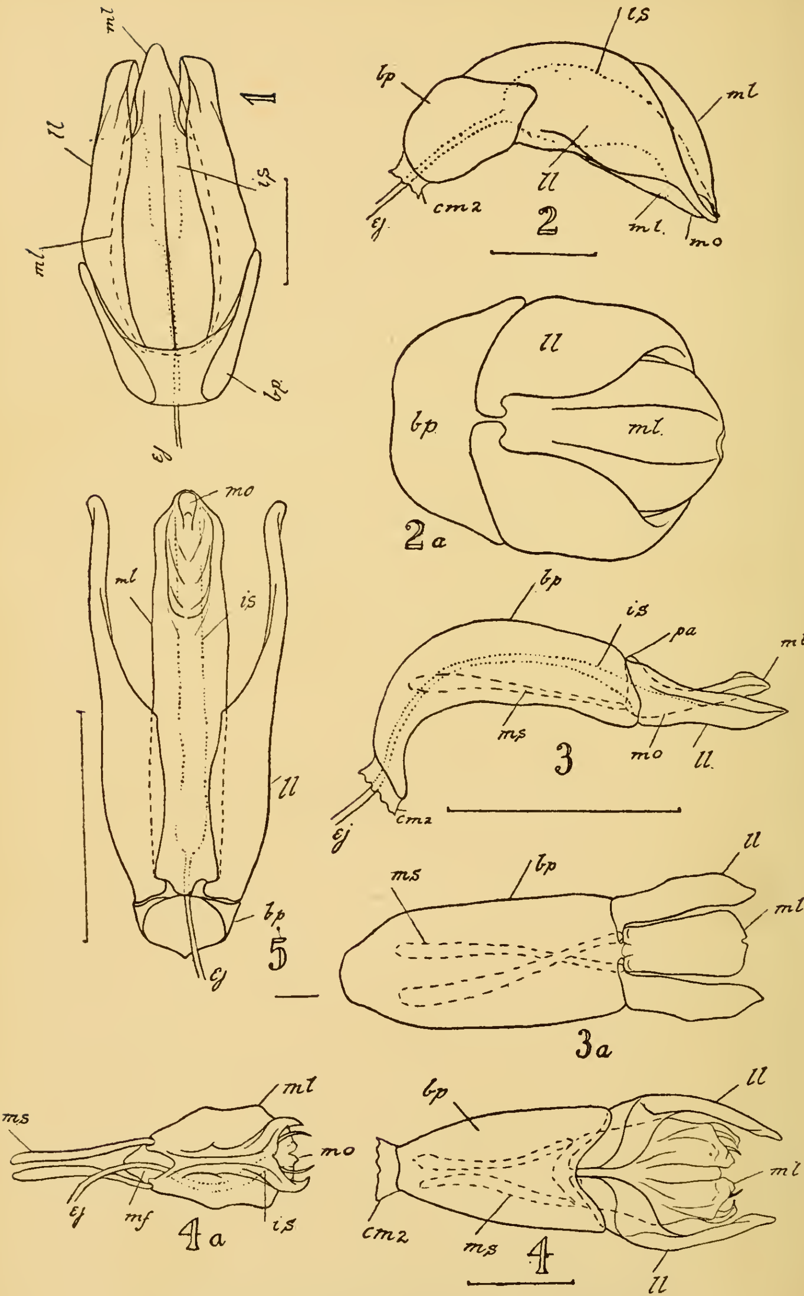
cm 2 = second connecting membrane.
ej = ejaculatory duct.
fg = flagellum.
is = internal sac.
ld = last dorsal plate.
ll = lateral lobes.
lv = last ventral plate.
mf = median foramen.
ml = median lobe.
mo = median orifice.
ms = median strut.
pa = point of articulation.
pd = penultimate dorsal plate.
pv = penultimate ventral plate.
rt = rectum.
sp = spiculum.
tg = tegmen (lateral lobes + basal-piece; or basal-piece without lateral lobes.
ts = tegminal strut.
vp = ventral-piece.

For a fuller explanation of these letters see pp. 481–483.

Correction.

P. 491. If the position of Fig. 39 (*Haliplus*) be considered correct as regards upper and lower aspects, then it is the right lateral lobe. That is the broad one, not the left as stated in the text.

Dec. 24, 1912.



GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate XLII.

Fig. 1. *Trox*, sp. n.?; North Australia, dorsal view.
2. *Trox omacanthus*, lateral view.
2*a*. " " , dorsal view.
3. *Trox scaber*, lateral view.
3*a*. " " , dorsal view.
4. *Trox penicillatus*, dorsal view.
4*a*. " " , ventral view of median lobe.
5. *Ceratognathus niger*, dorsal view.

Descriptions on pp. 573, 577, etc. Explanation of the letters used uniformly on pp. 481–483.

Explanation of Plate XLIII.

Fig. 6. *Syndesus cornutus*, lateral view, with last abdominal segment.

6*a*. *Syndesus cornutus*, dorsal view.

6*b*. ,, ,, , lateral view of median lobe.

7. *Systenus caraboides*, dorsal view.

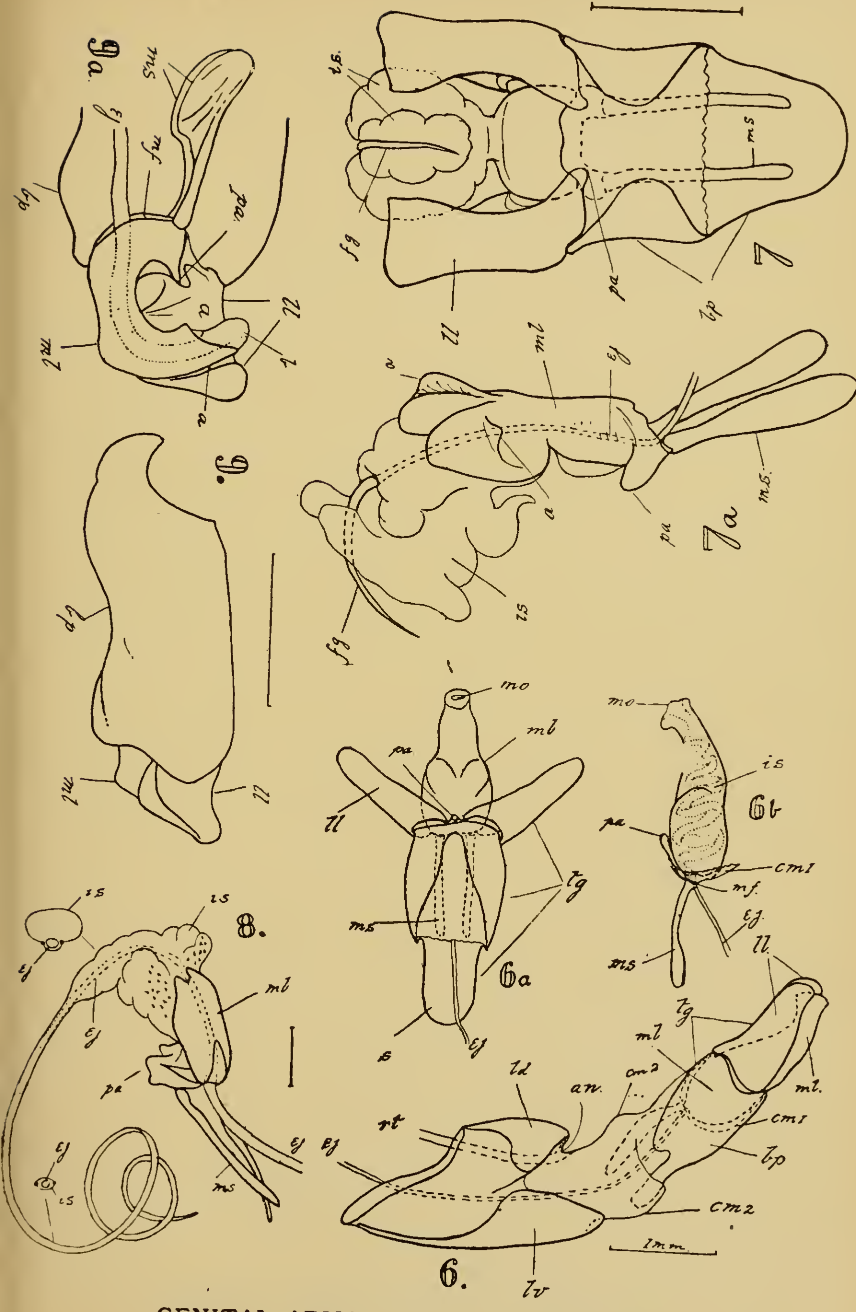
7*a*. ,, ,, , lateral view of median lobe.

8. *Lucanus cervus*, ventral-lateral view of median lobe.

9. *Sinodendron cylindricum*, lateral view.

9*a*. ,, ,, , lateral view of median lobe and right lateral lobe.

Descriptions on pp. 574–576. Explanation of the letters used uniformly on pp. 481–483.



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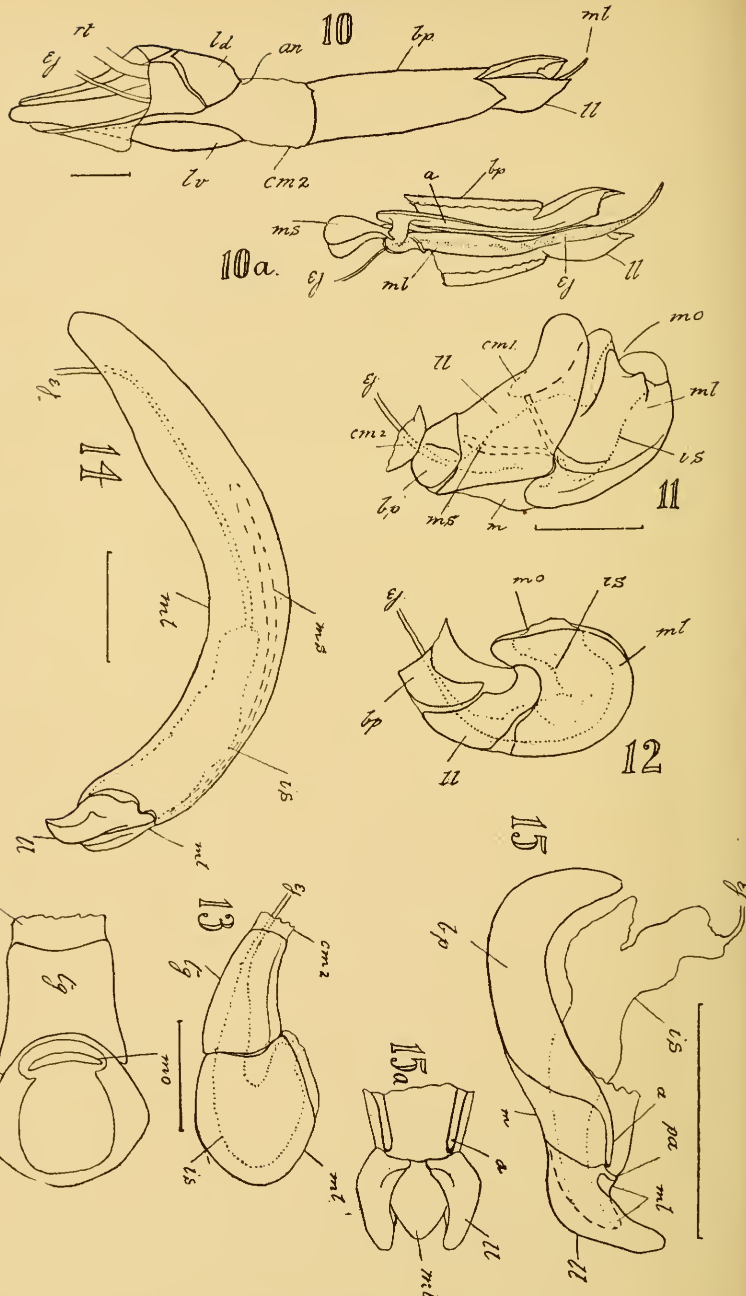


GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate XLIV.

Fig. 10. *Neolamprima adolphinae*, dorso-lateral view with last abdominal segment.

10*a*. *Neolamprima adolphinae*, end of tegmen opened to expose median lobe.

11. *Leptaulacides planus*, lateral view.

12. *Labienus ptox*, lateral view.

13. *Aulacocyclus edentulus*, lateral view.

13*a*. ,, ,, , dorsal view.

14. *Amphicoma vulpes*, lateral view. The lower *ml* is an error for *bp*.

15. *Cloeotus sinuatus*, lateral view.

15*a*. ,, ,, , dorsal view of median lobe and end of tegmen.

Descriptions on pp. 575, 579, 580, 584 and 587. Explanation of the letters used uniformly on pp. 481–483.

Explanation of Plate XLV.

Fig. 16. *Phoeochrous emarginatus*, lateral view.

16*a*. " " , lateral view of median lobe and right lateral lobe.

17. *Geotrupes* (*Typhoeus*) *typhoeus*, lateral view.

17*a*. " " , dorsal view of median lobe.

18. *Aphodius punctatosulcatus*, lateral view.

18*a*. " " , lateral view of median lobe with internal sac evaginated.

19. *Anomala assimilis*, lateral view with median lobe extended and internal sac evaginated.

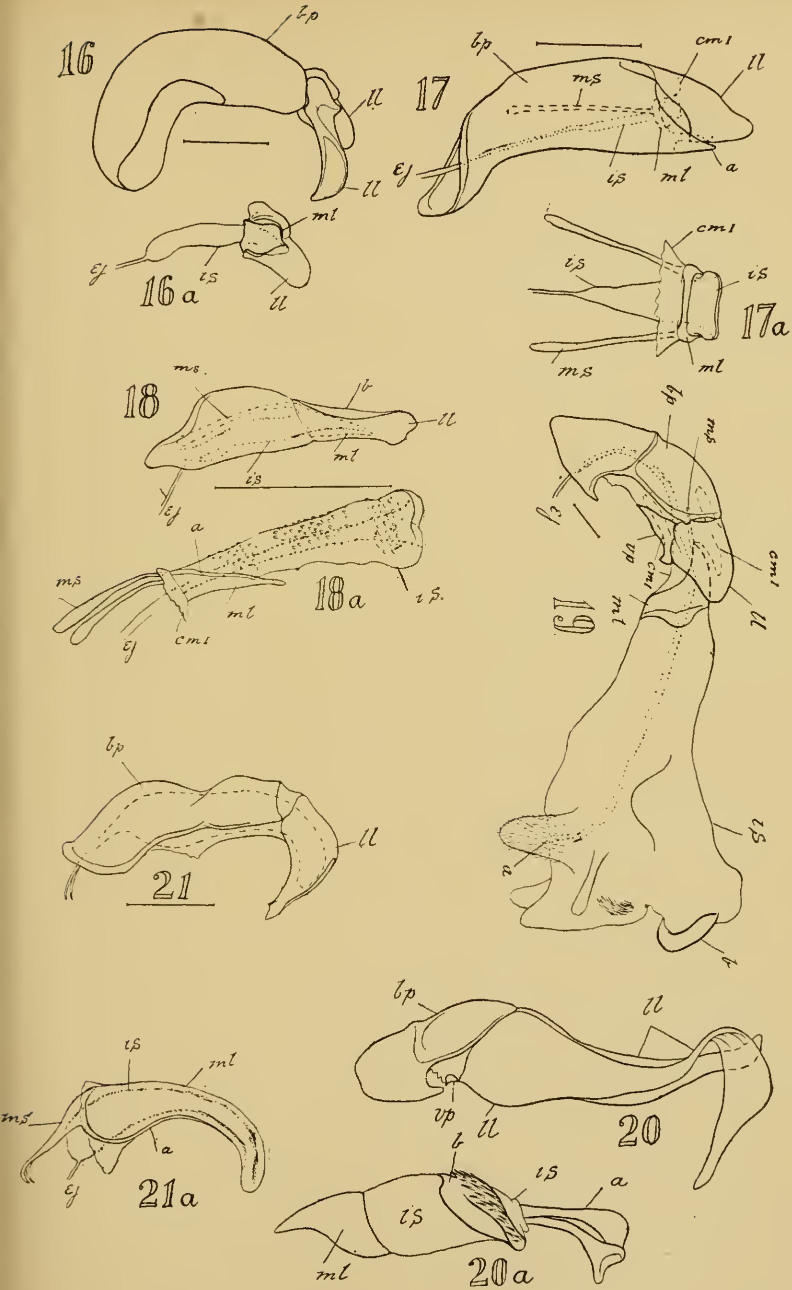
20. *Spilota regina*, lateral view of tegmen (median lobe dissected out).

20*a*. *Spilota regina*, lateral view of median lobe with internal sac evaginated.

21. *Diphucephala furcata*, lateral view.

21*a*. " " , lateral view of median lobe.

Descriptions on pp. 583, 586, 588 and 590. Explanation of the letters used uniformly on pp. 481–483.



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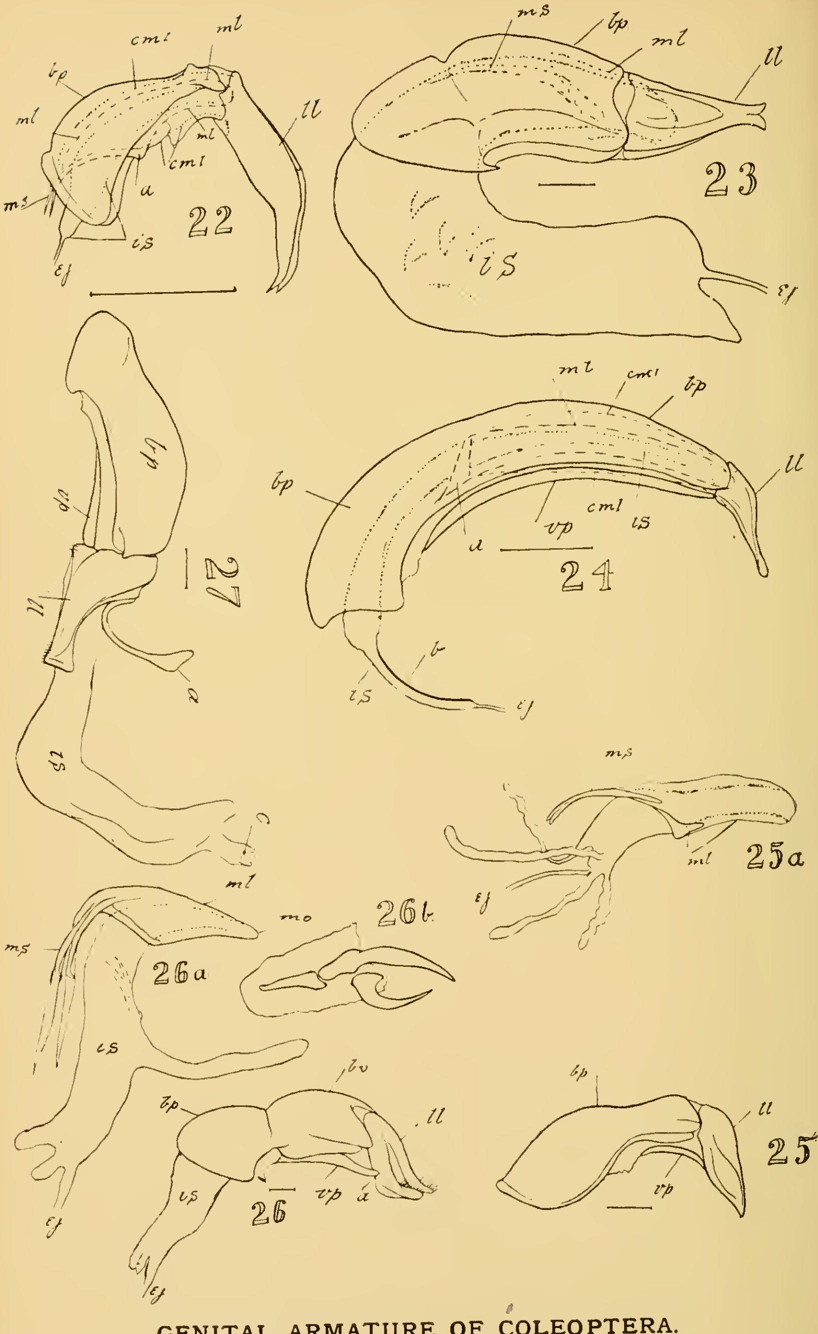


GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate XLVI.

Fig. 22 *Microplidius luctuosus*, lateral view.
23. *Pelidnota punctata*, dorso-lateral view.
24. *Bolax westwoodi*, lateral view.
25. *Hexodon unicolor*, lateral view.
25*a*. „ „ , lateral view of median lobe.
26. *Xylotrupes gideon*, lateral view.
26*a*. „ „ , lateral view of median lobe and internal sac.
26*b*. *Xylotrupes gideon*, armature on internal sac.
27. *Lomaptera xanthopus*, lateral view with internal sac evaginated.

Descriptions on pp. 588, 591, 592, 595 and 598. Explanation of the letters used uniformly on pp. 481–483.

Explanation of Plate XLVII.

Fig. 28. *Cetonia aurata*, dorso-lateral view.

29. *Therates labiatus*, lateral view.
30. *Cicindela tortuosa*, lateral view.
31. *Manticora tuberculata*, lateral view.

31*a*. „ „ , lateral view of tip with base of sac evaginated.

31*b*. *Manticora tuberculata*, junction of flagellum and ejaculatory duct.

32. *Carabus violaceus*, lateral view with sac evaginated.

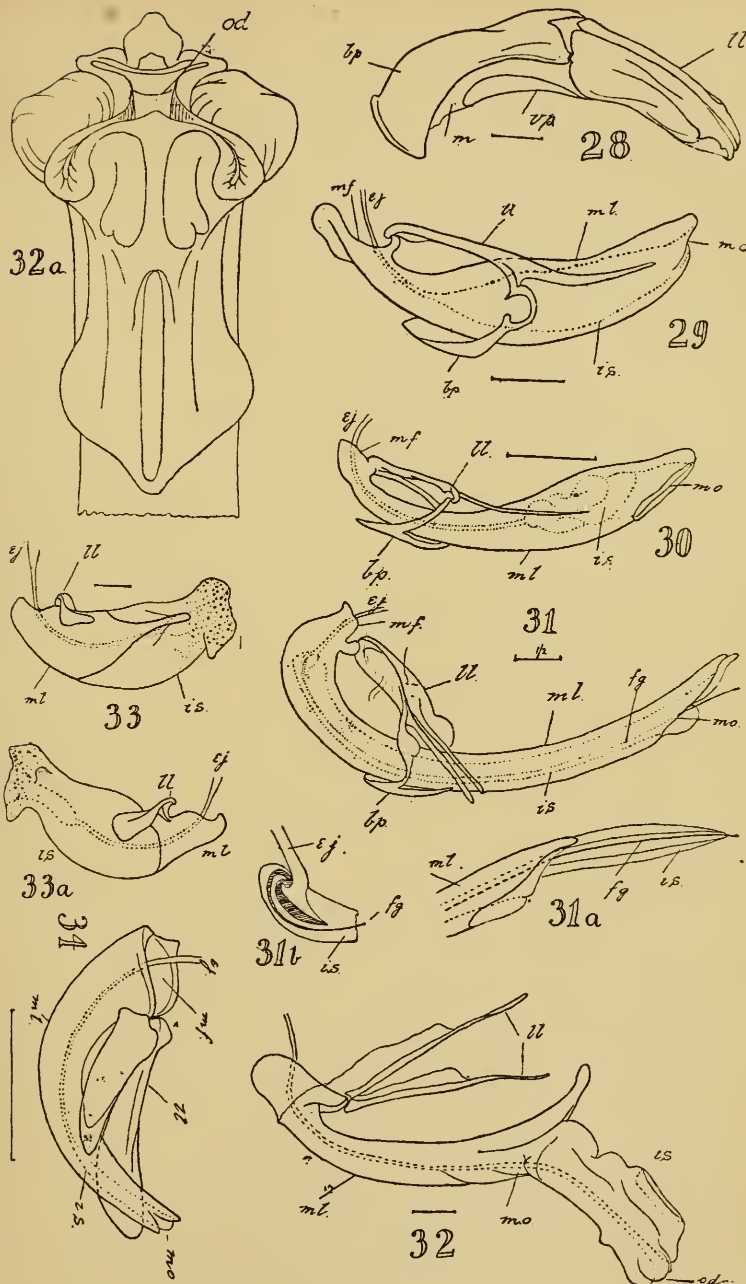
32*a*. „ „ , apex of internal sac.

33. *Mormolyce phyllodes*, lateral view, left side.

33*a*. „ „ , lateral view, right side.

34. *Nebria brevicollis*, lateral view (reversed).

Descriptions on pp. 599 (*C. aurata*) and 486–489. Explanation of the letters used uniformly on pp. 481–483.



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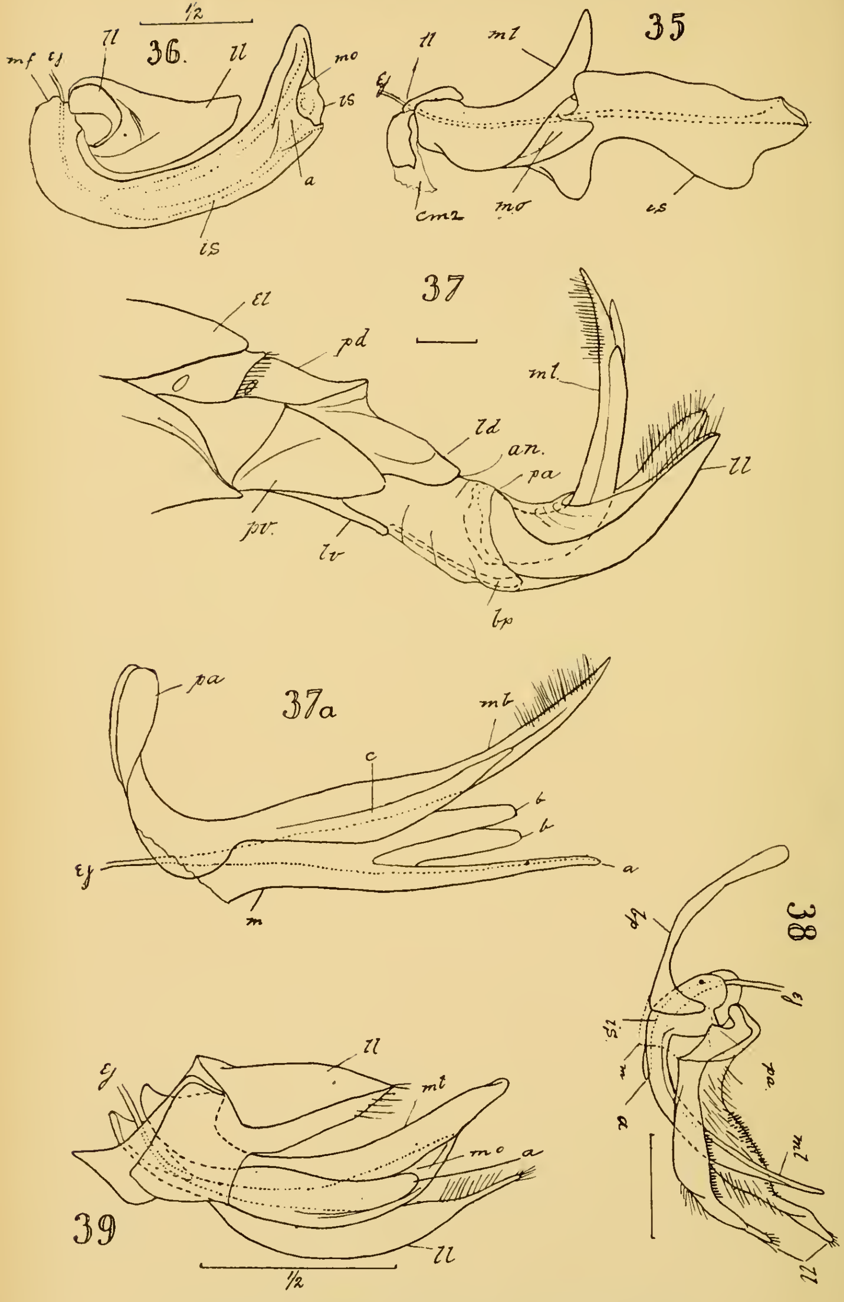


GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate XLVIII.

Fig. 35. *Pheropsophus agnatus*, lateral view, with sac evaginated (reversed).

36. *Rhysodes*, sp. n.? Australia, lateral view.

37. *Dytiscus punctulatus*, end of body with aedeagus protruded.

37*a*. *Dytiscus punctulatus*, lateral view of median lobe.

38. *Ilybius aenescens*, lateral view.

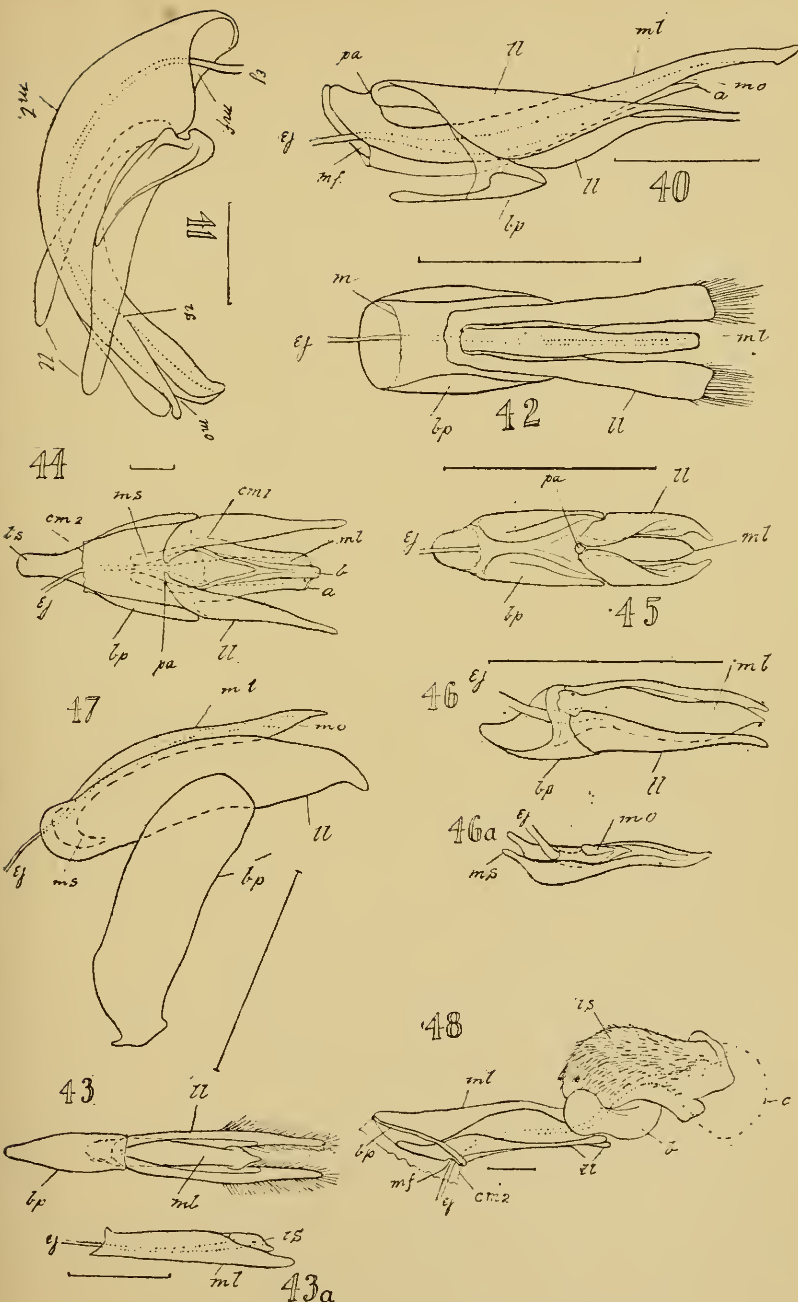
39. *Haliplus fulvus*, ventro-lateral view (reversed).

Descriptions on pp. 491 and 492. Explanation of the letters used uniformly on pp. 481–483.

Explanation of Plate XLIX.

Fig. 40. *Pelobius tardus*, lateral view.
41. *Orthopterus smithi*, lateral view (reversed).
42. *Gyrinus natator*, dorsal view.
43. *Orectochilus dispar*, ventral view.
43*a*. ,, ,, , lateral view of median lobe.
44. *Hydrophilus piceus*, dorsal view.
45. *Laccobius ytenensis*, dorsal view.
46. *Cyclonotum subdepressum*, dorso-lateral view.
46*a*. ,, ,, , median lobe (ventral face up).
47. *Berosus signaticollis*, lateral view.
48. *Silpha atrata*, lateral view, with sac evaginated.

Descriptions on pp. 491–495 and (*Silpha atrata*) p. 503. Explanation of the letters used uniformly on pp. 481–483.



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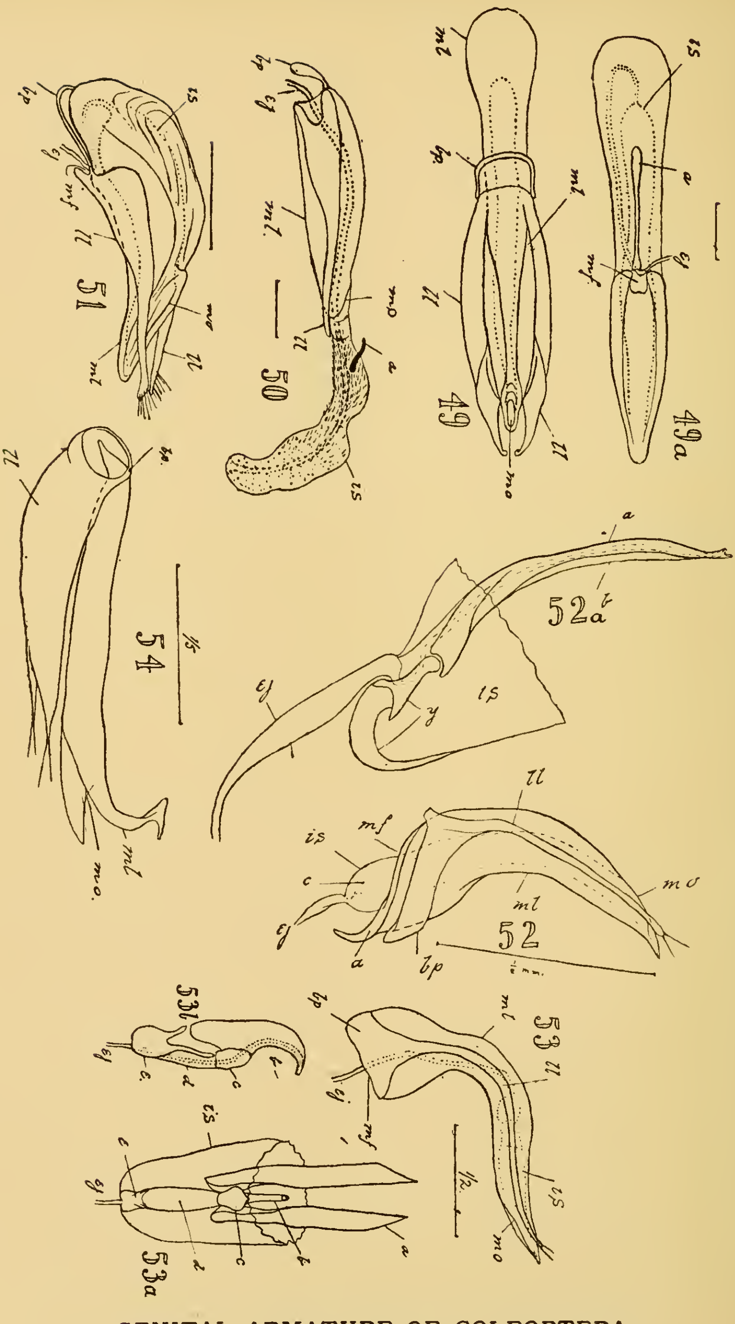


GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate L.

Fig. 49. *Silpha obscura*, dorsal view.
49*a*. „ „ , ventral view of median lobe.
50. *Silpha analis*, lateral view, with sac evaginated.
51. *Necrophorus mortuorum*, dorso-lateral view.
52. *Bathyscia*, sp. Piedmont, lateral view.
52*a*. „ , apex of sac with armature.
53. *Liodes humeralis*, lateral view.
53*a*. „ „ , apex of sac with armature.
53*b*. „ „ , lateral view of median piece of armature.
54. *Clambus minutus*, lateral view.

Descriptions on pp. 503–505. Explanation of the letters used uniformly on pp. 481–483.

Explanation of Plate LI.

Fig. 55. *Leptinus testaceus*, lateral view.

55*a*. " " , dorsal view.

56. *Stenichnus collaris*, lateral view.

56*a*. " " , ventral view of apex of median lobe with sac slightly evaginated.

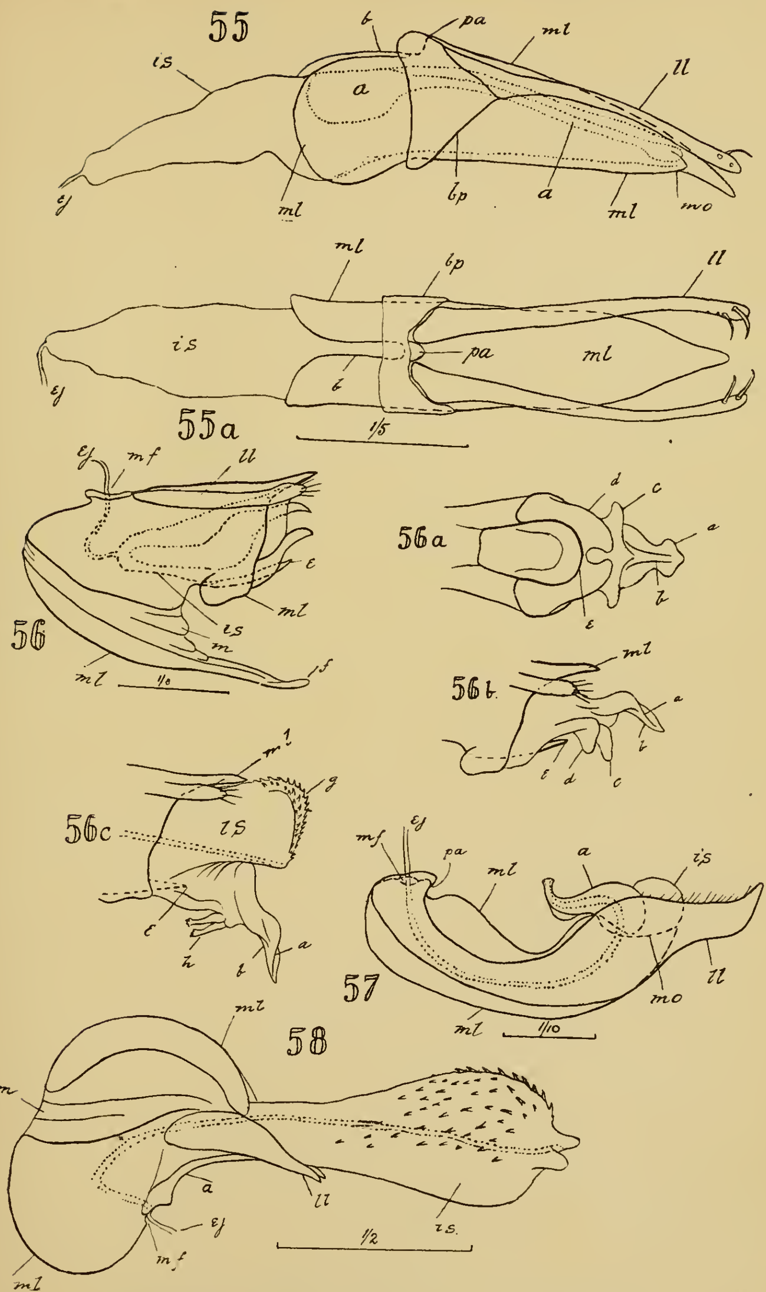
56*b*. *Stenichnus collaris*, ditto, lateral view.

56*c*. " " , lateral view with sac wholly evaginated, or nearly so.

57. *Eumicrus tarsatus*, lateral view.

58. *Physa inflata*, lateral view, with sac evaginated.

Descriptions on pp. 506–510. Explanation of the letters used uniformly on pp. 481–483.



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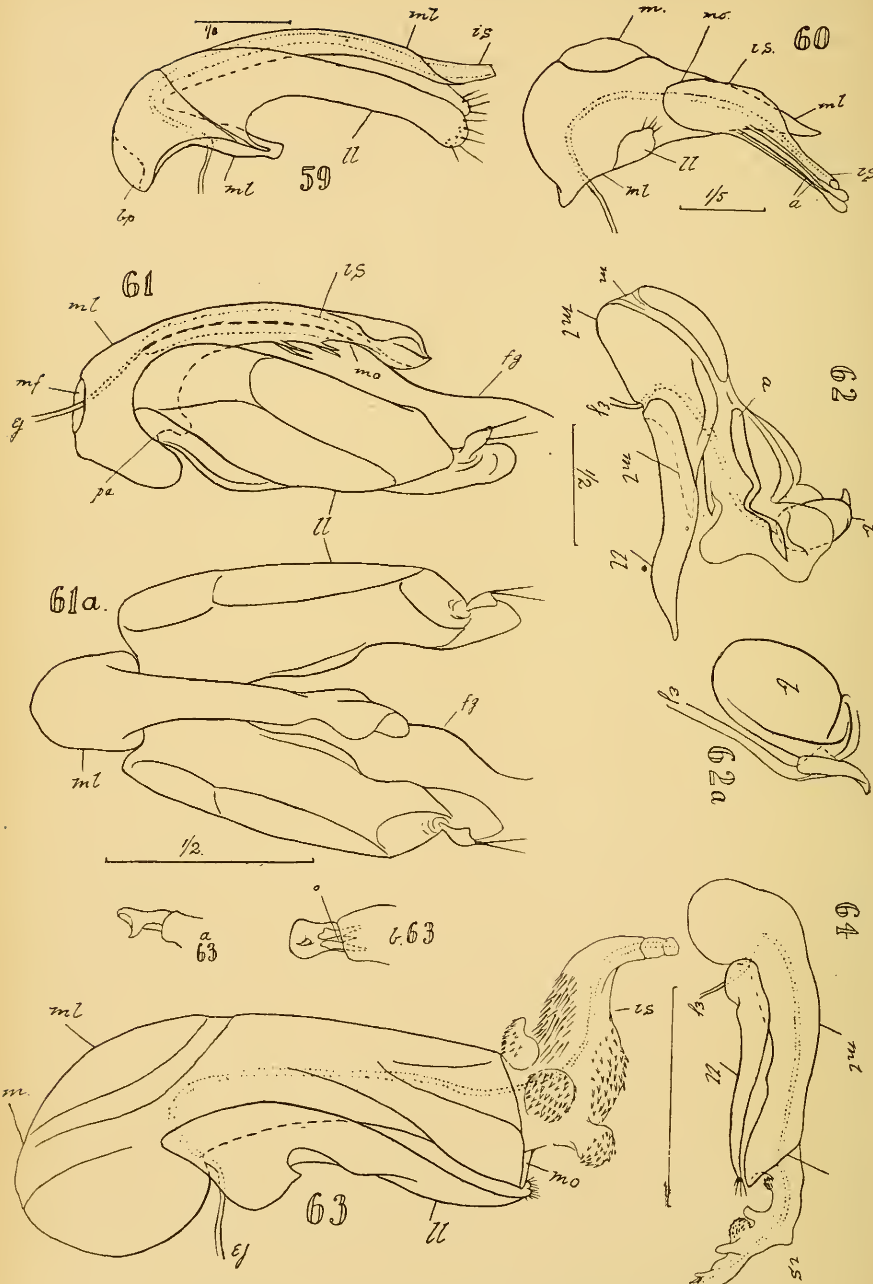


GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LII.

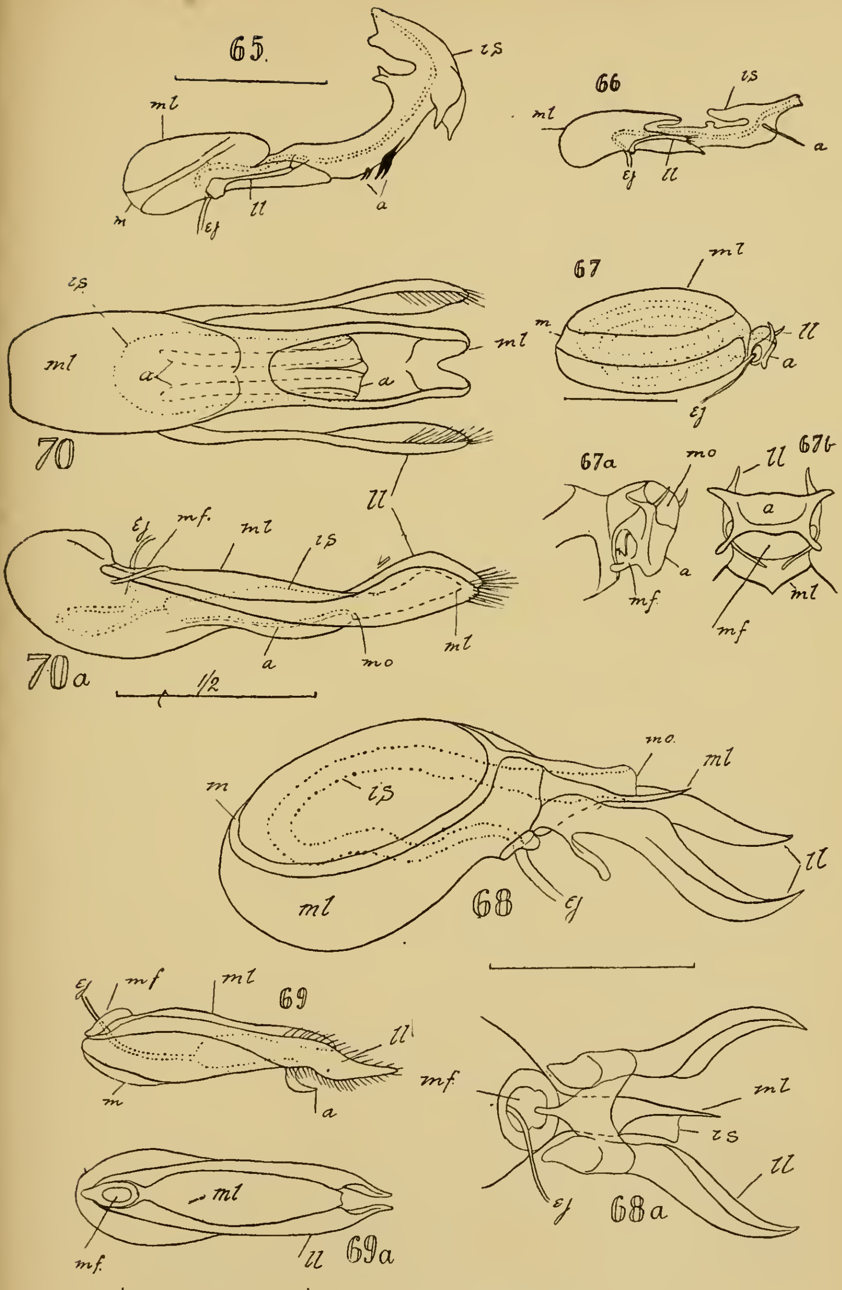
Fig. 59. *Sagola*, sp. New Zealand, lateral view.
60. *Palimbolus*, sp. n.? lateral view.
61. *Gyrophaena pulchella*, lateral view.
61*a*. ,, ,, , dorsal view.
62. *Tachinus subterraneus*, lateral view with sac evaginated.
62*a*. ,, ,, , armature at apex of sac.
63. *Ocypus cupreus*, lateral view.
63*a* and *b*. ,, ,, armature at apex of sac.
64. *Quedius ventralis*, lateral view, with sac evaginated.

Descriptions on pp. 510, 511 and 496–498. Explanation of the letters used uniformly on pp. 481–483.

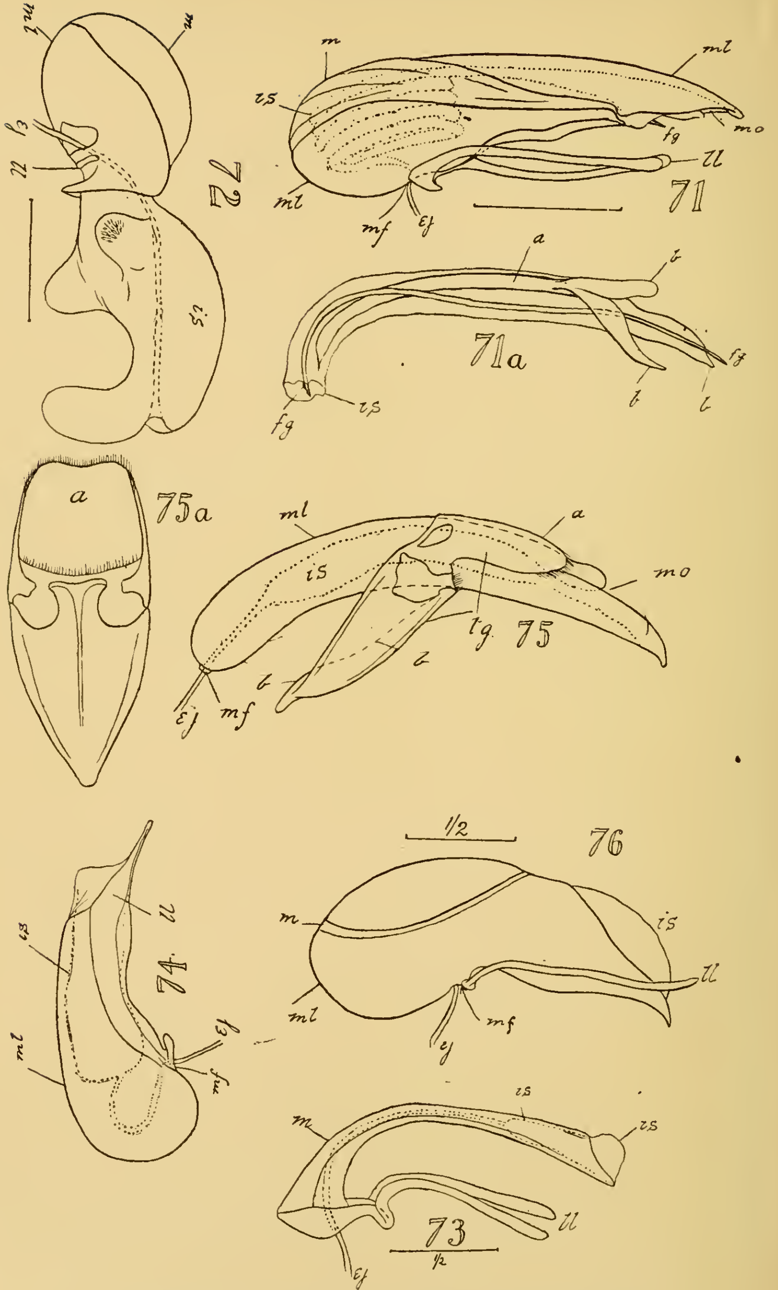
Explanation of Plate LIII.

Fig. 65. *Othius fulvipennis*, lateral view, with sac evaginated.
66. „ *melanocephalus*, do. „ „
67. *Xantholinus glabratus*, lateral view.
67*a*. „ „ , distal end of aedeagus, latero-distal view.
67*b*. *Xantholinus glabratus*, distal end of aedeagus, ventral view.
68. *Xantholinus (Eulissus) chalybeus*, dorso-lateral view.
68*a*. „ „ „ , ventral view of distal end.
69. *Paederus riparius*, lateral view.
69*a*. „ „ , dorsal view.
70. *Stenus speculator*, ventral view.
70*a*. „ „ , lateral view.

Descriptions on pp. 499–501. Explanation of the letters used uniformly on pp. 481–483.



GENITAL ARMATURE OF COLEOPTERA.



GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LIV.

Fig. 71. *Pinophilus rectus*, lateral view.

71*a*. " " , lateral view of base of sac and end of flagellum.

72. *Osorius*, sp. (Trinidad), lateral view, with sac evaginated.

73. *Zirophorus bicornis*, lateral view.

74. *Micropeplus fulvus*, lateral view.

75. *Sacium politum*, lateral view.

75*a*. " " , ventral view of tegmen.

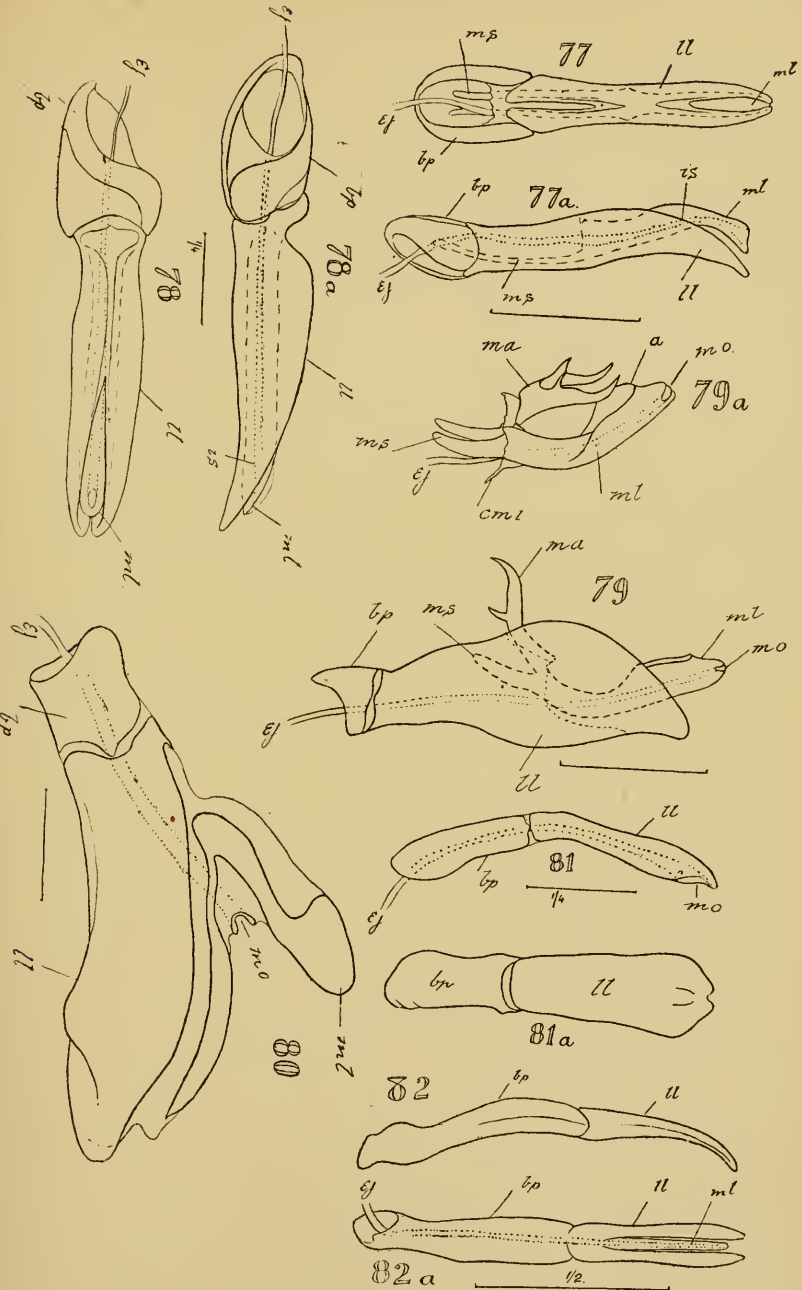
76. *Scaphidium 4-maculatum*, lateral view.

Descriptions on pp. 498, 501, 502, 507 (*Sacium*), 506 (*Scaphidium*). Explanation of the letters used uniformly on pp. 481–483.

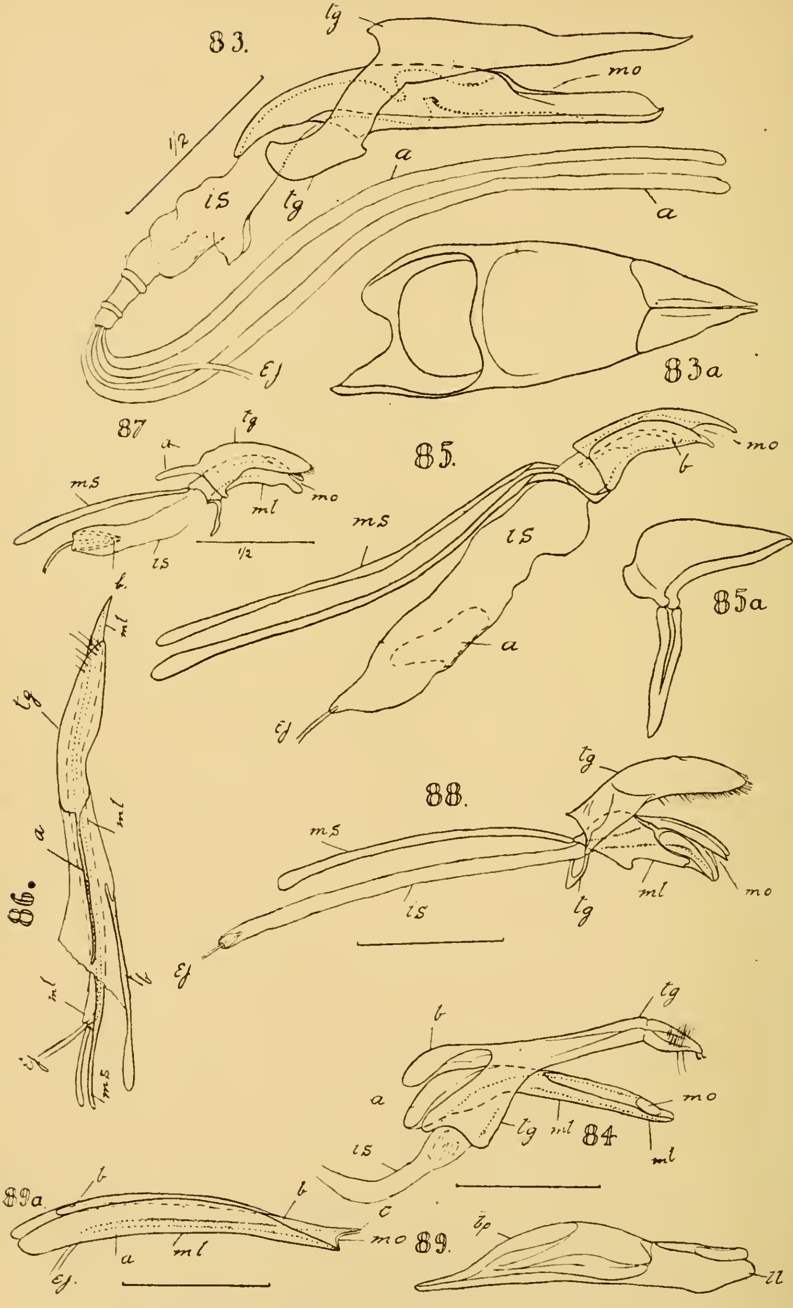
Explanation of Plate LV.

Fig. 77. *Syntelia histeroides*, ventral view.
77*a*. „ „ , lateral view.
78. *Sphaerites glabratus*, dorsal view.
78*a*. „ „ , lateral view.
79. *Hister cadaverinus*, lateral view.
79*a*. „ „ , lateral view of median lobe.
80. *Macrolister maximus*, lateral view.
81. *Hololepta elongata*, lateral view.
81*a*. „ „ , dorsal view.
82. *Niponius canalicollis*, lateral view.
82*a*. „ „ , dorsal view.

Descriptions on pp. 511–513. Explanation of the letters used uniformly on pp. 481–483.



GENITAL ARMATURE OF COLEOPTERA.



GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LVI.

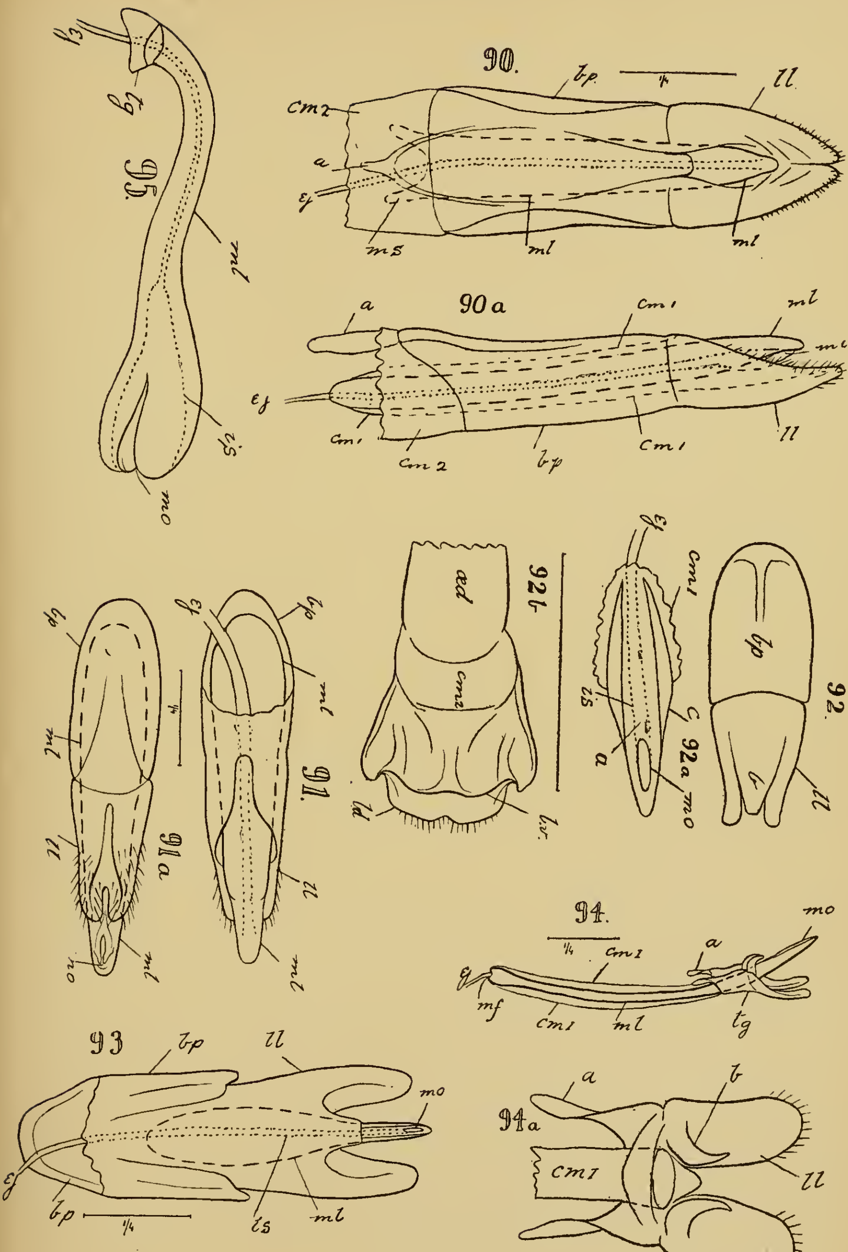
Fig. 83. *Phalacrus grossus*, lateral view.
83*a*. ,, ,, , dorsal view of tegmen.
84. *Litolibrus obesus*, lateral view.
85. *Monotoma conicicollis*, lateral view of median lobe and sac.
85*a*. ,, ,, , lateral view of tegmen.
86. *Byturus tomentosus*, lateral view.
87. *Psilotus atratus*, lateral view.
88. *Ips (Glischrochilus) japonicus*, lateral view.
89. *Temnochila virescens*, lateral view of tegmen.
89*a*. ,, ,, , lateral view of median lobe.

Descriptions on pp. 514–516. Explanation of the letters used uniformly on pp. 481–483.

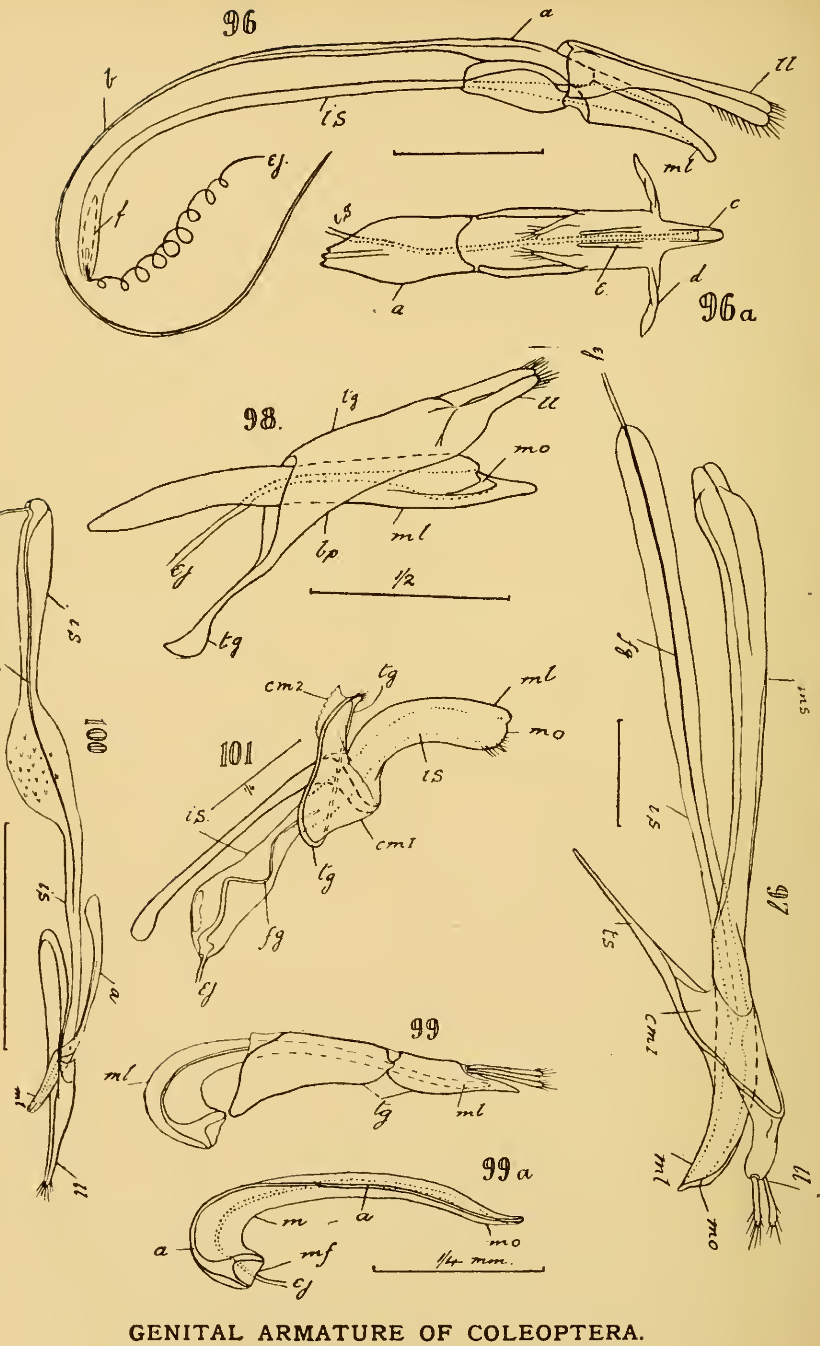
Explanation of Plate LVII.

Fig. 90. *Thymalus limbatus*, dorsal view.
90*a*. „ „ , lateral view.
91. *Aulonium bidentatum*, dorsal view.
91*a*. „ „ , ventral view.
92. *Enarsus bakewelli*, ventral view of tegmen.
92*a*. „ „ , ventral view of median lobe.
92*b*. „ „ , ventral view of end of body with aedeagus turned under.
93. *Taphiomimus indentatus*, dorsal view.
94. *Deretaphrus ignarus*, lateral view.
94*a*. „ „ , dorsal view of tegmen.
95. *Cerylon histeroides*, lateral view.

Descriptions on pp. 516 and 517. Explanation of the letters used uniformly on pp. 481–483.



GENITAL ARMATURE OF COLEOPTERA.



GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LVIII.

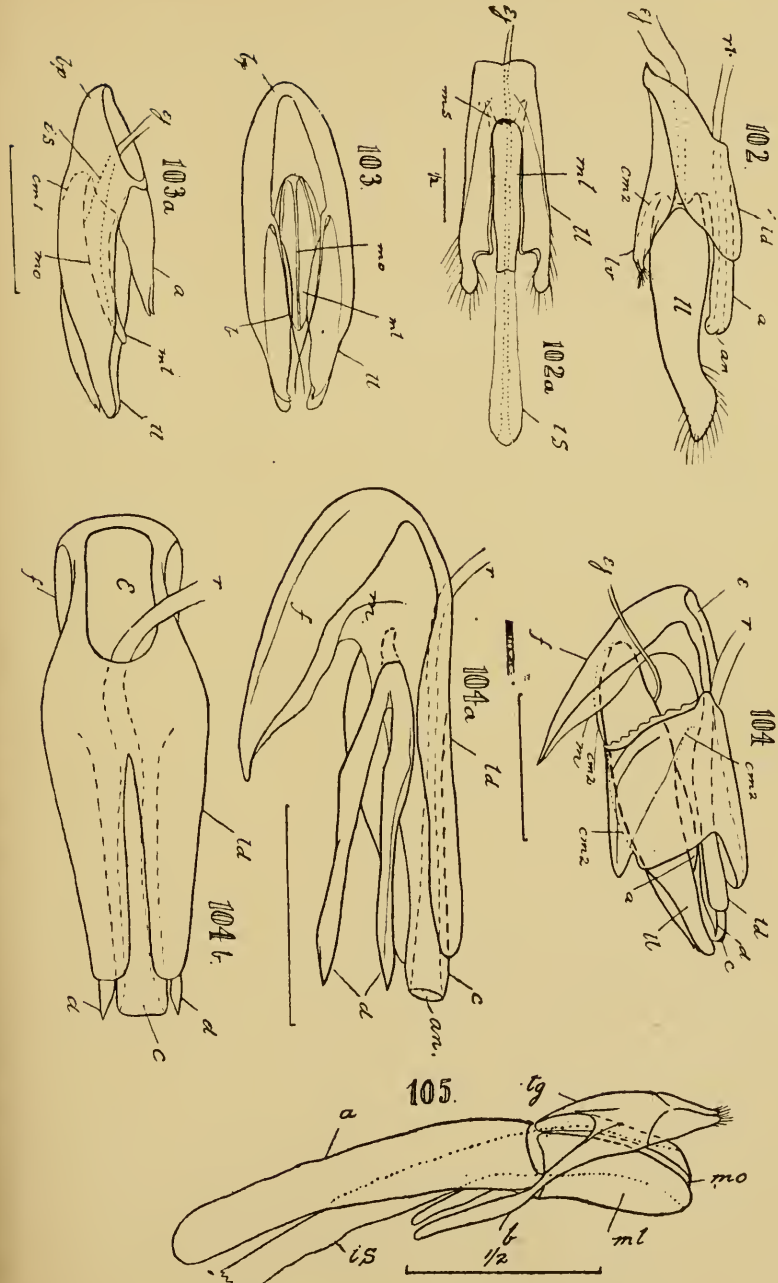
Fig. 96. *Passandra fasciata*, lateral view.
96*a*. ,, ,, , dorsal view of median lobe with sac partly evaginated.
97. *Cucujus mniszechii*, lateral view.
98. *Chaetosoma scaritides*, dorso-lateral view.
99. *Diagrypnodes wakefieldi*, lateral view.
99*a*. ,, ,, , lateral view of median lobe.
100. *Brontopriscus sinuatus*, lateral view.
101. *Rhizophagus depressus*, lateral view.

Descriptions on pp. 518–520. Explanation of the letters used uniformly on pp. 481–483.

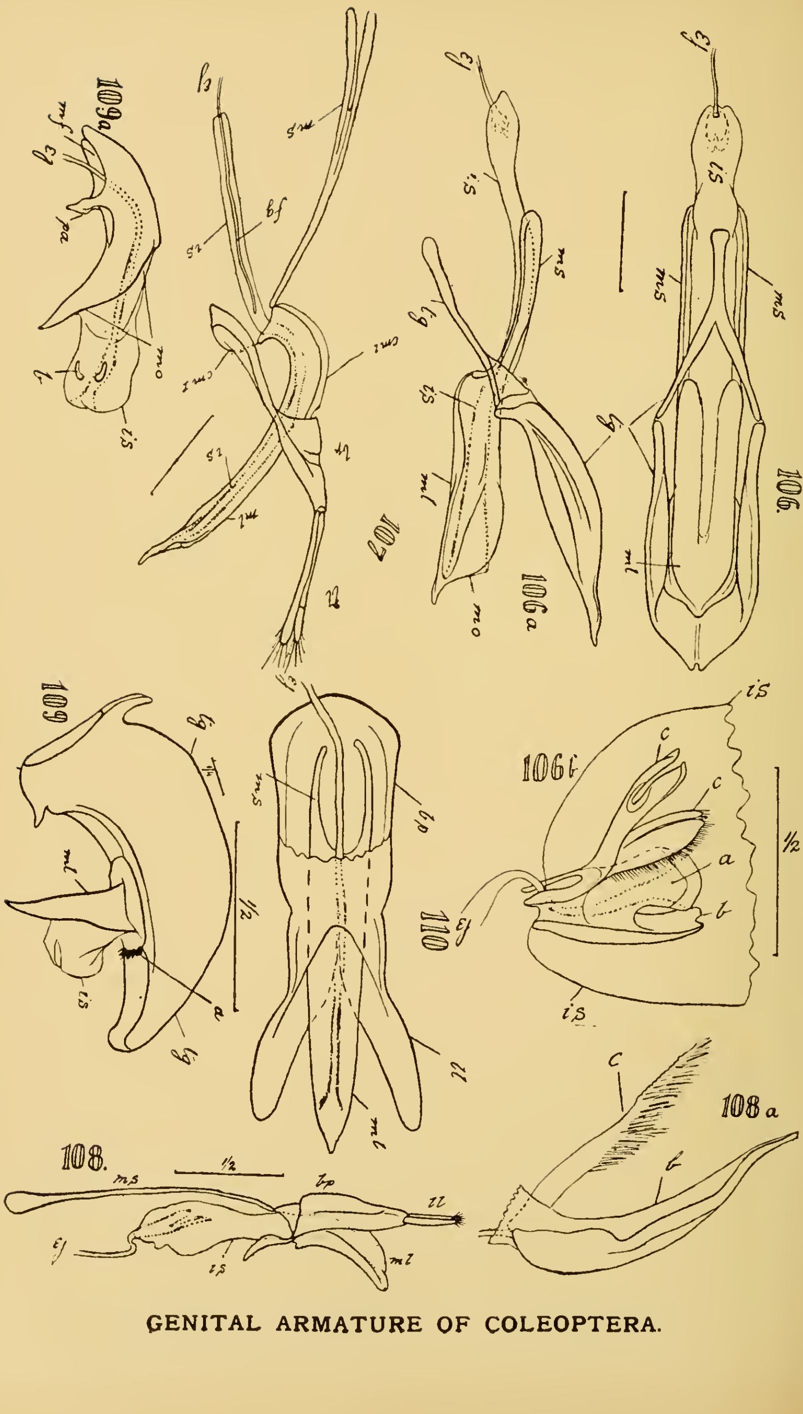
Explanation of Plate LIX.

Fig. 102. *Omma stanleyi*, lateral view, with last abdominal segment.
102*a*. „ „ , dorsal view, with sac evaginated.
103. *Cupes clathratus*, ventral view.
103*a*. „ „ , lateral view.
104. „ „ , lateral view of aedeagus surrounded by last two abdominal segments.
104*a*. *Cupes clathratus*, lateral view of last segment of abdomen.
104*b*. „ „ , dorsal view of last segment of abdomen.
105. *Antherophagus nigricornis*, dorso-lateral view.

Descriptions on pp. 521 and 522. Explanation of the letters used uniformly on pp. 481–483.



GENITAL ARMATURE OF COLEOPTERA.



GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LX.

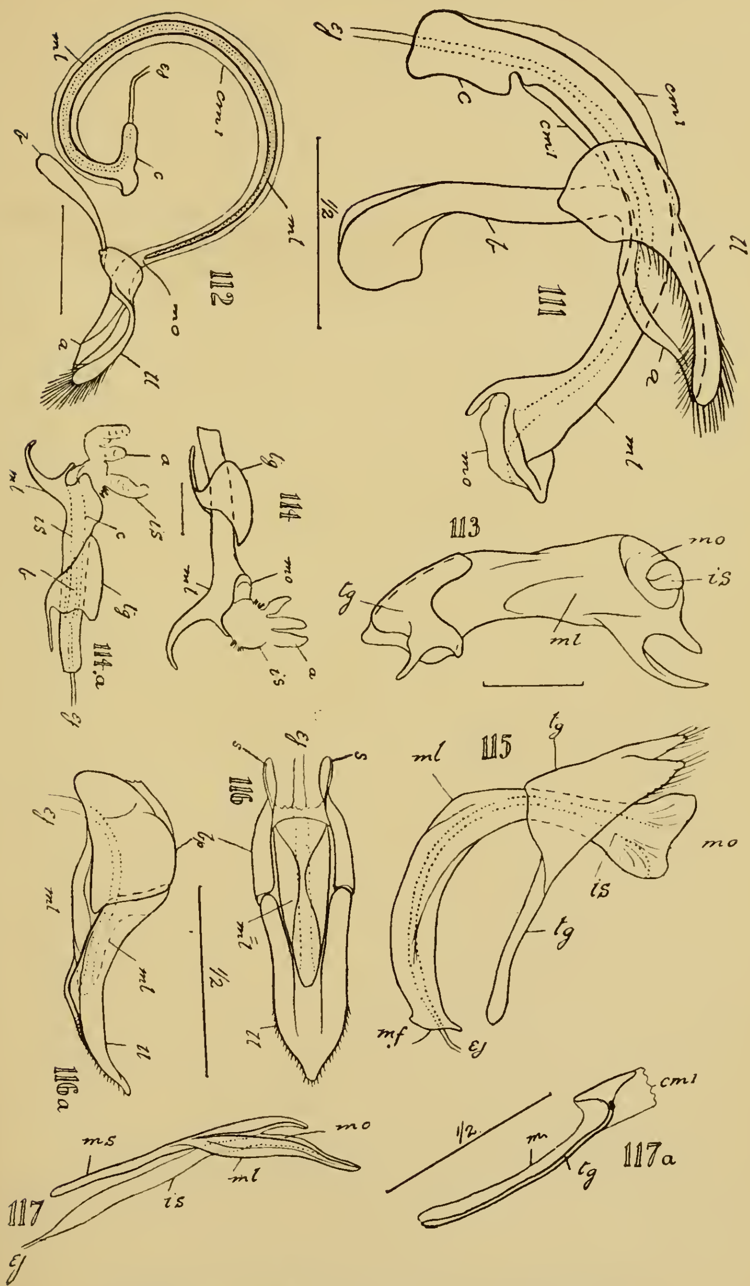
Fig. 106.	*Helota gemmata*, ventral view.	
106*a*.	,, ,, , lateral view.	
106*b*.	,, ,, , armature at apex of sac.	
107.	*Camptocarpus prolongatus*, lateral view.	
108.	*Cryptodacne vittata*, lateral view.	
108*a*.	,, ,, , armature at apex of sac.	
109.	*Notiophygus*, sp.?, lateral view.	
109*a*.	,, ,, , lateral view of median lobe.	
110.	*Mycetophagus quadripustulatus*, dorsal view.	

Descriptions on pp. 521, 523, 524, and 529 (*Mycetophagus*). Explanation of the letters used uniformly on pp. 481–483.

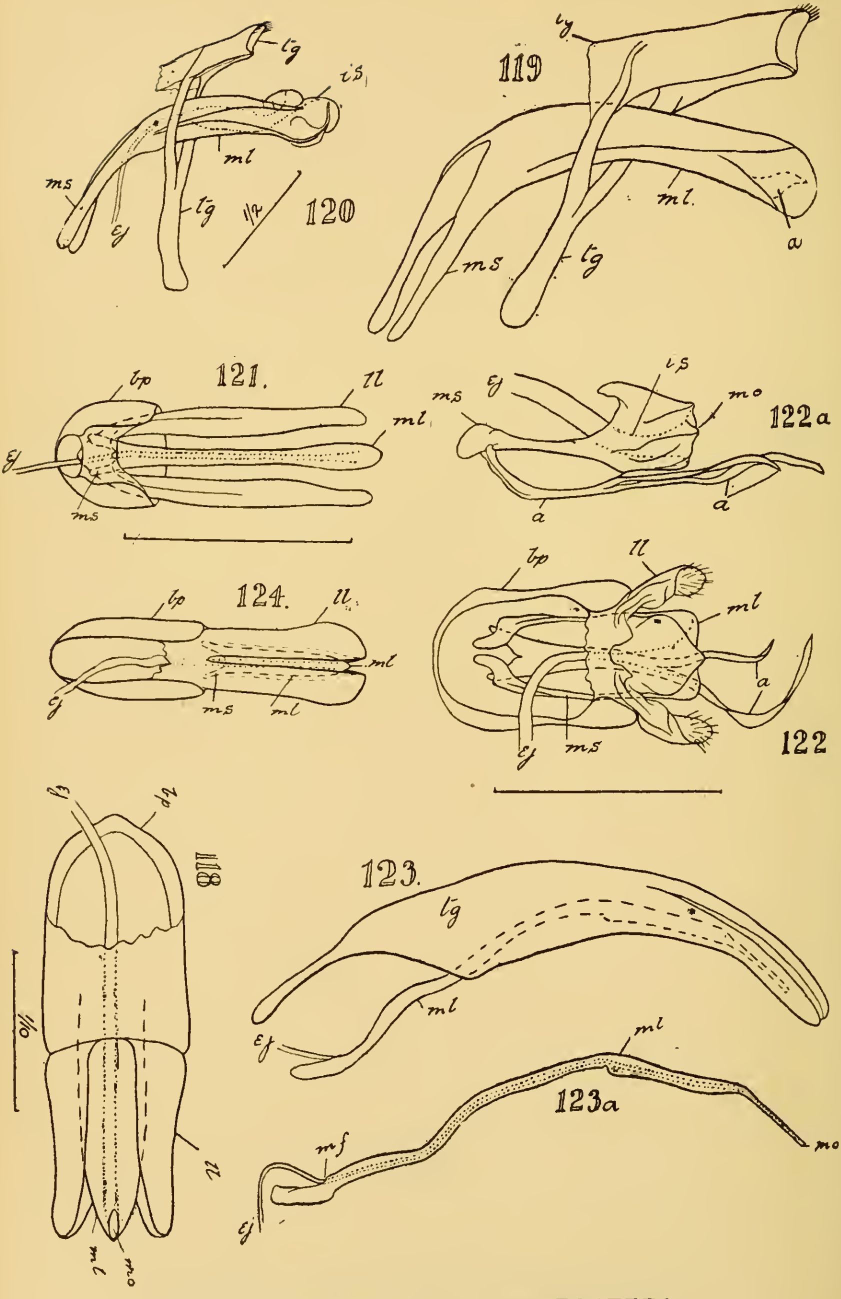
Explanation of Plate LXI.

Fig. 111. *Lasia globosa*, lateral view.
112. *Mysia oblongoguttata*, lateral view.
113. *Eumorphus*, sp. aff. *E. profani*, Borneo, lateral view.
114. *Eumorphus*, aff. *E. tetraspiloti*, Borneo, lateral view, left side.
114*a*. ,, ,, ,, , lateral view, right side.
115. *Mycetaea hirta*, lateral view.
116. *Lathridius lardarius*, ventral view.
116*a*. ,, ,, , lateral view.
117. *Corticaria punctulata*, lateral view of median lobe.
117*a*. ,, ,, , lateral view of tegmen.

Descriptions on pp. 524–527. Explanation of the letters used uniformly on pp. 481–483.



GENITAL ARMATURE OF COLEOPTERA.



GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LXII.

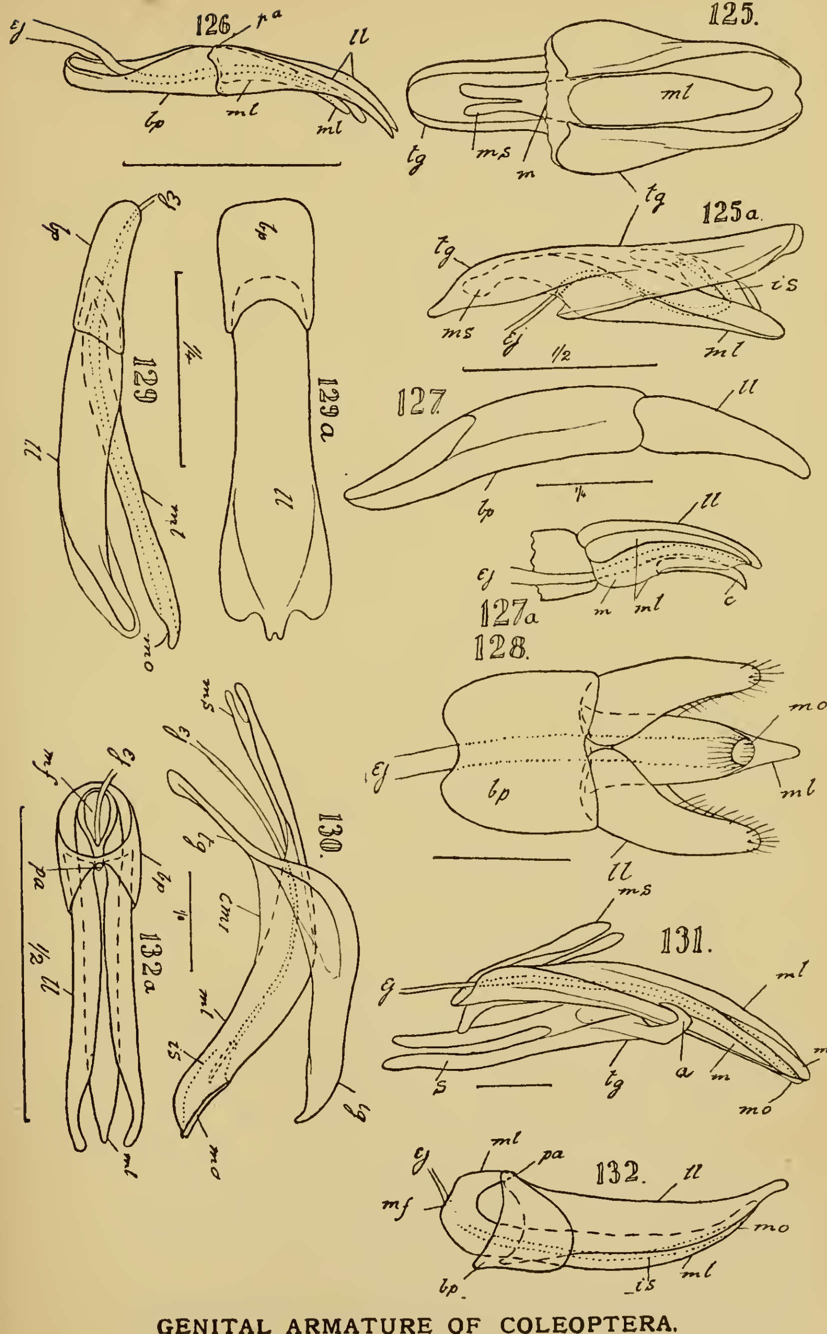
Fig. 118. *Adimerus crispatus*, dorsal view.
119. *Aglycyderes setifer*, lateral view.
120. *Proterhinus validus*, lateral view.
121. *Dermestes murinus*, dorsal view.
122. *Chelonarium zapotense*, dorsal view.
122*a*. ,, ,, , lateral view of median lobe.
123. *Cyathocerus horni*, lateral view.
123*a*. ,, ,, , lateral view of median lobe.
124. *Georyssus pygmaeus*, dorsal view.

Descriptions on pp. 527–531. Explanation of the letters used uniformly on pp. 481–483.

Explanation of Plate LXIII.

Fig. 125. *Heterocerus flexuosus*, ventral view.
125*a*. ,, ,, , lateral view.
126. *Pelonomus palpalis*, lateral view.
127. *Parnus luridus*, lateral view.
127*a*. ,, ,, , lateral view of median lobe and right lateral lobe.
128. *Laricobius erichsoni*, ventral view.
129. *Cis boleti*, lateral view.
129*a*. ,, ,, , ventral view.
130. *Aspidiphorus orbiculatus*, lateral view.
131. *Apate terebrans*, dorso-lateral view.
132. *Lyctus canaliculatus*, lateral view.
132*a*. ,, ,, , dorsal view.

Descriptions on pp. 531–533. Explanation of the letters used uniformly on pp. 481–483.



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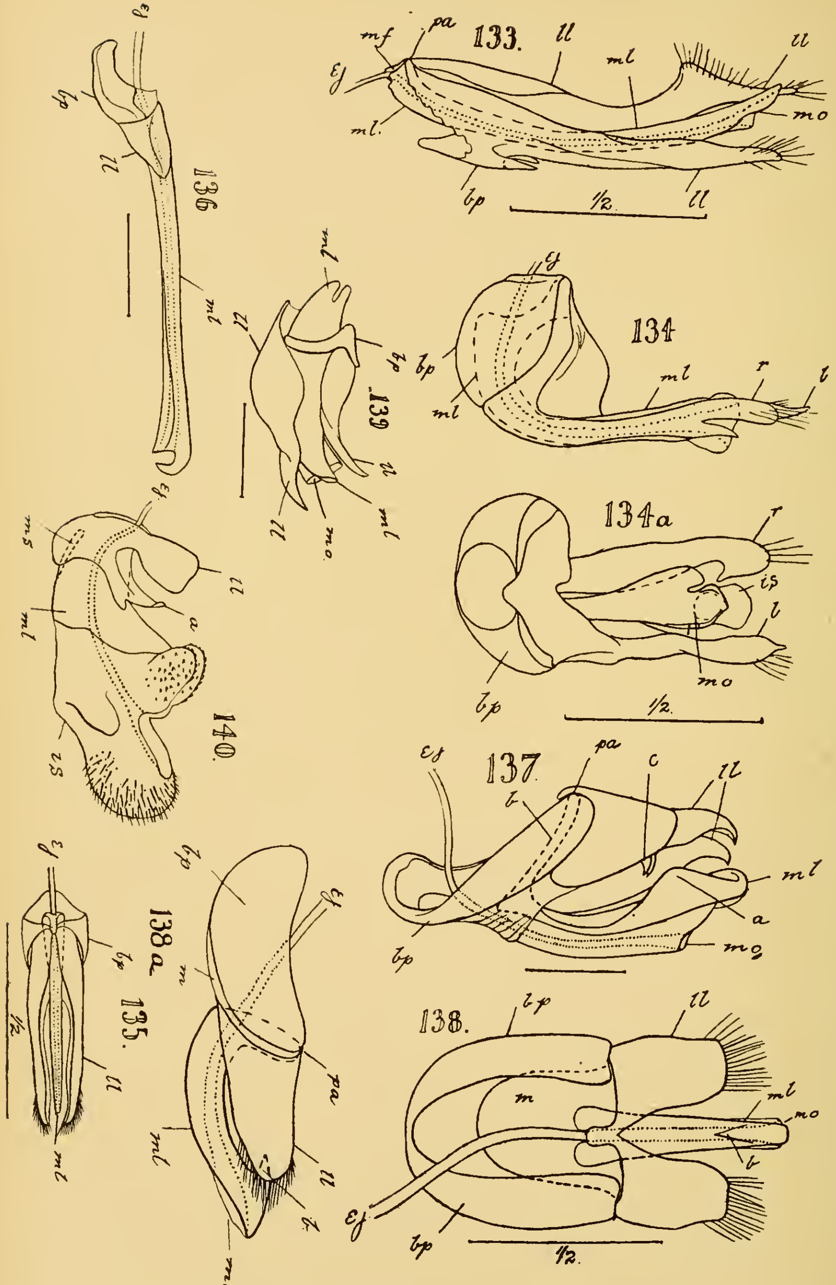


GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LXIV.

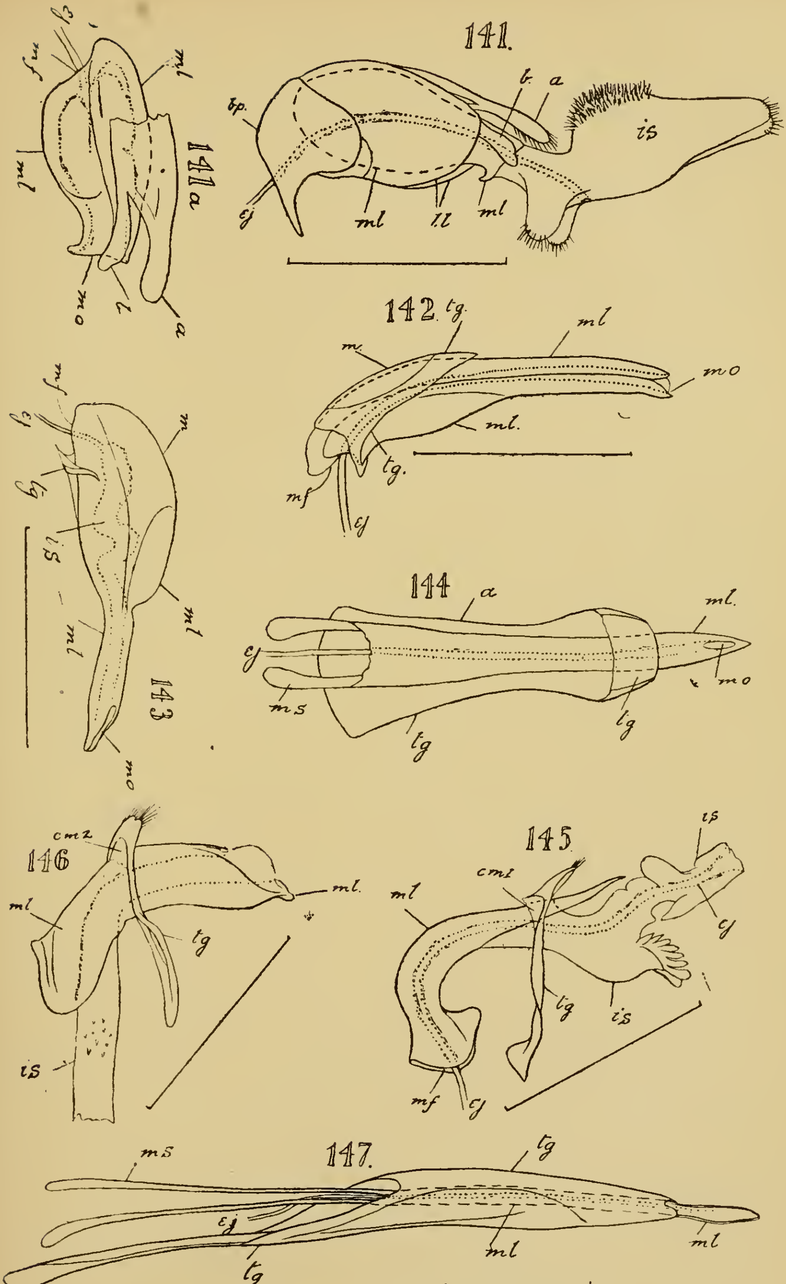
Fig. 133. *Ptinus fur*, lateral view.
134. *Ernobius mollis*, lateral view (reversed).
134*a*. „ „ , dorsal view.
135. *Ectrephes*, sp., dorsal view.
136. *Lycostomus gestroi*, lateral view.
137. *Cratomorphus diaphanus*, lateral view.
138. *Drilus flavescens*, dorsal view.
138*a*. „ „ , lateral view.
139. ? *Chauliognathus*, sp., dorso-lateral view.
140. *Silis ruficollis*, lateral view.

Descriptions on pp. 534–538. Explanation of the letters used uniformly on pp. 481–483.

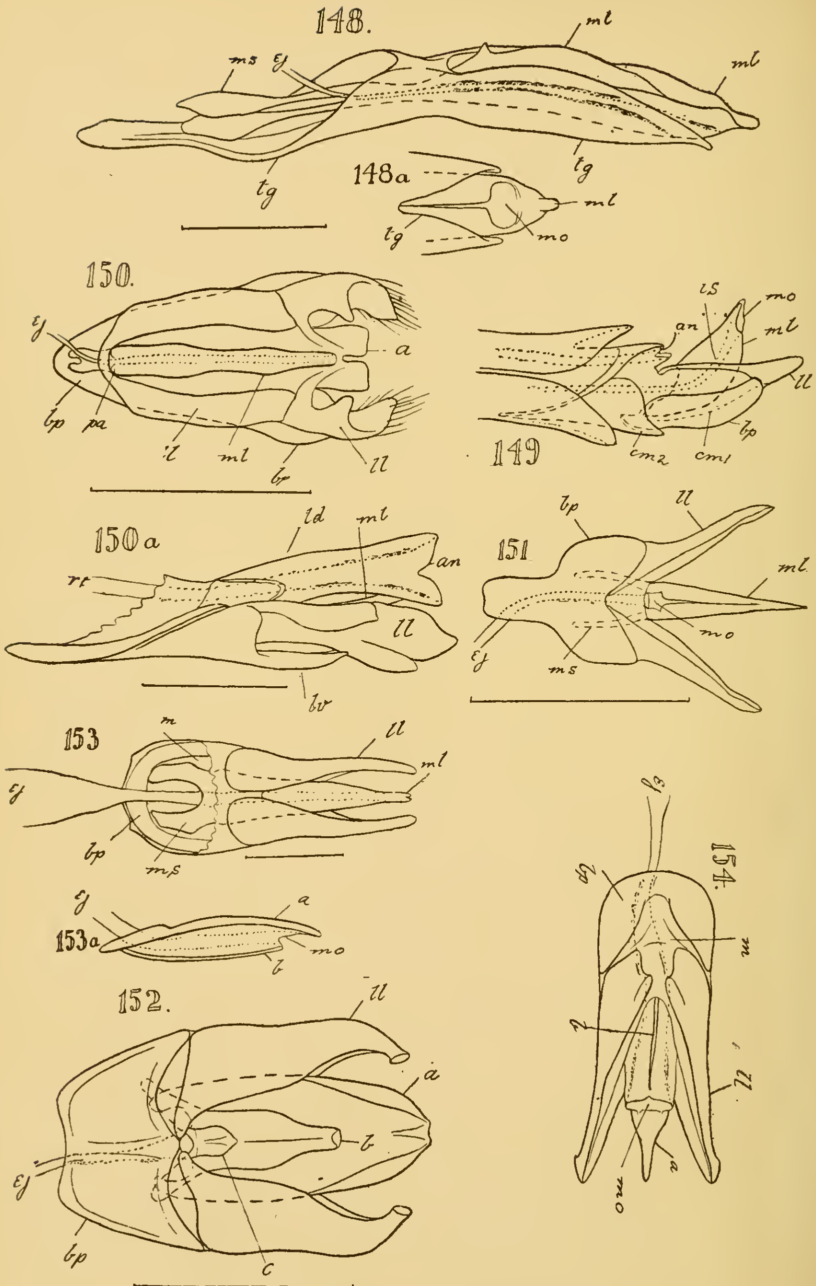
Explanation of Plate LXV.

Fig. 141. *Telephorus limbatus*, lateral view.
141*a*. ,, ,, , lateral view of median lobe.
142. *Malachius bipustulatus*, lateral view.
143. *Balanophorus mastersi*, lateral view.
144. *Phloeophilus edwardsi*, ventral view.
145. *Danacaea*, sp. ? Piedmont, lateral view.
146. *Psilothrix cyaneus*, lateral view.
147. *Natalis porcata*, dorso-lateral view.

Descriptions on pp. 538–541. Explanation of the letters used uniformly on pp. 481–483.



GENITAL ARMATURE OF COLEOPTERA.



GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LXVI.

Fig. 148. *Trogodendron fasciculatum*, dorso-lateral view.

148*a*. ,, ,, , ventral view of apex of median lobe and tegmen.

149. *Atractocerus valdivianus* ?, lateral view, including last two abdominal segments.

150. *Atractocerus africanus*, dorsal view.

150*a*. ,, ,, , lateral view with end of abdomen.

151. *Ptilodactyla*, sp. ?, ventral view.

152. *Dascillus cervinus*, ventral view.

153. *Callirrhipis philiberti*, dorsal view.

153*a*. ,, ,, , lateral view of median lobe.

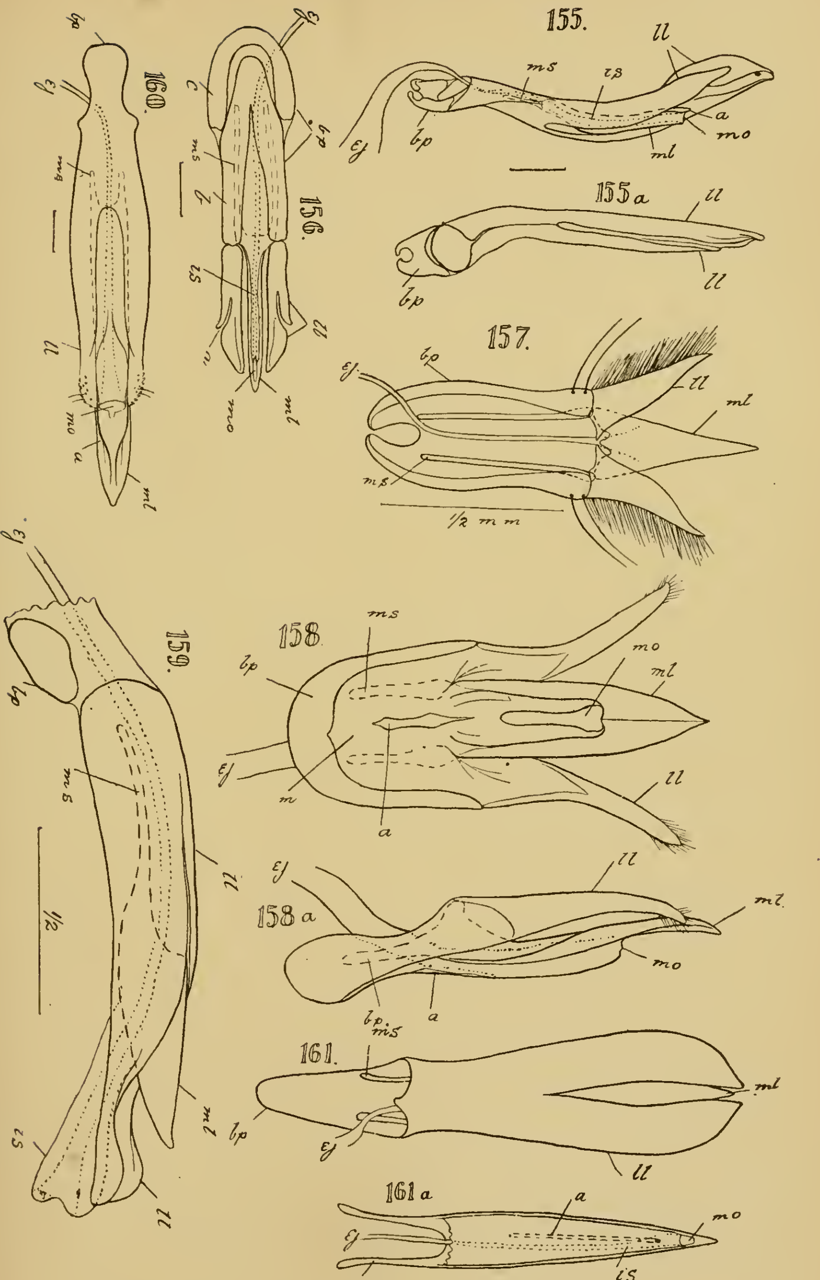
154. *Agrypnus* sp. ? ventral view.

Descriptions on pp. 541–545. Explanation of the letters used uniformly on pp. 481–483.

Explanation of Plate LXVII.

Fig. 155. *Anisomerus hacquarti*, lateral view.
155*a*. ,, ,, , dorsal view.
156. *Chalcolepidius albertisi*, ventral view.
157. *Throscus dermestoides*, dorsal view.
158. *Lissomus bicolor*, ventral view.
158*a*. ,, ,, , lateral view.
159. *Hemiopsida mastersi*, lateral view.
160. *Chrysodema aurofoveata*, ventral view.
161. *Polybothris quadricollis*, dorsal view.
161*a*. ,, ,, , ventral view of median lobe.

Descriptions on pp. 545–547. Explanation of the letters used uniformly on pp. 481–483.



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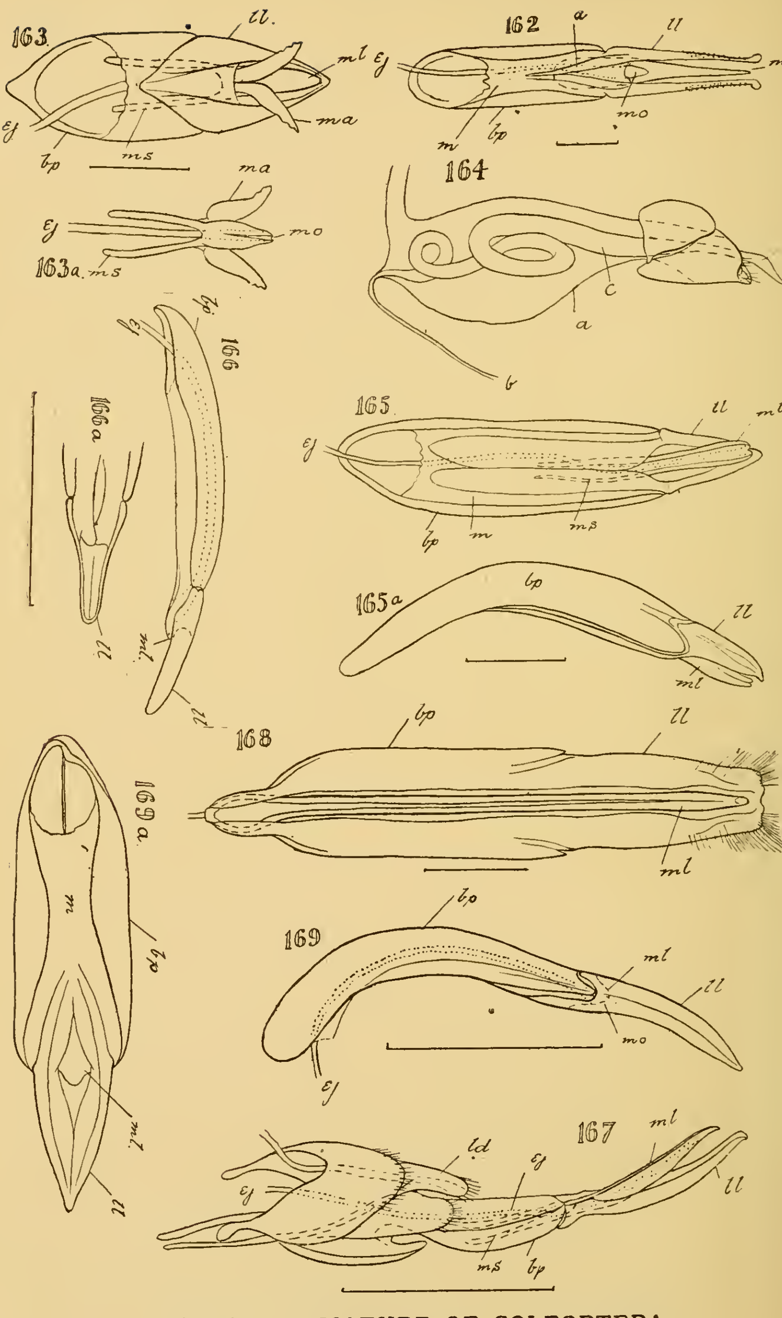


GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LXVIII.

Fig. 162. *Pediris*, sp. n. ?, ventral view.

163. *Eleodes dentipes*, ventral view.

163*a*. ,, ,, , median lobe, dorsal view.

164. ,, ,, , lateral view of oviduct.

165. *Chiroscelis digitata*, ventral view.

165*a*. ,, ,, , dorso-lateral view.

166. *Cossyphus insularis*, lateral view.

166*a*. ,, ,, , ventral view of apical portion.

167. *Stenosis angustata*, dorso-lateral view with end of abdomen.

168. *Zopherosis georgii*, dorsal view.

169. *Rhysopaussus*, sp. (Australia), lateral view.

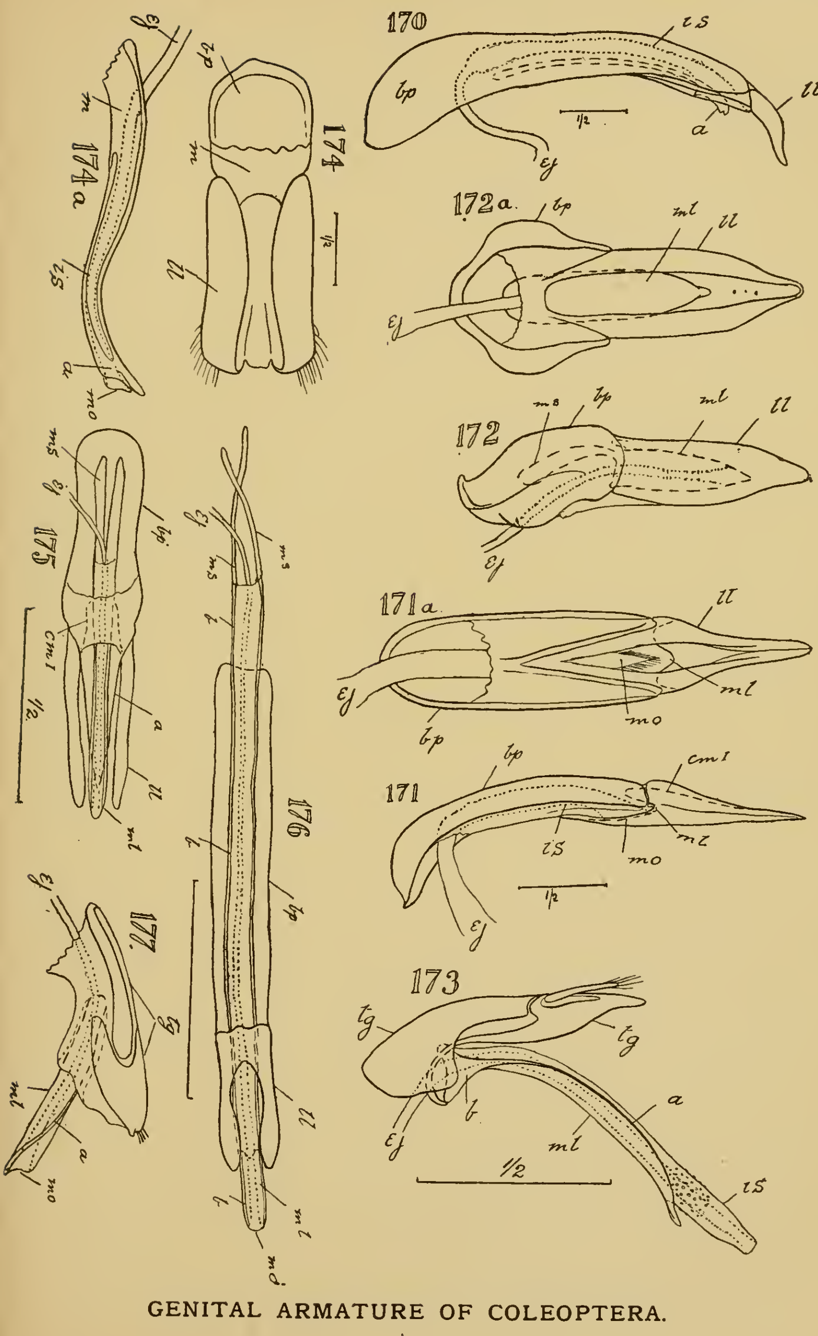
169*a*. ,, ,, , ventral view.

Descriptions on pp. 548–550. Explanation of the letters used uniformly on pp. 481–483.

Explanation of Plate LXIX.

Fig. 170. *Omophlus lepturoides*, lateral view.
171. *Prostenus dejeani*, lateral view.
171*a*. " " , ventral view.
172. *Othnius lyncea*, lateral view.
172*a*. " " , ventral view.
173. *Aegialites debilis*, lateral view, with sac partly evaginated.
174. *Monomma giganteum*, dorsal view of tegmen.
174*a*. " " , lateral view of median lobe.
175. *Orchesia micans*, ventral view.
176. *Phloeotrya rufipes*, ventral view.
177. *Melandrya caraboides*, lateral view.

Descriptions on pp. 550–552. Explanation of the letters used uniformly on pp. 481–483.



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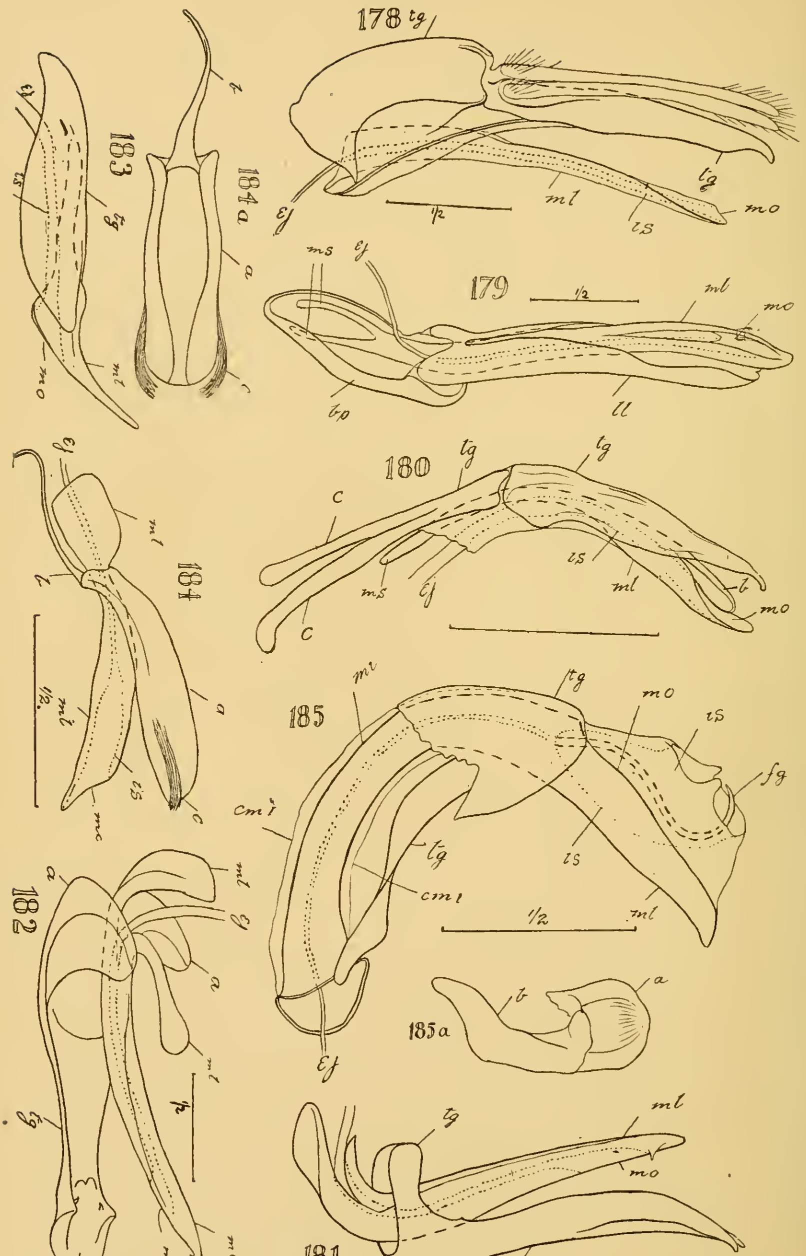


GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LXX.

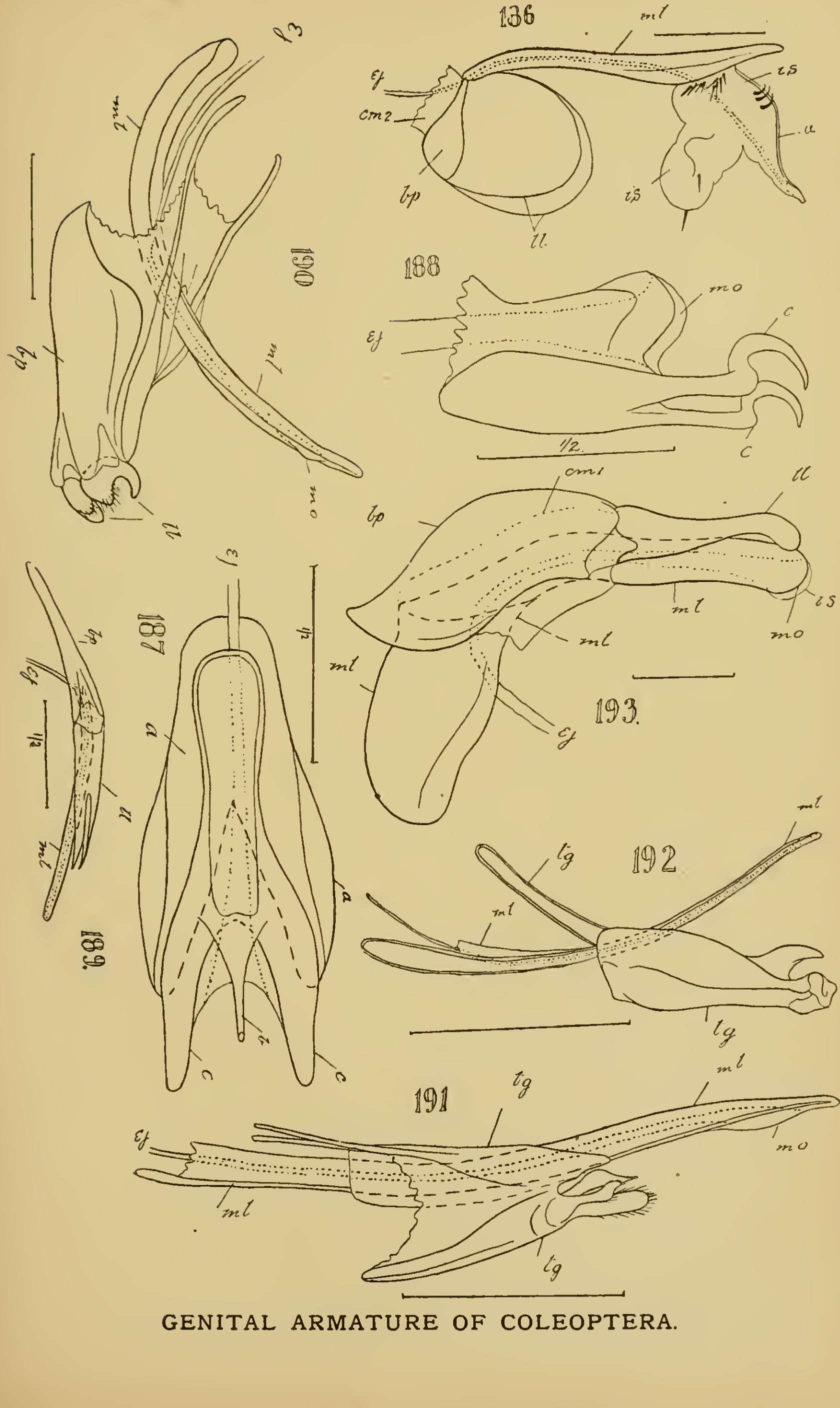
Fig. 178. *Pytho depressus*, lateral view.
179. *Pyrochroa pectinicornis*, dorso-lateral view.
180. *Anthicus maritimus* ?, lateral view.
181. *Oncomera femorata*, lateral view.
182. *Copidita (Sessinia) punctum*, dorso-lateral view.
183. *Dohrnia miranda*, lateral view.
184. *Trochoideus desjardinsii*, lateral view.
184*a*. „ „ , ventral view of tegmen.
185. *Endomychus coccineus*, lateral view.
185*a*. „ „ , ventral view of tegmen.

Descriptions on pp. 553 and 554, *Endomychus* p. 525, *Trochoideus* p. 526. Explanation of the letters used uniformly on pp. 481–483.

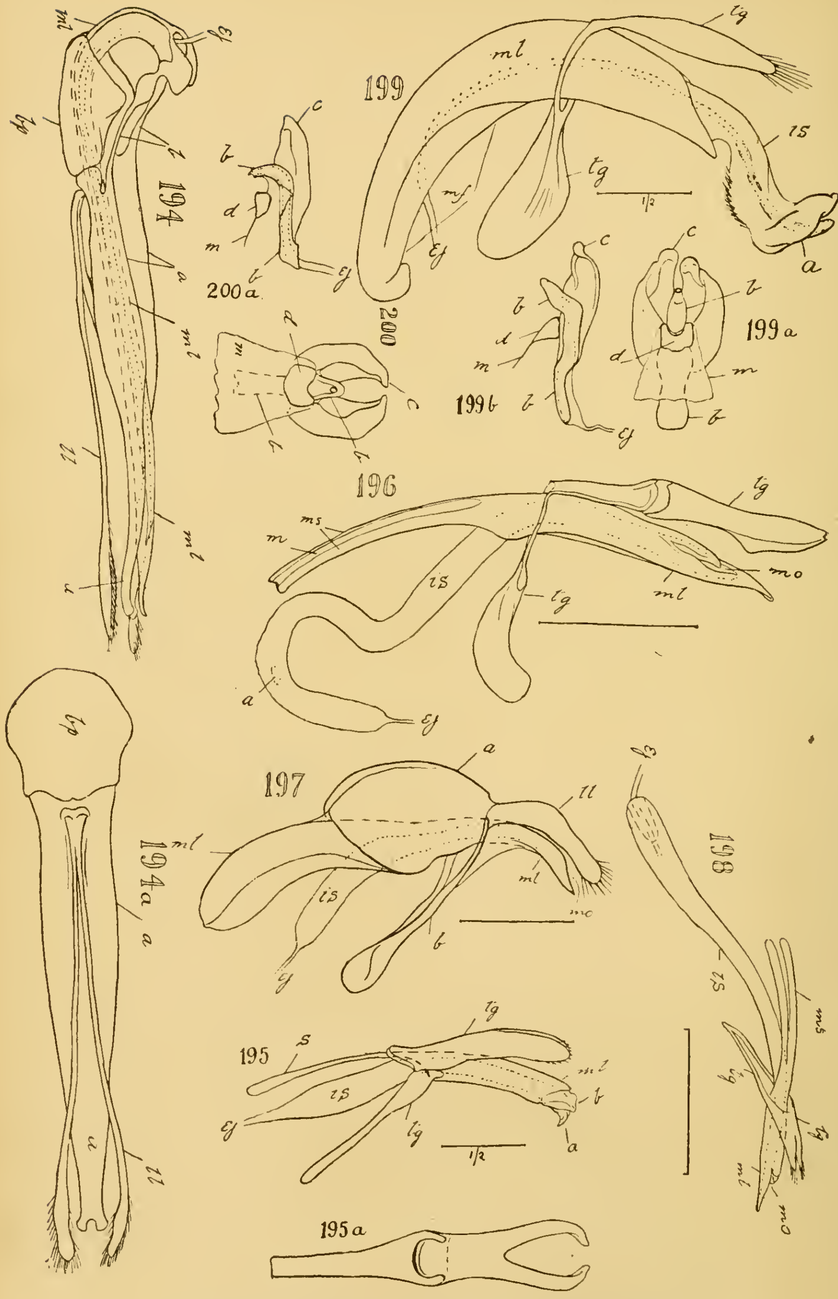
Explanation of Plate LXXI.

Fig. 186. *Metriorrhynchus thoracicus*, lateral view.
187. *Microcara livida*, ventral view.
188. *Cyphon coarctatus*, ventro-lateral view.
189. *Anaspis frontalis*, dorso-lateral view.
190. *Pelecotomoides conicollis*, lateral view.
191. *Tomoxia biguttata*, lateral view.
192. *Emenadia*, sp., lateral view.
193. *Horia (Cissites) debyi*, lateral view.

Descriptions on pp. 536 (*Metriorrhynchus*), 543 (*Microcara*), 544 (*Cyphon*), and 355, 356 (*Anaspis*, etc.). Explanation of the letters used uniformly on pp. 481–483.



GENITAL ARMATURE OF COLEOPTERA.



GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LXXII.

Fig. 194. *Trictenotoma thomsoni*, lateral view.

194*a*. „ „ , ventral view.

195. *Bruchus rufimanus*, lateral view.

195*a*. „ „ , dorsal view of tegmen.

196. *Caryoborus*, sp. n. ?, lateral view.

197. „ *nucleorum*, lateral view.

198. *Orsodacne nigriceps*, dorso-lateral view.

199. *Donacia sericea*, lateral view with sac evaginated.

199*a*. „ „ , armature on apex of sac.

199*b*. „ „ , lateral view of median piece and right lateral piece of armature on apex of sac.

200. *Donacia comari*, armature on apex of sac.

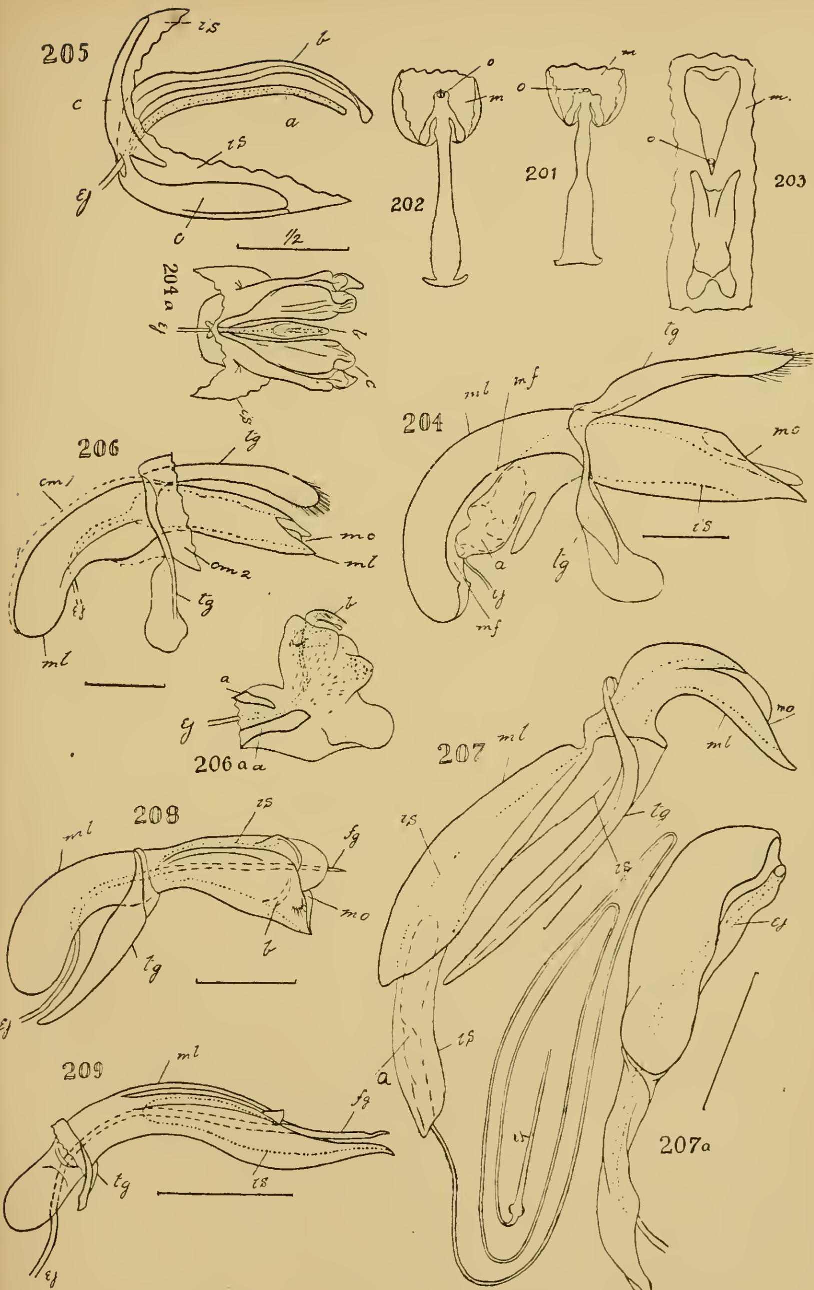
200*a*. „ „ , lateral view of median and lateral pieces of armature.

Descriptions on pp. 557–560. Explanation of the letters used uniformly on pp. 481–483.

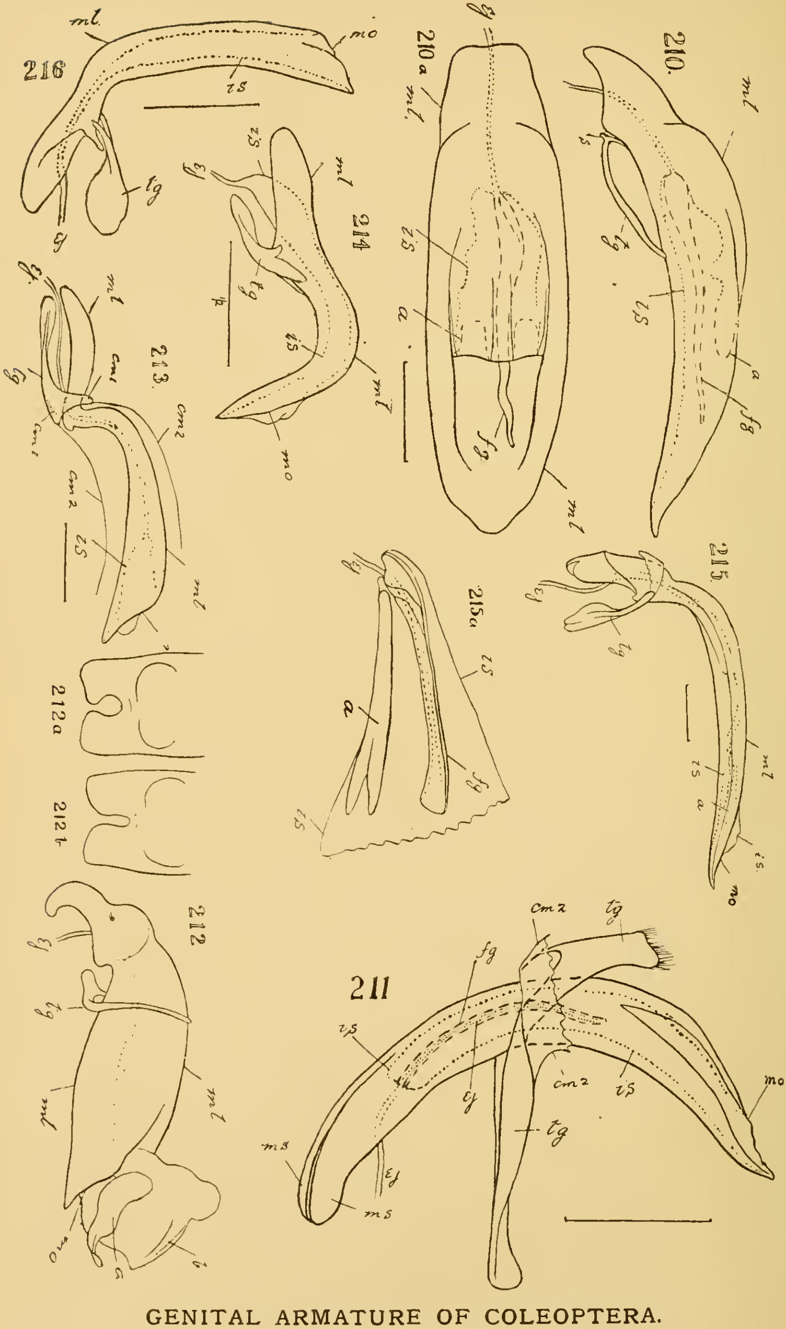
Explanation of Plate LXXIII.

Fig. 201. *Donacia bidens*, armature at apex of sac.
202. ,, *semicuprea*, ,, ,, ,,
203. ,, *lemnae*, ,, ,, ,,
204. *Carpophagus banksiae*, lateral view.
204*a*. ,, ,, , armature at apex of sac.
205. *Diaphanops westermanni*, ,, ,, ,,
206. *Sagra amethystina*, lateral view.
206*a*. ,, ,, , evaginated sac.
207. *Eumolpus surinamensis*, lateral view.
207*a*. ,, ,, , armature on apex of sac.
208. *Clythra laeviuscula*, lateral view.
209. *Orina elongata*, lateral view.

Descriptions on pp. 560–563. Explanation of the letters used uniformly on pp. 481–483.



GENITAL ARMATURE OF COLEOPTERA.



GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LXXIV.

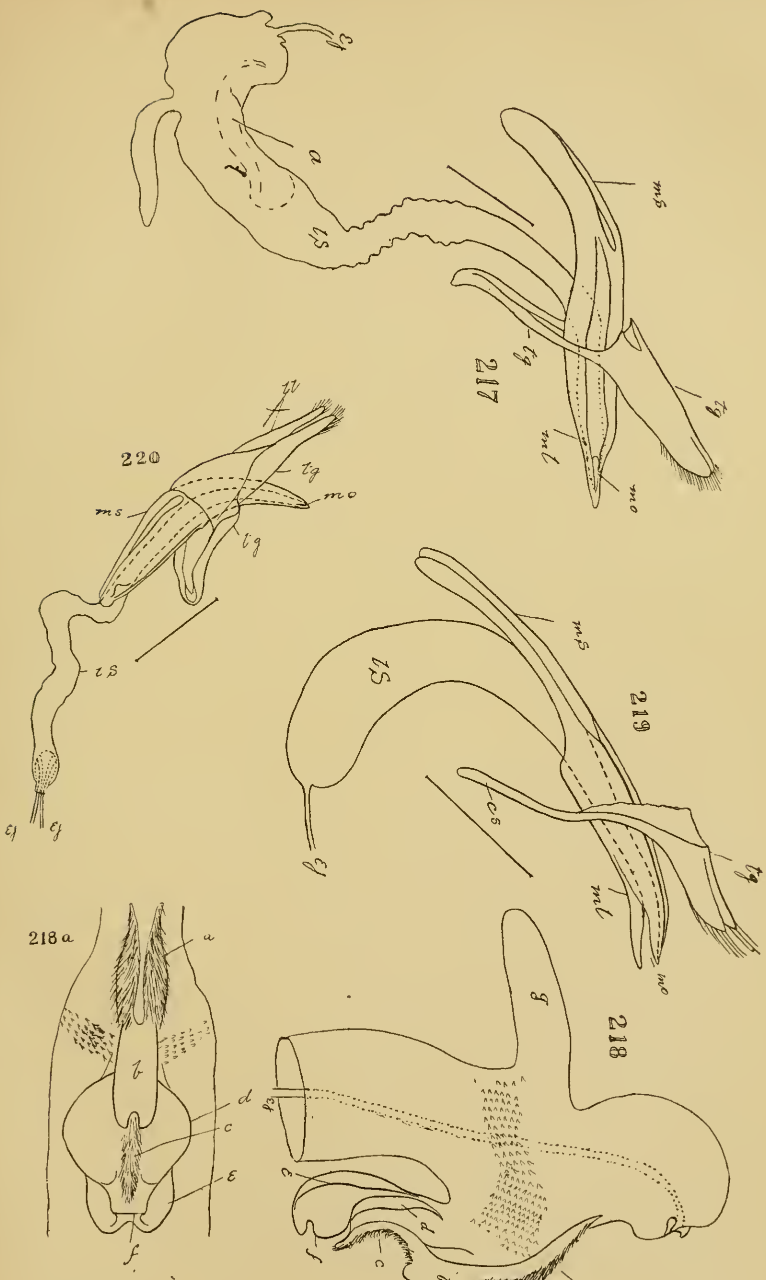
Fig. 210. *Paropsis variolosa* ?, lateral view.
210*a*. ,, ,, , dorsal view.
211. *Timarcha geniculata*, lateral view.
212. *Phyllodecta vitellinae*, lateral view, with sac evaginated.
212*a*. ,, ,, (sandhill variety), base of median lobe.
212*b*. ,, ,, , base of median lobe.
213. *Spilispa imperialis*, lateral view.
214. *Cephaloleia*, aff. *nigropictae*, lateral view.
215. *Mesomphalia pascoei*, lateral view.
215*a*. ,, ,, , armature at apex of sac.
216. *Aspidomorpha 4-maculata*, lateral view.

Descriptions on pp. 564–567. Explanation of the letters used uniformly on pp. 481–483.

Explanation of Plate LXXV.

Fig. 217. *Aromia maschata,* dorso-lateral view.
218. *Chloridolum dorycum,* lateral view of armature on sac.
218*a*. „ „ , frontal „ „ „
219. *Parandra,* sp. n. ?, dorso-lateral view.
220. *Gnoma ctenostomoides,* dorso-lateral view.

Descriptions on pp. 568 and 569. Explanation of the letters used uniformly on pp. 481–483.



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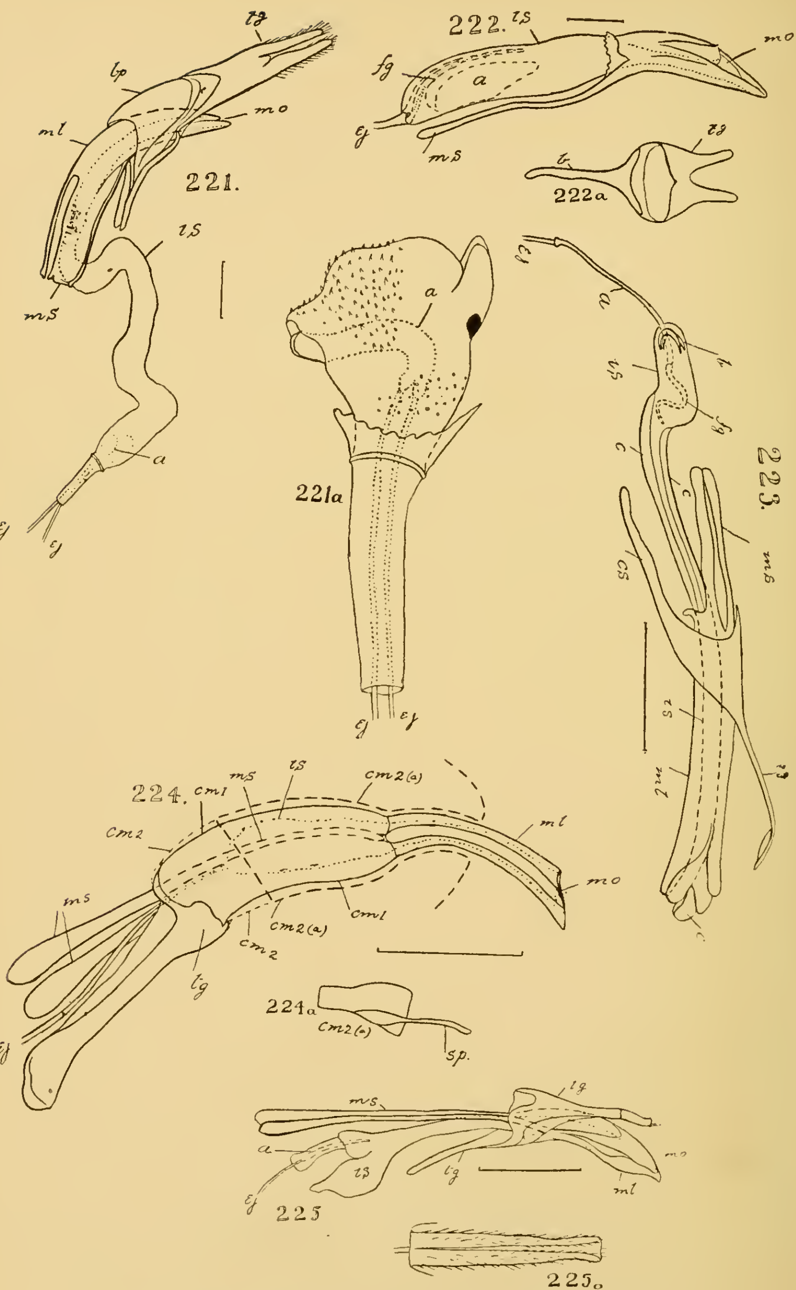


GENITAL ARMATURE OF COLEOPTERA

Explanation of Plate LXXVI.

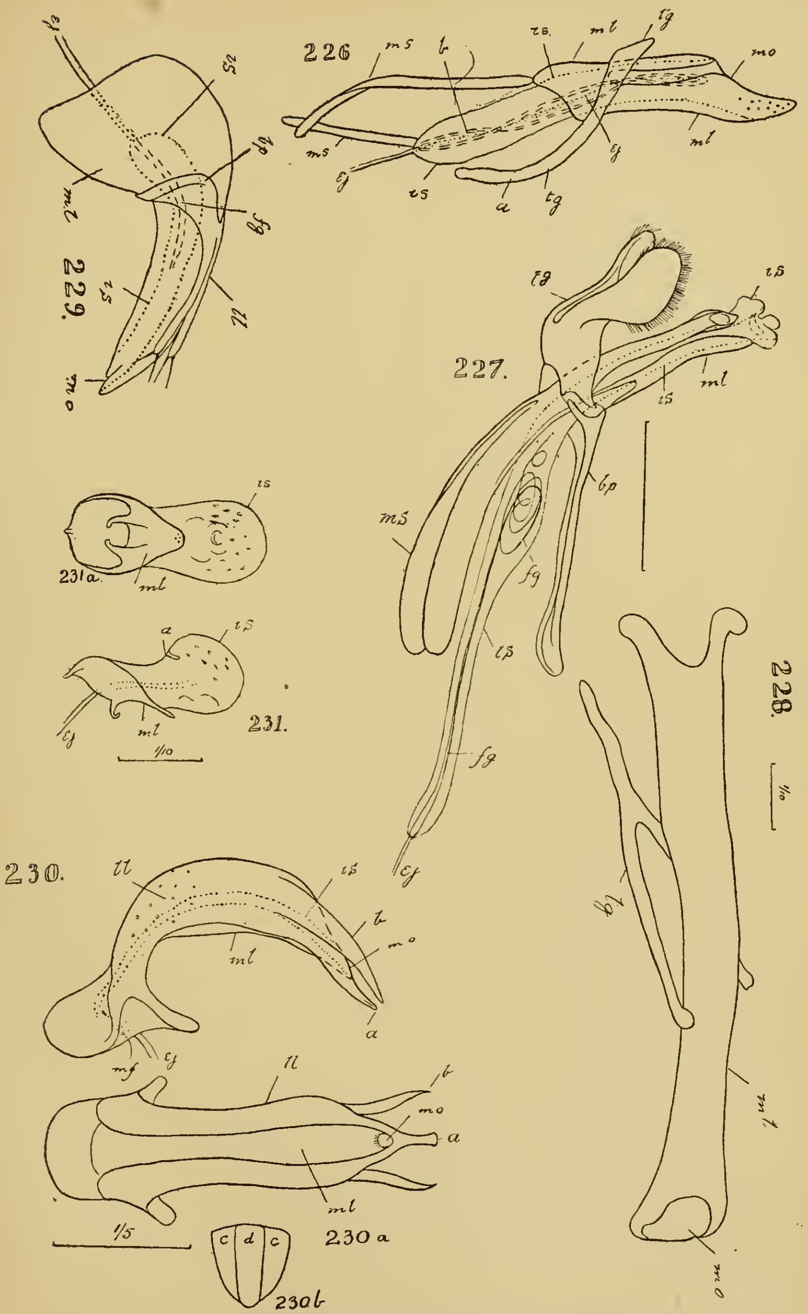
Fig. 221. *Monohammus longicornis*, dorso-lateral view.
221*a*. ,, ,, , opening of ducts on apex of sac.
222. *Eupholus chevrolati*, dorso-lateral view of median lobe.
222*a*. ,, ,, , dorsal view of tegmen.
223. *Belus bidentatus*, lateral view.
224. *Sphenophorus obscurus*, lateral view.
224*a*. ,, ,, , dorsal view of tegmen.
225. *Phloeobius alternans*, dorso-lateral view.
225*a*. ,, ,, , armature on apex of sac.

Descriptions on pp. 569–571. Explanation of the letters used uniformly on pp. 481–483.

Explanation of Plate LXXVII.

Fig. 226. *Tomicus laricis*, lateral view.
227. *Baryrhyncus miles*, dorso-lateral view.
228. *Crossotarsus barbatus*, dorso-lateral view.
229. *Platypsylla castoris*, lateral view.
230. *Bryaxis impressa*, lateral view.
230*a*. ,, ,, , dorsal view.
230*b*. ,, ,, , cross section near middle.
231. *Trichopteryx grandicollis*, lateral view.
231*a*. ,, ,, , ventral view.

Descriptions on pp. 572 and 573, 506 (*Platypsylla*), 510 (*Bryaxis*), 507 (*Trichopteryx*). Explanation of the letters used uniformly on pp. 481–483.



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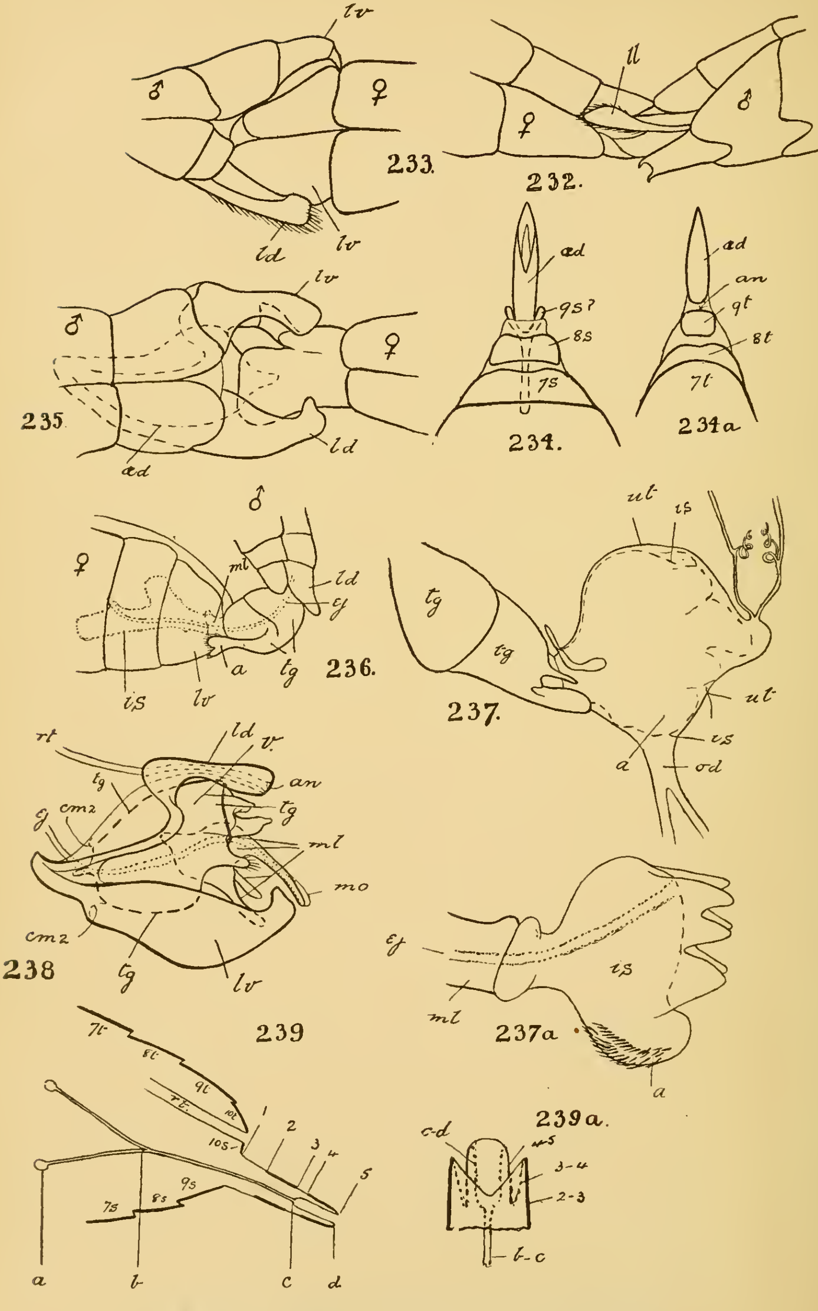


GENITAL ARMATURE OF COLEOPTERA.

Explanation of Plate LXXVIII.

Fig. 232. *Stenus speculator*, ♂ and ♀ in copula, extremities of abdomen.

233. *Malthodes marginatus*, ♂ and ♀ in copula, extremities of abdomen.

234. *Cistela atra*, ventral view.

234*a*. ,, ,, , dorsal view.

235. *Malthinus flaveolus*,* ♂ and ♀ in copula.

236. *Telephorus nigricans*, ?,* ,, ,, ,,

237. *Rhagonycha fulva*, uterus with internal sac of ♂ in situ.

237*a*. ,, ,, , internal sac evaginated.

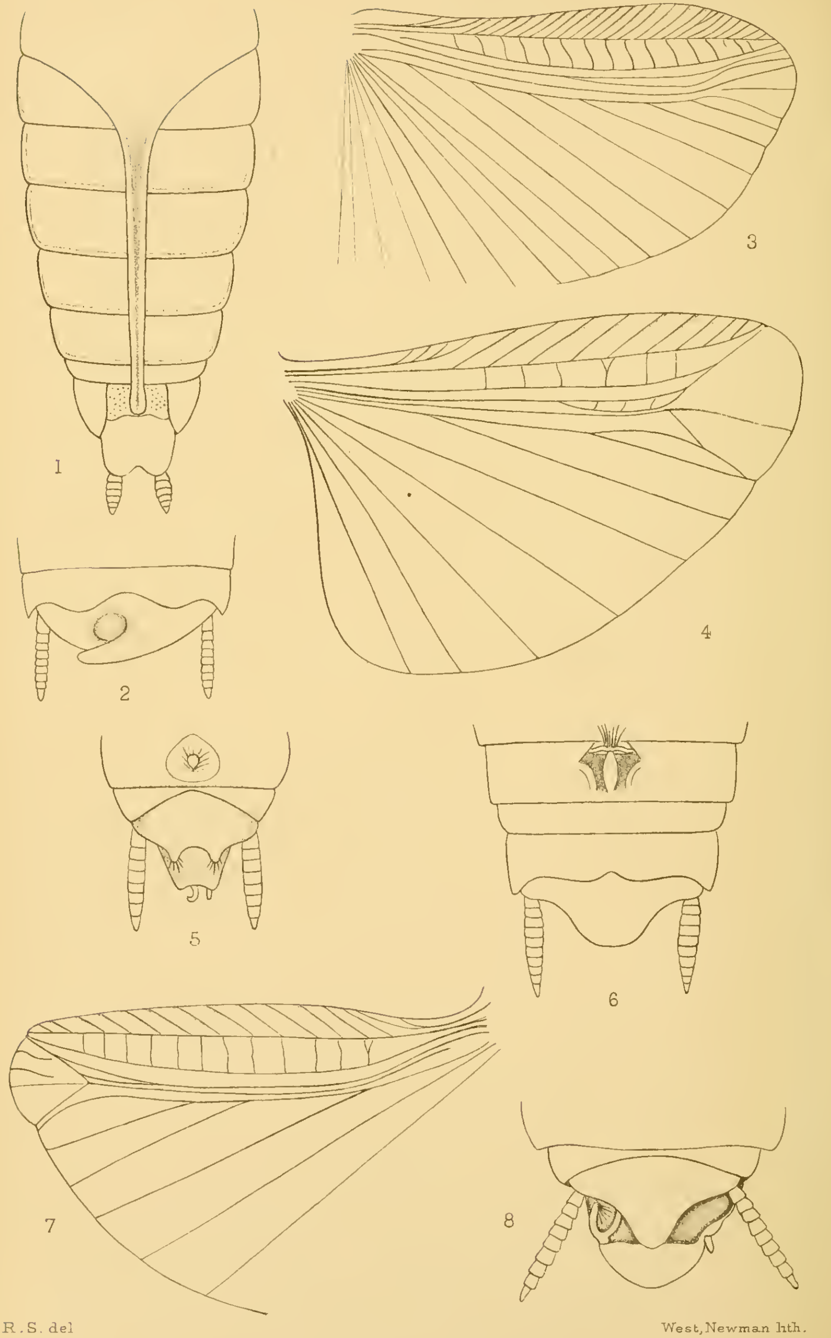
238. *Malthinus flaveolus*, ?,* last abdominal segment with aedeagus turned as during coition.

239. Diagram of ♂ genital tube (diagrammatic, testes misplaced purposely).

239*a*. Diagram of male tube with one invagination of the distal end.

* The pair from which this drawing was prepared has unfortunately been mislaid, but we believe it was of this species.

Descriptions on pp. 610, 612, etc. Full explanation of Figs. 239 and 239*a* on pp. 603, 604.



R. S. del

West, Newman lith.

DETAILS OF BLATTIDAE.

Explanation of Plate LXXIX.

Fig. 1. *Theganopteryx fantastica*, Shelf.—Abdomen of ♂ from above, showing the long process of the first abdominal tergite.

2. *Theganopteryx nitida*, Borg.—Apex of abdomen of ♂ from above.

3. *Theganopteryx nitida*, Borg.—Wing. Note the distorted ulnar vein. M.D. = medio-discal area. M.U. = medio-ulnar area.

4. *Theganopteryx gambiensis*, Shelf.—Wing. Note the ulnar vein impinging on the apical triangle and failing to reach the outer margin of the wing.

5. *Theganopteryx notata*, sp. n.—Apex of abdomen of ♂ from above.

6. *Theganopteryx lucida*, Br.—Apex of abdomen of ♂ from above.

7. *Theganopteryx lucida*, Br.—Wing. Note ulnar vein similar to that of *T. gambiensis*.

8. *Hemithyrsocera massuae*, Sauss. & Zehnt.—Apex of abdomen of ♂ from above. Note the horseshoe-shaped left style.

9. *Hemithyrsocera massuae*, Sauss. & Zehnt.—Apex of abdomen of ♂ in profile view.

Explanation of Plate LXXX.

Fig. 10. *Hemithyrsocera fallax*, Sauss.—Wing (drawn from all that remains of the type in the Geneva Museum) showing the small apical triangle and undistorted ulnar vein ; one extreme of the range of variation in wing-structure in this genus. The wing of *H. massuae* is practically identical with this.

11. *Hemithyrsocera circumcincta*, R. & F.—Tegmen, showing venation characteristic of this genus and of *Theganopteryx*.

12. *Hemithyrsocera circumcincta*, R. & F.—Wing. Note the conspicuous apical triangle with well-defined boundaries and ulnar vein very slightly upturned at apex : the other extreme of variation in wing-structure shown by this genus.

13. *Hemithyrsocera circumcincta*, R. & F.—Apex of abdomen of ♂ from beneath.

14. *Hemithyrsocera neavei*, sp. n.—Apex of abdomen of ♂ from beneath.

15. *Hemithyrsocera ridleyi*, sp. n.—Apex of abdomen of ♂ from beneath.

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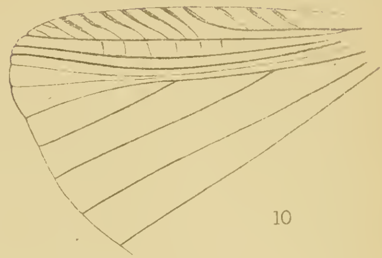

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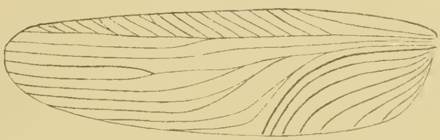

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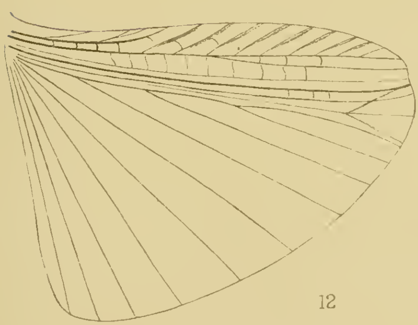

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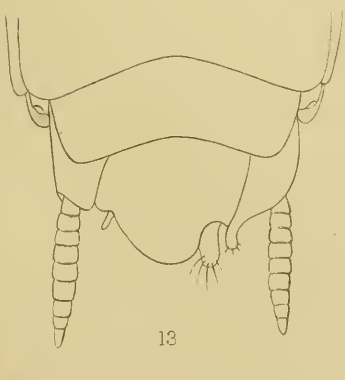

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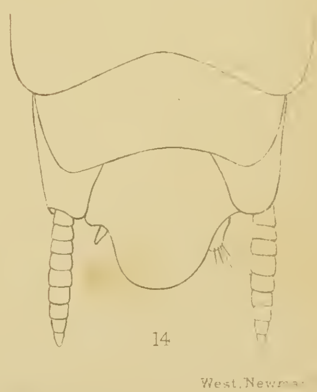

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R. del

West, Newman lith.

DETAILS OF BLATTIDAE.

XII. *Studies of the* Blattidae. By the late R. SHELFORD, M.A.

[Read June 5th, 1912.]

PLATES LXXIX—LXXX.

A REVISION OF THE GENUS *THEGANOPTERYX*, BR., TOGETHER WITH REMARKS ON SOME SPECIES OF *HEMITHYRSOCERA*, SAUSS.

THE great numbers of obscure and still undescribed species of cockroaches belonging to the subfamilies *Ectobiinae* and *Pseudomopinae* have convinced me that much more accurate and detailed diagnoses of genera must be drawn up if any order is to be introduced into the chaos at present existing. This is a task of no mean difficulty, for whilst the differences between the males of the various species are patent enough, the females resemble each other very closely, and the presence of characters which will enable the entomologist to brigade the species into genera can only be demonstrated after the most meticulous examination of all the external anatomy of the insects. But a still greater difficulty confronts the student. The characters hitherto employed to separate the subfamilies *Ectobiinae* and *Pseudomopinae* are so variable and so interchangeable that the allocation of a species or genus to this subfamily or that is as often as not dependent almost entirely on the personal opinion of the entomologist. So intimately do the subfamilies interlock that more than once I have considered the advisability of merging the two subfamilies, and I think that I would do so had I not a lingering conviction that further study of the species, both described and undescribed, will bring to light some really reliable diagnostic characters. Not one of the characters usually employed to distinguish the *Ectobiinae* from the *Pseudomopinae* is peculiar to the former subfamily. The transverse supra-anal lamina of the male, the sparse armature of the femora, the well-defined apical triangle of the wings occur sporadically in the *Pseudomopinae*. When these three important characters are shown by one species it is easy to recognise that species as a typical Ectobiine. But what of the species that exhibit, let us say, two of the above-mentioned features, whilst the third character is typical of the *Pseudomopinae*? It is true that the *Ectobiinae* as a whole have a general facies which enables the expert to recognise them almost at a glance, but it is impossible to define this facies in cut-and-dry phrases. For example, it would be folly to remove "*Theganopteryx*" *malagassa* Sauss., from the *Ectobiinae*, or the two species of *Chrastoblatta* from the *Pseudomopinae*. Yet in the former species the apical triangle is not sharply marked off from the rest of the wing, and the two latter species have the femora most sparsely armed. Quite apart from this difficulty of expressing in words the Ectobiine facies, there is the difficulty of placing the genera which present neither an Ectobiine nor a Pseudomopine facies; these baffle even the specialist. *Mallotoblatta*, Sauss., and *Escala*, mihi are cases in point,* they present some Ectobiine characters but do not *look* like *Ectobiinae*, and to include them in the *Ectobiinae* renders a diagnosis of the whole subfamily more difficult than ever, and the same happens if they are included in the *Pseudomopinae*.

It is perhaps the irony of fate that in this, my last serious contribution to the taxonomy of the *Blattidae*, I feel compelled to recant some of the opinions expressed in my first essay on the same subject. In that paper (Trans. Ent. Soc. London, 1906) I, with all the rashness of inexperience, rushed in where such authorities as Brunner von Wattenwyl and de Saussure had feared to tread, and declared with no uncertain voice that the simple or bifurcate ulnar vein of the wing was a character of the greatest reliability whereby to separate the *Ectobiinae* from the *Pseudomopinae*. The position cannot be held. Reliance on this character involved the removal of *Hemithyrsocera* from the *Pseudomopinae* to the *Ectobiinae*, but further knowledge has shown me that its genus is akin to *Blattella*, in fact the two genera grade into each other. Moreover, when the wings of a cockroach become reduced in size or semi-aborted the first wing-veins to disappear are the branches of the ulnar vein, consequently nearly all the species of *Ceratinoptera*, a truly typical

* It is some comfort to know that de Saussure was evidently as puzzled about the correct systematic position of *Mallotoblatta* as I am.

Pseudomopine, would, following my erroneous views, fall into the *Ectobiinae.* It is perfectly true that the simple or bifurcate ulnar vein of the wings is an Ectobiine character, there being but few exceptions (*Anaplectoidea* and one or two species of *Anaplecta*), but it occurs so often amongst the *Pseudomopinae,* that taken by itself it has no great diagnostic value.

It was my intention to write a complete revision of the Ectobiine genera, but circumstances over which I have no control prevent me from accomplishing this piece of work, either now or in the future, and I must content myself with giving a definition of the *Ectobiinae,* a revision of one characteristic Ectobiine genus, *Theganopteryx,* Br., and descriptions of a few critical species of *Hemithyrsocera,* Sauss. I hope that my researches will enable other orthopterists to recognise clearly the differences which separate the two genera—a point in classification which was never very clear before, and by that means to discern the characters of the two subfamilies to which the two genera belong.

i. Diagnosis of the Sub-family Ectobiinae.

Fully winged, or tegmina and wings reduced, or aborted, or absent. Sexes similar or dissimilar. Vertex of head not covered by pronotum, which is transversely elliptic or trapezoidal. Tegmina with discoidal sectors longitudinal or oblique. Wings nearly always with simple or bifurcate ulnar vein; a triangular apical area is invariably present except in those forms in which it has developed into a large apical field, reflected when the wing is folded; the triangular apical area is typically defined very clearly and easily distinguished from the rest of the wing. Supra-anal lamina of the male generally short and transverse. Subgenital lamina of the male and the styles generally asymmetrical. Femora usually very sparsely armed. Oötheca chitinous and carried with the suture uppermost.

ii. Revision of the genus Theganopteryx, Br.

I was led to a revision of this genus by an examination of its type, *T. lucida,* Br., which was kindly lent to me with several others by Dr. Dohrn of the Stettin Museum. The type has lost its abdomen and never was provided with a locality label, for the describer hazarded the opinion that the species came from Australia. On seeing the specimen I recognised its identity with a long series of the same species in the Genoa Museum collection, then in my hands, which came from West Africa, and I have no doubt that Brunner's type was taken, as were many other species in the Stettin Museum described by the same author, in Old Calabar. The genus being a critical one I made a very careful examination of the type and of the Genoa specimens, and in course of time arrived at the conclusion that the genus was far more limited in scope and in its geographical distribution than had been supposed by the authors who followed Brunner. *Theganopteryx* is in fact confined, so far as our present knowledge goes, to Tropical Africa. The majority of species which by other authors as well as by myself have been referred to this genus belong in reality to the almost cosmopolitan genus *Hemithyrsocera*, Sauss., but for the Malagasy species of *Theganopteryx* I have recently erected the new genus *Eutheganopteryx*. In the following revision I have thought it advisable to describe at some length every species of the genus, it is certainly convenient to have under one cover a complete conspectus of a genus.

Genus THEGANOPTERYX, Br.

Theganopteryx, Brunner v. Wattenwyl, Nouv. Syst. d. Blatt., p. 53 (1865); Saussure, Mém. Soc. Sc. Phys. Nat. Genève, xx, p. 229 (1869); Saussure and Zehntner, Biol. Centr.-Amer. Orth., i, p. 16 (1893).

Sexes similar. Antennae setaceous. Pronotum trapezoidal. Tegimna extending beyond the apex of the abdomen; costals regular, radial vein simple, discoidal sectors longitudinal, anterior ulnar usually simple, posterior ulnar multiramose. Wings fully developed; mediastinal vein 3- 5-ramose, rarely simple, costals regular, incrassated, radial vein simple, ulnar vein simple or bifurcate running close to the vena dividens, the interspace seldom crossed by transverse venules, its apex bent up and frequently failing to reach outer margin of wing impinging on the boundary of the apical triangle, medio-discal area 3–4 times broader in the middle than the medio-ulnar area. Triangular apical area well-defined, prominent, clearly marked off from rest of wing. Supra-anal lamina variable but typically trigonal. Sub-genital lamina (♂) more or less asymmetrical. Femora moderately armed beneath; front femora on the anterior margin beneath armed according to

Type B. Tarsi long, posterior metatarsi longer than the succeeding joints.

Type of the genus—*T. lucida*, Br.
Distribution of the species—West Africa, Congo region and N.E. Rhodesia.

KEY TO THE SPECIES.

1. Unicolorous, testaceous or castaneous.
    2. Eyes close together on vertex of head (almost touching in ♂). . . . . *T. fantastica*, Shelf.
    2′. Eyes not close together on vertex of head.
        3. Species barely exceeding 10 mm. in length . . . . *T. camerunensis*, sp. n.
        3′. Species much exceeding 10 mm. in length.
            4. Uniform castaneous . . . . . *T. nitida*, Borg.
            4′. Uniform testaceous . . . . . *T. obscura*, Shelf. (♂).

1′. Not unicolorous.
    2. Pronotum without darker vittae.
        3. Pronotum unicolorous . . . . . *T. obscura*, Shelf. (♀).
        3′. Pronotum not unicolorous but piceous, marginal with hyaline . *T. gambiensis*, Shelf.
    2′. Pronotum with 2 castaneous vittae or blotches.
        3. Pronotum with 2 castaneous blotches at base. . . . . *T. affinis*, sp. n.
        3′. Pronotum with 2 castaneous vittae.
            4. Tegmina uniform testaceous . . *T. rhodesiae*, sp. n.
            4′. Tegmina not uniform testaceous.
                5. Apex of anal field of tegmina hyaline; sub-genital lamina (♂) scarcely asymmetrical . *T. notata*, sp. n.
                5′. Anal field concolorous; sub-genital lamina (♂) very asymmetrical . . . . . . *T. lucida*, Br.

Theganopteryx fantastica, Shelf. (Plate LXXIX, fig. 1.)

Theganopteryx fantastica, Shelford, Mem. Soc. españ. Hist. Nat. i, No. 27, p. 476 (1909).

♂. Pale flavo-testaceous. Head and antennae unicolorous; eyes piceous, almost touching on vertex of head. Pronotum unicolorous.

Tegmina with 19 costals, radial and anterior ulnar veins simple, posterior ulnar 5-ramose. Wings hyaline, costal margin faintly suffused with flavid, mediastinal vein simple, 18 costals the more proximal slightly incrassated, medio-discal area nearly four times broader in the middle than the medio-ulnar area, crossed by about 13 transverse venules, a prominent apical triangle, 1st axillary 4- to 5-ramose. 1st abdominal tergite produced as a flat narrow process extending nearly to the apex of the abdomen, grooved along its dorsal aspect and slightly spatulate at its extremity; 8th tergite depressed and punctate in the middle, the posterior angles triangularly produced. Supra-anal lamina quadrately produced, apex slightly bilobed, covering the bases of the cerci which are short and situated close together. Subgenital lamina produced, asymmetrical, apex concavely emarginate, two minute styles. Femora moderately armed, front pair with 3 stout spines on the anterior margin beneath, succeeded distally by piliform setae (Type B).

♀. Similar, eyes less close together on vertex of head. Wings, uniformly suffused with pale flavid. Supra-anal lamina produced, trigonal; subgenital lamina semi-orbicular, ample. Cerci longer not situated close together.

Total length (♂) 9 mm., (♀) 11 mm.; length of body (♂) 8·1 mm., (♀) 9·6 mm.; length of tegmina (♂) 7 mm., (♀) 9·5 mm.; pronotum (♂) 2·9 mm. × 3·2 mm., (♀) 3 mm. × 4·5 mm.

Hab. S.E. and N. KAMERUN (*Conradt*) (Berlin Mus., types; coll. Bolivar); BIAFRA, Cabo S. Juan (*Escalera*) (Madrid Mus.; Oxford Mus.).

Theganopteryx camerunensis, sp. n.

Differs from *T. fantastica* by the greater distance apart of the eyes in both sexes, the smaller size of the ♀, the absence of the process of the 1st abdominal tergite in the ♂. Colour and venation as in *T. fantastica.* Supra-anal lamina (♂) subquadrate, not strongly produced, apex emarginate, (♀) triangular. Subgenital lamina (♂) symmetrical, posteriorly concavely emarginate, two minute styles. Cerci short, fusiform, very broad at base with 8 visible joints in ♂, narrower and longer in ♀.

Total length (♂) 8·5 mm., (♀) 9 mm.; length of body (♂) 7·1 mm., (♀) 7 mm.; length of tegmina (♂) 7 mm., (♀) 7 mm.; pronotum 2 mm. × 3 mm.

Hab. S.E. KAMERUN (*Conradt*) (Berlin Mus., type ♂; coll. Bolivar, type ♀).

Theganopteryx affinis, sp. n.

♂. Closely allied to *T. fantastica*, but tegmina with anal field and a stripe on the discoidal field, castaneous; distance apart of eyes on vertex of head greater than the breadth of the 1st antennal joint; wings faintly suffused with castaneous, ulnar vein bifurcate, the rami joining again at their extremities. Secondary sexual apparatus of ♂ as in *T. fantastica*. Posterior angles of 8th abdominal tergite less produced; supra-anal lamina not sub-bilobate. Subgenital lamina symmetrical, apex concavely emarginate, two styles. Cerci narrower, situated less close together, their bases not hidden by the supra-anal lamina.

Total length 10·2 mm.; length of body 8·1 mm.; length of tegmina 8 mm.; pronotum 2–2·5 mm. × 2·5–3 mm.

Hab. Congo State, W. of Kambove, 3,500′–4,500′ (*S. A. Neave*) (British Mus., type).

Theganopteryx nitida, Borg. (Plate LXXIX, figs. 2, 3.)

Theganopteryx nitida, Borg. Bih. Svensk. Vet.-Akad., Handl. xxviii, Afd. 4, No. 10, p. 4, pl. 1, fig. 8 (1904).

♂. Castaneous or rufo-castaneous, unicolorous. Antennae fuscous, not incrassated. Tegmina with 19–21 costals, radial and anterior ulnar veins simple, posterior ulnar 6-ramose. Wings suffused with castaneous, mediastinal vein 4-ramose, 21 costals, the proximal 16 slightly incrassated, medio-discal area in the middle about four times broader than the medio-ulnar area, crossed by 14 transverse venules, ulnar vein bifurcate, flexuose, reaching the outer margin, 1st axillary vein 7-ramose, triangular apical area large, prominent. Posterior margin of penultimate tergite sinuate; no scent-gland opening visible. Supra-anal lamina very asymmetrical, its posterior angles produced as two incurved hooks, the right overlapping the left. Subgenital lamina surpassing the supra-anal lamina, produced, asymmetrical, irregularly notched on the left side, apex with a blunt style. Cerci moderate, 9-jointed. Legs testaceous.

Total length 11·5 mm.; length of body 9 mm.; length of tegmina 9·8 mm.; pronotum 3 mm. × 3·1 mm.

Hab. Kamerun (*Sjöstedt*, Stockholm Mus. type; *Conradt*, coll. Bolivar); Biafra, Cabo S. Juan (*Escalera*, Madrid Mus.).

Theganopteryx obscura, Shelf.

Theganopteryx obscura, Shelford, Rev. Zool. Afric. i, fasc. 2, p. 199 (1911).

♂. Uniform flavo-testaceous. Head castaneous, antennae fuscous; eyes piceous, their distance apart on vertex of head nearly equal to 1st antennal joint. Pronotum posteriorly produced very obtusely. Tegmina with 23 costals, radial and anterior ulnar veins simple, 7 discoidal sectors. Wings faintly suffused with ochreous, mediastinal vein simple, 15 costals, medio-discal area in middle about four times broader than medio-ulnar area, crossed by about 15 transverse venules, ulnar bifurcate, the rami joining at their apices, a prominent triangular apical area. Scent-gland openings on the 2nd and 7th abdominal tergites; supra-anal lamina trigonal, surpassed by the subgenital lamina which is produced, symmetrical, posteriorly emarginate and furnished with 2 minute styles. Cerci short, sub-acuminate, situated close together at base.

♀. Tegmina with the discoidal field and the disc of the abdomen beneath castaneous, supra-anal lamina triangular, cerci longer and more slender.

Total length (♂) 11·1 mm., (♀) 11·5 mm.; length of body (♂) 10 mm., (♀) 8·5 mm.; length of tegmina (♂) 9·1 mm., (♀) 9·1 mm.; pronotum 3 mm. × 3·5 mm.

Hab. CONGO STATE, West of Kambove, 3,500′–4,500′ (*S. A. Neave*) (British Mus.), S.E. Katanga (*S. A. Neave*) (British Mus., Oxford Mus.), Kapema-Kipaila (*Sheffield Neave*) (Musée du Congo); N.E. RHODESIA, Serenje District (*S. A. Neave*) (British Mus.), Chisinga plateau (Oxford Mus., types); PORTUGUESE E. AFRICA, Kurumadzi River (*C. F. Swynnerton*, Oxford Mus.).

Theganopteryx gambiensis, Shelf. (Plate LXXIX, fig. 4.)

Theganopteryx gambiensis, Shelford, Trans. Ent. Soc. London, 1906, p. 236.

♂. Head castaneous; antennae fuscous, ciliate. Pronotum castaneous, anteriorly and laterally margined with testaceous. Tegmina and wings exceeding the apex of the abdomen. Tegmina flavo-hyaline, outwardly margined with hyaline, 10 costals the last two ramose, radial vein simple, anterior ulnar 3-ramose, 8 discoidal sectors. Wings with anterior part faintly suffused with castaneous, mediastinal vein 4-ramose, radial vein simple, 8–9 costals, slightly incrassated, ulnar vein bifurcate, the rami reuniting at apex, not reaching the margin of the wing, medio-discal area a little more than twice as broad as medio-ulnar area crossed by a few transverse venules, triangular apical area very large, the vena dividens crossing it in the lower half, 1st axillary 3-ramose. Abdomen above piceous in basal half, the tergites margined laterally and posteriorly with testaceous, rufous in apical half; scent-gland opening on 7th tergite; supra-anal lamina trigonal. Abdomen beneath piceous, laterally margined with testaceous; sub-genital lamina asymmetrical bordered on either side by lappets, the inflexed margins of the 9th tergite, the left lappet with apex slightly produced, the right style minute, the left stout, hirsute, more or less concealed beneath the lamina. Cerci fuscous, moderate, 9-jointed. Coxae castaneous at base, testaceous at apex; femora castaneous; tibiae flavo-testaceous tipped with castaneous.

Total length 13 mm.; length of body 10·5 mm.; length of tegmina 11 mm.; pronotum 4 mm. × 4·3 mm.

Hab. Gambia (Oxford Mus., type).

Theganopteryx rhodesiae, sp. n.

♂. Testaceous. Head flavo-testaceous; antennae fuscous. Pronotum with two broad castaneous vittae, lateral margins hyaline. Tegmina with 20 costals, 6 longitudinal discoidal sectors, anterior ulnar simple. Wings with marginal field infuscated, mediastinal vein 3- 4-ramose, 13 incrassated costals, medio-discal area about twice as broad as the medio-ulnar, crossed by 12 transverse venules, ulnar vein bifurcate, upper half of triangular apical area crossed by two veins, 1st axillary 3-ramose. Abdomen fuscous with pale lateral margins. Supra-anal lamina rounded, surpassed by the subgenital lamina which is produced and symmetrical; styles absent. Cerci piceous, situated close together at base. Legs testaceous.

♀. Similar, but in some examples the tegmina and wings do not extend beyond the apex of the abdomen. Supra-anal lamina trigonal, sub-genital lamina semi-orbicular ample.

Total length (♂) 9 mm., (♀) 7–9 mm.; length of body (♂) 8 mm., (♀) 8 mm.; length of tegmina (♂) 9 mm., (♀) 7–9 mm.; pronotum 2–5 mm. × 3 mm.

N.E. Rhodesia, shores of L. Bangweolo and Upper Kalungwisi valley (*S. A. Neave*) (Oxford Mus., types).

Theganopteryx notata, sp. n. (Plate LXXIX, fig. 5.)

♂. Head testaceous, antennae fuscous, setaceous, distance apart of eyes on vertex of head less than length of 1st antennal joint. Pronotum testaceous with 2 broad fuscous vittae. Tegmina and wings exceeding the apex of the abdomen. Tegmina castaneous, the marginal field and the apex of the anal field testaceo-hyaline, 14–16 costals, radial and anterior ulnar veins simple, 6 longitudinal discoidal sectors. Wings suffused with castaneous, mediastinal vein 3-ramose, 14 costals the first 8 incrassated, medio-distal area in middle about 3 times broader than medio-ulnar area, crossed by 12 transverse venules, ulnar vein bifurcate, the rami sometimes reuniting at their apices, triangular apical area large and conspicuous, 1st axillary 4-ramose. Abdomen castaneous above, laterally margined with testaceous, beneath testaceous, laterally margined with castaneous. Scent-gland opening on 7th abdominal tergite; supra-anal lamina bullate, apex emarginate with a small tuft of rufous hairs on either side of the notch; surpassed by the sub-genital lamina which is symmetrical, produced, with the apex emarginate, right style minute, left style stouter, curved, median in position. Cerci moderate, 8-jointed. Legs testaceous.

♀. Similar, supra-anal lamina trigonal.

Total length 9–10 mm.; length of body 9 mm.; length of tegmina 8–8·5 mm.; pronotum 3–5 mm. × 4 mm.

Hab. FRENCH CONGO, Ndjole, Lambarene, Fernand Vaz (*L. Fea*) (Genoa Mus., types; Oxford Mus.).

Theganopteryx lucida, Br. (Plate LXXIX, figs. 6 and 7.)

Ectobia [*Theganopteryx*] *lucida*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 62 (1865).

♂. Rufo-testaceous. Distance apart of eyes on vertex equal to length of 1st antennal joint. Pronotum with 2 broad fuscescent vittae, occasionally obsolescent. Tegmina and wings exceeding the apex of the abdomen. Tegmina suffused with castaneous near the base, 17–20 costals, radial and anterior ulnar veins simple, 5–6 longitudinal discoidal sectors. Wings with the veins castaneous, mediastinal vein 4-ramose, 12–14 costals, all but the last 2 or 3 incrassated, medio-discal area in middle 3 times broader than the medio-ulnar area crossed by about 15 transverse venules, ulnar vein bifurcate, the rami reuniting at their apices, triangular apical area large and prominent its upper half crossed by 2 venae spuriae, 1st axillary 5-ramose. Opening of scent-gland on 7th abdominal tergite; supra-anal lamina triangular, sub-truncate at apex; sub-genital lamina asymmetrical, notched to the left of the middle line, left style long and slender, right style absent. Femora as in the preceding species.

♀. Similar; supra-anal lamina trigonal; tegmina more heavily suffused with castaneous.

Oötheca chitinous, carried with the suture uppermost, sides and base multicarinate, the carinae produced posteriorly to form minute teeth.

Total lengths 10 mm.; length of body (♂) 9 mm., (♀) 8 mm.; length of tegmina 8·5 mm.; pronotum 3 mm × 3·5 mm.

Hab. ? KAMERUN (Stettin Mus., type; coll. Bolivar; Berlin Mus.); FRENCH GUINEA, Kouroussa (Paris Mus.); PORTUGUESE GUINEA, Bolama, Rio Cassine (*Fea*) (Genoa Mus., Oxford Mus.); FERNANDO PO, Basilé (*Fea*) (Genoa Mus.); BIAFRA, Cabo S. Juan (*Escalera*) (Madrid Mus.); CONGO STATE, Kasenga Kalumba (*Sheffield Neave*) (Musée du Congo).

One of the Portuguese Guinea examples was found in a Termites' nest. The Biafra specimens are much darker than those from other localities; in the Kamerun examples the pronotal vittae tend to become obsolete.

iii. DIAGNOSIS OF HEMITHYRSOCERA, Sauss. (Subfamily *Pseudomopinae*).

Sexes similar or dissimilar.

Vertex of head not covered by the pronotum. Antennae setaceous but occasionally incrassated or plumose. Pronotum trapezoidal, posteriorly produced obtusely. Tegmina and wings in ♂ always exceeding the apex of the abdomen; in the ♀ the tegmina and wings resemble those of the ♂, or in a few species the tegmina are reduced to quadrate lobes and the wings are rudimentary. Discoidal sectors of tegmina longitudinal. Ulnar vein of the wing simple, bifurcate, or rarely trifurcate; apical triangle variable but usually much longer than broad and with ill-defined boundaries, not cutting off the apex of the ulnar vein from the outer margin of the wing. Medio-discal and medio-ulnar areas narrow. Subgenital lamina of the ♂ and styles usually very asymmetrical. Femora strongly armed, front femora armed after Type A. Oötheca a membranous or coriaceous capsule carried with the suture on one side.

Type of the Genus: *Thyrsocera histrio*, Burm.

Geographical distribution—The tropical and sub-tropical regions of the world.

Every variation of which the apical triangle of the wing seems capable is presented in this genus; it may be very narrow and almost inconspicuous (e.g. *histrio*, Burm., *fallax*, Sauss., *massuae*, Sauss. and Z., *sabauda*, Giglio-Tos), and when in this form the type of wing-structure approaches that of *Blattella* very closely. The other extreme causes the wing-structure to resemble that of *Theganopteryx* (e. g. *circumcincta*, R. and F., *neavei*, sp. n.) and every gradation may be found between the two extremes if a large enough number of species is examined. As a matter of fact the apical triangle is not a character of the first importance, its form appears to be correlated with the relative length and breadth of the wing, which again depends largely on the body-length; the longer the wing the narrower and the more ill-defined the apical triangle is a general rule, with of course many exceptions, and the converse holds true also.

The species described below are either new to science or else of considerable interest as having long occupied very precarious situations in classification; the synonymy of *H. circumcincta*, R. and F., is a good example of the latter.

Finally I give a list of the species of *Hemithyrsocera*, and it will be noted that I have transferred to it some species from the old "portmanteau" genus *Phyllodromia*, Serv., and also some species which in my "Genera Insectorum" memoir (*Ectobiinae*) I placed in *Theganopteryx*. Concerning these latter species I shall doubtless be accused of chopping and changing, but in palliation of my offence can only urge that my predecessors appear to have held as vague and uncertain views of the limits of the two puzzling genera discussed in this paper as I did until recently. It was not till I had critically examined a large number of type-specimens that I was able to gain a clear picture of the two genera. That being done I now hope that the views expressed here are quite final and decisive, and that there will no longer be confusion between the two genera.

A word may be said in passing on the genus *Pseudectobia*, Sauss. Originally erected to include the species with a conspicuous apical triangle and multiramose vena ulnaris alarum as opposed to the simple ulnar vein of *Theganopteryx*, it gradually came to include a number of most diverse species and its boundaries became so elastic that they could not be defined with accuracy. Later, de Saussure, in his work on the Orthoptera of Madagascar, regarded *Pseudectobia* as a mere sub-genus of *Theganopteryx*, but to adopt this view involves the removal of the type species *P. luneli*, Sauss., from the genus! *P. luneli* is unfortunately known from but a single specimen in a shocking state of preservation. I have made as careful an examination of the dilapidated type as is possible, and find that the apical triangle is not at all conspicuous, and its boundaries are ill-defined; the femora are sparsely armed and the discoidal sectors of the tegmina so far as can be seen are longitudinal, but this latter point is exceedingly doubtful, owing to the damage sustained by the tegmina. In my opinion none of the other species included by different authors in this genus are congeneric with *luneli*, and for the present I prefer to regard *Pseudectobia* as a monotypic genus.

iv. Descriptions of some Species of Hemithyrsocera.

Hemithyrsocera massuae, Sauss. and Zehntner. (Plate LXXIX, fig. 8, LXXX, fig. 9, compare also fig. 10.)

Blatta massuae, Saussure and Zehntner [*in*] Grandidier's Hist. Madagascar, Orth. i, p. 28 (1895).

♂. Flavo-testaceous. Head rufo-castaneous, eyes on vertex wide apart; antennae testaceous. Pronotum anteriorly and laterally margined with sub-opaque testaceous. Tegmina and wings barely exceeding the apex of the abdomen. Tegmina with 14–16 costals, radial-vein bifurcate from the middle, anterior ulnar bifurcate, 6–7 longitudinal discoidal sectors. Wings hyaline, veins flavous, mediastinal vein 2- or 3-ramose, 10 incrassated costals, radial vein bifurcate from middle, medio-discal area about 3 times broader than medio-discal, ulnar vein simple, triangular apical area moderately distinct, 1st axillary 3-ramose. Supra-anal lamina triangular, exceeded by the sub-genital lamina; opening of scent-gland on 7th abdominal tergite. Sub-genital lamina symmetrical, produced at apex to form a rounded and slightly deflected lobe, right style minute, left style large and shaped like a horseshoe. Cerci moderate, 9-jointed. Femora rather sparsely armed.

Total length 10·5 mm.; length of body 9 mm.; length of tegmina 8·5 mm.; pronotum 3mm. × 3·2 mm.

Hab. Abyssinia, Massowa (Geneva Mus., type); Erythraea, Mt. Geleb (Geneva Mus.).

Through the kindness of Dr. J. Carl of the Geneva Museum I have been permitted to examine one of de Saussure's specimens; it is evident that the learned Swiss entomologist overlooked the very remarkable genital styles of this species.

Hemithyrsocera circumcincta, Reiche and Fairm. (Plate LXXX, figs. 11–13.)

Blatta circumcincta, Reiche and Fairmaire, [*in*] Ferret and Galinier, Voy. Abyss., iii, p. 241, pl. 27, f. 3 (1847).

Blatta senegalensis, Saussure, Rev. Zool. (2), xx, p. 354 (1868).

Ectobia (*Theganopteryx*) *senegalensis*, Saussure, Mém. Soc. Sc. Phys. Nat. Genève, xx, p. 231 (1869).

Blatta fulvipes, Walker, Cat. Blatt. Brit. Mus., p. 105 (1868).

Blatta amoena, Walker, *t. c.*, p. 220 (1868).

Phyllodromia pulchella, Gerstaecker, Mitt. Ver. Neuvorpomm. u. Rugen, xiv, p. 61 (1883).

Theganopteryx senegalensis, var., Saussure, Ann. Mus. Civ. Genova, xxxv, p. 71 (1895).

Theganopteryx aethiopica, Saussure, *t. c.*, p. 72 (1895); Shelford, Gen. Insect. 55me fasc., Blattidae, Ectobinae, plate, f. 1 (1907).

? *Temnopteryx abyssinica*, Saussure and Zehntner, [*in*] Grandidier, Hist. Madagasc., Orth., i, p. 51 (1895); Saussure, Abh. Senckenb. Ges., xxi, p. 576 (1899); Shelford, Gen. Insect., 73me fasc. Blattidae, Phyllodromiinae, pl. 2, f. 3 (1908).

Temnopteryx saussurei, Bolivar, Ann. soc. ent. France, lxvi, p. 292 (1897).

Theganopteryx saussurei, Shelford, Gen. Insect., 55me fasc. Blattidae, Ectobinae, p. 8 (1907); Shelford, [*in*] Sjöstedt's Kilimandjaro-Meru Exped., xvii, 2, Blattodea, p. 14 (1907).

♂. Head piceous; distance apart of eyes on vertex of head equal to length of 1st antennal joint; antennae fuscous to piceous. Pronotum castaneous, margined anteriorly and laterally with testaceous, the margins inwardly sinuate. Tegmina and wings extending beyond the apex of the abdomen. Tegmina rufo-testaceous to castaneous, outer margin hyaline, radial vein bifurcate at its middle or in the distal third, 10–13 costals, anterior ulnar simple or bifurcate, very rarely 3-ramose, 7–8 longitudinal discoidal sectors. Wings hyaline, costal margin faintly suffused with testaceous, mediastinal vein 4-ramose, radial vein bifurcate, 9–10 costals more or less incrassated, medio-discal area about twice as broad as the medio-ulnar and crossed by several transverse venules, ulnar vein simple, triangular apical area moderate, well-defined, 1st axillary vein 3- to 4-ramose. Abdomen above and beneath piceous to castaneous, margined laterally with flavo-testaceous, 7th tergite more or less testaceous and bearing the scent-gland opening. Supra-anal lamina trigonal. Sub-genital lamina asymmetrical, margined posteriorly with flavo-testaceous, on either side of it a lappet formed by the inflexed margins of the 9th tergite, the lappets are asymmetrical, the left being produced into a dentiform process beset with spiniform setae, the right obliquely truncate; right style minute, left style stout, covered with long hairs and more or less hidden beneath the lamina. Cerci castaneous, moderate, 9-jointed. Coxae piceous tipped and outwardly marginal with testaceous, femora castaneous or testaceous in basal $\frac{2}{3}$ and castaneous in apical third, tibiae rufo-castaneous tipped with castaneous, tarsi fuscous, with basal joints rufous; femoral and tibial spines rufous. Femora moderately armed, front femora armed according to Type A.

♀. Long-winged form (*aethiopica*); tegmina and wings extending beyond the apex of the abdomen; tegmina castaneous, outwardly margined with testaceous; supra-anal lamina trigonal; apical half of the coxae, basal $\frac{2}{3}$ of the femora, the tibiae except at extreme base and apex, testaceous, remainder of legs castaneous. Medium-winged form (*circumcincta*); tegmina lanceolate, castaneous to rufous, together with the wings not extending beyond the 5th abdominal tergite; fore femora usually piceous, otherwise the legs are coloured as in the long-winged form; supra-anal lamina occasionally faintly emarginate. Short-winged form (*abyssinica*): tegmina quadrate not extending beyond the 1st abdominal tergite, castaneous or rufous; wings squamiform; the legs vary in colour from that described for the medium-winged form to testaceous with traces of castaneous markings at bases of coxae and femora.

♂. Total length 12–13·5 mm.; length of body 10 mm.; length of tegmina 10·5–11·5 mm.; pronotum 3 mm. × 4 mm.

♀. Total length 10–13 mm.; length of body 10–10·5 mm.; length of tegmina 3·4, 7, 10 mm.; pronotum 3 mm. × 4 mm.

Hab. Erythraea, Asmara (Oxford Mus.), Bogos (*Beccari*) (Genoa Mus.); Abyssinia (Ferret and Galinier) (Paris Mus., type of *circumcincta*), Massowa (Geneva Mus., type of *abyssinica*); Shoa, Let Marefia (*Beccari*) (Genoa Mus.); Galla Land, various localities (*Bottego*) (Genoa Mus., Geneva Mus.); German E. Africa, Kilimandjaro, Meru (*Sjöstedt*) (Stockholm Mus.; Oxford Mus.); "W. Africa" (British Mus., type of *amoena*); Senegal (Geneva Mus., type of *senegalensis*); Portuguese Guinea, Bolama (*Fea*) (Genoa Mus.); Sierra Leone (British Mus., type of *fulvipes*); Gold Coast (Geneva Mus., type of *aethiopica*); Togo, Bismarckburg (*Büttner*) (Berlin Mus.); Biafra, Cabo S. Juan (*Escalera*) (Madrid Mus.); Kamerun, (Griefswald Mus., type of *pulchella*); Congo, Buta (*Ribotti*) (Genoa Mus.).

This is a most variable species which I am unable to split up even into constant local varieties. The West African male specimens have the tegmina rufo-testaceous and the anterior ulnar vein of the tegmina usually bifurcate, but specimens from Shoa also have the tegmina rufo-testaceous, and the East African males in general sometimes have the anterior ulnar vein simple sometimes branched, so that these characters cannot be employed for subdividing the species. The form of the terminal segments of the abdomen in the male also varies within small limits, but the variations are quite independent of the geographical distribution and in some cases I believe that the variations are really due to distortion of the parts after death. The long-winged females (*aethiopica*) occur only on the West Coast, but they are found side by side with the medium-winged forms (*fulvipes*) which occur also in East Africa; the short-winged forms occur in Abyssinia (*abyssinica*) and also in Togo.

In Dr. Sjöstedt's Kilimandjaro collections was found a short-winged female with the oötheca protruding from the end of the abdomen; this oötheca was a thin-walled membranous sac, carried with the suture directed to one side and transparent so that the eyes of the contained embryoes could be seen through the walls. The oötheca, which thus differs very markedly from that of *T. lucida*, Br., is probably deposited but a few hours before the emergence of the young, and is thoroughly characteristic of the sub-family Pseudomopinae.

Hemithyrsocera neavei, sp. n. (Pl. LXXX, fig. 14.)

♂. Differs from *T. circumcincta* in larger size, antennae testaceous at base; tegmina rufo-castaneous sometimes darker at base, 15–18 costals, otherwise venation the same; left inflexed angle of 9th abdominal tergite not dentately produced; legs testaceous, the extreme base of the coxae and tibiae and the apex of the tibiae castaneous.

♀. Very similar to short-winged E. African form of *T. circumcincta* (*abyssinica*) but larger and pronotum not bordered posteriorly with testaceous.

Total length (♂) 15 mm.; length of body (♂) 12 mm., (♀) 13·2 mm.; length of tegmina (♂) 13 mm., (♀) 4 mm.; pronotum 4 mm. × 4·8 mm.

Hab. Congo State, S.E. Katanga, 4,000′ (*S. A. Neave*) (British Mus., Oxford Mus.); N.E. Rhodesia, Serenje district, 4,500′ (*S. A. Neave*) (British Mus., types; Oxford Mus.).

This is quite distinct from the preceding species.

Hemithyrsocera vinula, Stål.

Blatta vinula, Stål, Oefv. Vet.-Akad. Förh., xiii, p. 166 (1865).

Blatta amoena, Walker, Cat. Blatt. Brit. Mus., p. 229 (1868) (part).

♂. Head and antennae piceous; distance apart of eyes equal to length of 1st antennal joint; antennae slightly incrassated. Pronotum piceous, margined all round with flavo-hyaline. Tegmina and wings exceeding the apex of the abdomen. Tegmina castaneous, the marginal area hyaline, the disc with a darker streak or the base darker than the apex, radial vein bifurcate in posterior third, the lower branch frequently multiramose, 12–15 costals, anterior ulnar vein bifurcate, 7 longitudinal discoidal sectors. Wings suffused with castaneous, mediastinal vein 5-ramose, 7–8 costals which with the mediastinal rami are incrassated, radial vein bifurcate, anterior ulnar vein simple, medio-discal area more than twice as broad as medio-ulnar and crossed by 7 or 8 transverse venules, triangular apical area moderate, divided only by the vena dividens, 1st axillary 4-ramose. Abdomen piceous, margined laterally with testaceous; supra-anal lamina trigonal; scent-gland opening on 7th tergite; sub-genital lamina rather asymmetrically produced, bordered with lappets as in the two preceding species, the left lappet produced. Cerci moderate, piceous. Legs piceous, apices and lateral margins of coxae testaceous, all the spines rufous. Front femora armed according to Type B.

♀. Similar to ♂, but sub-genital lamina semi-orbicular, ample, supra-anal lamina triangular.

Total length (♂) 11 mm., (♀) 12 mm.; length of body (♂) 9 mm., (♀) 10 mm.; length of tegmina (♂) 8·9 mm., (♀) 10·2 mm.; pronotum 2·8 mm. × 3·4 mm.

Hab. Natal (Stockholm Mus., type; British Mus.); Portuguese E. Africa, Beira (S. African Mus.); N.E.

RHODESIA, Loangwa R. (*S. A. Neave*) (Oxford Mus.) CONGO, Katanga and Lualaba R. (*S. A. Neave*) (British Mus.), Umangi (*Wilwerth*) (Brussels Mus., Oxford Mus.).

Hemithyrsocera nigerrima, sp. n.

♀. Closely allied to *H. vinula*, but the antennae not incrassated; tegmina uniform piceous except for a narrow marginal band which is testaceous and extends throughout the entire length of the tegmina; radial vein of wing simple; tarsi testaceous.

Total length 10·5 mm.; length of body 9·2 mm.; length of tegmina 9 mm.; pronotum 2·8 mm. × 3·5 mm.

Hab. KAMERUN, Jaunde-Stat (Berlin Mus., type).

Hemithyrsocera ridleyi, sp. n. (Pl. LXXX, fig. 15.)

♂. Flavo-testaceous. Antennae setaceous, testaceous; eyes widely separated on vertex of head. Pronotum widely trapezoidal, margins hyaline. Tegmina and wings exceeding the apex of the abdomen. Tegmina with 19 costals, radial vein bifurcate from the middle, anterior ulnar bifurcate, 7 discoidal sectors. Wings hyaline, mediastinal vein 4-ramose, 16 costals slightly incrassated, radial bifurcate from the middle, medio-discal area about 2½ times broader than medio-ulnar, ulnar vein simple, discal area crossed by numerous transverse venules, triangular apical area moderate, distinct. Abdomen above banded with fuscous, no scent-gland visible, supra-anal lamina shortly triangular, apex sub-truncate. Sub-genital lamina extremely asymmetrical, on the extreme left a blunt curved process, on the inner side of this another blunt process tufted with stiff brown hairs, the rounded apex of the lamina fimbriate, the left style small situated to the right of the apex, the right style a large sinuose structure. In addition there appear under the supra-anal lamina a pair of bifurcate and denticulate processes which apparently are not connected with the gonapophyses. Cerci 12-jointed, of moderate lengths, apex acuminate. Femora very strongly armed (front femora missing).

Total length 13 mm.; length of body 12 mm.; length of tegmina 12 mm.; pronotum 3 mm. × 4 mm.

Hab. SINGAPORE, Botanic Gardens (*H. N. Ridley*), (Oxford Mus., type).

The complicated nature of the secondary sexual apparatus of this species is highly remarkable.

v. List of the Species of Hemithyrsocera.

Oriental Species.

H. histrio, Burm.
H. palliata, Fab. (= *nigra*, Br.).
H. soror, Br.
H. suspecta, Bol.
H. ferruginea, Br.
H. communis, Br.
H. lateralis, Walk.
H. ignobilis, Shelf.
H. vittata, Br.
H. fuliginosa, Br. (from *Phyllodromia*).
**H. curvinervis*, S. & Z. (from *Phyllodromia*).
**H. irregulariter-vittata*, Br. (from *Phyllodromia*.)
**H. marmorata*, Br. (from *Phyllodromia*).
H. ridleyi, Shelf.

Ethiopian Species.

H. circumcincta, R. & F.
H. neavei, Shelf.
H. vinula, Stål.
H. nigerrima, Shelf.
H. testacea, Shelf.
H. sabauda, Gig. Tos.
H. massuae, S. & Z.
H. brachyptera, Adel (from *Mallotoblatta*).
H. kraussi, Adel (from *Mallotoblatta*).
H. patricia, Gerst (from *Phyllodromia*).

Neotropical Species.

H. fallax, Sauss. (from *Theganopteryx*).
H. pilosella, S. & Z. (from *Theganopteryx*).

Doubtful Species.

H. tessellata, Rehn.
H. australis, Tepp.
H. apicigera, Walk.

* If eventually the genus *Hemithyrsocera* becomes overcrowded, these species can be put into a separate genus, the diagnostic character being the tri-ramose ulnar vein of the wings.

Explanation of Plates LXXIX, LXXX

[*See Explanation facing the* Plates.]

XIII. *An unrecognised European* Lycaena, *identified as* Agriades thersites *(Boisd. MSS.) Cantener.* By T. A. Chapman, M.D.

[Read June 5th, 1912.]

Plates LXXXI—LXXXV.

Nearly two years ago Mr. P. P. Graves (of Constantinople) sent me some specimens of a blue butterfly taken by him in Syria on the Cedar Mountains, asking me to determine it. It was somewhat puzzling and I finally decided to declare it a new species under the name of *Agriades gravesi*, with description and figures in the Ent. Mo. Mag., p. 159 (1912).

In investigating *gravesi*, I came across some Asiatic (Tianshan and Amasia) specimens supposed to be *icarus* ab. *icarinus*, but found that they were not a *Polyommatus*, which *icarus* is, but an *Agriades*.

Whether Tutt's division of certain Plebeiid butterflies between these two genera be accepted or not, it is certain that the most typical species of each group have very decided structural differences from those of the other.

What were these Asiatic *Agriades* passing as forms of a *Polyommatus*? A new species possibly, with which I could do little or nothing, having no great supply of material and that of somewhat vague origin. It was clearly related to *gravesi*, but by no means certainly the same species. It finally, as it ought to have done sooner, occurred to me to examine European *icarinus*, and I found at once that they agreed with these Asiatic examples. There were of course genuine *icarinus*, i. e. *icarinus* that were forms of *icarus*, also. No English specimen of the new species has so far come before me and I believe there are none, all English *icarinus* are varieties of *icarus*.

I think it is probably the case that *icarinus*, the aberration of *icarus*, is as scarce on the Continent as it is in England and that the great majority of specimens that are accepted as that aberration are in reality *thersites.* It so happens that I have obtained *thersites* from various continental localities, but have not received from any continental dealer a genuine European *icarinus*, although I have several Asiatic specimens.

Having obtained possession of Tutt's series of "*icarus*," or most of them, I found I had amongst them a sufficiency of the new species (*thersites*) to enable me to reach some very definite conclusions and to find several structural details differentiating it from *icarus*.

Tutt's habit of taking long series of each species from each locality he visited, and especially devoting time to this, wherever much variation occurred, has resulted in this accumulation of material and it would have gratified him to have found it so useful in this instance.

Tutt, in his account of *icarus* ab. *icarinus*, no doubt refers to our species, when he says (Brit. Butts., iv, p. 159) in some places "as common as the typical form, whilst in others again it is much more common and almost racial"; "in the lower valleys of the Dauphiny Alps—Bourg d'Oisans, Bourg d'Aru, La Grave, Clelles, etc., the form is abundant and almost racial in both sexes." "It is very abundant in some seasons at Gresy-sur-Aix (July 21, 1897, August 21, 1906); at Bourg St. Maurice (August 1–7, 1898, August 1–5, 1905)." "Commonly between Vex and Useigne on August 13, 1903." Other references may be to *thersites* or to genuine *icarus* ab. *icarinus*.

That Tutt did not appreciate the full meaning of these facts, was no doubt largely due to the circumstance that in most cases there is absolute mimicry between *thersites* and the form of *icarus* with which it occurs.

This peculiarity of the species no doubt goes a very long way to account for the refusal of Entomologists to recognise it as distinct. When it occurs with *icarus*, it, in each instance, imitates very closely the particular form of *icarus* that occurs in that locality. This is very marked in some specimens I have from the Tutt collection, of which I may mention a large form from Pré St. Didier, in which both species attain to 38 and 39 mm., a rather less large one from Trelex of 36 to 37 mm. in both species; the whole tone of colouring, intensity of orange marginal spots, and other markings, make each such association identical throughout in both species, except of course as regards one or two distinctive points. There are, however, other localities in which the two species seem to be quite independent.

The definite distinction between *thersites* and *icarus*, which first attracted my attention, was in the male appendages. No doubt the chief reason that the species has for so long been refused recognition is that apart from the genitalia (both sexes) and the androconia, no character can be stated that absolutely and certainly distinguishes *thersites* from *icarus*, though there are some points that are very useful for that purpose.

It would appear that no one has chosen hitherto to examine either the genitalia or the androconia of the species, certainly not comparatively with those of *icarus*.

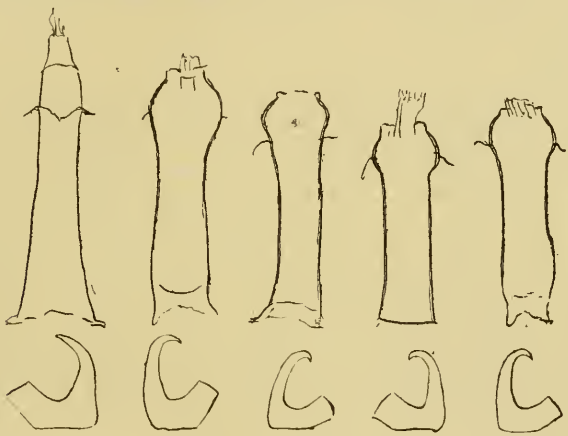
The whole of the Plebeiid blues have a very similar form of appendages in the male, and in some species there is a considerable range of variation in some particulars, so that there is, in such cases, a difficulty in seizing constant points by which to separate allied species. In the present case, however, no such difficulty arises, as the differences between the two species are such as are not only of decided specific value, but actually of generic, or at any rate of subgeneric importance, placing *icarus* in the genus *Polyommatus*, Latr., and *thersites* in *Agriades*, Hb., accepting these genera as adopted by Tutt, who distinguished between them before the differences in the genitalia were noted.

I have made camera sketches of the most important (for differential purposes) structures in *icarus*, *thersites* and in *escheri*.

The form of the Aedeagus is very different in *icarus* (*Polyommatus*) from that in *thersites* and *escheri* (*Agriades*). It will be noted that *thersites* and *escheri* are almost identical except in size, *escheri* being decidedly larger as 6 to 5. The dorsal hooks also differ notably, the portion that is upright in the sketches is broader basally and tapers more regularly in *icarus* and is fairly straight terminally. In *thersites* and *escheri* it is comparatively narrow basally, tapers more slowly, and has a hooked curve at the end, it is and looks longer and more slender than in *icarus*. As in the aedeagus, *thersites* is here distinctly smaller than *escheri*, as it is in the other portions of the appendages.

What is the relation of *thersites* to *escheri*? The genitalia appear to be the same except in a constant difference in size, which holds so far as I have examined them throughout the range of both species independently of the actual size of the specimens, so that it is impossible to accept them as one species, though that *thersites* is a derivative of *escheri* is extremely probable (a form that somehow found its living could best be got by mimicking *icarus* ?).

I now accept *gravesi* as a form of *thersites*. The genitalia appear to prove this, though it has a very different facies from the *icarus* of the district in which it occurs and is not quite identical with any *thersites* I have seen.



1. 2. 3. 4. 5.

Camera outlines of the *Aedeagus* and dorsal hook × 30 of—

1. *Polyommatus icarus.* 2. *Agriades escheri* (*Gavarnie*).
3. *Agriades thersites* (*Pré St. Didier*). 4. *Agriades thersites* (*Trelex*).
5. *Agriades thersites* (*Altai*).

Photographs of the ♂ appendages of *thersites* (var. *gravesi*) and *escheri* will be found in the E.M.M. 1912, pl. VII and VIII.

Gravesi is therefore a local race of *thersites*.

Having got so far the question arose, did the name *icarinus* belong to this new species or to the variety of *icarus*. Scriba's original note and the figure in Esper to which he refers give us really no assistance in deciding the point, and there seems therefore every reason to leave the name *icarinus* to apply to the *variety* of *icarus*, as it has been supposed to do for a hundred years or so.

Thersites, Boisd., appeared to be a *nomen nudum*, and it seemed highly probable that it referred to *icarinus*, accordingly, I wrote and presented this paper to the

Society with *Agriades alexius*, Frr., in the title. I have, however, since (November) met with a reference to the butterfly in Cantener.* On plate XI he figures upper and underside of "Argus Alexis ♂," the text deals with "33. Argus Alexis, (1) Fab. God. Boisd., pl. XI, fig. 1 et 2," followed by twenty-one lines, referring only to *Alexis* (*icarus*), but the note (1) says, "L'individu figuré ici est le véritable Thersites, Boisd. (collection). Cet Argus a été confondu jusqu'a présent avec l'*Alexis*, et n'en diffère que par l'absence de deux points ocellés placés près de la base des ailes supérieures. On le rencontre aussi communément dans le midi de la France que l'*Alexis*."

So far as the description goes it does not rescue the insect from being confused with *icarus*, var. *icarinus*. But when we refer to the figure we find the underside shown is that of our insect (*thersites* or *alexius*) and not of *icarus*, var. *icarinus*, that is, the two last spots at the tornus of the upper wing are in line with the preceding one, and the first orange spot of the lower wing is advanced basally; both these characters no doubt occur in *icarus*, but rarely, and the two combined more rarely still. I don't think I have such a specimen, certainly not in the *icarinus* form, and when we take this with the statement that it occurs freely in the South of France, there is no room for doubt as to what the insect is.

This circumstance illustrates in a remarkable way M. Oberthür's demand that all descriptions should be accompanied by good figures. The figure (otherwise of no particular excellence) shows us two items which Cantener did not see and indeed, by implication, denied the existence of, and enables us to know what species he was dealing with. Very possibly some of the claims set forward for *icarinus* being a good species may have been founded on *thersites*, but in the absence of figures, no conclusion can be reached as to them, except to assume that they are *icarinus*, a name that can only be accepted as the variety of *icarus*.

Boisduval's type specimens (♂ and ♀) of *thersites* are in the collection of M. Oberthür, and he has very kindly

* Histoire Naturelle des Lepidoptères Rhopalocères ou Papillons diurnes des départemens des Haut et Bas-Rhin, de la Moselle, de la Meurthe et des Vosges, Par L. P. Cantener, Avocat, ex-Professeur à l'école de Sorège. Paris, 1834.

sent them to me for examination. These are of the species that has been the subject of the inquiries that I report in this paper. As regards size and setting, the male specimen might very well be the one from which Cantener's figure is drawn, neither of these specimens has any label as to locality. There are also two specimens from the Bellier collection, the male labelled "thersites, Boisduval," and also "Digne," the female "Autriche" and "thersites ♀ secundum Bellier"—the latter apparently in M. Oberthür's writing. This female has the first orange spot less advanced than is at all usual in *thersites*, and apart from dissection may be open to a little doubt. There is a further specimen from the Guenée collection, labelled by Guenée, "6. var. ♂, hybridata, Gn., Gn. Ind.", with locality "Hautes Alpes." The label also carries a note by Guenée, "Cette variété très remarquable surtout par la disposition des pointes, est, en dessus, d'un bleu plus sombre, presque comme sur *acis*. Nul doute, que si j'en eusse trouvé plusieurs et autre sexe, je ne l'eusse considéré comme espèce distincte."

I have no doubt that this specimen is one of *thersites*, but it is remarkable in having on both wings the post-discal row of spots, removed outwards so far, that most of them are in contact with the marginal row, a circumstance that sometimes occurs with one or two spots, most frequently that between veins 4 and 5 of the forewing. The spots are also, accordingly, in a very continuous line, curved, of course, but not angled, and straight in the sense of all being close to the marginal series. This specimen is, no doubt, a very unusual aberration. The upperside has a lilac colour, much as in many *icarus* or *thersites*. The specimen is set as an underside and cannot have faded much, but certainly has not now the dark *semiargus* colour noted by Guenée.

As my knowledge of the species is mostly based on material from the South of France, where also it is probably more plentiful than elsewhere, it is appropriate that its name should be that given by a French Naturalist, but this does not detract from the merits of Herr Schreiner, its German discoverer.

Boisduval does not mention *thersites* in the "Index" (1829), nor in the "Icones"; in the "Index" (1840) he merely notes under "89. Alexis, F., etc.," "var. ? *thersites*, B., Gallia."

Accepting *thersites* therefore as the name of my butterfly, I may in other respects resume my paper as first written.

The only name that I found to require consideration was *alexius* of Freyer. The name is founded on a butterfly taken at, or near, Weimar, and studied for many years, some two-and-twenty apparently, by Herr Ministerial-Registrator Schreiner, and asserted by him to be a good species and to have nothing to do with *icarus, icarinus, thersites,* etc. Some of his grounds for this opinion do not appeal to me, such as the darker ground-colour beneath, the brighter marginal spots, and so on, though on the authority of so close an observer as Herr Schreiner obviously was, these differences no doubt marked the local race of *alexius,* in comparison with the local form of *icarus,* and were not without value. The circumstances that led me, however, to believe that Herr Schreiner's species was not *icarinus,* but one we are considering, is first, the fact that it occurred in some numbers, not as a sporadic variety of anything else; then, the fact that Herr Schreiner often found *alexius* paired with *alexius,* but never with *icarus.* That our species occurs at Weimar is most probable, as I have a specimen labelled "Saxe," which is practically the same district.

Herr Schreiner notes one fact that does not accord with the, certainly somewhat meagre, information I have as to other areas, he says that *alexius* does not appear in either the first or second brood, till the corresponding brood of *alexis* has been long on the wing.

We must also attach some little weight to the opinion of Herr Schreiner who was unquestionably a good student, who considered the species to be distinct, after noting it for fifteen years, and after seven years' further observations in view of Freyer's scepticism and doubts, felt sure his opinion was correct.

I cannot resist the conclusion that this butterfly of Schreiner's is the same species as the one I find to be unrecognised, and confounded with *P. icarus* ab. *icarinus.* Herr Schreiner's grounds for believing it to be distinct do not seem to have convinced entomologists since, because of course the facts he brings forward were by no means conclusive ones to any one who had not a belief in Herr Schreiner's intuition in such matters.

Freyer's figure is not unquestionably distinctive of the species in one point, I shall allude to later, the position of the apical orange spot of the hindwing, though it is rather *thersites* than *icarus*, the butterfly represented might be *icarus*, though there is a certain roundness of wing, which is more marked in the smaller forms of *alexius* (mihi) than in any *icarus*.

Though I was ignorant of Herr Schreiner's name, until this investigation led me to look up Freyer's account of *alexius*, I must express a certain satisfaction, in, so far as I do do so, showing that the work of this keen Entomologist is sound, although it has been treated with contempt for more than half a century.

It is remarkable that Boisduval named our insect *thersites*, but seemed to be sufficiently doubtful about it to refrain from publishing it. This fell to Cantener, who appears to have had no doubt about it. And later, Freyer, though he got so far as publishing for it the name *alexius*, seemed very much in doubt about it, Schreiner being the real author.

Thersites is a rather ungrateful name, and one is tempted to imagine that Boisduval gave it grudgingly and ineffectively, to be rid of the badgering of some one, possibly Cantener himself, who wished the species to be recognised.

I had hoped this summer to have obtained eggs of *thersites* and observed the larval stages. I was, however, rather too early on the ground and so failed, but I made one observation of value, though the species was rather scarce where I found it, *icarus* being fairly common, and I only saw three females of *thersites* altogether, but I found a pair of *thersites in cop.* confirming Herr Schreiner's observation.

As regards spotting otherwise than as to the want of the basal marks, it may be noted that the spots are always quite as strongly marked as in *icarus*, whereas in ab. *icarinus* there is nearly always a tendency for the other spots as well as the basal ones to be weak or wanting. It may also be noted that the two (often conjoined) small spots at the anal angle of the forewing are in *thersites* quite in line with the one above them, whilst in *icarus* they are not, the lower being nearer the hind margin. This is subject to exception in individual cases, due to the variation in position of all the spots to which this section of "blues" is so prone.

As illustrating that these distinctions are only general and have many exceptions I may note specimens of *icaru* ab. *icarinus* from the North Downs taken by Mr. Grosvenor that look like *thersites* rather than *icarus* and are strongly marked and coloured, and that as regards the post-discal row of spots, Freyer's figures of *icarus*, pl. 616, have this row of spots more in the disposition usual in *thersites* than is shown in his figure of *alexius*, pl. 676.

The point as to which Freyer's figures are indecisive has reference to the apical spots of the hindwing. This is not referred to in the text, and its precise representation may easily have been left to the artist.

One important result of having obtained such an accession of material as the Tutt series, is that I am able to point out those differences in markings between *thersites* and *icarus* (with its var. *icarinus*) that are fairly, if not quite constant, and will perhaps enable the entomologist, who likes something he can easily see, to appreciate the specific distinctions of the two insects.

One very obvious difference in the markings of *icarus* and of *thersites* that is sufficiently constant to enable the great majority of *thersites* to be distinguished from *icarus*, apart from the basal spots, is the relation of the apical orange spot of the hindwing beneath to the two first spots of the post-discal row.

In *thersites*, the black line bounding this spot basally, is level with the second post-discal spot, and it results that its distance from the first post-discal spot is about equal to that between the first and second spots. It may even be rather nearer the first spot than the second is. It is rarely further away and never markedly so.

In *icarus*, the black line of the apical orange spot is further from the base than the second discal spot, and so is obviously further from the first discal spot than the second one is. The position of the orange spot varies more in *icarus* than in *thersites*; and so specimens are not rare in which it occupies much the average position that it does in *thersites*, and may be even nearer the base. Nevertheless few errors would be made in separating the two species by this character without reference to the basal spots of the forewing (pl. LXXXI).

In none of our other common blues does this orange spot take up the position it has in *thersites*. In *thetis*, *corydon*, *eros*, *hylas*, *escheri*, etc., it is as far or further from the base than in *icarus*.

The other difference in markings already alluded to is in the double spot of the post-discal row at the tornus of the forewing. In *thersites* these two spots are in line with the one above them; in *icarus* the lower one is moved outward and often has the form of an oblique line. In this, as in the disposition of the orange spots, *thersites* is much more constant than *icarus*. *Thersites* does not vary to the *icarus* disposition, though *icarus* may be found with the arrangement that obtains in *thersites*.

These distinctions in markings may well be useful in the field, but of course have no such weight in deciding the specific question as the structural differences.

There is another definite distinction between *thersites* and *icarus*, viz. in the androconia. One may imagine this to be connected with a difference of scent, a desirable quality in view of the resemblance of the species otherwise.

These androconia present a considerable difference. One might select one androconial scale of each species such that it would be difficult to say which was which. But with as few as half a dozen of each the discrimination would be easy.

The typical number of rows of dots is five in *icarus* and four in *thersites*. *Icarus* may have four or six, *thersites* may have three or five. *Icarus* usually has a row down the middle of the scale in line with the shaft, in *thersites* the two central rows are usually one on either side of this line.

The distinction between the ribs of the androconial scales might be described as *thersites* having four ribs, and when it has five one is a trace of a rib along the margin. *Icarus* almost always has some trace of a marginal rib, and when it has only four strong ribs it has always a marginal one on each side making six. This is a very common form in *icarus*, whilst it is rare for *thersites* to have quite marginal ribs. In size and form the two scales are much alike, but that of *thersites* is shorter. The amount and constancy of these differences will be better appreciated by a reference to pl. LXXXIII. The ordinary scales also differ in the two species. The two photographs, pl. LXXXII, show the scales and androconia *in situ*, in corresponding portions of the wings of both species. The actual position is immediately in front of the basal portion of vein 6 of the forewing.

The scales in *icarus* are broader, flatter across their ends; in *thersites* their hind margin is full and rounded, or even produced into a blunt point. The rule in both species seems to be for each scale to be accompanied by two androconial scales, but in *icarus* it is not uncommon for there to be three, a circumstance that is comparatively rare in *thersites*, no doubt in accordance with the narrower scales.

The female genitalia present equally marked differences with the male. There is in the female of these Lycaenids a remarkable tube that in preparing the specimen can be protruded from the orifice between the eighth and ninth segment of the abdomen. I am not now concerned with the anatomy and function of this organ, but here only note that it usually terminates in a chitinous plate or button, that differs more or less in each species.

In *A. thersites* this terminal portion of chitin has a very special form; in *P. icarus* it is wholly wanting, or represented by a very minute chitinous plate, the only species (of the few I have examined) in which it is absent. There are other minor differences, but this one is very obvious and very decisive as to the two species being well separated.

Pl. LXXXIV, fig. 1, represents these parts in *thersites*, fig. 2 those in *icarus*.

A. thersites, notwithstanding its close resemblance to *P. icarus*, is really much more closely allied to *A. escheri*. I don't think any one is likely to confound these two species, although, before I knew much about it, I queried whether *Thersites* var. *gravesi* was not an Eastern form of *escheri*, and though a leading authority on the Lycaenids agrees, so far as the genitalia are concerned, *thersites* is *escheri*.

In this latter respect there is the constant difference of size. It seems desirable nevertheless to figure the ♀ genitalia of *A. escheri*, which shows a small but definite and constant difference, especially in size, from those of *thersites*, and especially photographs of the androconia which differ from those of *thersites* more than do those of *icarus* (pl. LXXXV).

Of the few other species I have examined, *damon* approaches most nearly to *escheri* and *thersites* in the structure of this portion of the female appendages. Apart, therefore, from its behaviour in the field as observed by Herr Ministerial-Registrator Schreiner, by Mr. Tutt and by myself, and from such evidence from the early stages as has yet to be gathered, we may summarise the following points, of which the first four are very definite structural ones, of distinction between *thersites* and *icarus.*

1. Male appendages belong in *thersites* to genus *Agriades.* Male appendages belong in *icarus* to genus *Polyommatus.*
2. Very marked differences in the female appendages.
3. Forms of ordinary scales upper side of wings differ.
4. Androconia have different forms and ribbing.
5. Basal spots forewing always absent in *thersites,* rarely (ab. *icarinus*) in *icarus.*
6. Advanced position of apical spot hindwing in *thersites* constant, rare in *icarus.*
7. Different alignment of tornal spots forewing.

The series of *icarus* from the Tutt collection, which had been inaccessible for a couple of years, throws a good deal of light on the distribution of *thersites,* and enables one to recognise as referring to *thersites* a number of the localities noted under *icarus* ab. *icarinus* in Tutt's "British Butterflies," vol. iv, p. 158 et seq.

This circumstance illustrates the great value of Tutt's practice of taking and preserving long series from as many localities as possible, a practice which he always endeavoured to impress on others as one that ought to be adopted.

The Tutt series contains specimens of *thersites* from all the localities I have referred to above. In addition, there are specimens of the spring brood from Digne in April. These specimens are remarkably small and pale in coloration, very like some small weakly coloured *icarus.* A specimen from Draguignan in May is much smaller than var. *centro,* but of average coloration. These appear to be the only examples of the first brood. The other examples are almost all taken in August: Via Mala, Ollon, Santa Maria (Münster Thal), Barcelonnette, Stalden, Pfynwald, La Batiaz, Allos (the last four localities ♀♀ only), Albarracin, Tragacete (of my capturing), Fontainebleau (one specimen only), Digne (a full-sized and normally coloured example), Lans-le-Bourg, Susa. Trelex (near Lausanne) provided some large specimens similar to var. *centro.*

Specimens I have from other sources include Siena, identical in general appearance and size with an *icarus* from same locality, both taken by the Rev. Geo. Wheeler; Autun, Saxe Csolnok, "Wien," "Wallis," Tianshan, Ongadai, Amasia, Piceno Central Italy.

The series of *P. icarus* at the British Museum is very meagre; there are amongst them only some half-dozen var. *icarinus*, and of these I am not sure that even one is *thersites.*

In the Hope Department of the Oxford University Museum are a number of specimens of *A. thersites.*

1 ♂ taken by Prof. Poulton at Montserrat (Barcelona), about 4000 feet, on July 15, 1901.

10 specimens, 9 ♂ 1 ♀, taken July 21–25, 1898, by Miss Cora B. Sanders and by Prof. Poulton, between Visp and Stalden, Upper Echelberg, opposite Visp on the south slopes of the Rhone Valley, and on the Simplon Road near Brieg, 2155 to 2650 ft., the latter (greater) elevation being on the warmer north slopes. The specimens in this series average 32 to 34 mm., one being 36 mm., as large as var. *centro.*

A series of 9 ♂♂ 1 ♀ from N.W. Persia, Seir, 8 miles west of Urumiah, captured August 16 (one August 19), 1898, by R. T. Gunther. These specimens are very similar to var. *orientalis* but are rather more brightly coloured, without being so bright and rich as var. *gravesi*; they expand 24 mm. to 30 mm.

The distribution of the species is only to be vaguely outlined by the material I possess. It seems to be comparatively a southern species—southern, that is, in the same sense that *damon, admetus,* and *escheri* are southern, as distinguished from *icarus, argus,* etc., that extend further north. The most northern localities I have are Weimar (Schreiner) and Saxony. From France I have specimens only from the south-east, Savoy, Dauphiny and Provence, except one specimen from Fontainebleau. From Italy, Piedmont, Piceno and Siena. Spain affords specimens from Tragacete, Albarracin and Barcelona. Syria, Persia, Central Asia probably imply a wide Asiatic distribution.

In the Rhone Valley it occurs at Trelex (near Nyon on Lac Leman), at Ollon. From here, past Martigny and through the most fully examined portion of the valley, there is no evidence of its existence till we find it in Prof. Poulton's series at Visp, unless perhaps specimens taken by Mr. Tutt and myself, not in the Rhone Valley but a short way up the Val d'Herens* be, as perhaps they should be, credited to the Rhone Valley. Prof. Poulton's series presents it at Visp on July 21 and 22; Visp to Stalden, July 22; Brieg, Simplon Road, July 24; on the north slopes opposite Visp, July 25—all 1898. The dates probably mark an itinerary rather than dates of appearance.

By way of bibliography and synonymy there are, no doubt, many references to this species under the name of *icarinus*; but it is hopeless to try to unravel these, except that quite recent one by Tutt with which I have already dealt.

THERSITES (Boisd. MSS.), Cantener, Papillons diurnes (1834), p. 35, pl. XI, figs. 1 and 2.

Alexius, Frr. Neu. Beit., vii, p. 133, pl. 676, figs. 1 and 2 (1858).

Alexis, var. Herrich-Schaeffer, Schm. Eur., fig. 246 (1843).

Icarus ab. *icarinus*, *pars*, Auct. & Tutt, Brit. Butt., iv, p. 158.

Var. *gravesi*, Chpm., E. M. M., xlviii, p. 159 and pl. VII, VIII, IX.

Var. *centro*, Chpm., a large form (36–38 mm.) occurring in the Tarentaise and surrounding districts.

Var. *orientalis*, Chpm., an Asiatic form of about size of type and of paler coloration.

The Persian specimens in the Hope collection are much closer to var. *gravesi*.

ab. *hybridata*, Gn. (MSS.).

I have not satisfied myself that other references really belong to our butterfly, e. g. Meigen's *thersites*, pl. XXVIII, fig. 2. *a* and *c* may be *icarus*, the underside, 2*b*, which is more definite, is almost certainly that of *medon*. Gerhard is equally indefinite.

EXPLANATION OF PLATE LXXXI.

Underside of 1. *thersites*, 2. *icarus*, to show the approximation of apical spot of hindwing (marked 1) to first post-discal spot

* Between Vex and Euseigne (3150 ft.), counting elevation as latitude, this is perhaps the most northern habitat of the species.

(marked 2) in *thersites*, making it nearer to 2 than the second post-discal spot (marked 3) is. The reverse being the case in *icarus*. Magnified. It shows also the different alignment of the tornal members of the post-discal series of spots. Photo by A. E. Tonge.

Explanation of Plate LXXXII.

Showing scales and androconia of 1. *thersites*, 2. *icarus*, from identical spots (costal to base of vein 6, forewing) in each species × 300. Photo by F. N. Clark.

Explanation of Plate LXXXIII.

Androconia of 1. *thersites*, and 2. *icarus*, showing differences of size, shape and ribbing × 500.

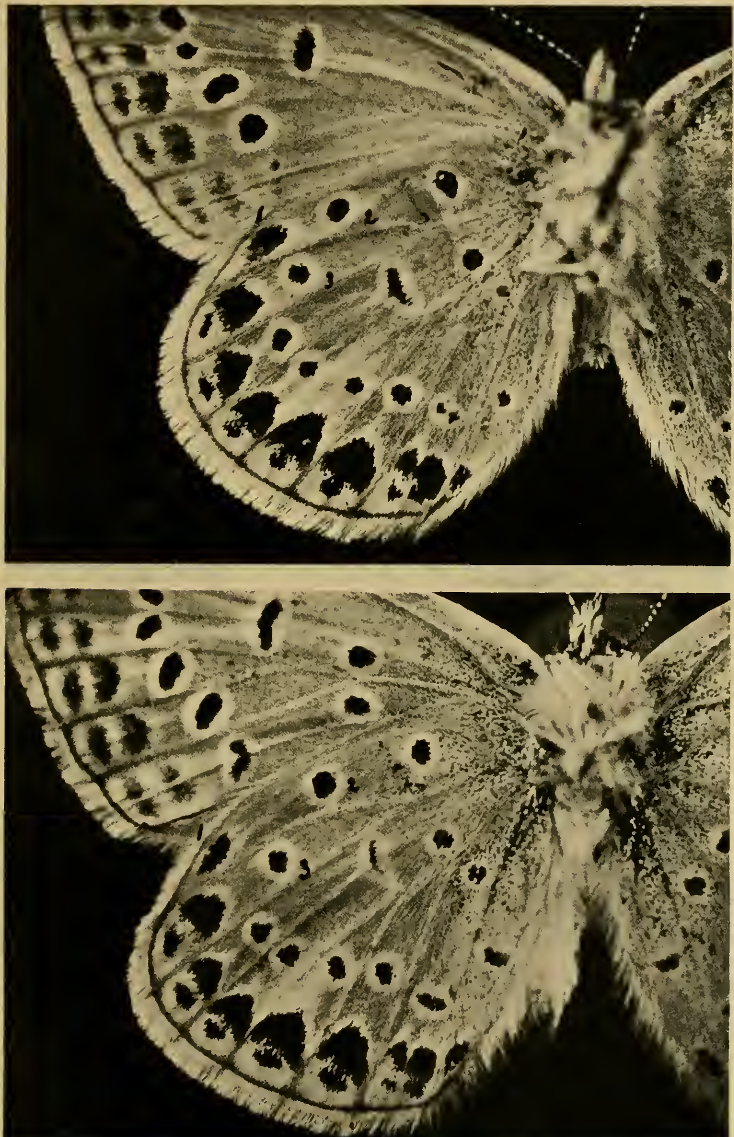
Explanation of Plate LXXXIV.

Showing terminal segments of abdomen of 1. *thersites* ♀ and 2. *icarus* ♀ × 25 and the differences in the curious eversible structure with a chitinous termination in *thersites*, which is hardly represented in *icarus*.

The everted ventral organ is not fully stretched in either specimen. In 1. the view is exactly lateral for the basal half, so that the two chitinous areas are superposed; in 2. the view is ventral, showing both areas. In neither is it fully extended. The terminal half being still slightly sheathed in the first and the end of the chitinous loop is still doubled back. This does not prevent it being obvious that the whole basal process is larger, wider and more chitinised in *icarus* than in *thersites*, and that in the terminal half *thersites* is much narrower and more slender than is *icarus*. Nevertheless there is a chitinous termination to this portion in *thersites*, of very definite form and outline, while in *icarus* there is merely a chitinous point. This final chitinous armature seems to be of definite peculiar form in each species. *A. damon* is the only species examined in which this armature resembles that of *A. thersites*.

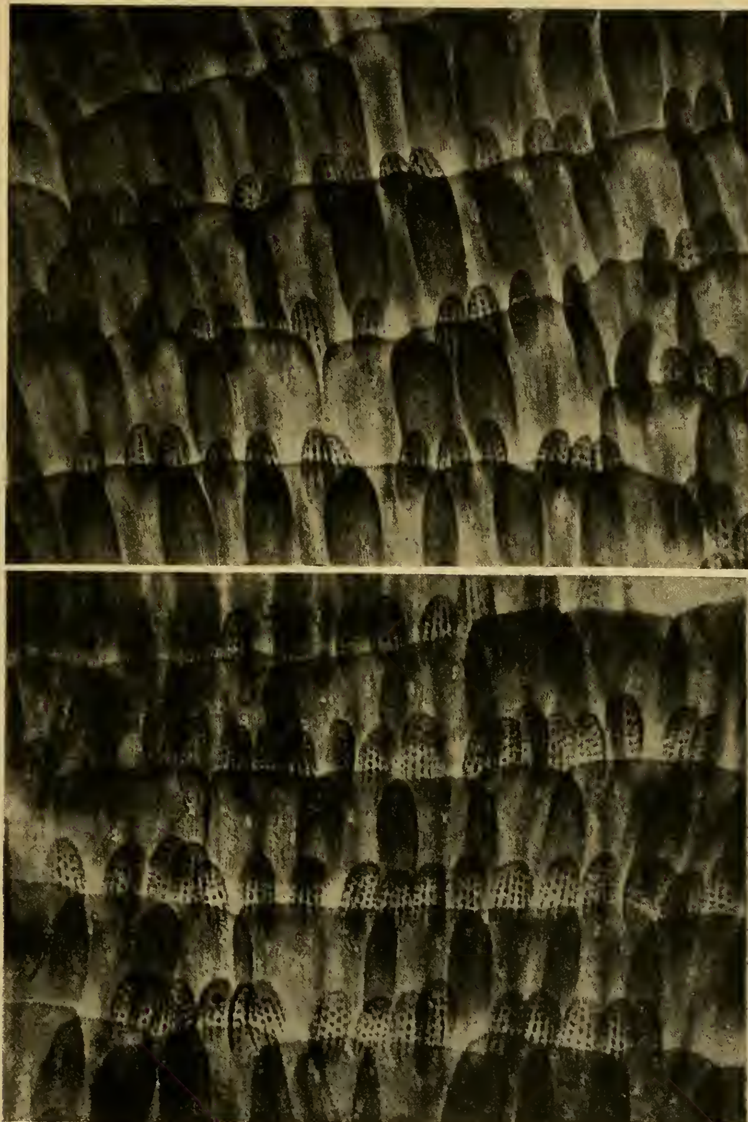
Explanation of Plate LXXXV.

Agriades escheri. Androconia × 500 and ♀ appendages × 25, the latter showing great similarity to those of *thersites* but markedly larger. The androconia are larger than in either *thersites* or *icarus* and have 6 or 7 ribs instead of 4 and 5.



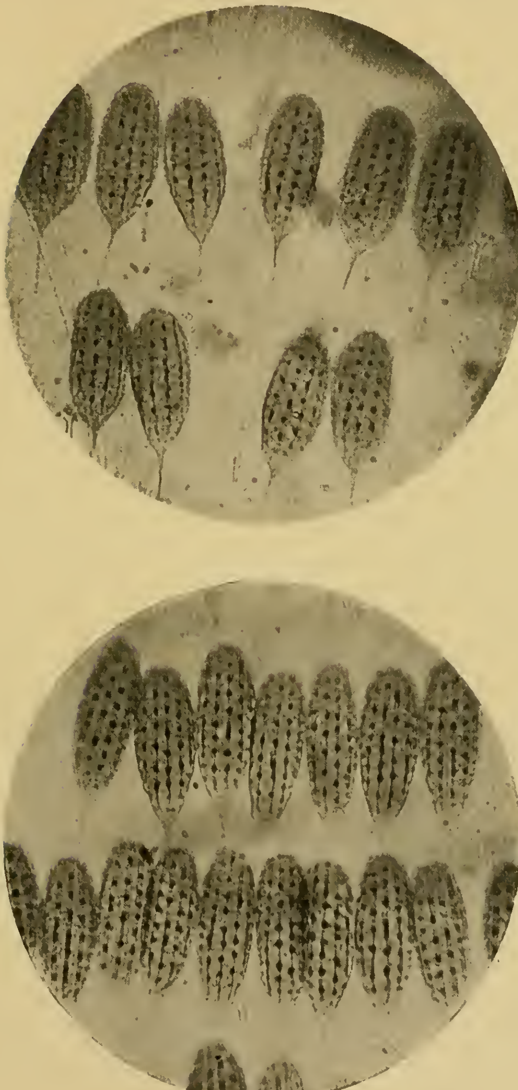
Photo, A. E. Tonge. *C. Hentschel.*

Undersides of (upper) *thersites* and (lower) *icarus*, showing different alignments of spots marked 1, 2, 3.



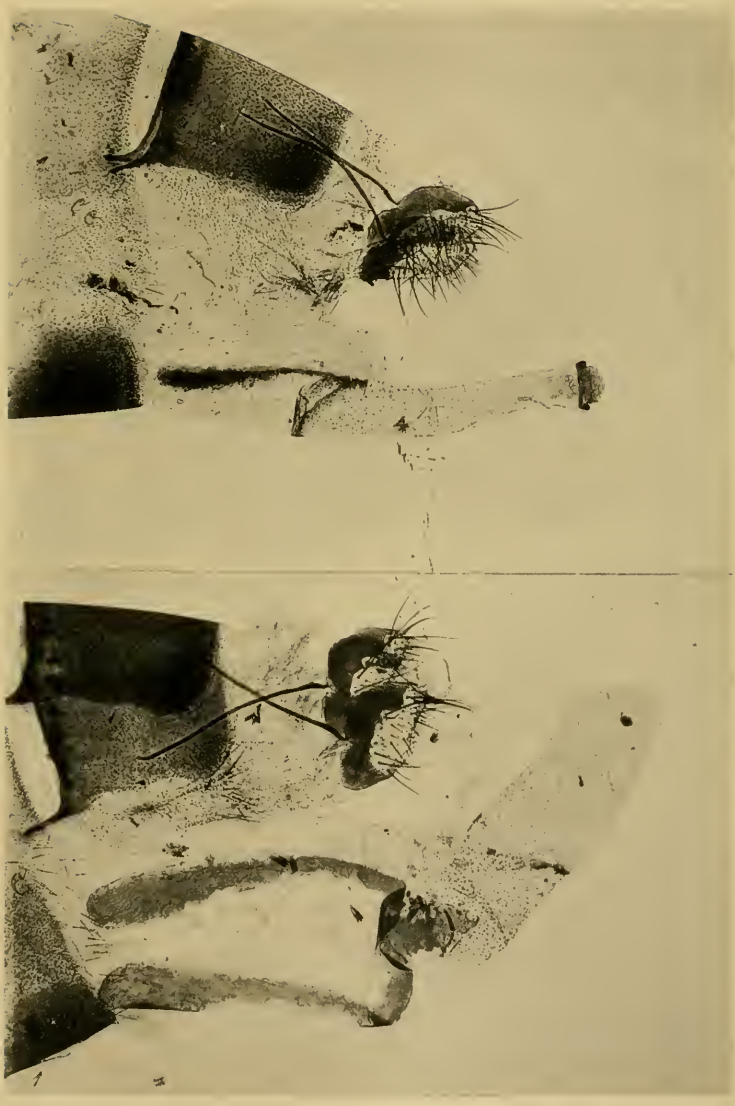
Photo, F. N. Clark. *C. Hentschel.*

Scaling of forewing of (upper) *thersites* and (lower) *icarus*, × 300.



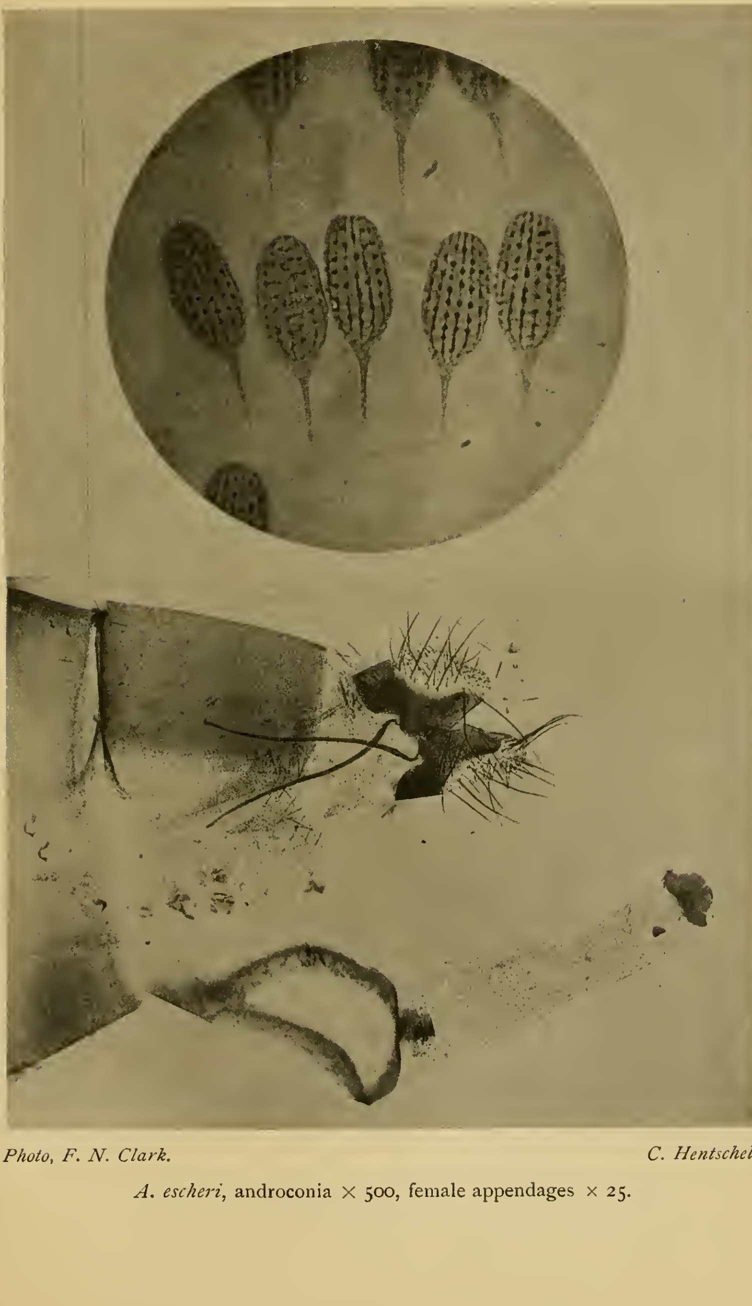
Photo, F. N. Clark. *C. Hentschel.*

Androconia (× 500) of (upper) *thersites* and (lower) *icarus*.



Photo, F. N. Clark. *C. Hentschel.*

Female appendages of (upper) *thersites* and (lower) *icarus*, × 25.



Photo, F. N. Clark. *C. Hentschel.*

A. escheri, androconia × 500, female appendages × 25.

XIV. *The Colour-groups of the* Hawaiian Wasps, *etc.* By R. C. L. Perkins, D.Sc., M.A., Jesus College, Oxford.

[Read October 16th, 1912.]

[In the autumn of 1911 I had the opportunity of discussing the subject of this memoir with Dr. Perkins during a too brief visit paid by him to Oxford. The discussion, thus begun, was continued with some energy on both sides, in a correspondence which only ended when Dr. Perkins sailed for Honolulu in November 1911. In the course of our correspondence he sent me a manuscript note-book, written about 1907–8, as part of his Introduction to the ' Fauna Hawaiiensis," now in the press. The facts and inferences concerning the present condition and past history of these Colour-groups seemed to me of such fundamental importance in the study of mimicry and indeed of evolution, that it appeared most desirable to publish the supplementary information and the further conclusions scattered through the letters. Dr. Perkins consented, and the following paper is the result. In order to understand the nature of the discussion, it has been necessary to quote passages and sometimes consecutive paragraphs from the note-book which will soon be published as the Introduction. For this free use of the manuscript I received the kind consent of Dr. David Sharp, F.R.S., Editor of the "Fauna Hawaiiensis." It must be clearly understood that the quotations are from the manuscript and not from the printed pages of the Introduction itself, and that some slight difference between the two accounts is to be looked for, owing to Dr. Perkins' final revision for the press. I have limited these quotations to the minimum quantity necessary to preserve continuity and to explain the letters, bearing in mind the inconvenience of printing the same passages twice over in two publications. No quotations from the note-book appear later than page 690, and in all the earlier part of the paper, where they occupy a large proportion of the pages, they are clearly discriminated from passages extracted from the letters, the latter being between inverted commas and dated. I have not necessarily kept the extracts from the note-book in their original order and have ventured to condense certain parts. Beyond the point where extracts from the note-book cease, the quotations from the correspondence are no longer placed between quotation marks and are dated at the head instead of at the foot as in the earlier parts of the paper. In the concluding pages the passages are grouped under three separate heads. The few slight additions of my own are placed between the square brackets. Species quoted without an author's name were described by Dr. Perkins himself.—E. B. POULTON.]

EUMENIDAE.

[This family is considered first because of the number of the Hawaiian species and the dominant position taken by them in the Colour-groups of these islands.]

The whole of the species, to the number of 102, belong to the almost ubiquitous genus *Odynerus, sensu latiori.* From this interesting complex I have split off three small groups of species and considered them as distinct genera, as indeed they are, although they appear to be derivations of the same stock as the Hawaiian *Odynerus* proper. The Hawaiian Eumenids are, I now think, clearly descendants of two quite distinct forms of original immigrants, one of which, a yellow-banded form, gave rise to the bulk of the species, as well as to the endemic genera that I have separated from these, while the other has produced but four distinct species, as at present discovered, viz. *O. nigripennis,* Holmgr., and its three allies. This little group has now been traced to an Asiatic ancestor which is, I suspect, an ancient or primitive type, showing some affinity to the genus *Rhynchium,* in which *nigripennis* itself was originally placed by Holmgren.

"I have not yet identified the Oriental species (just lately discovered while mounting some insects) that is allied to the *O. nigripennis* group. It is the closest approach I know to the genus *Rhynchium,* but it is not that genus." *Nov. 13th, 1911.*

Species of *Odynerus* are almost ubiquitous throughout the islands, though some of the densest and wettest boggy forests are absolutely devoid of them. At the same time a slight change in these, made by the incursion of cattle, is sufficient to allow of some species becoming established where previously they could not exist.

"Practically speaking, the cattle open up the dense forest, letting in sunlight and making it much drier. It is remarkable that no species of *Odynerus* should have been able to enter our densest and wettest virgin forests, because it would have found there such a vast store of (Lepidopterous) food, without other species to compete with it. Some of the bees have occupied such forests, in spite of the sun-loving habits of the group." *Nov. 13th, 1911.*

The prey of Hawaiian Eumenidae, so far as is known, consists entirely of caterpillars. On the whole it may be said that Pyralid and Microlepidopterous caterpillars are the favourite prey and that Geometridae are rarely utilised. It is most remarkable, seeing that the latter are occasionally taken (e. g. by *O. montanus*, Sm., *eucharis*, etc.), that this should occur so rarely, for the Geometrid caterpillars are so very numerous that they could be often obtained in any quantity.

In many localities at favourable seasons the number of individuals that are seen is extraordinary. On one occasion I visited a mountain gulch on Molokai nearly every day for three weeks, and I estimated that in a length of a couple of miles (below the line of forest) the population of adult wasps was at least one million. Five or six species were represented, but two or three were much more numerous than the others. I have noticed an almost similar abundance in other localities. It is probable that very few of the large number of species are really rare.

With experience and close attention in the field, it is fairly easy to discriminate between species that are exactly alike superficially, owing to indescribable differences in appearance, due to mode of flight and posture.

Only in exceptional cases do the Hawaiian Eumenidae exhibit important variation, and in very few cases is this more than of a trifling character, affecting the colour. A common variation, which occurs again and again and in the most diverse species, is the occasional assumption of a feeble yellow band or traces of such a band on the first and second abdominal segments in species which typically have an entirely black body. Examples of this are *Nesodynerus rudolphi*, Dalla Torre, *Odynerus venator*, and *O. heterochromus*, to instance only species very widely separated in structure. Sometimes the yellow band appears only on the *ventral* surface. The phenomena are precisely identical with those observed in the *Crabronidae* (see p. 688), and, I think, are explicable in the same way. The blackness of so many Hawaiian Eumenids has been produced in the islands and the abnormal individuals are reversions to a former general condition in colouring. The Eumenids, furthermore, like the Crabronids, have retained in some species the original yellow-banded coloration.

The general tendency to blackness of the Hawaiian Aculeata, as a whole, is one of their most remarkable features. The blackness of these insects is increased by the dark colour of their wings, which, in a large number of the species, exhibits striking blue or purple reflections.

" My original paper * on colour of Hawaiian wasps was written too early to have much value. I treated only the Kauai species as conspicuous on account of the pale bands. This was an error; all the things I send as examples are conspicuous in life: they are *the* conspicuous feature among the day-flying insects in the islands and about the only one, except at special times and places." *Nov. 8th, 1911.*

The following Colour-groups—entirely different from the groups based on structure and real affinity—are distinguished in the Introduction.

On Kauai are two Colour-groups, one of which contains only two known species.

Group I. Insects with much red marking, wings shining fuscous, when spread.

O. blackburni, Kirb., and *soror*: allied species.

Group II. Black insects with two conspicuous whitish or yellow bands † on abdomen; wings dark and with conspicuous blue or purple reflections. Fourteen species of diverse structure.

"Kauai is the most northern of the forest-bearing islands, and it has by far the widest channel between it and its next neighour—Oahu. The specific characters of its species are usually the most striking of those exhibited on any island, but it lacks representatives of many 'groups'

* Proc. Phil. Soc. Cambridge, vol. ix, Pt. VII (1897), p. 378. The examples alluded to were exhibited to the Entomological Society, May 1st, 1912 (Proceedings, pp. lvi–lxv).

† "When the insects are on the wing, these bands are clearly seen."—R. C. L. Perkins, in Proc. Phil. Soc. Cambridge, vol. ix, Pt. VII (1897), p. 378.

of species in big genera. We have found no representative so far of *Chelodynerus*, none of the '*nautarum*,' de Sauss., group of *Odynerus* (probably one of the most ancestral), and it has no peculiar structural group, so that probably the groups of *Odynerus* in the islands were already formed before the genus chanced to reach Kauai, and some have not yet reached it. This is likely to be the case from a consideration of the beetles; for the Carabid *Cyclothorax* (s. l.), now split into several genera, is unknown on Kauai, very poor on Oahu, the next island, very rich on the intermediate islands, and rather rich on Hawaii at the other extremity. This fact alone, without appealing to the geological reasons, is sufficient to disprove Lord Walsingham's conclusion that the islands were once a larger *continuous land-area.* (See also p. 697.)" *Nov. 15th, 1911.*

In Oahu are four Colour-groups, two of which (II and III) may be said to be peculiar to this island.

Group I. Black insects with dark wings, showing conspicuous blue or purple reflections.

O. nigripennis, Holmgr., *epipseustes*, *erro*, *iopteryx*, *montanus*, Sm., *konanus*, *unicus*; *Nesodynerus optabilis* and *rudolphi*, Dalla Torre.

Group II. Generally small species, black with shining fuscous wings: no blue reflections. In this group some species show feeble and variable pale abdominal bands, and others some red markings apparently tending to disappearance, and not conspicuous.

O. dubiosus, Sm., *threnodes*, *pterophaennes*, *waianaeanus*, *paludicola*, *paranaias*; *Nesodynerus oblitus* and *acyanus*.

"The differences between species of the same genus which enter different Colour-groups are well seen in *Nesodynerus*. Thus *N. rudolphi* (I) is very common and ubiquitous, frequenting both forest and open country, while *N. oblitus* (II) is also abundant, but only occurs in localities—never forests—in which the very common species of *Odynerus*, viz. *dubiosus*, etc. (II), are found." *Nov. 15th, 1911.*

Group III. Insects usually much marked with red, and the body with appressed fuscous tomentum. Wings to a large extent hyaline and with no blue reflections.

O. pseudochromus, *pseudochromoides*, *leiodemas*, *homoeophanes*, *eucharis*, *oahuensis*, Dalla Torre.

On one occasion all the six members of this group were taken in the same spot and on the same day.

"The species fall into three very distinct structural groups:—(1) *O. oahuensis*: isolated structurally and in habits: common in all suitable localities, but less so than *O. pseudochromus*: affinity with other Hawaiian *Odynerus* is not clear, but requires far more study; (2) *O. pseudochromus, pseudochromoides, leiodemas*: allied species, the first two ubiquitous and common in their proper localities: the third is probably generally to be found with them, but is much less numerous; (3) *O. eucharis, homoeophanes*: allied species, of which one is found with species of the structural group (2) in some localities, the other with them in other localities. They are probably always relatively rare." *Nov. 15th, 1911.*

Group IV. Insects with usually two pale abdominal bands, the wings more or less infuscate and with blue reflections, body generally with pale tomentum.

O. xerophilus, nautarum, de Sauss., *acoelogaster*; *Pseudopterocheilus relictus*.*

* [I was particularly anxious to see the members of Colour-groups which had been captured at the same time and place, in order to be able to estimate the relative numbers and obtain conclusive evidence as to the predominant species. Dr. Perkins very kindly collected for me on three occasions the specimens which are tabulated in the following extract from his letter, written May 20th, 1912, from Honolulu. The captures of each date are kept together in the Hope Department, where they may be studied at any time. They were exhibited, in illustration of Dr. Perkins' paper, at the Second Entomological Congress at Oxford during the past summer.]

I have been out in the country on three occasions lately to catch *Odynerus*, and had Kershaw to help me. It is a bad season on the lowlands, as we have had no winter rains and the country most favourable for Hymenoptera is parched up. It is interesting to see what is dominant under these conditions.

On the first day (April 26th, 1912, Makiki, Oahu, below 400 ft.) caught only one species, *O. nigripennis* (38 specimens), but I saw one individual either of *Nesodynerus rudolphi* or *Od. montanus*.

On the second day (May 3rd, lowlands near coast, east of Honolulu) we caught of the same all-black, blue-winged Group I:—

O. nigripennis (21) *O. montanus* (1) *O. iopteryx* (2) *Nesodynerus rudolphi* (6)	} 3 structural groups in these 4 species!

Of the white-banded Group IV:—

O. acoelogaster (10).
O. nautarum (1).
Ps. relictus (1).

On Maui, Molokai and Lanai, the fauna of each of which is largely the same, we have three groups :—

Group I. Identical with I on Oahu.

O. nigripennis, Holmgr., *purpurifer, instabilis, ecostatus, laevisulcatus, camelinus, brevicostatus, aprepes, lanaiensis, konanus; Nesodynerus eupteryx, paractias; Pseudopterocheilus congruus*, Sm.; *Chelodynerus chelifer.*

Group II. Identical with IV on Oahu.

O. molokaiensis, sociabilis, smithii, Dalla Torre, *insulicola*, Blackb., *nubicola, nivicola.*

Of the small shining-fuscous winged Group II :—

O. dubiosus (7).
O. threnodes (3).
Nesoprosopis assimulans (2).

Had it been a good season, of I there would have been many more *montanus*, otherwise proportion as above.

Of IV we should have found *O. xerophilus* numerous locally and *Pseudopterocheilus relictus* abundant, otherwise proportion as we found above.

Of II we should have also found *Nesodynerus oblitus*, local, not general like the two above-named species of this group.

The third day (May 10th, Palolo) we collected at 1200–1500 ft. in forest.

Of the curious clear-winged Oahu Group III, with dull red marks we got only :—

O. pseudochromus (16).
O. oahuensis (3).

On a good day we might have found the closely allied *O. pseudochromoides* nearly as common as *pseudochromus*, with *one or two individuals* each of the three rare species, *O. eucharis, leiodemas*, and one other closely allied to *eucharis*, viz. *homoeophanes*. All these occur in the very spot where we collected.

Of Group I we got *O. rudolphi* (10), *O. nigripennis* (4), and *O. montanus* (1): also *Hylocrabro tumidoventris* (5), *Xenocrabro unicolor*, Sm. (1).

Group I was also represented by the Ichneumonid, *Echthromorpha fuscator* (*maculipennis*, Holmgr.) (5).

The little endemic flycatcher, *Chasiempis*, was fairly common, young and old, and as tame as usual, but was clearly not paying any attention to Hymenoptera. The chief interest to me of the whole collection is the evidence as to what species are most abundant under circumstances unfavourable for Hymenoptera. From long experience I know exactly what one would, or might expect to get under favourable circumstances.

Group III. Insects with red thoracic or abdominal markings, or both, the wings dark and with blue reflections.

O. frater, Dalla Torre, *monas, cephalostictus, naiadum, tempe, dryas, potamophilus, microdemas, monobius, erythrostactes, montivagus, sandwichensis*, de Sauss., *petrobius, deinogaster, homocogaster.*

On Hawaii there is a general tendency of the above three groups to become fused into one large group, all representing I on Oahu, and on Maui, Molokai and Lanai. *O. obscurepunctatus*, Blackb., and *rubropustulatus*, Blackb., and one or two others may be recognised as obscure members of Group III, of Maui, etc. *O. newelli, sociabilis*, and *scoriaceus* represent II.*

Speaking generally of these groups, I find that in the field, the members of each are easily enough distinguished. There are, as might be expected, some cases of species that are intermediate in appearance and might be placed in either of two groups, but these are very few. On Kauai Group II stands out remarkably from all others, since nearly all the Kauai species belong to it, while it is only approached in appearance by a few species in Group IV on Oahu. The tendency of the species to become red-marked on the three intermediate islands (Maui, etc.) is very

* [At this point it is convenient to print Dr. Perkins' comments on the abstract of this paper and the lists of specimens sent by him for exhibition when it was read (Proceedings 1912, pp. lvi–lxv). Dr. Perkins arranged the specimens and wrote the lists in the midst of the preparations for his departure from this country, and he had no opportunity of revising the MSS. On his return to England he wrote, September 17, 1912, stating that my footnotes on pp. lviii, lix are correct, and that *N. pubescens*, var. in B (p. lviii), and *N. fuscipennis* in E (p. lix) should be transposed. He furthermore explained that the common typical *N. pubescens* placed in E (lix) does not in reality fit into any group on Hawaii. Dr. Perkins wrote :—

"I suppose I sent a specimen for comparison with the rare blue-winged form, which we should expect to be dominant, and if selective processes were going on now, would surely become so, this being a grand chance for natural selection to work upon. The rare variety is the one that fits the colour-scheme of Hawaii, the very abundant typical form does not."

Concerning *O. molokaiensis*, referred to in the footnote on p. lix, Dr. Perkins remarked that "the female never has bands and is a perfect representative of the dominant Colour-group (E = I). *O. molokaiensis* male may have two fairly good pale bands (as in II of Molokai, etc. = IV. of Oahu), or one may be entirely obliterated and the other faint."]

striking, nearly half the known species being so coloured. Group IV on Oahu (= II of Maui, etc.) is not very clearly marked off from its Group I, when the insects are seen in flight, but, as they usually have a characteristic grey or hoary appearance, they may be kept apart, especially as they represent species mostly peculiar to open country or open spaces in forest country. When their representatives on Hawaii are considered, they become much less distinct from those representing Group I on that island.

Groups II and III on Oahu are peculiar to itself, the dull red markings, clear wings and body clothing of the former giving them, dead or alive, an appearance unlike anything else, and the shining fuscous wings of the latter rendering these equally unmistakable.

In a few cases, isolated species have been found on islands, where they ill accord with the groups there represented, but one cannot overlook the probability of these being recent immigrants. Thus *O. frater*, Dalla Torre, a widely distributed species, has been found very rarely on Oahu, where it does not fit into any Colour-group, as it does on Maui, where it abounds. Excepting on Kauai, the Group I of Oahu is well represented on every island, besides tending to absorb all others on Hawaii, so that nearly half the known species of the wasps may be referred to it. The dominance of this group increases the blackness of our series, for it contains species almost or entirely black and with dark iridescent wings; and, when other groups of Hymenoptera are considered, is swelled by species of bees, of fossorial wasps, and even of parasitic Ichneumonoids.

"In these associations of Aculeates, the Eumenidae are probably dominant, although both the Fossores and bees are extremely ancient. In the Crabronidae several genera have been evolved probably from a single ancient immigrant species (see p. 688). Over fifty species of *Nesoprosopis* fall into structural groups of which one has become parasitic (inquiline) on the others and has lost the special pollen-sweeping apparatus on the front tarsi. Five of these inquiline species have been produced, of course from one original. The three most yellow-spotted species of *Crabro*, which always have a yellow-banded abdomen, are found on Kauai with the yellow-marked *Odyneri*. Two of these Crabros extend to the other islands, or some of the other islands, but one of these, on Oahu, is tending towards black, while the female is sometimes entirely black. The yellow-banded Crabros on islands other than Kauai are generally found *in the open country* where the yellow-banded *Odyneri* occur." *November 15, 1911.*

It is clear that the colour phenomena exhibited by our Hawaiian Hymenoptera are similar to those seen in other countries (whether in the Hymenoptera or in other orders) where such colour groupings are explained as being associations of inedible species, which are easily recognised by predatory enemies from their similarity of colour. Whether this explanation is true of the Hawaiian case is I think very doubtful, though I do not doubt that a satisfactory explanation of the latter would also explain the others. The Australian Eumenidae, Prosopidae and Fossorial wasps furnish instances very similar to the Hawaiian, and in the same groups, as I have myself observed in the field, in that country.

If we assume that these Colour-groups are formed by processes of natural selection and are indicative of inedibility, we are perplexed as to the immunity of insignificant forms, which do not attain notably iridescent wings or other markings and yet fly round in company with the others and are equally or sometimes more plentiful.

"If the Müllerian theory be correct, *wing coloration* is of paramount importance in the Hawaiian groups. It appears to be very suggestive that most of the clear-winged species of bees and wasps are open-country insects. Of course many of the dark-blue iridescent-winged ones mix with these, but then they are also common in the woods too—I mean individuals of a single dark-winged species are common in both situations.

"There are (with reference to colour of wings) distinct evidences in some Hawaiian Crabronidae, of sexual selection being operative. This again, in connection with Müllerian grouping, might start another distinct line of investigation!" *November 13, 1911.*

The writer collected series of nearly every land-bird on each island and so was able to examine the stomach contents of a large number of birds in all, and the finding of but a single *Mimesa* (in the stomach of the thrush *Phaeornis lanaiensis*) would not tend to show the Hymenoptera, as a favourite food, in any shape or colour. As a matter of fact, an Aculeate Hymenopterous insect (with rare exceptions) is so unlike that of any other Order by its general appearance in life, that one can hardly credit any vertebrate enemy with sense enough to distinguish between Colour-groups of these and without the sense to distinguish the class as a whole.

If Colour-groups in Hymenoptera have arisen as a mark of inedibility, the latter quality can I think have nothing to do with the possession of a sting.*

At one time † I supposed that the Hawaiian Colour-groups might be the result of the action of climatic differences, at least in so far as these groups were special to certain of the islands. This seems very doubtful, for we find the nearest approach to the Colour-group of wasps living in the forests of Kauai, in those living on the driest coasts of Oahu, and quite absent from its very similar forests. In fact a satisfactory explanation of the Colour-groups of Hawaiian Hymenoptera is wanting, and, when found, will no doubt explain some of the similar phenomena elsewhere.

It is interesting to trace the structurally allied forms on different islands and see how their superficial appearance is changed by entering different Colour-groups.

Odynerus eutretus of Hawaii is a black insect with dark-blue iridescent wings; on Maui, it is represented by *O. homoeogaster*, a red-marked wasp; on Kauai, by *O. mimus*, a conspicuously white-banded species. The *obscure-punctatus* group on Hawaii is replaced by the redder species *O. sandwichensis* and its allies on the intermediate islands; on Oahu, the blue iridescence of the wings is lost as well as all the red markings (*O. dubiosus* and allies), while on Kauai, the red markings remain, but the wings are of a shining fuscous (*O. blackburni* and *soror*), as in the Oahuan allies. *Odynerus nigripennis*, ubiquitous over all the other islands, is replaced on Kauai by the equally common, pale-banded *O. radula*, F.

PROSOPIDAE.—All the fifty-three species belong to the single genus *Nesoprosopis* based on the island forms but

* Compare Trans. Ent. Soc., 1904, pp. 645–6.—E. B. P.

† Dr. Perkins is evidently alluding to his paper in Proc. Phil. Soc. Cambridge, vol. ix, Pt. VII, 1897, p. 380, where he argued that the colours are due to "climate or some such cause." He also wrote, November 10, 1911, in reference to the above paragraph in the text :—

"I did not state other reasons against the 'climate' view because I hardly thought it worth considering—there are too many impossibilities in such a view !"

subsequently found to contain a European species, *Prosopis kriechbaumeri*, Först., and later a Chinese one. Thus an Asiatic origin is highly probable. The *Nesoprosopis* are almost the most ubiquitous of any Hawaiian insects.

CRABRONIDAE.—The Hawaiian Crabronidae are represented by eighteen described species, which I have distributed in four genera. All these forms appear to be closely allied, and, as it appears to me, might well be the descendants of one original immigrant yellow-spotted form, allied to the British *Crabro vagus*, L. To this latter there are closely allied species in China, if it does not occur there itself, and for this reason an Asiatic origin for the Hawaiian forms may be suspected. Of the eighteen species, three represent each one a distinct genus, while another genus, *Nesocrabro*, contains four species, so that the greater part of the known forms fall into one genus *Xenocrabro*, of which the others appear to be simply derivatives, and it is to the least remarkable of the Hawaiian species of *Xenocrabro* that the European *Crabro vagus* is most nearly related. None of the other diverse groups of Crabronidae are represented in the Hawaiian Islands.

Some of the species are much and conspicuously marked with yellow on all parts of the body, the yellow markings becoming reduced in others, until, in *X. mandibularis*, Sm., we have an entirely black insect. There is, in the yellow-marked species, much variety in the coloration, and the variation exhibited is often of an interesting character.

C. distinctus, described by Smith from a *Crabro* obtained from Hawaii early in the last century, was at first unknown to me, and I suspected a mistake in the locality. Later on, however, I found that Smith's species is an extreme and rare variety of *C. notostictus*, which is typically a black insect with small yellow thoracic markings. Intermediate specimens between the extremes are much commoner than typical *distinctus*. This brightly marked form has so far only been found at or near the coast, where the intermediate forms also occur, as well as the variety I called *notostictus*. In the mountains in the forest region the latter is predominant and intermediates are rarely met with. From these facts one might suspect that the hot dry climate of the coastal regions was productive of the conspicuously marked varieties. The following considerations make such an explanation improbable. In the genus *Nesocrabro* I described a species, gaily marked with yellow as *N. bidecoratus*, adding a remark to the effect that "In spite of its extremely distinct appearance I suspect it may prove to be a variety of the following," viz. *N. rubrocaudatus*, Blackb., and Cam. ("Fauna Hawaiiensis," vol. i, Pt. I, Hymenopt. Acul., p. 27, 1899). This now proves to be the case, intermediate varieties having been secured. The variation in this case is even more extreme than in the other, since typical *rubrocaudatus* is an entirely black-bodied insect, whereas the variety *notostictus* of *distinctus* has at least yellow thoracic markings. It is interesting to observe that the markings of the most highly coloured *N. rubrocaudatus* (var. *bidecoratus*) almost entirely resemble those of *Xenocrabro distinctus.* Looking at the localities where these highly marked varieties of *Nesocrabro* occur, we find that, far from living in the hot and dry places, they are found in the wet woods near Kilauea (4,000 ft.), in the still wetter district of Olaa, and other localities of Windward Hawaii. I think that these highly coloured varieties are "reversions" to an ancestral style of coloration, and I believe this is borne out by an examination of the varieties of other Hawaiian species. In these there is a general tendency to blackness of coloration, some few retaining conspicuous yellow markings, while most have these reduced to inconspicuousness or they are entirely absent. *Xenocrabro hawaiiensis* and *fulvicrus, Oreocrabro abnormis*, Blackb. and Cam., and *Hylocrabro tumidoventris*, species with normally black abdomen, all become spotted as exceptional and sometimes very rare varieties. Species like *Nesocrabro stygius*, Kirb., and *daemonius*, with immaculate abdomen above, frequently retain yellow pigment spots beneath, where they are concealed from view. Generally speaking yellow markings, especially thoracic, are less easily lost in the female than in the male. The general blackness of the Hawaiian Crabronids, as now manifested, has I think been produced within the islands, and while some still retain more or less the colour of their ancestors the majority have greatly departed therefrom, though many of them in exceptional individuals reproduce that coloration to a greater or less extent. Further, a study of the case cited of *Nesocrabro rubrocaudatus* and *Xenocrabro distinctus* lends strong confirmation to the community of descent that is suggested by the consideration of their structural characters. At least I find it difficult to understand how two species of these distinct genera can under totally different conditions of climate and environment produce remarkable colour varieties, totally dissimilar from their usual forms, yet almost identical with each other, unless they be reversions to a former style of coloration.

[No further quotations from the Introduction will be found beyond this point, but it has been necessary in the preceding paragraphs to quote from it somewhat extensively, in order that the discussion in the following letters may become clear. After reading the statements reproduced above, I asked Dr. Perkins, among other questions bearing on a possible Müllerian interpretation of the facts, whether the reversion to an ancestral pattern—or more probably the persistence of an ancestral pattern—in the form *distinctus*, might not be associated with the presence of the pale-banded *Odyneri* which are also found in the open country. He replied, Nov. 15, 1911, as follows:—]

X. notostictus, the *black*-bodied form of *distinctus*, seems to be the only form in the forest region where are no pale banded *Odynerus*, except occasional reversional individuals. Typical *distinctus* of Smith is essentially an open country, sublittoral form, but the *notostictus* form may occur with it, and intermediates. There is a number of pale-banded *Odynerus*, belonging to this open country, or sublittoral, and only belonging to this country. Several species of the predominant black group of *Odynerus* are common both in this open country and forest alike. This would be very suggestive to the Müllerian.

The case of var. *bidecoratus* is quite different, for instead of being coastal, it inhabits very wet forest districts, mixed with the typical form but rarer, and probably less widely distributed. Before I knew this, I thought the pale marked Crabronid vars. might be produced by the dryness and heat of the coast region—they average smaller in size also: *bidecoratus* upsets this view.

Müllerians would say that '*notostictus*' persisted in the coastal regions because of the presence of the pale-banded *Odynerus* (or, at least, for the same reason that the latter do, viz. absence of enemies), and would cite the fact that all Crabronids on Kauai are yellow-banded, the black-bodied group of *Odynerus* being absent there. Obviously the colour of the var. *bidecoratus* is quite out of place in wet forests on Hawai, where are no yellow-banded *Odynerus*, except rare varieties that have reverted to the ancestral pattern. No male form of *bidecoratus* has yet been found, the male *rubrocaudatus* only existing with these so far as is known, and this male is in perfect harmony with the *Odyneri* of the woods. On the Müllerian theory I should say that the more easily changed male of *rubrocaudatus* arrived at a very perfect and stable state of mimetic resemblance to the *Odyneri* of the woods, but that the more conservative female had never reached so perfect a condition—as shown also by its hyaline wings—and that, owing to its conservativeness, it had not reached the stable condition of the male abdominal colouring, when the causes leading to the mimicry (viz. bird attacks) were removed or much abated. I should look on it as a species of which the ancestrally coloured *bidecoratus* form might easily in future times become dominant again.

I have made a crude sketch of a *distinctus* female, from which you can judge how different it appears from an all-black-bodied *notostictus* var., and the brightest female *Nesocrabro rubrocaudatus bidecoratus* has almost a yellow abdomen, the black is so reduced.

[The accompanying drawing of the ♀ *X. distinctus* showed that the following structures and markings are yellow: the pronotal collar, a transverse spot on the scutellum and another on the post scutellum, a curiously shaped spot on the 1st abdominal segment, a band on the 2nd, 4th and 5th, a minute lateral spot on the 3rd, not really visible in a strictly dorsal view. The var. *notostictus* possesses the above-described thoracic markings, but is without the abdominal, although intermediates occur. Another drawing, of the basal abdominal segment of *Nesocrabro rubrocaudatus* var. *bidecoratus*, showed the similar character of the variable yellow spot to that of *X. distinctus.*

Dr. Perkins added :—]

The typical *rubrocaudatus* is entirely black, but in some examples the thorax may have the yellow markings of the var. *bidecoratus*, without any abdominal markings. If abdominal markings are present, thoracic ones are invariably developed.

[Concerning the tendency of the females to lose the white or yellow bands on the abdomen, Dr. Perkins wrote, Nov. 15, 1911 :—]

In *Odynerus*, the species of the structural group of *O. sociabilis* and the group of *O. nautarum* have always the bands more faint or altogether absent in the female. In the Crabronidae the females seem harder to shift from the normal, and I believe that this kind of 'conservatism' is really true of the female sex among insects in general. For instance, in *N. rubrocaudatus*, the male has characteristically dark wings with blue iridescence, but the female has clear wings. In many of the species, the male wings are darker than the female, as though it were hard for the latter to become changed, and this is the same with the thoracic spots, which in three species of *Nesocrabro* with black abdomen are altogether wanting or reduced in size in the male, while they are in two species always, or nearly always, present in the female, and in the third are present in some varieties. They seem to give up these characters with great difficulty.

I should think it much more probable on the Müllerian theory that 'the predominance of female mimicry in butterflies' is due to the necessity of a long life (for egg-laying) for the females, and not to 'a greater female variability in features associated secondarily with sex.'

On the Müllerian theory, I should say that the presence of numerous reversional examples in the Hawaiian species is likely to be due to the fact that nowadays the bird competition has become ineffective. These reversion colours, in *Odynerus* at least, are more often found in males than females; I should say because the females, having once arrived at a stable condition, are less easily changed, i. e. more 'conservative.' There is a war between the greater need to change in the female and the 'conservatism,' doubtless, in producing Colour-groups, just as sexual selection may cause interference. There is not the least doubt that in Hymenoptera generally, the males are of very transitory appearance compared with the females, the difference in length of life often being one of months.

Facts and Arguments for and against Müllerian Mimicry as the Interpretation of the Colour-groups of Hawaiian Aculeates.

[From this point the passages from Dr. Perkins' letters are grouped under heads.]

Nov. 8, 1911.

I have myself for years considered the Batesian theory of little moment compared with Fritz Müller's: possibly all of Bates's examples are simple Müllerian ones.

Nov. 10, 1911.

I am unable to suggest any explanation whatever for the Colour-groups other than the Müllerian one; but I could not get any definite evidence that this is true. I have examined vast quantities of *young birds* in the islands—they are always present *at all seasons* owing to the equable climate, but what I have examined is nothing to the numbers I have watched at close quarters. Camping entirely alone, as I so often did in untrodden forests—for weeks together during some six years—where the birds had never seen a human being, the young were often so tame, they could even be knocked down with a switch! It was often impossible to shoot a bird, as they would come so close out of curiosity and one could not get away from them, especially young birds.

Nov. 14, 1911.

I should say the present-day Hawaiian birds are very well educated by the parents in the matter of choice of food. It was always a marvel to me why the parents should tend them so long. I have doubtless remarked on it often, but may here quote at random, from "Fauna Haw." I, p. 404, of that common species, *Vestiaria coccinea*, "the yellow, black-spotted young follow the parents sometimes till they are far advanced in their red (i. e. mature) plumage, but they very early learn to obtain nectar for themselves, even at a time when the parents are still feeding them on caterpillars." Again, p. 406, of *Palmeria*: "The young follow the parents often until they have arrived at almost their full plumage, and after they have acquired their full song, but in the winter months these companies are disbanded. In February and March they are generally paired."

I think similar remarks might be made on almost every insectivorous Hawaiian bird, certainly all the common ones. I noted even of the rare and extraordinary *Pseudonestor*, p. 432, "they are unwearying in supplying their *full-fledged* young with food, and when the latter are soliciting this from their parents they form a most comical group."

I do not think any one will ever again see Hawaiian birds as I did from fifteen to twenty years ago. Some that I found commonly seem now quite extinct, and others greatly reduced in number. It would be almost impossible to duplicate the observations I then made.

Nov. 10, 1911.

What troubles me as to Hymenoptera is, that any bee or wasp in life is so utterly unlike anything else, that the veriest duffer of a bird can hardly mistake it for anything else, and it is clear that in the islands those which remain small in size with no colour of any sort (i. e. no pattern and ordinary wings) are not now eaten and are fully as successful as any belonging to the Colour-groups. Why then on one little island (Oahu) should a lot of species associate themselves in several Colour-groups for protective purposes? It would appear much more advantageous for all to belong to the dominant black-coloured blue-winged group on the one island, as one would say it would be much easier for birds only to have to learn one colour pattern than several. One tasting might do for the whole lot, if they were one colour, but a number of tastings might be necessary for a lot of groups; and then I come back to the old doubt, why is not the fact that all are characteristically Hymenopterous (whatever be the colour) sufficient in itself?

Nov. 15, 1911.

If birds can select between very slight colour variations so as to produce the closest mimetic resemblance, it seems strange that they should not recognise *any* Hymenopterous insect as such quite apart from colour and pattern. That they do recognise Hymenopterous characters other than colour, seems to be proved by a mimetic Australian *Mantispa*. Although superficially quite unlike a Hymenopterous insect, this *Mantispa* is, from its behaviour and attitude, a perfect mimic—in fact the best known to me. No Syrphid with all its wasp-like coloration can approach it.*

* The mimicry of *Mantispa* was observed by W. M. Wheeler in Nebraska (1888), G. A. K. Marshall in Natal (1896), and R. Shelford in Borneo (1898–1900) and Singapore (Trans. Ent. Soc., 1902, pp. 536–7; Proc. Zool. Soc., 1902, pp. 235–7). Both Marshall and Shelford speak of the excellence of the mimicry on the wing. At the same time Shelford's Plate (P. Z. S. 1902, XIX, figs. 22–7), and both his and Wheeler's descriptions show that colour may enter largely into the mimetic resemblance in certain species of *Mantispa*.—E. B. P.

Nov. 13, 1911.

If I could see the very ordinary-looking Hawaiian species —just like those one may see anywhere in the world—at the least disadvantage as compared with those of the special groups, I should have little doubt of the Müllerian theory—though I should still say that in our islands the groups were formed in the past, by causes no longer operative—but the insignificant forms, like many *Nesoprosopis,* are extraordinarily successful in life. Yet we have to admit that those coloured to fit special groups have originated from such forms. The general tendency for the latter to belong to open country and the changed condition of the Avifauna are *the points* that the Müllerian must lay the greatest stress on. I could make the case stronger for him by going into minute detail at considerable length. It would be quite easy to fill a volume with facts concerning these Hymenoptera, dealing with their variations, colours, structures, etc. The true affinities of the species, one to another, becomes very important, when considering the Colour-groups.

Nov. 10, 1911.

With the Hawaiian wasps (*Odynerus*) it must be remembered that, excluding one group of 4 species which are derived from some fairly ancient immigrant from Asia, all the rest are apparently the descendants of *a single very ancient immigrant species,* though by excessive evolutionary change the descendants have now formed distinct genera and structural groups within the islands. There is evidence for the conclusion that the original ancestor was black with yellow bands, such as one now sees all over the world. One must regard all these Colour-groups as having been formed (i. e. started) actually within the islands.

Conditions under which the Hawaiian Colour-groups may have arisen.

Nov. 10, 1911.

If the Müllerian theory is the right one in this case, I am sure that we must look back to a long past time for the formation of the Colour-groups and the causes are no longer operative. I have in the "Fauna Haw.", under "Aves," given a good deal of detailed information about birds, insects and plants, and have shown how in the birds themselves the causes which developed the weird forms of the peculiar family Drepanididae no longer exist. Nothing but the severest competition for food could ever have produced such birds as *Pseudonestor*, *Heterorrhynchus* and *Chloridops*, the main food of which consists of a single article of diet, to obtain which as a regular diet a very special and grotesque structure has been acquired in each case. Such forms are the tips of twigs in a tree of descent —and they can give rise to nothing further. It might almost be said they are the tips of twigs which, having produced a terminal blossom, themselves die back. A comparatively easy and successful living is possible for a time, but with a slight change of conditions there only remains extinction. They have no chance to adapt themselves to new conditions. It is, I think, noteworthy how often one finds the 'finest' things to be very rare in islands, and I think this is clearly due to the fact that what a systematic student calls 'fine,' is usually a form peculiarly specialised in some particular way, and this means a very particular mode of life. Such 'fine' things are rare, because the conditions suited to their mode of life are few. They are unfortunately the first things to become extinct in Oceanic Islands.

Nov. 8, 1911.

I ought to say I have not finished with the 'colour' question yet, because I have a still more 'general' part than that which I am sending, dealing with 'species formation,' 'variation,' etc., in a general and more comprehensive way, considering the whole fauna together, birds, land-shells, insects and plants.

One who has a wide systematic knowledge of the whole fauna can picture a very different condition of affairs from the present—when the vegetation of the islands formed no true forest, but the islands were covered by a shrubby growth of woody Composites, Lobeliaceae, etc., with few or no trees; when the birds were of less specialised forms like *Himatione* and *Chlorodrepanis* of to-day, with no wonderful developments like *Pseudonestor* and *Heterorrhynchus*, and there were only a few types present, which were numerous in individuals and wandered from shore (where now they are absent) to the mountain tops, and there was a competition for food between individuals, not to be seen nowadays. There were only a few species of Lepidoptera, mostly Pyralids and Micros., and the wasps, which necessarily came later than these, had no such field for securing food as at present. If the Müllerian theory is correct for these Hawaiian Hymenoptera, then the separation of the Colour-groups began and was developed gradually in past ages and the efficient causes are not observable now.

I stick out absolutely for the formation of all the genera of Drepanid birds within the islands—and what a time it must have taken to produce the extraordinary variety of forms, now seen in this exclusively Hawaiian family! Looking at the birds, one ceases to wonder at the hundreds of species of peculiar Achatinellidae in shells; at the fifty odd species of bees (*Nesoprosopis*) with their wonderful variety; at the 100 or more *Odynerus*, so varied in structure; at the vast genera in various groups of beetles; the (doubtless) hundreds of existing and very varied species of the fly genus *Drosophila*, etc. I doubt whether any but a systematist could rightly appreciate this wonderful fauna, or even a systematist who confined himself to a special group.

It has been a great advantage to me that I was able to work out all the Hymenoptera, Orthoptera and Neuroptera, a large part of the Coleoptera, practically all the Hemiptera (after Kirkaldy) as well as having largely studied many groups of the Lepidoptera and Diptera. Then I made a very large and perfect collection of the birds and wrote upon these also, made special studies in the land-shells, and have a moderate knowledge of the Botany.

Guppy, who wrote on the latter, could never have had his ideas, if he had studied the insects; and the conclusions of specialists like Lord Walsingham, who monographed the Micros., are in my opinion quite untenable (see p. 681).

Nov. 13, 1911.

If the Müllerian theory is true of the Hawaiian wasps, what probably happened is this:—

1. There was a very ancient immigrant *Odynerus* (? whence) which gave rise to the vast majority of the forms now present.
2. It was a black-bodied insect with 2 (or more) narrowish pale abdominal bands.
3. The descendant species of this *Odynerus* may have

formed some Colour-groups (e. g. those with red markings) amongst themselves.

4. A later immigrant species from Asia arrived, a black species with dark blue iridescent wings (like and allied to *nigripennis* of to-day).
5. It became the most abundant and widespread of all species occupying all localities (as *nigripennis* does to-day, excepting in Kauai) on all the islands, except Kauai.
6. On Kauai *only*, *nigripennis* did not remain specifically the same, but gave rise to an equally common, allied species *O. radula*, with two yellow bands.
7. This became *and is* the dominant species on Kauai, and (*a*) may have formed the model for the chief (and almost only) Colour-group on that island, or (*b*) it is likely that the pale-banded group may have previously been a feature of Kauai, and absorbed the immigrant *nigripennis*-like insect (which became also structurally modified), or (*c*) the large series of Kauai forms may have at least developed their dark blue iridescent wings after the pattern of the *nigripennis*-like insect, and it acquired their bands.
8. In the open country of all the islands (excepting Kauai) whether above or below the forest, a large number of species remain, which probably most nearly show the superficial appearance of the original immigrant *Odynerus*.
9. This open country is that which would always (from the nature of the avifauna) have been either devoid of insectivorous birds or very sparsely frequented by them.
10. On Hawaii, the big island, the tendency is decidedly to one uniform condition of blackness and the formation of a single group—the pale-banded forms tending to lose the bands, or having quite lost them in the female sex; the red-marked species having the red marks diminished, faint or dull, as compared with the nearest allied species on the neighbouring islands. Hawaii is very rich in birds.
11. Except on Kauai, the ancestral character of the yellow bands is confirmed by their retention by those species which are least peculiar as compared with foreign forms, and by the fact that almost

any species is, as a very rare variety, liable to produce such a form, the band in such case being often very faint and fine, only found on one segment, sometimes fragmentary, or represented only on the ventral surface, where it is, of course, invisible in life.

12. Though the *nigripennis* group is probably of much later origin in the islands than the other, which it is to be noted has produced within the islands *distinct genera* (*Nesodynerus, Pseudopterocheilus, Chelodynerus*), yet it also is ancient; for it is represented by a highly modified species *O. localis* in Kauai, and by a second distinct one on Oahu, *O. epipseustes.* In *localis* such important structures are modified that much time would be required.
13. Consequently the arrival of the ancestor of the *nigripennis* group may well have happened at a time when the condition of the avifauna was very different.
14. The *nigripennis* group of *Odynerus* might possibly have become much more numerous in species had not the islands been already occupied by a great number of forms developed from the earlier immigration. We may compare the case of the bird family Drepanididae, with that of the later-arriving Meliphagidae.

Importance of the Hawaiian fauna in the study of Evolution.

Nov. 4, 1911.

I believe the Hawaiian islands are for the solving of many most important problems, without any equal elsewhere as at present known. The excessive complications of great continental faunas or continental islands are absent, yet the fauna is itself large enough to present many of the same phenomena. I saw this many years ago and referred to it in my paper on the "Vertebrata" (under the Birds) in the "Fauna Hawaiiensis."

Nov. 13, 1911.

I cannot follow the de Vries people at all. Their mutations and fluctuations are distinctions without any particular difference to me. They know nothing about the instability of the latter. For instance, suppose we get by selection a melanic form from a pale creature. If it is then placed under exactly similar conditions to those of the parent pale form, it is certainly likely to revert, but if it is, as probably would be the case in nature, maintained for generations, it seems to me the whole life of the creature would be profoundly modified, and germ-cells and many other parts would be affected. Many important external agencies would be changed, absorption of heat, e. g. They seem to expect to see everything revert, because it is known to do so in a limited number of examples and after a few generations.

One of the most important parts of my introduction will deal with insects known to have been introduced. Some of these produce a brood every three weeks or so throughout the year. Is it not remarkable that after years in the islands, and having come from very different countries, we do not find these producing varieties under such new conditions, and after so many generations?

It seems that it ordinarily takes a great time to start a variable condition, but it does come in the end, for, if we look at the species which are peculiar to the islands, but are comparatively recent arrivals (i. e. not very peculiar and which have not yet given rise to allied species), we see that these are almost always *excessively variable.* Consider how constant are the undersides of *Vanessa atalanta*, *cardui*, etc., yet our *V. tammeamea*, Esch., allied to these, presents the most remarkable variations constantly. *Hypenodes altivolans*, hardly different from a species found in England, New Zealand, etc., is extraordinarily variable with us, and the same is true of many other Hawaiian species.

Nov. 15, 1911.

I am much impressed with the stability of species for many generations under changed conditions—to which I have referred previously.

Of course a species already in a highly plastic condition would presumably be more likely to exhibit change in a short time. But—

(*a*) In Blackburn's collection (of which I have a large part), formed thirty years ago, variable species exhibited the same varieties then as now.

(*b*) Introduced species from other very diverse countries have not altered after many generations. This applies to species which are *known* as being plastic outside the islands, i. e. ones which have formed marked varieties or races in countries different from the one whence they were imported to our islands, but which they, no doubt, reached naturally, and at a much more remote period.

From my knowledge of insects generally I should say that species we call very variable are usually really constant in their varieties, i. e. the varieties themselves are of regular occurrence *in nature*—some rarer some commoner, like species. It evidently requires *much time* to alter either species or varieties. What a time it must have taken to produce the eighteen genera of Drepanididae, a family peculiar to the islands! This and the extreme specialisation of so many of the genera seem to point to an ancient excessive competition, unrealisable on present conditions.

I suspect that some day a widespread cause inducing plasticity will be discovered. It must be remembered that many of our commonest imported insects have no enemies at all to keep them constant by selection, but they have not begun to vary *yet.**

* [The following contribution to this discussion was contained in a letter written by Dr. Perkins from Honolulu, May 20, 1912 :—]

I am astonished after my experience here at the permanency of specific characters. When I see the enormous changes in climate and general conditions produced by the white man's destructive work, and compare examples of all sorts of insects collected to-day with those taken over 75 years ago by old collectors, or 30–40 years ago by Blackburn, I should have expected to have found at least some perceptible difference between the individuals after so many generations (things breed all the year here, many of them average a brood to a month or six weeks).

Again, the conspicuous dominant wasps of the genus *Polistes* introduced nearly half a century ago—more conspicuous and fierce, and more numerous than any *Odyneri*—might have been expected to influence the more plastic of the indigenous species, viz. those which have a coloration that could be easily changed to resemble the new arrivals. In general it appears that an enormous time must be allowed for specific change, unless it occurs abruptly and suddenly. We have lately had a tropical American *Odynerus* introduced here, of quite a different type from our groups; but its appearance could easily be arrived at by some of the native species. This new species (no doubt, imported by man) is already, after a year or so, a most dominant species. Theoretically it should be badly off, as it would be unknown to our endemic birds, etc., and it is not very startling in colour.

XV. *Synaposematic resemblance between* Acraeine larvae. By G. D. H. Carpenter, B.A., B.M. (Oxon.), F.E.S., Member of the Royal Society's Sleeping Sickness Commission.

[Read October 16th, 1912.]

When breeding Acraeine larvae I have on several occasions been deceived by the very close likeness existing between larvae of different species. In May 1911, on Damba Island, Victoria Nyanza, I found a company of *Acraea* larvae, and reared them to maturity. These were sent to Prof. Poulton, who identified them as *Acraea terpsichore*, L. Subsequently I found more larvae which I took to be the same as the former. The imagines bred from them were, however, identified by Prof. Poulton as *Acraea alicia*, E. M. Sharpe. The larvae were light green, shining, with head and legs black, with a transverse row of six rather long spinose spines across each segment, the four central ones being black, the lateral ones green and directed downwards. The pupae also appeared to be similar, but I did not take a written description.

The second instance is of some interest.

About the middle of June, 1911, on Damba Island, I found a company of small larvae feeding in the jungle on one leaf of the food-plant which appeared to be a species of nettle, stinging very feebly. I reared them, and the imagines supplied the first epigonic proof that *Acraea alciope*, Hew., and *Acraea aurivillii*, Staud., were male and female of the same species. These larvae were dull yellowish, with a lateral line of a more pronounced yellow, above which was a black line; from the latter, at right-angles, narrow black streaks ran dorsalwards, but not so far as the mid line. Head and legs black. Of the six spines on each segment the one on each side arising from the lateral line was yellowish, the rest black.

About two months later I found another company of similar larvae on a leaf (of the same plant) and reared them. To my astonishment the imagines were a totally different *Acraea*, whose name I knew not. Mr. Eltringham identified them as *Acraea humilis*, E. M. Sharpe, and *Acraea orestia*, Hew., so that these two were shown to be forms of one species. Both larvae and pupae had been so like those of *A. alciope* that no suspicion had crossed my mind that they were of a different species.

The third instance of resemblance concerns larvae of the genus *Planema*. On August 17th, in the jungle of Damba Island, about 5 p.m., I saw a female *Planema macarista*, E. M. Sharpe, sitting on the leaf of a creeper, apparently just completing oviposition. I saw her lay the last egg, and then captured her. The eggs were laid all together on the upper surface of one leaf, but each distinct from the others. They were barrel-shaped, rather elongated, lemon yellow, attached to the leaf in an upright position by one extremity. Under a low power of the microscope the surface was seen to be longitudinally ribbed, with faintly marked cross bars between adjacent ribs. They were twenty in number. All except one hatched on August 25th ; and the dates of the successive ecdyses of the larvae were Aug. 31st, Sept. 7th, Sept. 11th, and Sept. 16th. Unfortunately the majority of them died after this from an infectious disease, but one or two, though dwarfed pupated on Sept. 21st, these pupae subsequently dying.

The larvae were of a bright, shining, claret colour, with black head, legs and spines, the latter being rather long. Until more than half grown these larvae congregated together in a mass, whereby, under natural conditions, their conspicuousness would of course have been greatly accentuated. Though I obtained no imagines from this brood, the parent was undoubtedly *Pl. macarista*. [The parent was exhibited to the Society on Oct. 16th, 1912.—E. B. Poulton.]

The description of the pupa was as follows :—

Pinkish white, with black veins on the wings, and small black linear markings on the ventral surface. On the head are two widely separated pointed processes of the same colour as the body. From the dorsal surface of the abdomen project four pairs of long thin black spines, hooked at the tip, arising each from an orange pink tubercle, on each side of the outer aspect of the base of which is a black line ; except the anterior tubercle which has only a short black line anteriorly to its base.

In October, one of my boys brought me from the Damba jungle on the leaves of a creeper of a different species from the former, three larvae of identically the same appearance as recorded above. These pupated almost immediately, and the pupae also corresponded with the above description. I naturally concluded they also were *Pl. macarista*; and when the imagines emerged on Oct. 18th, and showed the orange band on the forewings and white on the hindwings, I concluded they were all males, and put them away without a careful examination. They were sent to Prof. Poulton in due course, who, to my great interest and astonishment, pronounced them to be two males and a female of *Planema poggei*, Dewitz., and not *Pl. macarista.*

At the beginning of 1912 I moved to Bugalla Island, forming one of the Sesse group in the N.W. corner of the Victoria Nyanza.

In April I found in the forest a larva which exactly corresponded with the description previously given,—claret-coloured with head, spines and legs black. It pupated on April 19th. I carefully looked at the pupa, and saw no difference in it from those of *Pl. macarista* and *poggei.* However, when the imago came out on May 1st, it was neither *macarista* nor *poggei*, but *Pl. arenaria*, E. M. Sharpe. I have since reared other specimens of this species from larvae found in the forest.

Here, then, we have larvae and pupae of three common and very conspicuous Planemas so closely resembling each other that I have not been able to distinguish any difference; though I have not had specimens of each to compare side by side.

July, 1912.

Note.—Later in the year Dr. Carpenter sent spirit specimens of some of the species referred to above. Concerning the larvae and pupae of *Pl. arenaria* he wrote Nov. 26, 1912:—

"The very young larvae are dull green with black anterior segments. After the first ecdysis the black becomes claret colour, and the green a sort of vague dull pink, which gradually becomes darker owing to the anterior claret tint spreading backwards, until the whole larva is of that tint. Its colour is then indistinguishable from that of *macarista* or *poggei.* Inasmuch as the larva of *macarista* is from birth onwards always the same, I think the facts show that the *arenaria* larva mimics that of *macarista*. (I have only just discovered this, or would have told you when I made my remarks on Acraeine larvae.) The two *pupae of Pl. arenaria*, which might equally well be *macarista* or *poggei*, are very remarkably resistant to the cyanide bottle—even more so than the imagines! I put them in one evening; next morning I took them out and they were still, literally, kicking. Next evening I repeated the experiment with the same result! I had to chloroform them eventually."

XVI. *The Life History of* Pseudacraea eurytus hobleyi, *Neave.* By G. D. H. Carpenter, B.A., B.M., (Oxon.), F.E.S.

[Read November 6th, 1912.]

When I came out to Uganda as a member of the Royal Society's Sleeping Sickness Commission, I obtained permission from the Society to send the Lepidoptera which I might collect to Prof. Poulton; and it is to frequent correspondence with him that the following interesting result is due, which confirms the suggestion made by Dr. Karl Jordan that several forms of *Pseudacraea*, hitherto regarded as distinct species, would be found to be only polymorphic forms of one species.

At the beginning of 1912 my investigations into the bionomics of *Glossina* took me to Bugalla, one of the Sesse Islands—a group lying in the N.W. corner of the great Lake Victoria, some twenty-five miles S.W. of Entebbe. Here I soon found that *Pseudacraeae* of the three forms *terra*, *hobleyi*, and *obscura*, together with intermediate forms, were extremely abundant; *terra* being more numerous than the other two put together. Everything was favourable for testing Dr. Jordan's suggestion. I obtained many females in succession, and put them in a large box with gauze front, hoping they would oviposit on the leaves which I put in; but none would lay. I was not at this time aware of the specific food-plant, and had not been able to find the food-plant of *Pseudacraea lucretia* which Prof. Poulton suggested would probably be the food-plant of the *hobleyi* forms. Thinking that the atmospheric conditions in my hut, on top of an open grassy hill about 150 feet above the lake, were not suited to the forest-loving butterflies, I took the box down into the forest in which the Pseudacraeas fly, and stood it on supports in a large basin of water. Still the Pseudacraeas would not lay, and I was beginning to despair. However, on Sunday, June 16th, 1912, in the forest on the lake shore, I saw a *Pseudacraea* which I had been following about, and vainly trying to catch, settle on the under surface of a leaf of a sapling, remain motionless, hanging from it with wings closed, and then fly away quickly. On looking at the leaf, to my intense pleasure, I found an egg on the middle of the under surface, still glistening with the secretion affixing it to the leaf, and of a dull yellow colour.

Let me here briefly state the main facts of the life-history. The *parent* was one of the intermediate forms so plentiful in the locality, being an "*obscura*" with large pale areas, and a reddish suffusion strongly marked on the under surface of the base of the hindwing, indicating an admixture of the "*hobleyi*" form.

The egg was laid on June 16.		
The egg hatched.		June 25.
1st larval ecdysis.		July 1.
2nd	do.	July 7.
3rd	do.	July 14.
4th	do.	July 21.
Larva pupated.		August 1.
Imago emerged.		August 16.
The imago was *a male, of the form "terra."*		

This in itself was sufficient to prove the identity of the forms "*obscura*," "*hobleyi*" and "*terra.*" Further, the larva and pupa corresponded exactly with the coloured drawings of those of *Ps. imitator*, Trim., as drawn by Miss Margaret E. Fountaine, and published in the Transactions of the Ent. Soc., Part I, 1911 (pp. 57–59, and Pl. X), thus bringing this form into the same category. Miss Fountaine, however, makes no mention of the great difference in the appearance and habits of the young larva before and after the first ecdysis.

I will now proceed with the detailed description of the various stages.

The Ovum.—When freshly deposited on the 16th June, at noon, was of a uniform dull yellow colour. In shape it was spherical, but slightly flattened at point of attachment to the leaf: the surface being of a shagreen texture and deeply sculptured into hexagonal cells. On June 18th the periphery became clearer and less yellow, the centre opaque and dull pinkish. On the 24th the centre became black, and the outer parts white and semi-transparent.

The Larva.—Finally, without further change in the appearance of the ovum, at 9.15 a.m. on June 25th the young larva ate its way through the shell, and at once set to work to consume the rest, which it accomplished in half an hour. The larva was rather "maggotty looking," being of a dull greenish white, and quite smooth, with no processes whatsoever on body or head, which was smooth shining black. In a very short while the larva took up its position along the edge of the leaf: and within a few hours, before it had eaten any of the leaf, had affixed to its back one or two pellets of excrement. The way in which it subsequently ate the leaf was interesting. It ate a small hole out of the edge, and then continued this down the side of a lateral rib of the leaf, subsequently doing the same on the other side of the rib, which was cut out from the rest of the leaf tissue but attached by its base. On this bare rib the young larva rested, and very soon had accumulated a large number of light brown pellets of excrement on its back and on the leaf around it. It always returned to rest at the same spot after feeding.

First Ecdysis.—The first ecdysis occurred on July 1st, with a complete change in appearance and habits. The larva no longer covered itself with pellets; and the appearance it took on persisted until after the fourth ecdysis; the characters acquired at the first being merely accentuated by the second and third ecdyses. The description of the larva after the third ecdysis is as follows. (See also Miss Fountaine's drawing.)

From first to fourth Ecdysis. Dorsally.—From behind the third segment to the posterior margin of the tenth, of the same green hue as the leaf, bordered with a pale brownish lateral line. Along this line, from each segment arises a spine, beset with smaller spines. The former are quite small except on segments two, three, eleven, and twelve, while that on segment two is the largest of all, and the pair diverge outwards and forwards like antlers, reaching the level of the front of the head. The pair on the third segment is similar but smaller. On segments two and three the dorsal green colour is much marked by pale brown areas continued inwards and backwards from the bases of the "horns" to meet mid-dorsally, making the hinder sides of a triangular area whose base is formed by a similar line extending transversely between the bases of the "horns." The first segment, dorsally, is mostly blackish, with a narrow antero-posterior mid-dorsal white line.

Posteriorly, there are two more pairs of enlarged spines, those on the eleventh segment being a little larger than those in the middle of the body; and those on the twelfth midway in size between those of the second and third segments, and curved upwards and forwards. The colouring of the last two segments dorsally is ashy grey, dotted and mottled with blackish.

Laterally.—From behind the head until the eighth segment the larva is greenish black, but on the eighth segment this is bevelled off and gradually replaced by ashy grey, which is continued to the end of the body and there becomes continuous with the same colour dorsally. On the seventh segment the dark colour is interrupted by a large, raised, triangular whitish flap, with its base at the lateral line, and its apex running on to the base of the clasper, and there ending in a spine which points almost directly outwards at right angles to the body. There is a similar, dark, spine, on the base of the clasper of the seventh segment.

Head.—Greenish black, slightly bifid at top, beset with numerous small white spines. A narrow whitish band bordered with blackish starts on each side of mid-line at the crown, nearly meets its fellow in the middle of the front of the head, and curves away again below.

As regards its *habits* the larva has the same "homing" instinct as when much younger, always resting at the tip of a bare rib, and returning there after feeding. In the resting position the head and first five segments are raised off the leaf, and also all that part of the body behind the fourth pair of claspers, this being held up at quite a sharp angle, thus bringing more into evidence the lateral ashy colour of that part of the body. The larva is very sluggish and rarely moves except in connection with feeding.

The fourth Ecdysis.—This took place on July 21st and brought great change in appearance. The general colour was now a velvety purplish brown, and under a lens the whole integument was seen to be finely dusted with minute green dots. Here and there the purplish tint was replaced by greenish mottling. The flap on the side of the 7th segment, and the formerly grey area behind it, now became light pinkish brown, and just anterior to the flap were two raised circular dots of pure white. The first segment still bore a short white mid-dorsal line. With this ecdysis the spinous processes are considerably developed, those on segments four to nine, inclusive, being trifid at the extremity, the central prong slightly the largest. The pair on the second segment are even larger than before, very thick, slightly flattened at the extremity, and are set with minute spines along the edges. They diverge upwards and outwards, and then turn forwards at an angle. The spines on the third segment are only a little larger than those on the middle segments.

The processes on the tenth segment are a little larger than those on the third, and flattened from side to side. The last pair of processes (on eleventh segment) are very large, and almost leaf-like, owing to the great flattening from side to side: the anterior and posterior edges have a frayed appearance, owing to their being set with small spines close together. These processes curve forwards and upwards.

The *head* is very spiny, ash-coloured in front, dark brown at sides.

Pupation.—On July 29th the larva spent the day curled up on a leaf eating nothing, and on the evening of the 30th suspended itself by the last pair of claspers from the tip of a leaf. On the 1st August, very early in the morning, before daybreak, it pupated. After this first experience I have reared numbers of these larvae, and it is very interesting to note that the preparations for pupation always occur in the same way. During one night, after remaining motionless in a curled-up posture on the leaf for some twelve hours, the larva will suspend itself from the leaf tip; and pupation takes place during the next night. Presumably by this adaptation the pupa gains by not being exposed to daylight till the protective green colour is fully developed, which takes some hours. The pupa corresponded exactly with the figure and description of that of *Ps. imitator* (loc. cit.), save only that the long processes from the head were not twisted but quite straight and parallel to each other.

The pupa in colour was leaf green, but the lower surface of the dorsum, and head, was slightly tinted with a light bluish grey bloom, as if to neutralise shadow. From the top of the head project a pair of flattened stalk-like processes, soldered together along adjacent edges except at the extreme tips, which are square. These processes immediately after the shedding of the larval skin are separate from each other, short, and curved dorsally. They appear to be straightened out to their final position and shape by the forcing into them of fluid, and the triangular processes on the abdomen are similarly distended, being very small at first. The cephalic processes are about one-third of the length from top of head to end of abdomen. They make a large obtuse angle with the ventral surface of the body, but are in the same longitudinal plane. The body is very much flattened from side to side: each abdominal segment is slightly ridged in the mid-ventral line, the edge of the ridge being outlined in dark brown. From the dorsal surface of the abdomen project two large triangular processes, very thin from side to side, with edges outlined in dark brown. One, near the tip of the abdomen, is only half the size of that arising from the base of the abdomen, which has on its posterior edge a secondary triangular eminence.

Emergence of the Imago.—On Aug. 13 the antennae and limbs became very distinct through the pupal skin, and on Aug. 15 two dark patches showed on the forewing. These dark areas were the future tawny areas on the forewing of the imago, and soon assumed that colour, the rest of the wing then becoming black. On the morning of the 16th I was able to see how the wings were separated from the pupal skin by the secretion of air between the two, and very shortly the imago emerged; a male of the form hitherto described as a distinct species under the name *Pseudacraea terra*, Neave.

The fortunate observation that showed me the food-plant has enabled me to recognise it in the forest: it is the tree which serves as food for *Ps. lucretia*, but I have been unable to get full botanical specimens of flower, etc., for identification. I have now had no difficulty in getting captive females to oviposit on food-plant in the box in the forest, and up to the time of writing have secured one or more ova from six females of all three forms. The young larvae are rather delicate, and sometimes exhaust themselves so much by wandering about, spinning a silk foothold as they go, that they are unable to eat the hard dry leaf, and die. I have lost some of each brood save one, from this cause. Of one brood of four which all hatched on one day, the members all seemed equally thriving, when one, for some reason unknown, ceased feeding and shrivelled up. The food-plant being so dry, has to be renewed every other day, in spite of being kept in water. In spite of these disappointments, however, I hope to provide Prof. Poulton with specimens of each form reared from the other.

August 1912.

APPENDIX.

[I have thought it well to add to this paper an account of specimens subsequently bred by Dr. Carpenter from three known females of the *obscura* form. All three were captured in the neighbourhood of Dr. Carpenter's camp on the east side of the centre of Bugalla Island. Having had the opportunity of comparing the whole of the "set" material, I have added a few notes to Dr. Carpenter's descriptions of the three parents and their offspring, but it has not been deemed necessary to indicate the slight additions.—E. B. POULTON.]

Series B.—Parent *obscura*, captured in the forest just above lake level, June 30, 1912 (laid four eggs).

Hatched.	1st Moult.	2nd.	3rd.	4th.	Pupated.	Imago.
1. July 12	July 20	July 26	Aug. 1	Aug. 7	Aug. 18	Sept. 3
2. July 12	July 21	July 26	Aug. 1	Aug. 9	Aug. 21	Sept. 6
3. July 13	July 21	July 26	Aug. 2	Aug. 10	Aug. 23	Sept. 8

Remarks.—The female parent has a pronounced pale forewing bar and the hindwing towards the base is paler than usual. The umber brown marking on the hindwing under surface is rather more developed than is usual in *obscura*.

1 is a ♀ *terra* with pale fulvous forewing bar which on the under side is nearly white.

2. A particularly interesting ♀ specimen. I do not think I have caught one quite like it. It would *take very little to make it into imitator*. The subapical bar is white, the inner marginal forewing pale area is very faintly marked, and a very little would cause it to disappear altogether; and to make the hindwing like *imitator* you only want a concentration of the pale colour into a band. The specimen bears much resemblance to the female parent, differing in the more pronounced forewing bar and the less pronounced pale areas on the rest of the expanse of both wings.

3. A ♀ *terra*, with rather more white suffusion on the forewing bar than in 1.

Traces of the umber marking appear in all three offspring, faintly in 1 and 3, distinct in 2 which resembles the parent in this respect.

Series C.—Parent a pale *obscura,* captured in the forest just above lake level, July 9, 1912 (only laid one egg, on July 9).

Hatched.	1st Moult.	2nd.	3rd.	4th.	Pupated.	Imago.
July 17	July 24	July 30	Aug. 4	Aug. 10	Aug. 22	Sept. —

Remarks.—The parent is more worn than B, but apparently the chief pale area of both wings was much less pronounced than in the latter. The basal area of hindwing under surface is free from the umber brown marking.

1. Imago a ♂ *obscura* tending in the direction of *terra.* No umber marking on under surface.

Series D.—Parent *obscura-hobleyi,* captured on flowers at the edge of the forest, July 15, 1912 (laid 13 ova).

One egg shrivelled, one failed to hatch, one larva died before first moult, another was a "wanderer" and died from exhaustion, another died during first moult and one after. Result seven pupae only.

Hatched.	1st Moult.	2nd.	3rd.	4th.	Pupated.	Imago.
1. July 25	July 30	Aug. 4	Aug. 9	Aug. 15	Aug. 26	Sept. 10
2. July 25	July 30	Aug. 4	Aug. 9	Aug. 16	Aug. 28	Sept. 11
3. July 26	July 31	Aug. 4	Aug. 10	Aug. 16	Aug. 28	Sept. 12
4. July 26	July 31	Aug. 5	Aug. 10	Aug. 17	Aug. 29	Sept. 13
5. July 27	Aug. 1	Aug. 9	Aug. 14	Aug. 26	Sept. 4	Sept. 20
6. July 28	Aug. 4	Aug. 11	Aug. 17	Aug. 26	Sept. 6	Sept. 21
7. July 28	Aug. 5	Aug. 12	Aug. 20	Aug. 29	Sept. 7	Sept. 23

Remarks.—The parent is worn like C, but its pale areas had been apparently much like those of B, showing like the latter a tendency towards the female *hobleyi* in the emphasis of the white bar. The umber marking is present, but faded, and it is difficult to estimate the original development of this marking.

1. ♀ *terra* tending towards *hobleyi* ♀ in the paleness of all the forewing markings, especially on the under surface (where they are white), in the distinct umber marking on the under surface and the traces of a white bar along its outer margin.

2. ♀ *terra* with a trace of *obscura.* The umber marking barely visible.

3. ♀ *terra* with white forewing subapical bar. In this and the umber marking and the white areas on the under

surface of the forewing this specimen exhibits the same tendencies as 1.

4. ♀ *terra*, dark, with faintest trace of *obscura*; very similar to 2.

5. ♂ *obscura*, much like C 1, but tending rather more strongly in the direction of *terra*. Umber marking barely visible.

6. ♀ similar to 5, only tending rather more strongly towards *terra* on the hindwing upper surface.

7. ♂ similar to 5, but tending slightly more strongly towards *terra*. *Sept. 21, 1912.*

[The two families tabulated below, together with the notes upon them, were received in a letter from Dr. Carpenter, dated October 17, 1912.]

Series E.—Female parent a typical ♀ *hobleyi*, captured at the edge of the forest, July 24, 1912.

Hatched.	1st Moult.	2nd.	3rd.	4th.	Pupated.	Imago.
1. Aug. 4	Aug. 11	Aug. 17	Aug. 27	Sept. 2	Sept. 14	Sept. 28
2. Aug. 4	Aug. 11	Aug. 20	Sept. 2	Sept. 9	Sept. 21	Oct. 4
3. Aug. 4	Aug. 13	Aug. 21	Sept. 3	Sept. 11	Sept. 22	Oct. 6

Remarks.—1. A typical (dwarfed) ♀ *hobleyi*.

2. ♀, approach to *imitator* like B 2.

3. ♂, a combination of *hobleyi*, *terra* and *obscura*, showing early stage towards No. 2.

The *hobleyi* influence is shown in both 2 and 3 by the strong development of the umber triangle on the hindwing under surface.

Two other ova shrivelled up without hatching.

Series F.—Female parent a typical *terra*, captured Aug. 2, at the edge of the forest.

Hatched.	1st Moult.	2nd.	3rd.	4th.	5th.	Pupated.	Imago.
Aug. 11	Aug. 25	Sept. 1	Sept. 7	Sept. 14	Sept. 23	Oct. 4	Oct. 18

Remarks.—For some reason this larva grew slowly and put in an extra ecdysis on Sept. 23 (the 5th). The butterfly is a typical ♂ *terra*, except for the presence of a strongly marked indication of the umber triangle. The female parent was cut to pieces by ants which got into the cage, but the wings show no trace of the umber marking.

Series G.—Female parent a typical ♀ *hobleyi*, captured on flowers at the edge of the forest, Aug. 6, 1912.

Hatched.	1st Moult.	2nd.	3rd.	4th.	Pupated.	Imago.
1. Aug. 17	Aug. 26	Sept. 1	Sept. 8	Sept. 14	Sept. 25	Oct. 9
2. Aug. 18	Aug. 27	Sept. 1	Sept. 8	Sept. 15	Sept. 26	Oct. 10
3. Aug. 18	Aug. 27	Sept. 1	Sept. 8	Sept. 16	Sept. 27	Oct. 11
4. Aug. 18	Aug. 27	Sept. 2	Sept. 8	Sept. 16	Sept. 27	Oct. 11
5. Aug. 18	Aug. 27	Sept. 2	Sept. 8	Sept. 16	Sept. 27	Oct. 11
6. Aug. 18	Aug. 27	Sept. 3	Sept. 8	Sept. 16	Sept. 27	Oct. 12

Remarks.—No. 2 a typical ♂ *hobleyi*. All the others typical female *hobleyi* except No. 4 and No. 6, in which the white bar of the hindwing is continued on to the forewing so as to meet, or nearly meet, the subapical white bar. This latter feature is seen in the parent.

There were, alas, *seven* other eggs, but six young larvæ died soon after hatching, one as a result of 3rd moult. All the survivors were pure *hobleyi*. 5 ♀♀, 1 ♂.

From the results I have obtained so far, it appears that form *hobleyi* has a very strong influence and it is *the most distinct form* (*dominant* in the *non*-Mendelian sense). Let me tabulate the following reasons.

I. An *enormous* number of otherwise more or less typical *terra* and *obscura* have a reddish tint at base of the hindwing under surface, and this applies still more to a large number of intermediates strongly tinted with *hobleyi*.

II. But though *terra-hobleyi*, and *obscura-hobleyi* are common enough, yet I have not yet, so far as I am aware, *sent you a single specimen* of *hobleyi-terra* or *hobleyi-obscura*—i. e. a form which you could say was *hobleyi* tainted with *obscura* or *terra*.

III. I have *not bred a pure hobleyi from terra or obscura.*

IV. Lastly (which seems most important) from two *hobleyi* parents I have bred, on the one hand, in series E, a typical *hobleyi* and two intermediates (no typical *terra* or *obscura*), on the other, in series G, six offspring, of which *not one was anything but typical hobleyi* ! This seems extremely interesting, and I suppose indicates that *hobleyi* is the longest established form in Uganda at any rate.

I should, a day ago, have said that I supposed *hobleyi* had nearly become a true species—but yesterday I read Dr. Jordan's paper, and at the end he dealt with this very fallacy!

So *hobleyi* seems dominant over both *terra* and *obscura*; the former of the last two being also stronger than the latter. *Hobleyi*, thus, is the most interesting form to breed from, and I have now got another in confinement.

XVII. *On some Luminous* Coleoptera *from Ceylon.* By E. Ernest Green, F.E.S., Govt. Entomologist, Royal Botanic Gardens, Peradeniya.

[Read November 6th, 1912.]

PLATE LXXXVI.

Harmatelia bilinea, Walk.

A short note on the occasional luminosity of this beetle was published in "Spolia Zeylanica," vol. vii, Part XXVIII, p. 212, Aug. 1911.

At that time I had not personally noticed any luminous phenomena connected with this insect, although many living examples of *Harmatelia* had been under observation. But, in September 1911, two specimens, caught in the Peradeniya Gardens, exhibited a distinct light when examined in a dark room.

It was seen at once that the light was not confined to a single area, as in most other *Lampyridae*, but was emitted from several distinct foci on each side of the body. These luminous spots appeared to be closely connected with the spiracles. Eight luminous foci could be distinguished on each side of the abdomen, and one on each side of the thorax—the latter apparently situated beneath the shoulder of the elytron. When emitting the light, the abdomen was slightly depressed, to expose the dorso-lateral area, and, when at its brightest, the whole abdomen appeared to be irradiated internally. The luminous spots were more brilliant on the dorsum, but could be plainly distinguished (by transmission) on the venter of the insect.

The accompanying figure (Plate LXXXVI, Fig. 1) shows, diagrammatically, the position of the phosphorescent foci as seen from below, the luminous spots being represented in red.

I have not yet succeeded in determining the female of this beetle, and it remains uncertain whether the other sex is an apterous grub-like creature, or whether it is in the form of a normal beetle.

Dioptoma adamsi, Pascoe.

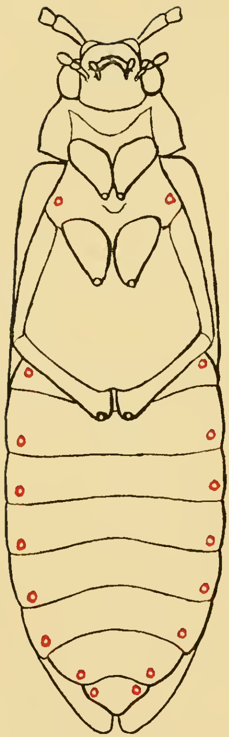
Of this insect, Dr. Sharp remarks (Camb. Nat. Hist., Insects, Part II, p. 252): "Nothing is known as to the habits of this curiosity, not even whether it is luminous in one or both sexes."

I am now in a position to state definitely that *Dioptoma* is luminous, in both sexes. On the 12th of this month (Sept. 1912) I observed a glow-worm displaying its light and evidently signalling for the male. The hinder part of her body was recurved over the back, so that the large sub-terminal photogenic organ was fully exposed. While examining the female (without disturbing her) I witnessed the advent of the male. His approach was not heralded by any display of fireworks on his part; but his arrival caused a partial eclipse of the luminous disc on the female, and her tail was immediately turned down to the normal position. On boxing the specimens, I found the male *in coïtu*, and discovered that I had captured the two sexes of *Dioptoma adamsi*.

Later, when examining my captures in the dark, I was interested to observe that the male *Dioptoma* (hitherto supposed to be non-luminous) displays—under sexual excitement—a brilliant series of lights of an emerald green colour. There is a transverse series of 4 luminous spots along the posterior margin of the prothorax; a marginal abdominal series of 8 on each side; and two converging dorsal series (of 3 points) on the hinder segments of the abdomen. It is possible that this dorsal series may extend towards the base of the abdomen, but the other spots would be eclipsed by the opaque elytra. When viewed from below, intermittent flashes appeared to emanate from the ventral area of the thorax, but I was unable to locate their exact position.

The accompanying diagram (Plate LXXXVI, Fig. 2) represents a dorsal view of the male *Dioptoma*, with elytron and wing removed on one side, to show the position of the luminous spots. I cannot guarantee the absolute accuracy of the position of each spot, as it is difficult to determine the segments of the living insect—when examined in the dark; but the number of visible luminous points was verified several times.

The female *Dioptoma* is an elongate apterous grub-like insect; the body sub-cylindrical, slightly broader than deep; the segments approximately of equal width, except



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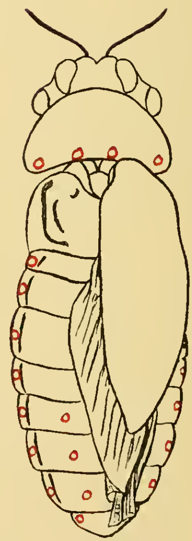

2

E. E. Green, del. C. Hentschel.

LUMINOUS COLEOPTERA FROM CEYLON.

the first which is narrowed in front. Posterior segment truncately rounded. Photogenic organ roundly quadrate, almost completely occupying the venter of the penultimate segment; emitting an intense greenish-yellow light. Colour brownish ochreous, the basal half of each dorsal segment dark brown.

Length 30 mm. Breadth 7 mm.

Although, in the example under observation, the light was confined to the area of the large photogenic organ, two examples of what appear to be the same species, from Kandy, were reported by the collector to have exhibited—when freshly caught—a supplementary series of luminous points along each side. He describes them as being situated intersegmentally, and states that there were two luminous points (one dorsad, the other ventrad to the lateral line) at each junction of the segments. He did not count the number, but thinks that the series extended along the whole length of the abdomen. When I received them, the insects were more or less moribund, and displayed light from the terminal ventral organ only. Some eggs laid by these examples did not exhibit any luminescence.

Lamprophorus tenebrosus, Walk.

The males of this species, though ordinarily exhibiting a very brilliant light, invariably approach a "calling" female with their light shut off. I have frequently observed the advent of the male, when watching a female that was displaying its signal. The first intimation of the arrival of the other sex is the partial eclipse of the luminous discs of the female. Several males are often in attendance upon a single female.

The male of this species apparently seeks the female solely by sight, for I have found them visiting females of other species, including that of what I now know to be *Dioptoma*. They are also constantly attracted to lamps at night.

Explanation of Plate LXXXVI.

Fig. 1. *Harmatella bilinea*, Walk. (diagrammatic) × 13 (p. 717).
2. *Dioptoma adamsi*, Pasc. (,,) × 10 (p. 718).

XVIII. *On new Species of* Fossorial Hymenoptera *from Africa, mostly* Elidinae. By Rowland E. Turner, F.Z.S., F.E.S.

[Read November 6th, 1912.]

Dr. Brauns has forwarded to me a number of species of *Myzine*, mostly unique specimens, the types of the new species remaining in his collection.

Although a considerable number of males have been described from S. Africa, and some are still undescribed in various collections, very few females have hitherto come to hand. The collection is therefore of great interest, containing several undescribed females. These show much variety both in the length and neuration of the wings, from the fully developed wings of *rufifrons*, Fabr., to the very short wings of *perniciosa*, Turn., in which there is only one cubital cell. For the species with short wings the name *Pseudomeria*, Saund., may be conveniently retained, but should not be treated as of more than sub-generic importance, at all events until the males are known. At present both sexes are known in only two or three of the S. African species of *Myzine*, and it is quite possible that some of the short-winged females may have quite ordinary males, though probably the only known male with strongly reduced neuration, *M. stigma*, Turn., will prove to have a female of the small *Pseudomeria* type.

I also append descriptions of a few species of other families recently received by the British Museum from East Africa.

Family SCOLIIDAE.

Sub-family ELIDINAE.

Key to the Species of *Braunsomeria*, Turn.

♀♀. Females.

1. Punctures coarse and often confluent longitudinally; abdomen black marked with creamy white; length 12 mm., robust . . . . *B. mutilloides*, Turn.

Smooth or finely and evenly punctured; abdomen more or less red, without white marks; slender, length about 7 mm.	2.
2. Finely and evenly punctured; ferruginous, head and abdominal segments 3–5 black	*B. perpunctata*, Turn.
Almost entirely smooth and shining .	3.
3. Head red; pronotum as broad as long .	*B. quadraticeps*, Turn.
Head black; pronotum longer than broad	*B. atriceps*, Turn.

Braunsomeria perpunctata, sp. n.

♀. Aptera, punctata, ferruginea; capite fusco-ferrugineo; segmentis dorsalibus 3–5 nigris.

Long. 7 mm.

♀. Head rectangular, a little broader than long, almost flat; mandibles not narrowed to the apex, bidentate at the apex, the teeth of about equal size, the inner tooth bent abruptly inwards. Antennae scarcely longer than the head, inserted close together, the tubercles above the base of the antennae well developed and distinctly separated. Eyes almost round and rather flat; ocelli absent, their position indicated by large punctures. Head, thorax and abdomen closely and rather finely punctured, most finely on the abdomen. Pronotum narrower than the head, longer than broad; tegulae absent; scutellum short, broadly rounded at the apex; median segment a little shorter and narrower than the pronotum, obliquely sloped posteriorly. Petiole about as long as the first joint of the posterior tarsi, first abdominal segment broadly rounded at the base beyond the petiole; second and third dorsal segments no longer than the others and slightly constricted at the base, sixth dorsal segment smooth and shining at the apex and in the middle, broadly rounded at the apex. Ventral surface shining, very sparsely and finely punctured.

Hab. Cape Colony, Willowmore (*Dr. Brauns*).

Easily distinguished from *B. quadraticeps* and *atriceps* by the close and even puncturation.

Braunsomeria mutilloides, sp. n.

♀. Nigra; thorace segmentoque mediano ferrugineis; tarsis testaceis; mandibulis flagelloque fusco-ferrugineis; segmento dorsali secundo maculis tribus magnis apicalibus; quarto fascia lata apicali utrinque emarginata, quinto macula apicali utrinque pallide flavis.

Long. 12 mm.

♀. Mandibles broad, not narrowed to the apex, bidentate, the teeth of about equal size, the inner tooth bent abruptly inwards. Clypeus very short, broadly arched; the labrum slightly exposed. Antennae longer than the head, the first joint of the flagellum concealed in the apex of the scape; interantennal prominence well developed, truncate at the apex. Head rectangular, half as broad again as long, very slightly convex, coarsely punctured, the punctures more or less confluent longitudinally; eyes large, oval; ocelli absent. Thorax and median segment coarsely punctured reticulate; tegulae very small; pronotum a little longer than broad; scutellum short, broadly rounded at the apex; median segment as long as the pronotum and a little narrower, obliquely sloped posteriorly, the sides of the segment almost smooth. Abdomen petiolate, the petiole narrow and about as long as the second joint of the posterior tarsi, the basal segment abruptly widened from the petiole and subtruncate anteriorly, more than half as wide at the base as at the apex, closely punctured, the sculpture somewhat concealed by close black pubescence; second and third segments longitudinally punctured striate, not larger than the other segments; fourth and fifth closely punctured; sixth shining and sparsely punctured, smooth in the middle and at the apex, broadly rounded at the apex. Intermediate coxae widely, posterior narrowly separated; legs short; tarsal ungues small, with one tooth near the middle.

Hab. Salisbury, Mashonaland (*G. A. K. Marshall*).

Type in Coll. Brauns.

In general appearance this curious insect resembles some of the *Mutillidae*, the pale markings of the abdomen representing the patches of pale pubescence so common in that family. Although differing much in size and sculpture from other known species of *Braunsomeria*, I do not consider the structural differences sufficient to remove it from that genus.

Key to the Ethiopian Species of *Myzine*.

♀♀. Females.

1. Stigma situated before one-fifth from the base of the forewing; second dorsal segment with a broad, white, transverse band. Wings very short . . . . *M. neavei*, Turn.

Stigma situated at or beyond one-third from the base of the forewing; second dorsal segment without a white band. Wings sometimes short, usually of normal length	2.
2. Second cubital cell absent	3.
Second cubital cell present . . .	10.
3. Third cubital cell absent, the neuration not extending beyond the stigma	*M. perniciosa*, Turn.
Third cubital cell present	4.
4. Entirely black; size 17 mm. or more, very robust	5.
More or less marked with red or ferruginous, smaller and less robust	6.
5. Forewing scarcely longer than the thorax and median segment combined, mandibles with a tooth bent sharply inwards close to the apex; apical dorsal segment aciculate	*M. infradentata*, Turn.
Forewing as long as the head, thorax and median segment combined; mandibles without a tooth bent inwards; apical dorsal segment smooth	*M. klugii*, Westw.
6. Median segment with a median sulcus or carina	7.
Median segment without a sulcus or carina	9.
7. Head and pronotum red, abdomen black; size about 15 mm.; wings of normal length	8.
Head and thorax ferruginous, abdomen ferruginous at the base with white lateral spots; size about 10 mm.; wings short . .	*M. perornata*, Turn.
8. Legs red; apical dorsal segment smooth	*M. semirufa*, Gerst.
Legs black; apical dorsal segment punctured-striate	*M. rufosplendida*, Turn.
9. Pronotum red	*M. sublevis*, Turn.

	Pronotum black	*M. limata*, Sm.
10.	Black, without any ferruginous colour	11.
	Black, with more or less ferruginous colour	12.
11.	Frontal sulcus almost obsolete; pubescence on median segment dark	*M. umbratica*, Turn.
	Frontal sulcus well defined; pubescence on median segment white	*M. inconspicua*, Turn.
12.	Pronotum red	13.
	Pronotum black	14.
13.	Head black, mesonotum red; robust.	*M. multipicta*, Turn.
	Head red, mesonotum black; slender	*M. quadrata*, Turn.
14.	Abdomen ferruginous, head black or ferruginous	*M. abdominalis*, Guér.
	Abdomen black, sometimes red at the apex; head more or less ferruginous	15.
15.	Wings fuscous, flushed with blue; median segment transversely striated on the posterior slope and on the sides of the dorsal surface, smooth only in the middle	*M. rufifrons*, Fabr.
	Wings fusco-hyaline; median segment smooth, shallowly punctured on the posterior slope .	*M. rufitarsis*, Cam.

I have not seen *Myzine* (*Meira!*) *immaculatus*, Cam., and the description is not sufficiently good to include the species in the key.

♂♂. Males.

1.	Neuration beyond the stigma obsolete, only one cubital cell . . .	*M. stigma*, Turn.
	Neuration continued beyond the stigma, three cubital cells . .	2.
2.	Cubital and discoidal nervures of forewing not continued beyond the cells	3.
	Cubital and discoidal nervures of	

forewing continued beyond the cells, almost reaching the margin.	5.
3. Basal abdominal segment nodose, longer than broad	*M. swalei*, Turn.
Basal abdominal segment not nodose, as broad as long . . .	4.
4. Antennae stout, thickened to the apex ; third cubital cell as long as the second on the radius . .	*M. braunsi*, Turn.
Antennae slender, not thickened to the apex; third cubital cell very short, not more than half as long as the second on the radius . .	*M. diffinis*, Turn.
5. Entirely black	*M. klugii*, Westw.
Abdomen and pronotum more or less banded with yellow . . .	6.
6. The yellow bands on the abdomen emarginate or interrupted on each side	7.
The yellow bands on the abdomen entire, not emarginate or interrupted laterally	16.
7. Basal abdominal segment at least red	8.
Basal abdominal segment black .	10.
8. Basal abdominal segment only red .	*M. rufinodis*, Turn.
Two basal abdominal segments red.	9.
9. Yellow abdominal bands emarginate laterally; median segment smooth posteriorly	*M. rufonigra*, Bingh.
Yellow abdominal bands interrupted laterally; median segment punctured-rugose throughout . . .	*M. consanguinea*, Turn.
10. Posterior margin of the pronotum without a yellow band . . .	*M. kristenseni*, Turn.
Posterior margin of the pronotum with a yellow band	11.
11. Anterior margin of the pronotum without a yellow band ; basal abdominal segment globular. .	*M. constrictiventris*, Turn
Anterior and posterior margins of the pronotum, both banded with yellow; basal abdominal segment not globular.	12.

12. Second recurrent nervure interstitial with the second transverse cubital nervure . . . . *M. basutorum*, Turn.
    Second recurrent nervure received by the third cubital cell . . . 13.
13. Basal abdominal segment tuberculate at the apex beneath; apical abdominal segment red except at the base . . . . *M. capicola*, Turn.
    Basal abdominal segment not tuberculate beneath; apical segment black, sometimes marked with yellow . . . . 14.
14. Apical segment wholly black; abdominal bands interrupted laterally . . . . *M. interrupta*, Cam.
    Apical segment with a yellow spot on each side; abdominal bands emarginate laterally . . . . . 15.
15. Pronotum shallowly emarginate anteriorly; emargination of the apical dorsal segment broader at the apex than deep . . . . . *M. abdominalis*, Guér. (= *M. continua*, Cam.).
    Anterior margin of pronotum straight; emargination of the apical dorsal segment as deep as the apical breadth . . . . . *M. rufifrons*, Fabr.
16. The apical processes of the seventh dorsal segment broadly truncate at the apex . . . . *M. semirufa*, Gerst.
    The apical processes not truncate . 17.
17. Pronotum as long as the mesonotum, distinctly narrowed anteriorly . . . . *M. politissima*, Turn.
    Pronotum much shorter than the mesonotum, not distinctly narrowed anteriorly . . . . . . 18.
18. Abdomen very closely and finely punctured, subopaque and strongly pubescent, with slight blue gloss. *M. meruensis*, Cam.
    Abdomen rather sparsely and less finely punctured, without blue gloss . . . . *M. impetuosus*, Turn.

The following males are not described with sufficient accuracy to enable me to identify them.

1. *Myzine haemorrhoidalis*, Guér.

Myzine haemorrhoidalis, Guér., Dict. Pitt. Hist. Nat., V, p. 581 (1837), ♂.
Myzine capensis, Sm., Cat. Hym. B. M., III, p. 74 (1855), ♂.

"Tête, antennes et corselet noirs, ponctués et velus, abdomen plus étroit à la base, noir, à l'extremité rouge ; deux petites stries au premier segment et une bande aux quatres autres jaunes, ailes incolorés, pattes fauves.

"Long. 12 mm. Du Cap de Bonne Esperance."

2. *Myzine servillei*, Guér.

Myzine servillei, Guér., Dict. Pitt. Hist. Nat., V, p. 582 (1837), ♂.

"Tête et antennes noires, sans taches. Thorax noir avec deux petites stries jaunes interrompues sur le prothorax. Ailes transparentes, incolorés ; pattes fauves avec les cuisses noires ; abdomen noir avec le bord fauve ; le premier segment ayant une bande et les autres trois taches postérieures jaunes. Dessous sans taches avec le bord postérieur des segments brunâtre.

"Long. 16 mm. Du Cap."

3. *Myzine pacificatrix*, Cam.

Plesia pacificatrix, Cam., Ann. Transvaal Museum, II, p. 118 (1910), ♂.

4. *Myzine transvaalensis*, Cam.

Plesia transvaalensis, Cam., Ann. Transvaal Museum, II, p. 119 (1910), ♂.

Myzine (*Pseudomeria*) *neavei*, Turn.

Myzine (*Pseudomeria*) *neavei*, Turn., Ann. and Mag. Nat. Hist. (8), VIII, p. 614 (1911), ♀.

This is the only Ethiopian species known to me in which the stigma is as near to the base of the wings as in *M.* (*Pseudomeria*) *graeca*, Saund. But so many intermediate forms occur between this and the ordinary species with wings fitted for flight that I do not think that any satisfactory distinction can be drawn from this character. In *M. infradentata*, Turn., and *M. perornata*, Turn., the wings are too short to be used for flight, also in *M. perniciosa*, Turn., in which the third cubital cell is absent.

Myzine perniciosa, sp. n.

♀. Nigra, nitida; pronoto rufo; mandibulis, antennis tarsisque fusco-testaceis; alis subhyalinis, brevissimis, thorace brevioribus, cellulis cubitalibus secundo tertioque obliteratis.

Long. 5 mm.

♀. Mandibles with a blunt tooth on the inner margin before the apex. Head slightly convex, a little broader than long, slightly rounded at both the anterior and posterior angles, smooth and shining; eyes elongate ovate; ocelli very small, situated in a triangle on the vertex; the posterior margin of the head with a fringe of short whitish hairs; interantennal prominence bilobed. Thorax narrower than the head, smooth and shining, pleurae very minutely punctured; pronotum longer than broad, slightly narrowed and rounded anteriorly; scutellum narrowly truncate at the apex, longer than the mesonotum. Median segment a little longer than the scutellum, smooth, subopaque, the sides microscopically striated, steeply sloped posteriorly. Abdomen smooth and shining, the petiole as long as the second joint of the posterior tarsi, the apical segment narrowly rounded at the apex. Sting when exserted nearly as long as the abdomen. Wings very short, the forewings no longer than the thorax without the median segment; the stigma situated at about two-fifths from the base of the wing, the neuration beyond the stigma absent, so that the second and third cubital and second discoidal cells are missing.

Hab. Cape Colony, Algoa Bay (*Dr. Brauns*), January.

Myzine perornata, Turn.

Myzine (*Pseudomeria*) *perornata*, Turn., Ann. and Mag. Nat. Hist. (8), I, p. 499 (1908), ♂.

Hab. Orange Free State, Dewetsdorp (*Dr. Brauns*). The type is from Piet Retief.

Myzine infradentata, sp. n.

♀. Nigra, politissima; segmento mediano opaco, crasse punctato; mesopleuris rugosis; alis fusco-cyaneis, brevissimis; mandibulis apice bidentatis, apice subtus dente verticali instructis.

Long. 17 mm.

♀. Mandibles rather stout, bidentate at the apex, the inner tooth short and blunt; a strong tooth on the outer side of the mandibles and at right angles to them originating from the base of the outer tooth. Palpi fairly stout, maxillary palpi six jointed, labial palpi four jointed. Head rectangular, more than half as broad again as long, shining, with a few scattered punctures; the eyes elongate ovate, touching the base of the mandibles, ocelli in a broad triangle on the vertex; the frontal tubercles above the base of the antennae well developed, separated by a shallow, short, longitudinal sulcus. Antennae twelve jointed, the first joint of the flagellum almost concealed in the apex of the scape. Thorax smooth and shining, mesopleurae rugose, propleurae punctured-rugose; pronotum fully half as broad again as long, narrower than the head; mesonotum scarcely as long as the scutellum. Median segment scarcely longer than the scutellum, subopaque, closely and coarsely punctured; the posterior slope steep, smooth at the base, coarsely punctured at the apex. Abdomen smooth and shining, sixth dorsal segment finely aciculate, rounded at the apex. Wings short, the costa of the fore-wing about equal in length to the thorax and median segment combined, the stigma situated at one-third from the base.

Hab. ORANGE FREE STATE, Bothaville (*Dr. Brauns*), October.

This fine species may be easily distinguished by the structure of the mandibles. Superficially it resembles *Myzine klugii*, Westw., but in that species the wings are very much longer and less brilliant. The large third cubital cell is present in this species as in typical *Myzine*, but the nervures are rather ill defined; the second cubital cell is absent.

Myzine klugii, Westw.

Meria klugii, Westw., Proc. Zool. Soc. London, III, p. 53 (1835), ♀.

Myzine nigrita, Turn., Trans. Ent. Soc. London, p. 391 (1910), ♂.

According to Dr. Brauns these are sexes of one species, appearing early in September before other species of the group.

Myzine rufosplendida, sp. n.

♀. Nigra, nigro-pubescens, nitida, sparse punctata; fronte, vertice pronotoque antice late rufis; alio fusco-caeruleis; segmento mediano dense punctato; pygidio tenuiter punctato-striato; tibiis tarsisque anticis fusco-ferrugineis.

Long. 16 mm.

♀. Mandibles stout, simple, without teeth. Head subrectangular, about half as broad again as long, shining and almost smooth, the clypeus and the space between the eyes and the base of the antennae closely punctured; the prominences above the base of the antennae well developed, a short, shallow, longitudinal sulcus on the front. Pronotum more than half as long again as broad, smooth and shining, the pleurae sparsely punctured; mesonotum and scutellum smooth and shining; median segment coarsely and closely punctured, with a short carina from the base, the posterior slope almost smooth in the middle. Petiole as long as the penultimate joint of the posterior tarsi; abdomen smooth and shining, the apical dorsal segment finely longitudinally punctured striate. The neuration is not quite as in normal *Myzine*, the usual petiolate second cubital cell being absent, owing to the loss of the second transverse cubital nervure. Beyond the stigma the forewing is brightly glossed with blue; the base of the forewing and the hindwing are more feebly glossed with purple.

Hab. ORANGE FREE STATE, Bothaville (*Dr. Brauns*), January.

Myzine multipicta, sp. n.

♀. Nigra, nitida, nigro-pubescens; pronoto, mesonoto, propleurisque rufo-ferrugineis; segmentis dorsalibus 2–5 macula magna transversa utrinque, segmentis primo quintoque macula parva laterali utrinque albido-flavis; alis fusco-hyalinis, venis nigris.

Long. 12 mm.

♀. Mandibles stout, without teeth; clypeus transverse at the apex. Interantennal prominence well developed and strongly bilobed; antennae not very stout, the third joint of the flagellum distinctly longer than the second, the first concealed. Head subrectangular, distinctly broader than long, smooth and shining, the cheeks as broad as the eyes, ocelli in a wide triangle, the posterior pair at least as far from the posterior margin of the head as from each other. Thorax smooth, a few large punctures on the scutellum and pleurae; pronotum twice as broad as long, narrower than the head. Median segment smooth and shining, steeply sloped posteriorly, with a sulcus from the base to the apex, the sides and extreme apex of the segment striated. Abdomen smooth and shining, with a few scattered punctures on the ventral surface; apical dorsal segment broadly rounded. Wings large, reaching to the fifth dorsal segment, the costa of the forewing fully half as long again as the thorax and median segment combined; second cubital cell present, triangular, petiolate; stigma situated just before the middle of the costa.

Hab. CAPE COLONY, Willowmore (*Dr. Brauns*).

Allied to *erythrocephala*, Fabr., but differs in the greater length of the head; the colour of the pubescence, also of the head and thorax; the more arched slope of the median segment and the sparser puncturation.

Myzine limata, Sm.

♀. Nigra, nitida, albido-pilosa; mandibulis basi antennisque fusco-ferrugineis; abdomine pallide ferrugineo, segmentis secundo tertioque macula parva albida utrinque; pedibus fuscis, tarsis testaceis; alis hyalinis, venis tegulisque testaceis; cellula cubitali secunda obliterata.

Long. 4–5 mm.

♀. Mandibles without teeth, acute at the apex; head rather small, about one quarter broader than long, slightly rounded at the angles, scarcely convex, smooth and shining, the cheeks no broader than the eyes. Antennae not slender, the third joint of the flagellum no longer than the second. Thorax shining, very sparsely punctured; pronotum a little broader than long, slightly narrowed anteriorly, the posterior margin broadly smooth. Median segment smooth and shining, with a few long hairs springing from punctures on the lateral margins, the sides of the segment smooth and shining, the dorsal surface slightly convex and without a sulcus. Abdomen shining, very sparsely punctured, segments 2–5 with a raised curved mark on each side at the base. Wings much longer than the thorax and median segment combined; the second cubital absent owing to the loss of the second transverse cubital nervure; the stigma not very large, situated at about two-fifths from the base of the wing.

Hab. ALGOA BAY (*Dr. Brauns*), November; Caia, Zambesi River (*Dr. Swale*), July.

A variety has the segments of the abdomen clouded with black in the middle.

Myzine inconspicua, sp. n.

♀. Nigra, albopilosa, nitida; segmentis dorsalibus secundo tertioque macula albida utrinque; mandibulis tarsisque brunneo-errugineis; calcaribus albidis; alis pallide fusco-hyalinis.

Long. 6 mm.

♀. Mandibles with a very small tooth on the inner margin near the apex. Head a little broader than long, rounded at the angles, smooth and shining, with a distinct frontal sulcus and a few large punctures near the eyes; the tubercles at the base of the antennae moderately developed, the third joint of the flagellum very little longer than the second. Thorax smooth and shining, the pronotum nearly twice as broad as long, rather closely punctured on the anterior margin, pleurae sparsely punctured. Median segment shining, sparsely and finely punctured, with a shallow median sulcus, the sides of the segment shining and microscopically striated. Abdomen shining, with a few minute punctures. Wings a little longer than the head, thorax and median segment combined; second cubital cell very small, only half as high as its petiole, stigma situated just before the middle of the costa.

Hab. Cape Colony, Port Elisabeth (*Dr. Brauns*), March.

Near *M. umbratica*, Turn., but differs in the reduced size of the second cubital cell, in the colour of the pubescence, in the distinct frontal sulcus, and in the different sculpture of the pronotum and median segment.

Myzine quadrata, sp. n.

♀. Nigra, nitida, nigro-pilosa; capite, prothorace tegulisque rufis; segmentis abdominalibus 2–4 macula laterali utrinque albida; pedibus fuscis, tarsis rufo-testaceis; alis fusco-hyalinis; venis nigris, basi fusco-testaceis.

Long. 10 mm.

♀. Mandibles without teeth; head subquadrate, slightly rounded at the posterior angles, a little broader than long, smooth and shining, the posterior ocelli as far from the posterior margin of the head as from each other, the tubercles at the base of the antennae moderately developed, the third joint of the flagellum scarcely longer than the second. Thorax very sparsely punctured, the pronotum a little broader than long, pleurae sparsely punctured; median segment smooth and shining, longer than the scutellum and postscutellum combined, obliquely sloped posteriorly, the dorsal surface with a well-marked median sulcus, the surface of the posterior slope subopaque and not quite smooth, a few very fine and indistinct striae on the sides of the segment. Abdomen smooth and shining. Second cubital cell present, the stigma situated a little before the middle of the costa, the forewing about as long as the head, thorax and median segment combined.

Hab. Cape Colony, Willowmore (*Dr. Brauns*), January.

Myzine rufifrons, Fabr.

Larra rufifrons, Fabr., Ent. Syst., II, p. 222 (1793), ♀.

Myzine (*Meira*) (*sic!*) *violaceipennis*, Cam., Rec. Albany Mus., I, p. 301 (1904), ♀.

Myzine (*Meira*) (*sic!*) *erythrostomus*, Cam., Ann. Transv. Mus., II, p. 117 (1910), ♀.

♂. Niger, albopilosus; mandibulis basi, clypeo, pronoto marginibus, segmentis ventralibus 2–6 fasciis apicalibus late emarginatis, dorsalibus 1–6 fasciis apicalibus bisinuatis; septimo macula magna utrinque, femoribus apice, tibiis tarsisque flavis; alis hyalinis, venis nigris, stigmate testaceo.

Long. 19–21 mm.

♂. Clypeus narrowly and shallowly emarginate at the apex. Antennae shorter than the head, thorax and median segment combined, of even thickness throughout. Eyes widely and not very deeply emarginate. The whole insect closely and not very finely punctured. Pronotum shorter than the mesonotum, the anterior margin straight. First dorsal segment more than twice as broad as long, rounded anteriorly, not globular; the other segments slightly constricted at the base, the yellow apical bands less strongly punctured than the base. Incision of the seventh dorsal segment triangular, about as deep as the breadth at the apex. Second and third abscissae of the radius about equal in length, the fourth much longer; position of the second recurrent nervure rather variable, sometimes almost interstitial with the second transverse cubital nervure, sometimes received as far as one-quarter from the base of the third cubital cell.

Hab. S. Africa, as far north as Salisbury.

The males in the British Museum are from Johannesburg and Salisbury. They are very near *M. abdominalis*, Guér. (= *continua*, Cam.), but the incision of the apical segment is a little deeper and the anterior margin of the pronotum is straight.

Although the sexes have not been taken in copulâ, I think there can be little doubt that they belong to one species. In females from Willowmore the usual red colour of the head is considerably obscured. In *M. abdominalis*, Guér., ♀, the colour of the head varies from black to ferruginous red.

Myzine capicola, sp. n.

♂. Niger, robustus, albopilosus; pronoto linea utrinque margine anteriore, fascia angusta margine posteriore, tegulis macula, segmento dorsali primo macula apicali utrinque, segmentisque 2–6 maculis tribus transversis apicalibus flavis; segmento dorsali septimo apice lateribusque late rufo; mandibus fusco-ferrugineis; tibiis tarsisque rufo-testaceis, flavo-variegatis; alis hyalinis, venis nigris, stigmate fusco-testaceo.

Long. 18 mm.

♂. Clypeus widely and shallowly emarginate at the apex, closely punctured. Antennae stout, of even thickness throughout, a little longer than the head, thorax and median segment combined. Eyes widely and very shallowly emarginate on the inner margin. The whole insect closely and not very finely punctured, more coarsely on the front than elsewhere. Pronotum shorter than the mesonotum, not much narrowed anteriorly, the anterior margin emarginate, the posterior margin widely arched. Median segment steeply sloped posteriorly. First abdominal segment broad, obliquely sloped anteriorly to the petiole, the surface of the slope slightly concave. First ventral segment with a distinct tubercle beneath at the base of the oblique apical truncation. Abdomen broad, the segments strongly depressed at the base; seventh dorsal segment flattened on the apical portion, the incision as deep as its apical breadth, the lateral processes pointed. Second abscissa of the radius long, a little longer than the third; second recurrent nervure received at about one-eighth from the base of the third cubital cell.

Hab. Cape of Good Hope.

Type in B. M.

This fine species may be distinguished by the tubercles on the first ventral segment, the black clypeus, the red apical segment and the short first dorsal segment with the slightly concave anterior slope. The colour somewhat resembles *M. haemorrhoidalis*, Guér., but the description does not altogether agree.

Myzine kristenseni, sp. n.

♂. Niger, sparse albopilosus; mandibulis basi, pronoto macula utrinque margine anteriore, tegulis basi, segmentis dorsalibus 2–6 maculis tribus transversis apicalibus, tarsisque flavis; antennis fuscis; alis hyalinis, venis nigris, stigmate fusco.

Long. 7 mm.

♂. Clypeus narrowly and very shallowly emarginate at the apex, closely punctured. Antennae stout, a little thickened towards the apex, the third joint of the flagellum longer than the second. Eyes widely, but very shallowly, emarginate. The whole insect closely and rather deeply punctured, rather more sparsely on the abdomen than elsewhere. Pronotum not narrowed anteriorly, shorter than the mesonotum, the anterior margin straight. Median segment short, very steeply sloped posteriorly, the dorsal surface marked with a shallow longitudinal groove. First dorsal segment short and broad, obliquely sloped anteriorly to the petiole. Abdominal segments distinctly constricted at the base; the incision of the apical segment much broader at the apex than deep, the lateral processes short and pointed. Third cubital cell small, less than half as long as the second both on the radius and on the cubitus; second recurrent nervure received at the middle of the third cubital cell.

Hab. S. ABYSSINIA, Harar (*G. Kristensen*).
Type in B. M.

Myzine consanguinea, sp. n.

♂. Niger, gracilis, albopilosus; mandibulis basi, clypeo, pronoto margine anteriore fascia late interrupta, margine posteriore fascia arcuata, tegulis, segmento dorsali primo macula parva apicali, segmentis 2–5 maculis tribus transversis apicalibus, sexto fascia bisinuata apicali, segmentis ventralibus 2–5 macula parva angulis apicalibus, femoribus apice, tibiis anticis intermediisque extus tarsisque pallide flavis; segmentis abdominalibus primo secundoque rufis; alis hyalinis, venis nigris, stigmate testaceo.

Long. 9 mm.

♂. Clypeus shallowly emarginate at the apex; antennae stout, of even thickness throughout, as long as the head, thorax and median segment combined. Eyes widely and rather shallowly emarginate on the inner margin; the frontal prominence between the antennae shallowly emarginate. Head, thorax and median segment closely and rather finely punctured; pronotum a little shorter than the median segment, slightly narrowed anteriorly, the anterior margin straight, the posterior margin widely but not deeply emarginate. Median segment rounded, the dorsal surface slightly convex. First abdominal segment subglobular, slightly constricted at the apex, the portion beyond the short petiole broader than long. All the segments shining and rather sparsely punctured. Incision of the seventh dorsal segment triangular, a little wider at the apex than deep, the lateral processes narrowly rounded at the apex. Second abscissa of the radius a little longer than the third, second recurrent nervure received just before one quarter from the base of the third cubital cell.

Hab. ZAMBESI, Caia (*Dr. Swale*), August.

Type in B. M.

In colour this approaches *M. rufonigra*, Bingh., but is a smaller and much less robust species.

Myzine basutorum, sp. n.

♂. Niger, gracilis, albopilosus; mandibulis basi, clypeo, pronoto margine anteriore fascia anguste interrupta, margine posteriore fascia arcuata, tegulis, mesopleuris macula magna subtriangulari antice, segmentis dorsalibus 1–6 fasciis apicalibus profunde bisinuatis, septimo macula magna utrinque, segmentis ventralibus 2–6 fasciis apicalibus bisinuatis, femoribus subtus, tibiis tarsisque pallide flavis; alis hyalinis, venis nigris, stigmate testaceo.

Long. 13 mm.

♂. Clypeus short and broad, widely and shallowly emarginate at the apex; antennae stout, of even thickness throughout, a little shorter than the head, thorax and median segment combined. Eyes broadly and not very deeply emarginate. Head, throrax and median segment very closely punctured and rather thickly clothed with long white pubescence. Pronotum shorter than the mesonotum, scarcely narrowed anteriorly, the anterior margin widely emarginate, the posterior margin broadly arched. Median segment steeply sloped posteriorly, the dorsal surface slightly convex. First abdominal segment beyond the petiole nearly twice as broad as long, not swollen or constricted at the apex. Abdomen finely and not very closely punctured, slender, the incision of the seventh dorsal segment as deep as the apical breadth. Third abscissa of the radius longer than the second; second recurrent nervure interstitial with the second transverse cubital nervure, which is strongly curved inwards near the radius.

Hab. BASUTOLAND (*R. Crawshay*). Three males.

Type in B. M.

Myzine impetuosus, sp. n.

♂. Niger, albopilosus; mandibulis, clypeo, pronoto marginibus, anteriore anguste interrupto, tegulis, mesopleuris macula magna triangulari antice, segmentis dorsalibus 1–6 fasciis apicalibus lateribus dilatatis, septimo macula magna utrinque, ventralibus 3–5 fasciis latis, secundo sextoque fasciis bisinuatis, femoribus apice, tibiis tarsisque flavis.

Long. 13 mm.

♂. Clypeus very shallowly emarginate at the apex. Antennae stout, of even thickness throughout, as long as the head, thorax and median segment combined. Eyes rather strongly emarginate. Pronotum short, the anterior margin straight. Head, thorax and median segment closely punctured and rather closely clothed with long greyish white pubescence. Abdomen shining and very sparsely punctured, thinly clothed with white pubescence; the first segment about three times as broad as long on the dorsal surface, somewhat rounded anteriorly; the other segments very slightly constricted at the base; the incision of the seventh dorsal segment as deep as the apical breadth, the lateral processes rounded at the apex. Second abcissa of the radius a little shorter than the third, second recurrent nervure received at about one-sixth from the base of the third cubital cell.

Hab. British East Africa, foot of Kikuyu Escarpment, near Naivasha, 7,300 ft. (*S. A. Neave*), March.

Type in B. M. Described from two specimens.

Elis (*Mesa*) *donaldsoni*, Fox.

Cosila donaldsoni, Fox, Proc. Acad. Philadelphia, p. 549 (1896), ♀.

Elis aliciae, Turn., Proc. Zool. Soc. London, p. 704 (1912), ♀.

From information received from Prof. Fernald of Massachusetts, I have no doubt that Fox was quite mistaken in placing his species in *Cosila*. As noticed in my remarks on the species in my paper quoted above, the description agrees well with *Elis aliciae*, which must sink as a synonym. Fox was probably not acquainted with any of the Old World species of *Elis*.

Elis (*Mesa*) *coeruleipennis*, sp. n.

♀. Nigra, albopilosa, crasse punctata; alis fuscis caeruleo-tinctis. Long. 14 mm.

♀. Clypeus short, finely punctured, with a low carina from the base not reaching the apex. Head deeply, but not very closely, punctured, the space round the ocelli shining and very sparsely punctured. Scape sparsely punctured, flagellum clothed with very fine greyish pubescence. Thorax deeply, but rather sparsely punctured; median segment scabrous, with a distinct median groove the edges of which are raised into distinct carinae, the apex of the segment margined, the surface of the posterior truncation coarsely punctured, the sides of the segment finely striated. Abdomen shining, rather closely punctured, more finely at the base of the segments than at the apex, the sixth dorsal segment finely longitudinally striated. Basal joint of the posterior tarsi with a scopa of white hair beneath. Third abscissa of the radius about twice as long as the second; first recurrent nervure received just beyond the middle of the second cubital cell, second just beyond the middle of the third cubital cell.

Hab. UGANDA PROTECTORATE, between Kumi and N. E. shore of Lake Kioga, 3,400–3,600 ft. (*S. A. Neave*), August. Type in B. M.

Nearly allied to *xanthocera*, Gerst., from which it differs in the colour of the antennae, the rather more sparse puncturation and the finer puncturation of the abdomen.

Elis (*Mesa*) *nyanzae*, sp. n.

♂. Niger, gracilis, albopilosus; tibiis anticis extus, tarsis anticis, tegulis basi, segmentisque dorsalibus 2–5 fasciis angustis apicalibus late bisinuatis pallide flavis; alis hyalinis, venis nigris.

Long. 17 mm.

♂. Clypeus and front clothed with long silvery pubescence. Front rugosely punctured, vertex coarsely punctured, a deep transverse sulcus above the posterior ocelli. Eyes very widely and shallowly emarginate. Antennae longer than the head, thorax and median segment combined, the apical joints a little more slender than the basal. Pronotum a little shorter than the mesonotum, the anterior margin straight and slightly raised, rather finely and closely punctured. Mesonotum and scutellum more coarsely punctured than the pronotum; median segment punctured-rugose. Scutellum with an obscure median carina. Abdomen slender; first abdominal segment about twice as long as the second, the petiole with a median groove occupying the basal third of the segment, which is considerably swollen on the apical portion, but not nodose or strongly constricted at the apex. The whole abdomen closely and finely punctured; second segment about one-third longer than the third, as broad at the apex as long, narrowed to the base. Seventh dorsal segment with a distinct elongate oval pygidial area, very shallowly emarginate at the apex. Third abscissa of the radius longer than the second, more than twice as long as the fourth; second recurrent nervure received just beyond one-quarter from the base of the third cubital cell.

Hab. EAST VICTORIA NYANZA, Lusinga Island (*S. A. Neave*), April 25, 1911.

Type in B. M.

Allied to *ametalla*, Turn., and *asmarensis*, Turn., but the first abdominal segment is distinctly shorter and more robust. In *ametalla* there is no distinct pygidial area, and in *asmarensis* it is less clearly defined and marked with a very strong longitudinal carina.

Sub-family TIPHIINAE.

Tiphia tegularis, sp. n.

♀. Nigra, robusta, crasse sed haud dense punctata; antennis dimidio basali fulvo-brunneis; alis fusco-caeruleis; tegulis maximis, elongatis; segmento mediano brevi; segmento dorsali primo basi carinato.

♂. Feminae simillimus.

Long. ♀, 15 mm.; ♂, 13 mm.

♀. Mandibles with a very ill-defined blunt tooth on the inner margin near the apex. Clypeus short, sparsely punctured, narrowly and shallowly emarginate at the apex. Antennae very stout, not strongly curved, the three basal joints of the flagellum broader than long, the scape short and stout, the apical joint of the flagellum elongate conical, almost pointed, longer than the penultimate. Head and thorax shining, coarsely but not very closely punctured; the posterior margin of the pronotum narrowly smooth; dorsulum very sparsely punctured. Tegulae large and long, reaching beyond the middle of the scutellum, the base smooth and shining, the apex subopaque and punctured. Median segment more than twice as broad as long, scarcely longer than the scutellum, opaque, the three carinae in the middle strongly marked, the middle one not reaching the apex, the outer ones nearly parallel, a little further apart in the middle than at the extremities, the sides and apex of the segment distinctly margined, the sides of the segment finely striated. Abdomen strongly but not closely punctured; the first segment broadly truncated at the base, with a strong, transverse, basal carina; second segment with a broad, transverse, longitudinally striated groove at the base; sixth dorsal segment closely punctured at the base, the punctures more or less confluent longitudinally, smooth and broadly rounded at the apex; second ventral segment very sparsely punctured. Spur of posterior tibia half as long as the basal joint of the posterior tarsus. Second recurrent nervure received just before two-thirds from the base of the second cubital cell. The tarsal ungues are bifid and also have a blunt lobe near the base. The posterior margin of the pronotum is broadly and almost regularly arched, but rather more deeply indented in the middle.

♂. The four apical joints of the antennae only are black; the abdomen is more closely punctured than in the female; the two outer carinae on the median segment converge a little towards the apex. The radial cell does not extend beyond the second cubital cell and is obliquely truncate at the apex.

Hab. TRANSVAAL, Lichtenberg (*Dr. Brauns*), January. Near *scabrosa*, Gerst., but is much less densely punctured.

Tiphia incrassata, sp. n.

♀. Nigra, albopilosa, punctata; mandibulis fuscis; antennis fusco-ferrugineis; alis fuscis, obscure caerulescentibus; segmentis abdominalibus albofimbriatis.

Long. 11–12 mm.

♀. Clypeus widely and shallowly emarginate at the apex. Head and mesopleurae closely and coarsely punctured. Pronotum rather closely punctured, broadly smooth and shining posteriorly, the arch of the posterior margin almost transverse in the middle; mesonotum and scutellum sparsely punctured. Median segment short, nearly twice as broad as long, widely and shallowly emarginate at the apex, the sides and apex distinctly margined, subopaque, finely and indistinctly punctured, with the usual three longitudinal carinae, the middle one not quite reaching the apex, the outer two strongly convergent towards the apex, almost twice as far from each other at the base as at the apex, the sides of the segment closely striated, the surface of the posterior truncation finely shagreened and slightly concave. Abdomen shining, rather sparsely punctured on the two basal segments, more closely on the others; the basal segment short, truncate at the base and with a distinct transverse carina; the apical dorsal segment irregularly longitudinally striated, broadly rounded and testaceous at the apex. Spur of the hind tibia fuscous, sharply pointed, and nearly as long as the basal joint of the hind tarsus. The tegulae are long, reaching beyond the middle of the scutellum, smooth at the base, finely punctured at the apex. Second recurrent nervure received just before two-thirds from the base of the second cubital cell; second transverse cubital nervure with a double curve.

Hab. TRANSVAAL, Johannesburg (*Kobrow*). In coll. Brauns.

Tiphia montivaga, sp. n.

♀. Nigra; antennis mandibulisque fusco-ferrugineis; femoribus, tibiis tarsisque laete ferrugineis; alis fusco-hyalinis, venis fuscis.

Long. 13–14 mm.

♀. Clypeus broadly rounded at the apex, punctured at the base, the apical margin narrowly smooth. Apical joint of the flagellum no longer than the penultimate. Head finely and sparsely punctured, more closely on the front than on the vertex. Pronotum very sparsely punctured, shining, broadly smooth posteriorly, the arch of the posteriorly margin almost transverse on the median portion ; propleurae smooth and shining. Mesonotum and scutellum shining, very sparsely punctured, mesopleurae finely and more closely punctured. Median segment less than twice as broad as long, shining, very shallowly and sparsely punctured, the three longitudinal carinae parallel and rather low, the two outer ones separated by a distance equal to about two-fifths of their length ; the sides of the segment shining and indistinctly striated. Abdomen shallowly and sparsely punctured ; the fourth and fifth segments more closely punctured ; the basal segment broadly rounded at the base, without a carina ; the second segment transversely depressed at the base ; pygidium punctured rugose on the basal half, ferruginous and very minutely punctured at the apex. Second recurrent nervure received at about three-fifths from the base of the second cubital cell. Tegulae large, longer than broad, smooth and shining.

Hab. UGANDA PROTECTORATE, Mt. Kokanjaro, S.W. of Mt. Elgon 6,400 ft. (*S. A. Neave*), August 7–9.

Type in B. M. 4 ♀♀.

Allied to *T. massaica*, Cam., in the sparse puncturation, but in that species the wings are hyaline and very iridescent, with black nervures and the details of the sculpture are different.

Sub-family ANTHOBOSCINAE.

Anthobosca rufocaudata, sp. n.

♀. Nigra, albopilosa, punctata ; mandibulis fusco-ferrugineis ; segmentis dorsalibus quinto sextoque, ventralibus quarto, quinto sextoque rufo-ferrugineis ; calcaribus albis ; alis hyalinis, venis nigris ; cellula radiali apice subacuta.

♂. Niger, albopilosus ; mandibulis basi, clypeo, margine interiore oculorum anguste, pronoto margine posteriore, tegulisque pallide flavis ; pedibus nigris, flavo-variegatis ; alis hyalinis, iridescentibus, venis nigris ; clypeo apice acute bidentato ; unguiculis bifidis.

Long. ♀, 6–8 mm. ; ♂, 7–8 mm.

♀. Clypeus short, with a low median carina, the apical margin depressed. Head rather sparsely punctured, more deeply on the front than on the vertex. Thorax rather sparsely punctured, median segment very finely and closely punctured. Abdomen minutely punctured, seventh dorsal segment finely aciculate, smooth and broadly rounded at the apex. Sides of the median segment smooth. Apical half of the posterior femora broadly rounded beneath; basal joint of posterior tarsi with a comb of about ten short bristle-like spines beneath. Tarsal ungues bifid. Radial cell subacute at the apex, no longer on the costa than the large stigma; third abscissa of the radius longer than the first and second combined; first recurrent nervure received a little beyond the middle of the second cubital cell, second at the middle of the third cubital cell, which is longer on the radius than on the cubitus.

♂. Mandibles bidentate at the apex, the inner tooth shorter than the outer. Clypeus with two strong black teeth at the apex. Antennae stout, of almost even thickness throughout, shorter than the thorax and median segment combined. Head finely punctured; thorax very finely and closely punctured; abdomen finely shagreened. Posterior tibiae with five spines on the outer margin; tarsal ungues bifid. Third abscissa of the radius longer than the first and second combined, third cubital cell longer on the radius than on the cubitus; recurrent nervures as in the female. First abdominal segment nearly half as long again as the second. Hypopygium rather narrowly linguiform.

Hab. CAPE COLONY, Willowmore (*Dr. Brauns*), September and October.

The female is the type.

The male resembles the species for which Cameron formed the genus *Odontothynnus*. I have no doubt, however, that he is mistaken in the statement that the ungues of the hind tarsi are simple. In colour the female resembles "*Plesia*" *melanaria*, Cam., which will probably prove to be the female of one of the males described by him under *Odontothynnus*.

Anthobosca natalica, Turn.

Anthobosca natalica, Turn., Trans. Ent. Soc. London, p. 85 (1908), ♀.

This species also occurs at Willowmore, Cape Colony, in January.

Sub-family SCOLIINAE.

Scolia (*Trielis*) *braunsi*, sp. n.

♀. Nigra, cinereo-pilosa; mandibulis basi, flagello, tibiis subtus tarsisque fusco-ferrugineis, alis fuscis, venis nigris; segmentis abdominalibus nigro-ciliatis.

Long. 17 mm.

♀. Clypeus short, very broadly rounded at the apex, punctured at the sides, the middle raised and flattened, marked with three very strong longitudinal carinae, with one or two lower carinae between them. Head sparsely punctured, antennae inserted almost as far from each other as from the eyes ; the frontal prominence between them very broadly triangular, bounded laterally by well-marked carinae, at the base by a smooth transverse groove which almost reaches the eyes. Vertex very sparsely punctured, a large smooth space round the anterior ocellus. Pronotum closely and rather coarsely punctured, mesonotum and scutellum sparsely punctured ; median segment closely and coarsely punctured, the surface of the posterior truncation smooth. Pubescence black on the dorsal surface of the thorax and abdomen, more or less cinereous on the sides, very sparse. Abdomen finely and rather sparsely punctured, the dorsal segments with sparse ciliae of black hairs at the apex ; the sixth dorsal segment broadly rounded at the apex, coarsely punctured and clothed with short *fulvous setae.* Ciliae of the ventral segments sparse and whitish. Third cubital cell pointed on the cubital nervure, the length on the radial nervure equal to nearly two-thirds of the length of the second transverse cubital nervure. Radial cell extending beyond the third cubital cell. Spines of the hind tibiae pointed.

Hab. CAPE COLONY, Willowmore (*Dr. Brauns*), December.

Allied to *Scolia* (*Trielis*) *punctum*, Sauss., but differs much in the colour of the wings and pubescence, and in the less closely striated clypeus. It differs from *techowi*, Turn., in the same points of colour, also in the sculpture of the median segment and sixth dorsal segment.

Scolia (*Dielis*) *clotho*, Sauss.

Elis (*Campsomeris*) *clotho*, Sauss., Stett. Ent. Zeit., XX, p. 263 (1859), ♀.

Dielis masaica, Cam., Sjöstedt's Kilimandjaro-Meru Exp., II, p. 229 (1910), ♀.

In Cameron's type the wings are somewhat paler than is usual, but it is undoubtedly identical.

Scolia (*Dielis*) *coelebs*, Sich.

Elis (*Dielis*) *coelebs*, Sich., Cat. Spec. gen. Scolia, p. 184 (1864), ♀.

Dielis erionotus, Cam., Trans. S. Afric. Phil Soc., XV, p. 211, ♂.

Family POMPILIDAE.

Cyphononyx basalis, Sm.

Pompilus basalis, Sm., Cat. Hym. B. M., III, p. 138 (1885), ♀.
Cyphononyx caroli-waterhousei, Cam., Sjöstedt's Kilimandjaro-Meru Exp., II, p. 241 (1910).

Family CRABRONIDAE.

Sub-family PHILANTHINAE.

Philanthus histrio, Fabr., Syst. Piez., p. 301 (1804).
Philanthus flavolineatus, Cam., Sjöstedt's Kilimandjaro-Meru Exp., II, p. 271 (1910).

It is singular that Cameron should describe this common and wide-ranging East African species as new, without any note of comparison.

Cerceris vigilans, Sm., sub-sp. *pervigilans* sub-sp. n.

♀. Differs from Indian specimens in having the postscutellum yellow instead of black; the enclosed area at the base of the median segment is finely granulate instead of finely and closely punctured; the pygidial area is more strongly narrowed towards the apex; the petiole of the second cubital cell is a little longer; and the wings are sub-hyaline at the base, with a distinct fuscous apical border.

♂. The differences in the male are the same as in the female, but the pygidial area is narrower throughout than in typical *vigilans*.

Hab. British East Africa, Kirja Valley, S. Kavirondo, 4,000 ft., April 30—May 1; Simba, 3,500 ft., May 8 (*S. A. Neave*).

Type in B. M. 1 ♀, 3 ♂ ♂.

The differences seem to me to be too small to be of full specific value, the most important being in the shape of the pygidial area. The rather remarkable form of the clypeus is identical. Yet *vigilans* is an Indian species, not recorded from intermediate localities.

Cerceris yalensis, sp. n.

♀. Nigra; clypeo, fronte sub antennis, macula pone oculos, femoribusque anticis infra flavis; abdomine, segmento basili excepto, flavo-ochraceo; alis fusco-hyalinis; segmento ventrali secundo area basali elevata nulla ; segmento mediano area basali longitudinaliter striata.

♂. Feminae similis ; segmento mediano area basali obscure transverse striata, segmento ventrali sexto angulis apicalibus valide dentato.

Long. ♀, 14 mm.; ♂, 11 mm.

♀. Clypeus broad, the middle lobe more than half as broad again as long, the anterior margin almost transverse, very feebly quadridentate, the distance between the base of the clypeus and the antennae equal to about half the length of the clypeus ; interantennal carina high and narrow, triangularly truncate at the apex ; antennae rather stout, the second joint of the flagellum distinctly longer than the third. Cheeks nearly as broad as the eyes ; posterior ocelli more than half as far again from the eyes as from each other. Clypeus and front below the base of the antennae sparsely punctured ; front above the antennae irregularly longitudinally striated, vertex closely punctured. Pleurae coarsely punctured striate ; thorax very sparsely punctured in the middle, the punctures more or less confluent on the sides of the mesonotum. Median segment strongly, but not closely, punctured, the triangular area at the base coarsely longitudinally striated. Abdomen almost smooth, the fifth segment shallowly and sparsely punctured, first dorsal segment more than twice as broad as long, the segments not strongly constricted ; pygidial area granulate, gradually narrowed from the base, narrowly rounded at the apex, less than twice as long as the basal breadth, with a fringe of short hairs on the sides. First recurrent nervure received at two-thirds from the base of the second cubital cell, second at one-quarter from the base of the third cubital cell.

♂. Head and thorax closely and rather deeply punctured, sparsely on the clypeus and front below the base of the antennae ; middle lobe of the clypeus longer than broad, with three indistinct teeth at the apex. Apical joint of the flagellum slightly curved and truncate at the apex. Basal area of the median segment shining, with a median groove and very obscurely and transversely striated. Abdomen sparsely punctured, the basal segment not quite twice as broad as long ; sixth ventral segment with a broad tooth on each side at the apical margin ; pygidial area sparsely and coarsely punctured, twice as long as broad, the sides almost parallel, truncate at the apex. First recurrent nervure received close to the middle of the second cubital cell, second close to the base of the third cubital cell.

Hab. British East Africa, Yala River, S. edge of

Kakunga Forest, 4,800–5,300 ft., May 21–28; Uganda Protectorate, between Seziwa River and Kampala, 3,500 ft., August 27–31; Banks of the Nile near Kakindu, 3,400 ft., August 24 (*S. A. Neave*); Entebbe, Uganda, August 22 (*C. C. Gowdey*).

The difference in the sculpture of the enclosed area at the base of the median segment in the sexes is greater than is usual in the genus.

Sub-family SPHECINAE.

Sphex (*Chlorion*) *xanthocerus*, Ill., var. *unicolor*, Sauss.

Sphex unicolor, Sauss., Reise d. Novara, Zool., II, p. 37 (1867).

Sphex xanthocerus var. *unicolor*, Kohl, Ann. naturh. Hofmns. Wien, V, p. 185 (1890).

Sphex massaicus, Cam., Sjöstedt's Kilimandjaro-Meru Exp., II, p. 262 (1912).

Sub-family BEMBECINAE.

Bembex compedita, nom. nov.

Bembex kohli, Turn., Ann. and Mag. Nat. Hist. (8), IX, p. 415 (1912), ♂ (*nec* Morice, 1897).

The name *kohli* is preoccupied and must sink, as has been pointed out to me by Mr. Rohwer.

Bembex ugandensis, sp. n.

♂. Niger; mandibulis apice excepto, clypeo late marginibus, labro, orbitis oculorum, macula parva transversa utrinque sub ocello antico, pedibusque plus minusve nigro-variegatis flavis; segmento mediano linea arcuata angulisque, segmentis dorsalibus primo secundoque, apice maculisque duabus transversis nigris, segmentoque tertio macula transversa arcuata utrinque pallide flavo-olivaceis; oculis versus clypeum paulum divergentibus, segmento ventrali secundo tuberculo longitudinali parvo, sexto apice acute producto.

♀. Mari simillima.

Long. ♂ ♀, 23 mm.

♂. Clypeus subcarinate at the base, triangularly flattened at the apex; the eighth and ninth joints of the flagellum short and with a spine beneath, the tenth and eleventh joints concave beneath, but not broadened, the apical joint much longer than the penultimate, moderately curved, narrowed to the apex and slightly hollowed beneath at the base. Basal joint of the anterior tarsi with six spines on the outer margin, the outer half of the joint black. Femora not serrate. Second ventral segment with a very low median carina, which is produced into a very small tubercle near the apex; sixth ventral segment strongly produced at the apex and almost pointed. Seventh dorsal segment narrowed before the apex, the sides undulate. Thorax closely and evenly punctured. Cubital cell of the hindwing emitting one vein from the apex. Angles of the median segment rather prominent.

♀. Second ventral segment shining and sparsely punctured in the middle; sixth dorsal segment strongly punctured and clothed with short black pubescence, the extreme apex smooth and narrowly rounded.

Hab. UGANDA PROTECTORATE, Eastern Mbale district, S. of Mt. Elgon, 3,700 ft.; Mbale-Kumi Road, S. of Lake Salisbury, 3,700 ft. (*S. A. Neave*), August; Entebbe (*C. C. Gowdey*).

Type in B. M.

Allied to *B. diversipennis*, Sm., but differs from that species in the much narrower apical joints of the male antennae and in the shape of the seventh dorsal segment. The sixth dorsal segment of the female is broader than in *diversipennis*. In both sexes the antennae are black, not ferruginous as in *diversipennis*, and the colour is otherwise different, though *diversipennis* is so variable in this respect that little importance can be attached to colour differences. The male antennae are somewhat intermediate between *diversipennis*, Sm., and *monedula*, Handl.

Bembex lobatifrons, sp. n.

♂. Niger; clypeo, labro, mandibulis dimidio basali, scapo supra nigro-lineato, fronte supra basim antennarum macula magna bilobata nigra, genis, linea transversa interrupta occipitali, pronoto, lateribus dorsuli strigisque parvulis in disco, scutello, postscutello, segmentoque mediano fasciis curvatis apicalibus, lateribus thoracis plus minusve nigro-lineatis, segmento dorsali primo fascia lata sinuata, secundo tertio quartoque fasciis latis bisinuatis, quinto sextoque fere totis, septimo apice anguste, segmentis ventralibus tribus basalibus fere totis, quarto, quinto sextoque fasciis latis apicalibus, pedibus, thoraceque subtus, mesosterno excepto, pallide flavis; alis hyalinis, venis bruneis.

♀. Mari simillima, fasciis segmentorum dorsalium secundi tertiique maculas nigras binas includentibus.

Long. ♂ ♀, 14 mm.

♂. Eighth and ninth joints of the antennae with a minute spine beneath, tenth to twelfth slightly excavated beneath, apical joint longer than the penultimate, distinctly curved and rounded at the apex. Fore tarsi normal, the basal joint with six spines on the outer margin, fore femora not serrate, intermediate femora with one or two small spines beneath near the apex, not distinctly serrate, basal joint of intermediate tarsi normal, intermediate tibiae not produced at the apex. Seventh dorsal segment broad, narrowly truncate at the apex, the sides not sinuate. Second ventral segment with a longitudinal carina which is gradually raised into a rounded tubercle at the apex, the surface of the segment closely and evenly punctured; sixth ventral segment with a small, low, rounded tubercle in the middle; seventh ventral segment with three longitudinal carinae placed rather far apart. Wings rather short, not reaching when closed much beyond the apex of the third dorsal segment; cell of the hindwing emitting only one distinct vein from the apex.

♀. Similar to the male except in the usual sexual characters; the sixth dorsal segment with a very large yellow apical spot, the sides not sinuate, the apex narrowly rounded. Second ventral segment evenly punctured. The colour of the female is a deeper yellow than in the male.

Hab. British East Africa, Uchweni Forest, March 1–2; Lake Mpeketomi near Kipini (*S. A. Neave*), March 4–5.

Type in B. M.

This species approaches the *oculata* group, but differs in only having one vein at the apex of the cell in the hindwing, and the carinae of the seventh ventral segment (♂) are far apart.

Sub-family NYSSONINAE.

Gorytes silverlocki, sp. n.

♀. *G. monstroso*, Handl., affinissima. Nigra; pronoto in medio interrupto, callis humeralibus, segmento dorsali secundo fascia angusta apicali, tibiis tarsisque macula basali pallide flavis; alis subhyalinis, cellula radiali obscuriore.

Long. 5 mm.

♀. Eyes strongly convergent towards the clypeus, separated at the base of the clypeus by a distance scarcely exceeding half the length of the scape; clypeus very short, the anterior margin distinctly raised. Antennae short, about as long as the thorax without the median segment, the five basal joints of the flagellum very short and not stout, the five next longer and stouter, the apical joint longer and slenderer than the penultimate and slightly curved. Ocelli situated in a very wide triangle on the vertex, the posterior pair nearly half as far again from each other as from the eyes. Thorax short and stout, a distinct groove in front of the mesopleurae for the reception of the anterior femora, the mesosternum notched at the sides close to the groove and produced into two short teeth. Intermediate trochanters without a tooth; posterior tibiae thickened. Abdomen petiolate, the first segment gradually broadened from the base, nearly twice as wide at the apex as at the base, distinctly longer than the apical breadth, not constricted at the apex; second segment large and globose, constricted at the base; sixth segment broadly triangular, with a narrow pygidial area. Closely and rather strongly punctured; the punctures longitudinally confluent near the apex of the mesonotum; scutellum and postscutellum longitudinally striated, basal area of the median segment obliquely striated, a smooth opaque space on each side near the apex of the basal area, the posterior slope of the median segment with a deep median groove; ventral surface of the abdomen almost smooth except on the coarsely punctured second segment; the extreme apex of the sixth dorsal segment smooth. Both recurrent nervures received by the second cubital cell; second abscissa of the radius shorter than the first; third cubital cell entirely absent on the right side, on the left side the third transverse cubital nervure is present on the cubitus, but does not reach half way to the radius.

Hab. N. RHODESIA, Sinapunga (*Silverlock*), February. Type in B. M.

Differs from *monstrosus*, Handl., in colour, in the sculpture of the scutellum, postscutellum and median segment, in the absence of a spine on the intermediate trochanters, in the shape of the petiole and in the absence of the third transverse cubital nervure. The latter character may be an individual aberration.

Sub-family CRABRONINAE.

Dasyproctus aurovestitus, sp. n.

♀. Nigra, opaca; scapo subtus, pronoto angustissime antice, petioloque macula utrinque apicali pallide flavis; pedibus nigris fusco-ferrugineo variegatis; abdomine dense auro-piloso; alis hyalinis, costa anguste infuscata, venis nigris; tegulis fusco-ferrugineis.

Long. 12 mm.

♀. Clypeus with a median carina. Head large, the eyes on the front separated by a distance not quite equal to half the length of the scape; second joint of the flagellum twice as long as the first and fully half as long again as the third. Cheeks as broad as the eyes; posterior ocelli much further from each other than from the anterior ocellus, as far from the eyes as from each other, and more than half as far again from the posterior margin of the head as from each other; the whole head minutely punctured and clothed with fine brownish gold pubescence, a deep sulcus on the inner margin of the eyes near the summit. Pronotum deeply transversely grooved, the anterior margin higher and broader than the posterior. Median segment with a deep median sulcus, the basal triangular area strongly obliquely striated, with fine punctures between the striae; the posterior slope of the segment finely rugulose. Abdomen petiolate, the first segment a little shorter than the second and third combined, as long as the posterior femur and trochanter combined, the apex not nodose, the apical breadth equal to about two-fifths of the length of the segment; the remainder of the abdomen densely clothed with short brownish gold pubescence.

Hab. UGANDA, Entebbe (*C. C. Gowdey*), August 13. Type in B. M.

Easily distinguished from other African species by the golden brown pubescence and the almost complete absence of yellow markings on the abdomen. The sculpture of the median segment differs from *kibonotensis*, Cam., in which there are no yellow markings, and in that species the pubescence is whitish.

Sub-family LARRINAE.

Liris diabolica, Sm.

Larrada diabolica, Sm., Ann. and Mag. Nat. Hist. (4), XII, p. 294 (1873), ♀.
Liris violaceipennis, Cam., Sjöstedt, Kilimandjaro-Meru Exped., II, p. 285 (1910), ♀.
Larra (*Liris*) *opipara*, Kohl, Ann. Naturh. Hofmus. Wien., IX, p. 297 (1894), ♀.

Notogonia pseudoliris, sp. n.

♀. Nigra, dense aureo-sericea tomentosa; mandibulis basi, antennis, tegulis, pedibus, segmentisque abdominalibus quinto sextoque ferrugineis; segmentis abdominalibus 1–4 margine apicali testaceis;

alis flavo-hyalinis, limbo late infuscato; venis basi testaceis, apice fuscis.

Long. 16 mm.

♀. Clypeus almost transverse at the apex, with a very shallow and narrow emargination in the middle. Second joint of the flagellum equal in length to the third, about three and a half times as long as broad. Eyes separated on the vertex by a distance equal to the length of the second joint of the flagellum. Median segment finely transversely aciculate, with a low median carina on the basal half, much longer than the breadth at the base, the sides of the segment striated. Sixth dorsal segment closely punctured and without much pubescence. Comb of the anterior tarsi very short and with few spines, only five spines on the basal joint. Tarsal ungues long, without a tooth. Third abscissa of the radius nearly half as long again as the second. The whole dorsal surface, except the middle of the median segment and the sixth dorsal segment, clothed with short golden pubescence.

Hab. Uganda, Entebbe (*C. C. Gowdey*), August 15.

Type in B. M.

This closely resembles a small specimen of *Liris haemorrhoidalis*, Fabr., but is a true *Notogonia*. *N. primania*, Kohl, resembles the same species, but is larger, and differs in the proportionate length of the second joint of the flagellum compared with the distance between the eyes on the vertex, in the comb of the anterior tarsi, and in the sculpture of the median segment. The antennae of *primania* are much shorter and stouter than in the present species.

Notogonia gowdeyi, sp. n.

♀. Nigra, mandibulis basi, clypeo apice, scapoque fusco-ferrugineis; tarsis anticis fuscis; alis nigro-violaceis; segmento mediano transverse rugoso-striato.

♂. Feminae simillimus.

Long. ♀, 21 mm.; ♂, 14 mm.

♀. Clypeus almost transverse at the apex, with a shallow and narrow emargination in the middle, the apical half strongly, but sparsely, punctured, the basal half finely shagreened. Second joint of the flagellum as long as the third, more than three times as long as its breadth in the middle. Eyes separated on the vertex by a distance equal to about three-quarters of the length of the second joint of the flagellum. Median segment longer than the basal breadth, coarsely transversely rugose-striate, without a median carina, the sides of the segment finely and very obscurely striated. Sixth dorsal segment clothed with stiff blackish bristles. Comb of the anterior tarsi fairly long and stout, six spines on the basal joint; tarsal ungues long, without a tooth. Third abscissa of the radius about half as long again as the second, first recurrent nervure received very near the base of the second cubital cell, more than twice as far from the second recurrent nervure as from the angle of the cell. A little silver pubescence on the face and cheeks, abdomen bare.

♂. Antennal joints shorter than in the female, the eyes separated on the vertex by a distance equal to the length of the two basal joints of the flagellum; apex of the dorsal segment with a very indistinct marginal band of greyish pubescence; apical dorsal segment closely punctured, shallowly emarginate at the apex.

Hab. UGANDA, Entebbe (*C. C. Gowdey*), August 19–28. Two ♀♀ and 1 ♂.

Type in B. M.

Superficially this species resembles the oriental *Liris ducalis*, Sm.

Notogonia sericosoma, sp. n.

♀. Nigra; mandibulis, clypeo apice, antennis, tegulis, pedibus, abdomine, segmentis dorsalibus secundo tertioque modice infuscatis, ferrugineis; alis pallide flavo-hyalinis, limbo apicali pallide infuscato, venis testaceis, capite, thorace, abdomineque pallide aureosericeis.

Long. 13 mm.

♀. Clypeus subtruncate at the apex, not emarginate in the middle. Second joint of the flagellum equal in length to the third, about two and a half times as long as its breadth in the middle. Eyes separated on the vertex by a distance half as great again as the length of the second joint of the flagellum. Comb of the fore tarsi long and stout, six spines on the outer margin of the basal joint. Median segment finely transversely striated, the apex almost smooth, the sides finely striated, the segment longer than its breadth at the base, slightly convex, and without a median carina. Sixth dorsal segment closely punctured and covered with very fine pale golden pubescence. Tarsal ungues long, without a tooth. Second abscissa of the radius nearly as long as the third; first recurrent nervure received distinctly nearer to the basal angle of the second cubital cell than to the second recurrent nervure. The whole dorsal surface except the middle of the median segment is covered more or less closely with very fine pale golden pubescence, which in some lights becomes almost silvery.

Hab. BRITISH EAST AFRICA, near Wangi, coast of mainland (*S. A. Neave*), February 21–22.

Type in B. M.

Motes liroides, sp. n.

♀. Nigra, pallide aureo-pilosa; tarsis tegulisque fusco-ferrugineis; alis flavis, apice late fuscis; segmento mediano transverse striato.

Long. 16 mm.

♀. Clypeus short, very feebly rounded at the apex, with an obscure carina from the base not reaching the apex. Second joint of the flagellum twice as long as the first and distinctly longer than the third. Eyes separated on the vertex by a distance equal to the length of the second joint of the flagellum. Closely and very minutely punctured, the median segment distinctly transversely striated, longer than broad. The whole dorsal surface of the head, thorax, median segment and abdomen more or less densely clothed with very delicate pale golden pubescence; the apical dorsal segment closely covered with short fulvous setae, the sides of the segment converging strongly towards the apex, which is rather broadly rounded and less than half as wide as the base of the segment. All the tarsal ungues have a small but distinct tooth close to the middle. The two recurrent nervures are received close together more than twice as far from the basal angle of the second cubital cell as from each other.

Hab. BRITISH EAST AFRICA, Witu (*S. A. Neave*), February 25–28.

Type in B. M.

This is another case of close resemblance to *Liris haemorrhoidalis*, Fabr., but the structure is different. It may be easily distinguished from the West African species *M. odontofora*, Kohl, and *M. cyphononyx*, Kohl, by the strongly convergent sides of the pygidial area and the different colour of the wings, which are quite as dark as in the most highly coloured specimens of *Liris haemorrhoidalis*.

Tachytes mira, Kohl.

Tachytes mira, Kohl, Ann. naturh. Hofmus. Wien, IX, p. 293 (1894), ♀.

Tachytes pulchrivestita, Cam., Sjöstedt's Kilimandjaro-Meru Exp., II, p. 284 (1912), ♀.

This differs from *velox*, Sm., in the narrower pygidial area.

Gastrosericus neavei, sp. n.

♀. Nigra, albopilosa; orbitis interioribus verticem versus haud convergentibus, genis pone oculos spina magna obtusa instructis; alis fusco-hyalinis; tibiis posticis intus pallide flavis.

Long. 7 mm.

♀. Head broad, the eyes not converging towards the vertex, their inner margins parallel, separated on the vertex by a distance equal to about two-thirds of the length of the flagellum; the third joint of the flagellum fully as long as the second. Clypeus very broadly rounded at the apex, covered with short white pubescence; head very closely and distinctly punctured, a short longitudinal sulcus above the base of the antennae; posterior ocelli oblique, situated on a rounded prominence which is not divided by a sulcus, a narrow curved groove behind the posterior ocelli. Cheeks more than half as broad as the eyes, armed with a short, strong, blunt spine. Pronotum depressed below the mesonotum; the latter closely and rather strongly punctured, slightly depressed in the middle on the anterior margin. Mesopleurae and scutellum closely punctured; median segment shorter than the mesonotum, transversely rugulose and rounded posteriorly. Abdomen very minutely punctured; the first segment subpetiolate, the second slightly constricted at the base. Anterior coxae armed with a long seta. Second abscissa of the radius scarcely half as long as the first; the two recurrent nervures unite before their junction with the cubitus at one-third from the base of the second cubital cell, so that the second discoidal cell is distinctly petiolate.

Hab. British East Africa, Upper Kuja Valley, S. Kavirondo; 4,200 ft. (*S. A. Neave*), May 5–8.

Type in B. M.

This species is easily distinguished by the great distance between the eyes on the vertex and by the spine on the cheeks.

Feb. 11, 1913.

THE

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

For the Year 1912.

Wednesday, February 7th, 1912.

The Rev. F. D. Morice, M.A., President, in the Chair.

Nomination of Vice-Presidents.

The President announced that he had nominated as Vice-Presidents for the present session Mr. A. H. Jones, Dr. Malcolm Burr, and Mr. J. H. Durrant.

Dates of Meetings.

The Rev. G. Wheeler said that he had received, as Secretary, a large number of applications for cards of the dates of meetings for this year, and explained that as these always contained the names of the Vice-Presidents, which could not, by the bye-laws, be announced until the February meeting, the cards could never be issued till after that date. He added that the date of the February meeting for next year would be given on this year's card, a precedent which he hoped would always be followed in future.

Letters of Thanks.

The Rev. G. Wheeler read letters of thanks for their election as Hon. Fellows from Prof. J. H. Comstock and Fr. Erich Wasmann, and on behalf of the latter presented to the Society a copy of all his Entomological books and pamphlets, for which a special vote of thanks was unanimously passed to Fr. Wasmann on the motion of the President.

Exhibitions.

Rare Coleoptera.—Mr. W. E. Sharp exhibited specimens of *Carpophilus* 6-*pustulatus*, F., and *C. obsoletus*, Er., taken under bark of beech trees near Doncaster in October 1911; the former having been recorded from the same locality only on a few occasions during recent years, and the latter never having been known to occur under natural conditions in England previously.

Mr. Sharp having explained that both species had been previously found in England amongst bad raisins, a discussion arose as to the means by which they might possibly have been transferred to such a locality as that in which they were found. Mr. J. E. Collin observed that raisins unfit for human consumption were a well-known bait for attracting pheasants, and the President suggested a picnic party as the possible cause; the exhibitor, however, said that the wood in which these beetles had been found had been for many years a fox-cover, and that it was not a place to which picnic parties came. The Rev. G. Wheeler observed that in any case it was obvious that Entomologists had access to the wood, and said that he himself frequently took raisins as a part of his lunch when out for the day, and that some one else might have done the same thing, and if he found his raisins bad would naturally have left them behind. Mr. Waterhouse thought it probable that the natural habitat of the insects was under bark, and that they merely came to raisins as so many insects come to sweet substances, but Mr. Champion was of opinion that they naturally fed upon fruit.

Birds as a Check on Insect Pests.—Mr. Champion called attention to a paper by Mr. H. C. Bryant, recently published in an ornithological periodical, the "Condor," for November 1911, entitled "The relation of birds to an insect outbreak in northern California during the spring and summer of 1911." The insect in question was a butterfly, *Eugonia californica* (an ally of *E. polychloros*), and five species of birds were found to feed on it, one of which, the Brewer blackbird (*Euphagus cyanocephalus*) took 95 per cent. of all the butterflies eaten by the birds. The birds, in feeding on the butterfly were stated to attack the insect at a critical point in its life-history, and were therefore of more value as a check than they would have been had they fed on the larva or pupa. The smaller birds probably had a more intimate relation to the outbreak when the insect was in the larval or pupal stage. The data collected showed of what value birds may be in the checking of an insect outbreak rather than their value in the prevention of such an outbreak.

GEOMETRID MOTHS OF THE GENUS ALETIS, AND THEIR MIMICS FROM THE NEIGHBOURHOOD OF ENTEBBE. — Prof. POULTON exhibited a large but not quite complete series of the members of this important combination collected, between May 23, 1909 and September 14, 1910, by Mr. C. A. Wiggins, D.P.M.O. of the Uganda Protectorate. The specimens had been collected just as they were met with, and in sufficient numbers to give some indication of the proportions. By far the most abundant species was *Aletis* (*Leptaletis*) *erici*, Kirby (56 examples). *A. helcita*, Clerck, although much commoner in collections, was comparatively a rare insect (4). The explanation of its prominence in collections is probably to be found in the fact that *helcita* is rather larger and of a richer colour than *erici* and has been mistaken by collectors for fine specimens of the common species. There are in the British Museum two rows of *helcita*, but only three examples of *erici*. Another common species of *Aletis*—paler and smaller than either of the above—was *Aletis* (*Leptaletis*) *forbesi*, Druce (11). The following mimics were also present, all of them in very small numbers: the Hypsid moth *Phaegorista similis*, Walker (2), the female Agaristid moth *Xanthospilopteryx poggei*, Dewitz (1), the Nymphaline butterfly *Euphaedra ruspina*, Westwood (2), the Lycaenid butterfly *Telipna nyanza*, Neave (1). The proportions of the three species of *Aletis* seem to be about the same in the Lagos district, where Mr. W. A. Lamborn has bred *erici* and *helcita*, and finds that their caterpillars have different patterns, and that *erici* is gregarious and *helcita* solitary in the larval state.

Hypolimnas (Euralia) dubius, Beauv., a Mendelian dominant, and H. (E) anthedon, Boisd., recessive.—Prof. Poulton exhibited part of an all-*anthedon* family recently bred by Mr. Lamborn at Oni Camp seventy miles east of Lagos, from an *anthedon* female parent, and part of an all-*dubius* family also bred from an *anthedon* female. Both families were amply large enough to preclude the possibility of accident. The facts indicate that in the first family a recessive female had paired with a recessive male, in the second that a recessive female had paired with a dominant male. There can be little doubt that the pattern of *anthedon* conforms more closely to that of the genus than the pattern of *dubius* and that the dominant form is therefore the more recent development.

Butterflies a Natural Food of Monkeys. — Prof. Poulton read the following note received in a letter from Mr. W. A. Lamborn, November 17, 1911 :—

" Our District Commissioner, Captain Neal, who occasionally spends a few days with us [at Oni Camp] tells me that he has several times seen 'dog-faced monkeys,' (not baboons but probably mangabeys), squatting beside mudholes, such as butterflies of some kinds resort to in large numbers in the dry season, and catching them one after the other and eating them. It occurred to me that this evidence might be valuable as showing that butterflies may be a natural food of monkeys."

The urticating hairs of a Lasiocampid larva disseminated through the air.—Prof. Poulton exhibited specimens of the Lasiocampid moth *Mimopacha gerstaeckeri*, Dewitz, bred from the caterpillars referred to by Mr. Lamborn in the quotation from his letter printed below. Prof. Poulton said that although the subject had been extensively discussed he thought it was important to show that the hairs were a powerful defence against natural enemies, and also that they were spread through the air—a fact he had himself observed in studying the cocoons of *Porthesia similis*, Fuessly. Although he had been careful to touch the cocoons only with the tips of the forceps he well remembered the irritation which had been caused, especially on the neck beneath the collar.

"A very large company of these larvae was pointed out to me by the native clerk, on the trunk of a tree in the village $1\frac{1}{2}$ miles away [from Oni] on October 18. I had the tree felled and collected them and they formed cocoons between October 20 and 24. The hairs on the larvae are intensely urticating, and, as they come off readily, float in the air if there is any draught. They get into one's eyes and produce a troublesome conjunctivitis. The cocoons are massed together side by side and are covered with the downy hairs from the caterpillars so that an even surface is produced, and the hair comes off them very easily too. As I kept feeling skin irritation as a result of hairs blowing about, I placed the boxes outside, and the female Mona must have gone to investigate the cocoons, for I found one torn open and lying on the ground, the pupa being there but damaged. The monkey suffered very badly for her curiosity, for her eyes became so swollen and inflamed that she could hardly see out of them, and the hairs were so urticating to her skin that she rolled on the ground trying to scratch herself with all four feet at the same time, and it was some days before she was herself again. I still left the boxes outside but none of the other monkeys went near them. Nov. 17, 1911."

The anal tufts of the female Glutophrissa protruded during courtship.—Prof. Poulton drew attention to the following observation recently made by Mr. Lamborn at Oni:—

"On December 27 I saw a male *Glutophrissa saba* courting a female. She was resting on a leaf with wings expanded. Her abdomen was raised to an angle of rather more than 45° to the thorax and two little tufts very similar to those possessed by male *Danainae* protruded from the anal extremity. The male fluttered round her very closely, occasionally settling on her wings, though he still continued fluttering while touching her. He eventually became alarmed at my presence and flew away. Dec. 29, 1911."

A new species of Vesperus.—Dr. Malcolm Cameron exhibited a new species of *Vesperus* from Lagos, Portugal, a description of which appears in the March number of the

E.M.M. as *V. reitteri*, and for comparison a specimen of *V. bolivari*, Rtt. These two are the only dark-coloured species of the genus at present known. In both cases the ♀♀ are unknown, but are probably only furnished with rudimentary wings as is usual in this genus.

HYBRID OPORABIAS.—Mr. E. A. COCKAYNE exhibited the following specimens of this genus: *O. christyi* from Ireland and Scotland, hybrid *O. christyi* ♂ × *O. dilutata* ♀, and *O. dilutata* ♂ × *O. christyi* ♀; *O. dilutata* from Scotland and Epping Forest, hybrid *O. dilutata* ♂ × *O. autumnaria* ♀, and larva; *O. autumnaria*, hybrid *O. autumnaria* ♂ × *O. filigrammaria* ♀, and *O. filigrammaria* ♂ × *O. autumnaria* ♀; *O. filigrammaria* from Yorkshire and Scotland. Most of the hybrids were bred by Mr. J. E. R. Allen. He remarked that the species fall naturally into two groups—

(1) *O. dilutata* and *O. christyi*.

(2) *O. autumnaria* and *O. filigrammaria*,

and that hybridisation is easy between the members of each group, but very difficult between the members of the different groups, though probably all are good species. The hybrid *dilutata* and *autumnaria* showed the dull grey of *dilutata*, a colour never met with in *autumnaria* whose melanic forms are brown, but has the markings of the latter, the sharp angle in the elbowed line and the central spot far from the line.

Papers.

The following papers were read:—

"On some hitherto imperfectly known South African Lepidoptera," by ROLAND TRIMEN, M.A., F.R.S.

"On the Comparative Anatomy of the Genital Tube in ♂ Coleoptera," by D. SHARP, M.A., F.R.S., and F. MUIR, F.E.S.

"Descriptions of New Species of Lepidoptera-Heterocera from south-east Brazil," by F. DUKINFIELD JONES, F.Z.S., F.E.S.

"The Effect of Oil of Citronella on two species of *Dacus*," by F. M. HOWLETT, B.A., F.E.S.

"On the Genera *Liothrips* and *Hoodia*," by Dr. H. KARNY, of Elbogen, Austria; translated by E. A. ELLIOTT, F.E.S., and communicated by R. S. BAGNALL, F.L.S.

"On the Early Stages of *Albulina pheretes*, a Myrmecophilous Plebeiid Butterfly," by T. A. Chapman, F.Z.S.

"The Food-plant of *Callophrys avis*," by T. A. Chapman, F.Z.S.

"An Experiment on the Development of the Male Appendages in Lepidoptera," by T. A. Chapman, F.Z.S.

"The Study of Mimicry (Batesian and Müllerian) by Temperature Experiments on two Tropical Butterflies," by Lieut.-Col. N. Manders, R.A.M.C., F.Z.S., F.E.S.

A long and important discussion arose on many points in connection with the last paper, of which a full report is appended.

Prof. Poulton said that Col. Manders was much to be congratulated on the positive results that he had obtained in both *D. chrysippus* and *H. misippus*, female. Furthermore the indication that the female of *D. chrysippus* was more sensitive than the male was of the highest interest. When Col. Manders first expressed the intention of making these experiments the speaker thought they were rather in the nature of "a forlorn hope" and the results were as surprising to him as they were interesting. He felt that Col. Manders had made out a case for reconsidering the conclusion (which Prof. Poulton had published in Trans. Ent. Soc. 1902, pp. 475–6, 482–4) that the type form of *chrysippus* was older than the *dorippus* form. The reasons for this conclusion still appeared to him to be strong as well as numerous, but the whole subject required to be reinvestigated in the light of these new results.

When we compared *chrysippus* with its form *dorippus* and the female *misippus* with the form *inaria*, it was quite clear that both forms differ from their types by the omission of a part of the pattern, and in no other way. Hence the type should be a Mendelian dominant in both species, as Rev. K. St. Aubyn Rogers had shown to be probably the case in *H. misippus* (Proc. Ent. Soc. 1911, p. xliv). But Mendelian dominance did not help towards the phylogenetic solution; for, accepting the generally received "presence or absence" hypothesis, it was obvious that a newer form may arise from an older by the addition (= dominance) or the omission (= recessivity) of a factor.*

* Bateson, "Mendel's Principles of Heredity," Cambridge, 1909, p. 278.

The results of Col. Manders' experiments upon *misippus* did not seem to point uniformly towards *inaria* as the older form; for although the replacement of black by fulvous in the apical region of the forewing, and the overspreading by fulvous of the subapical white bar, supported this interpretation, the form and increased size of the bar itself suggested an opposite one. It was to be observed that the bar is unusually developed in the specimens which had been exposed to heat, and that its basal margin (viz. that turned towards the cell) possessed a remarkably bold zigzag outline. The shock of the experiment had therefore in some respects carried the individuals towards *inaria*, but in other respects had carried them further away from it.

With regard to Col. Manders' conclusion that the mimicry was simply an accidental resemblance of no bionomic significance, Prof. Poulton said that, if this were found to be true of the female forms of *H. misippus* he did not see how the theory of mimicry could be sustained at all. If these females, in departing so immensely from the ancestral pattern preserved by their male, had undergone these changes without relation of any kind to the corresponding forms of the Danaine butterfly regarded as their model, he would be prepared to look on all mimicry as accidental. He thought that Col. Manders and those writers who agreed with him, expected too much when they sought for evidence of the preferences of insectivorous birds. Such inquiries were extraordinarily difficult and wearisome, and a large proportion of the labour must inevitably lead to negative results. Prof. Poulton felt convinced that mimicry was an advantageous resemblance, not because of the direct evidence but on account of the enormous and ever-increasing mass of facts which received an interpretation on this hypothesis—for the same reasons, in fact, which justified a belief in evolution itself. No other hypothesis as yet proposed could be reconciled with the facts, and it was extremely improbable that any hypothesis as yet unknown would supply the interpretation of resemblances so numerous, so wide-spread, so well known, and so much studied and discussed. At the same time he was always urging his correspondents to seek for direct evidence on every possible opportunity. Although he disagreed with Col. Manders' opinion on this point, he wished, in concluding his remarks, again to congratulate him on the solid results he had obtained and shown to the meeting.

The Rev. G. WHEELER challenged the position referred to in the paper that, because shock has been shown in some cases to produce atavistic results, there is anything inherently improbable in its producing in other cases an impetus in the direction in which development is tending. He maintained that this might be expected to depend on two factors, one internal the other external to the organism affected; first whether the organism subjected to the shock had reached a stage in which the tendency to new development was stronger than the atavistic tendency, and secondly whether the nature of the shock was in the direction of the forces (whatever they might be) tending to produce the newer form, or in the direction of those tending to check such development.

Mr. MERRIFIELD said that his experiments on *Rumicia phlaeas*, to which Col. Manders had referred, were on the pupae, not the larvae. He had not at that time realised, as he had done since, the important effect of temperature in the larval stage. Applied to pupae it had an effect on the general colouring of the imago, very marked in the case of many of the "Thorn" moths, and other *Geometridae*; a high temperature in the later part of the pupal stage tended to produce a chestnut colouring, verging on orange, a low temperature, darker colouring approaching chocolate. But in these species, which were double-brooded, and in the double-brooded butterfly *Araschnia levana*, the most complete effects, not merely in colouring but in habits, were produced in the larval stage, and especially in its earlier instars; larvae of either of the two broods of *A. levana* could thus all be converted by the appropriate temperature into the other seasonal form—into the winter phase with its long fixed pupal period, producing in spring a butterfly resembling in appearance a small "fritillary," or into the summer phase (*prorsa*) with its very brief pupal period, resembling a small *L. sibylla*. As regards "shock" it appeared to be in favour of that view that when the temperatures to which the pupae were subjected were extreme—below freezing point, or considerably above 100° F.—the effects in appearance produced by such cold and heat were very similar. Prof. Standfuss and Dr. E. Fischer had both, he believed, suggested that as regards these different temperatures the one brought out past atavistic features, the other developed future anticipatory ones. That was a point on which he could form no opinion, so he must be content with the word "shock," without being able to enter on the question of the rationale of its operation.

He could not refrain from thanking Col. Manders for his paper and for its judicial tone, recording observations, which, from their impartial character would be of so much assistance to all in arriving at due conclusions on the probable explanation of the facts observed.

Dr. Chapman congratulated Col. Manders on his success in carrying out a valuable and difficult experiment. He said that in interpreting the result as showing that *dorippus* is the ancestral form, we overlooked certain considerations, or hypotheses, that, though unprovable, like mimicry itself as Prof. Poulton had just told us, still similarly enabled us to form a connected picture of otherwise isolated and even contradictory phenomena. The hypothesis, as applied to *chrysippus*, pictured it and *dorippus* as having in their past history (no matter which be the older form) frequently crossed with each other, and as subjected to alternative conditions either by migration or by change of climate, so that at the present day an individual, say of *chrysippus*, had ancestors that were often pure *chrysippus*, often pure *dorippus*, and though it may be in an area where *dorippus* does not occur, it still possesses, inherited in its tissues, the materials for producing under a suitable change of environment the race *dorippus*, deeply recessive though the *dorippus* inheritance may be—recessive of course not in any strictly Mendelian sense.

This view of the relation of dimorphic forms to each other seemed to afford the only possible explanation (not of why, but) of how melanic races appear in a very few years, on a change of conditions. *A. betularia*, when apparently a pure race, had probably had in its ancestry very many, not only crosses with *doubledayaria*, but actual changes from *betularia* to *doubledayaria* and back again. Such an alternation of inheritance probably went back not to the beginning of *betularia* as a species, but much further, to a time when the present genus, subfamily, or even family, was represented by one ancestral species, or even further.

All dimorphic or polymorphic forms might be represented as two (or more) forms combined together, as dominant and recessive, the dominance not being conditioned as in the Mendelian relation purely by inheritance, but by the environment.

Levana and *prorsa* had been shown by Mr. Merrifield to be quite interchangeable at an early larval stage. As the change of conditions necessary had an annual cycle, there was the appearance, without the fact, of an alternation of generations. The regular change however kept each form ready to appear at once; but in the case of our melanic forms, or of *chrysippus*, the changes of environment were not annual but rather secular, so that in the intervals the form that is for the moment recessive receded more and more, and conceivably might be eliminated, but in the result a change of conditions operated gradually in bringing it to the front again.

That this semi-Mendelian character of dimorphism goes back far into the ancestry of dimorphic species was clear from the circumstance that seems fairly obvious, that each form of a dimorphic (or polymorphic) group is naturally selected apart from its associate, and (by selection) resents the natural tendency for the two forms to coalesce by inheritance from each other. Sexual dimorphism might possibly be the most ancestral form of dimorphism, and from it other forms might have arisen. At any rate, it fell in with the same views of dimorphism that he had attempted to sketch, but which doubtless would need a long essay to illustrate clearly, and without which it would not perhaps be easily appreciated that the same mechanism exists whether the dimorphism be apparently alternative or secular, whether the distinct forms occur together in one race or in different localities as different races, though in the latter instance it might be difficult to say whether we have a dimorphic species, or two distinct geographical races either of which should present traces of the common ancestor but not of the other form. The conclusion from Col. Manders' experiments therefore was that if *chrysippus* and *dorippus* are geographical races and not dimorphic forms *dorippus* is the essential form, if they are dimorphic forms similar experiments with *dorippus* should yield specimens with some definite *chrysippus* aspect.

Wednesday, March 6th, 1912.

The Rev. F. D. Morice, M.A., President, in the Chair.

Election of Fellows.

The following gentlemen were elected Fellows of the Society :—Messrs. Harold Hodge, Chapel Place Mansion, 322, Oxford Street, W.; Samarenda Maulik (Calcutta), c/o Messrs. T. Cook & Son, Ludgate Circus, E.C.; Roland T. Smith, 54, Osbaldeston Road, Stoke Newington, N.

Exhibitions.

A Coleopteron new to Britain.—Mr. Donisthorpe exhibited a specimen of *Catops montivagus*, Heer, new to the British list, taken at Nethy Bridge, on June 27 last, under a dead squirrel. Also *C. tristis*, Panz, for comparison, the nearest species previously known as British.

Three families of P. dardanus, Brown, bred from hippocoon, F., females in the Lagos district by W. A. Lamborn.—Professor Poulton exhibited the first of these families and a part of the second. He stated that these three families were the first successful attempt, outside Natal, to breed *P. dardanus* from a known female parent. In the Durban district the form *cenea* had always predominated in the female offspring bred from a *hippocoon* parent, while in the Lagos district the female offspring of *hippocoon* were themselves always *hippocoon* in all three families bred by Mr. Lamborn,—a result which harmonised with the presence of *Amauris niavius*, L., the model of *hippocoon*, and the absence on the Nigerian coast of all the other Natalian Danaine models of the female *dardanus*, except *Danaida chrysippus*, L.

The following notes and observations on the three families of *dardanus* had been extracted from letters written by Mr. W. A. Lamborn to Professor Poulton :—

"Oni Camp, 70 miles E. of Lagos,
"*Nov.* 27, 1911.

"I send all that remains of the female parent of my second *dardanus* family, for I took the female Mona with me while I was doing some gardening, and she ran off when my attention was occupied and took the butterfly out of its box before I could get near her. However I expect the fragments will serve their purpose, and I have quite a good number of larvae. I am catching all these female *dardanus* in the same neighbourhood near three native villages close together 1½ miles off. This is doubtless because lime-trees are plentiful there and not elsewhere in the bush."

"*Dec.* 4, 1911.

"My visit to Lagos was as usual disastrous from an entomological point of view; for most of my *Planema* larvae died, 4 new Psychid moths (males) died and were eaten by ants, and my *dardanus* males have lost their 'tails' and are otherwise damaged. However all the first family of *dardanus* are out, save 3, and all the females are of the *hippocoon* form. There are enough undamaged males for show specimens. The man who volunteered to look after them explained their damaged condition on the ground that they had emerged and were flying before he was up in the morning.

"I watched all the others come out. They did so almost uniformly at about 8 a.m. and were ready, both males and females, to fly at about 9.30. None came out later in the day.

"I am satisfied that the freshly emerged males were more on the alert against possible danger than the females; for if one approached, even when the wings were wet and flaccid, the males dropped down and attempted to crawl away, whereas the females did not betray alarm.

"The imagos were able to emerge and develop, whatever the attitude of the pupa. Some having an insufficient girdle were suspended head down, and two or three were on the floor of the box."

"*Dec.* 17, 1911.

"My two other families of *P. dardanus* are now pupating. I am disposed to think that the females oviposit more readily when confined in a large box than when cramped up in a small one. In common with such other female Papilios as I have observed ovipositing,—*nireus*, *demodocus*, *menestheus*, and *policenes*—they do so while still fluttering on the wing, and I think that if their movements are hampered, they get frightened and exhausted by coming into constant contact with obstacles.

"You will have seen by now the truth of your prophecy that all females would be *hippocoon*.

"By the way I find difficulty in getting captive females to feed, but they will sometimes take weak sugar solution off the petals of flowers and one fed freely on sugar stirred up in muddy earth."

"*Dec.* 29, 1911.

"I notice that the first signs of colour in the pupal wings are visible at from 7 to 8 p.m. on the day preceding emergence. Changes go on so rapidly that by 9 p.m. it is possible to determine the sex of the pupa from colour alone, and all these imagos came out early in the morning like those of the first family. Before the change in colour the pupa is green and is so well harmonised with its leafy surroundings that in cutting off twigs bearing pupae to pin up I accidentally cut into a pupa which I had not perceived.

"I imagine that this late appearance of pigment must be of great value as tending to ensure the safety of the pupa. I have never found *dardanus* pupae in natural surroundings, but I feel sure that when pigment has developed, they must be ever so much more apparent to enemies.

"By the way all females so far are *hippocoon*."

"*Jan.* 1, 1912.

"All are *hippocoon*."

The *hippocoon* female parent of the first family tabulated below had been captured Oct. 19, 1911, oviposited Oct. 21–23, and died Oct. 27.

The parent of the second family had been captured Nov. 17, oviposited Nov. 19–21, and was killed by the Mona Nov. 21.

The parent of the third family had been captured Nov. 24, and was found dead and eaten by ants Nov. 30. Oviposition was observed Nov. 26.

The dates of emergence of all the offspring and of pupation of the first family are printed below:—

	Date of Pupation.	Date of Emergence.	No. of ♂ offspring.	No. of ♀ offspring. All *hippocoon*.
FAMILY I.	1911. November 17	1911. November 30	5	2
	,, 18	December 1	3	3
	,, 19	,, 1	2	
	,, 19	,, 2	3	4
	,, 20	,, 2		1
	,, 20	,, 3		3
	,, 24	,, 6	2	1
		Totals	15	14

	Date of Emergence.	No. of ♂ offspring.	No. of ♀ offspring. All *hippocoon*.
FAMILY II.	1911. December 24	1	2
	,, 25	1	3
	,, 26	4	3
	,, 27	3	3
	,, 28	2	1
	,, 29	2	1
	,, 30	5	
	Totals	18	13

	Date of Emergence.	No. of ♂ offspring.	No. of ♀ offspring. All *hippocoon*.
FAMILY III.	1911. December 26	1	
	,, 27	4	3
	,, 28	3	2
	,, 29	2	3
	,, 31	2	2
	1912. January 1	1	
	Totals	13	10

Professor Poulton pointed out that the three families differed in the details of the pattern, thus showing that small features were hereditary—a very important consideration in the attempt to understand the growth of a mimetic likeness. In this respect these three families from the West Coast supported the conclusions previously arrived at from the study of Mr. G. F. Leigh's specimens (see Trans. Ent. Soc., 1908, pp. 443–445).

1. The "anal gap" in the sub-marginal black band of the hindwing was widely open in all the males of Family I; was widely open in 6, narrower in 2, and closed in 10 males of Family II; widely open in 2, narrower in 2, and closed or very nearly closed in 9 males of Family III.

2. The *hippocoon* females of Family I possessed a larger white patch on the hindwing than those of II and III. This effect, which tended in the direction of Eastern and South-eastern forms of *hippocoon*—mimics of the *dominicanus*, Trimen, form of *Amauris niavius*—was produced in part by the lightening to grey of the internervular black ground-colour, and in part by the extension outwards of the white scales into the same internervular spaces. A corresponding effect was visible on the under surface. The female parent also possessed a strongly developed hindwing patch, although the condition of parents

II and III was such as to prevent any accurate comparison. The female offspring of both these were remarkably uniform in the possession of a small patch like that of the Danaine model. The fact that the difference in the pattern is undoubtedly hereditary made it possible to understand the gradual origin of the Eastern *hippocoon* from the Western or *vice versa*.

3. The white spot in the forewing cell of the *hippocoon* females of Family I was small and divided, hourglass-like, by a constriction, in 8 specimens. In 11 females of Family II and in 8 of Family III the same spot was greatly lengthened by an additional terminal section, generally separated from the rest of the spot, and very minute in some individuals (especially so in Family III). The condition of the parents unfortunately prevented any accurate study of this marking, but there could be no doubt that the hereditary tendencies of Family I differed from those of Families II and III in this as in the features described in the two preceding paragraphs.

MONKEYS EATING BUTTERFLIES.—Professor POULTON drew attention to the following letter, received by Mr. W. A. Lamborn from Captain H. V. Neal, giving further details in support of the statement in the Proceedings on p. iv.

"Epe [50 miles E. of Lagos],

"*Jan.* 22, 1912.

"You have asked me about monkeys eating butterflies. This is very common, as every native will tell you. I have seen it myself. The monkey runs along a path, sees some butterflies fluttering round some filth, goes very quietly, and seizes one by the wings, puts the solid part [body] into his mouth, and then pulls the wings off. The poor butterfly goes down like an oyster. Of course you know that butterflies are very dirty feeders. Perhaps you have tried your own monkeys with a few butterflies. The dog-faced baboon and the large brown monkey with a very long tail, which seems to be the most common species in this colony, are great butterfly-eaters. The little spider-monkey also considers a butterfly a treat, and prefers one to a spider. I think I have told you the tale of an old native lady at Akwe [?] who saw me catching butterflies. A few days after this she arrived with a calabash full, but all the wings had been pulled off!"

DETERMINATION OF THE COCCID FOOD OF THE LARVA OF SPALGIS LEMOLEA.—Professor POULTON said that he had now submitted to Professor R. Newstead some of the Coccids which formed the food of *S. lemolea*, H. H. Druce. They had been sent in spirits by Mr. W. A. Lamborn, and, although unfortunately badly attacked by fungus, had been placed without hesitation in the genus *Dactylopius* by Professor Newstead, who had written, Feb. 19, 1912:—

"I have now examined the material bearing the label, 'With | 457 | Lycaenid larvae (*Spalgis lemolea*),' with the following results:—

"1. The Coccid is undoubtedly a species of *Dactylopius*, Targ-Tozz., and, as far as I can judge by the somewhat imperfect condition of the preparations, the species is identical with *D. longispinus*, Targ-Tozz., one of the common and widely distributed 'Mealy Bugs.' Only four examples (1 nymph, 3 adult females) were discoverable on the leaves, and all of these are badly infested with a microfungus of some kind—the body cavity being completely filled with hyphae or some other phase of the fungus; so that the morphological characters of the integument are almost completely obliterated; but, in spite of this, the salient characteristics of the insect are visible. The microscopical preparations are all *marked* A.

"2. An example of No. 1 completely destroyed by fungus. *Slide marked* B.

"3. Lepidopterous larva found buried in silken web. *Slide marked* C.

"4. Portion of silken web taken from the surface of the leaves. This contains the remains of the *Dactylopius*, plant hairs, frass and the spores of a fungus. *Two slides marked* D.

"5. The same as D, but stained. In one of the preparations you will find a bundle of the long hairs to which I called attention in my former communication. They do not belong to either the *Dactylopius*, the Lepidopterous larva or the plant. They are quite unknown to me. *Two slides marked* E."

EURYTELA DRYOPE, CRAMER, SHOWN TO BE DISTINCT FROM E. HIARBAS, DRURY, BY W. A. LAMBORN.—Professor POULTON exhibited examples of the above-named species, bred by Mr. W. A. Lamborn in the Lagos district. The cases of the pupae from which the butterflies had emerged were also exhibited, and retained their original form with a high degree of perfection.

It was obvious that the lateral extension of the pupal wings, as seen from a dorsal view, was greater in *hiarbas* than in *dryope*. Mr. Lamborn had also bred considerable families—of *dryope* twice, and *hiarbas* once—from known female parents. The *dryope* parents produced nothing but *dryope*, the *hiarbas* nothing but *hiarbas*. It was therefore almost certain that the two forms were distinct species, at any rate in the Lagos district, although in view of Mr. G. F. Leigh's records of their capture *in coitu* in Natal (Proc. Ent. Soc., 1909, pp. xxxv, xxxvi) it would be of much interest to repeat Mr. Lamborn's investigations in this part of the continent.

Further Captures of Pseudacraeas, etc., on Damba Island, near Entebbe, by Dr. G. D. H. Carpenter.—Professor Poulton exhibited specimens captured on Dec. 3, 10, and 17, 1911, by Dr. Carpenter, in the primitive forest which still exists in the centre of Damba Island. The following notes and observations had been received from Dr. Carpenter—

"*Dec.* 3, 1911.

"I had such an extraordinarily interesting morning's collecting to-day, that I am sending some of the specimens straight away, for your bionomic series, to show that models and mimics do fly together.

"Within the last few weeks I have found a way of getting into the primitive, untouched forest in the centre of the island. Hitherto I have only collected in the 'jungle' formed by the overgrown banana-plantations at the edge of the island. To-day I went into the forest proper, and was well repaid. It was a fine morning—the second after nearly a fortnight of dull wet weather—and butterflies were numerous. The ones I send you are only those of the mimetic associations;—the others (including some Lycaenids and a Hesperid I have not sent before) will follow in ordinary course. I was collecting from 9.15 a.m. to 1.15 p.m. up and down a game-track for about the length of half a mile."

The same letter also contained the following notes on the habits and occurrence of species entering as models or mimics into the great *Planema*-centred combinations of Uganda.

"*Planema paragea*, Grose-Smith. In deep shade. It flies *very* feebly, though if struck at and missed it is active.

"*Planema macarista*, E. M. Sharpe, should appear in the list, but I did not catch any to-day. A little while ago I saw its larva there, so it does exist in that same locality.

"*Acraea alciope*, Hew. You will see that *A. alciope* does not figure. I saw *none* in this locality, though it had appeared again in the more sunny 'jungle.' It appears not to like *too* dense forest.

"*Precis rauana*, Grose-Smith. This is the first time I have met this species, and I was delighted to see what a good mimic it is on the wing—though I could see it *was* a mimic before I caught it."

Concerning the captures on Dec. 10, Dr. Carpenter had written, on this date :—

"It has been no use collecting for the last two or three months—in fact last Sunday was the first time I had been out for a long time, and I thought it would be good because we had had a good deal of rain in the month before.

"I do not think *Planema tellus* is uncommon : at any rate I send a fair number of specimens now, and have seen what I think to be others, for I am now beginning to be able to differentiate Planemas from Pseudacraeas by their general appearance and 'manners.'

"To-day (Sunday, Dec. 10th) I went to the same place in the forest, and got a few more specimens. There were not so many things about, but oh ! I missed *heaps !*—a female *Ps. hobleyi* which appeared to be brownish instead of black and white; lots of male *hobleyi*, *Pl. macarista* or *poggei*, and what I believed to be intermediate Pseudacraeas ! Still, I send more *Pl. tellus* and *Ps. terra.* I said last Sunday I had seen no *A. alciope* in the forest. I saw two males to-day, and caught one, and *believe* I saw a female : anyhow, it is an addition to the list. I got another poor *Pr. rauana* to-day, and some more *Planema arenaria*, which I had not sent before Dec. 3."

The following extract from the same letter of Dec. 10 referred to the four wings of a male *Acraea orina*, Hew. The detached wings were exhibited by Professor Poulton, together with the left forewing of *Euralia anthedon*, Doubl., found on the ground by Dr. Carpenter on Dec. 17.

"I found some wings of a red *Acraea* neatly clipped off lying together on a leaf, and a bird-dropping beside, as if a bird had dropped both! I send the wings. It is a curious thing that out of 40–50 bee-eaters (of three species) I have shot, to see if *Glossina* could be found in their stomachs, never a single one has eaten a Lepidopteron! They seem to live, here, entirely on Dragonflies and Hymenoptera. True, I have shot most of them on the shore, and not in the forest where they are high up out of reach; but I suppose the same ones frequent both shore and forest. It is rather curious they will eat the *hugest* dragonflies—larger than the big brown chap at home!"

The following extracts were from the letter dated Dec. 17, describing the last of these three days' captures:—

"*Dec.* 17. To-day (Sunday) I had my last collecting in Damba forest, with satisfactory results. There were great numbers of the pale *Planema arenaria*, of which I send a number. Curiously enough, on my way to the forest, I saw one in the 'jungle,' where I have never seen it before. You will see a very beautiful specimen of the dark *Pseudacraea obscura*. *On the wing*, this *Pseudacraea* far more closely resembles the pale *Pl. arenaria* (of which there were swarms to-day) than it does the darker *Pl. paragea*. Both *arenaria* and *obscura* have rather a translucent, pale effect (the little yellow on the *Pseudacraea* shows up very plainly); whereas in *Pl. paragea* the yellow doesn't show, and it has just a sooty appearance. The flight of the *Pseudacraea* is also much more like that of *arenaria* than *paragea*, which is *very* feeble. Still, one must admit that the detailed marking in the cadaver (especially the basal red triangle) is much closer to *paragea*, although on the wing the likeness is the other way. I got another *A. alciope* to-day—a male—I haven't seen a female, but the forest is most certainly not the ideal place for it. The *Ps. terra* I was trying to get ova from escaped one day, so now

I must wait till I get to Sesse. I leave here in a few days—spend a week at Entebbe at Xmas—and then resume my solitary island life, which suits me well!"

Dr. Carpenter's captures in Damba Island, exhibited to the Meeting by Professor POULTON, are tabulated below :—

Dates in 1911.	*Planema tellus platyxantha*, Jord.	*Pseudacraea terra*, Neave.	*Planema poggei nelsoni*, Grose-Smith.	*Pseudacraea hobleyi*, Neave.	*Acraea alciope*, Hew.	*Precis rauana*, Grose-Smith.	*Planema epaea paragea*. Grose-Smith.	*Pseudacraea obscura*, Neave.	*Planema arenaria*, E. M. Sharpe.
Dec. 3	2 ♂	1 ♂ 3 ♀: first with pale, second with white sub-apical bar to f.w.: the second with clear trace of brown triangle at base of h.w. under side. Third ♀ has the upper surface pattern of the ♂ *A. alciope*. Markings are the pale fulvous of *terra*. Pattern of h.w. that of *terra*, of f.w. combined *terra* and ♂ *hobleyi*. On under side the white f.w. bar of ♀ *hobleyi* and the umber basal triangle of h.w. are distinct, the latter remarkably so.*	2 ♂	1 ♂ 3 ♀: one with the colour and to a large extent the pattern of the male.		1 ♀	4 ♂	1 ♂: the f.w. sub-apical pale bar distinct: the h.w. basal triangle faintly indicated on under side.	1 ♂ 2 ♀
Dec. 10	3 ♂	2 ♀: one with the umber triangle nearly equal to that of the specimen last mentioned.			1 ♂	1 ♀		1 ♀, similar to the above ♂.	2 ♂
Dec. 17	2 ♂	1 ♂ 3 ♀: one with very pale nearly white f.w. bar.		2 ♂ 1 ♀	2 ♂	2 ♀	1 ♀	2 ♂: one with the umber triangle remarkably distinct and deeply tinted.	5 ♂ 5 ♀
Totals	7 ♂	2 ♂ 8 ♀	2 ♂	3 ♂ 4 ♀	3 ♂	4 ♀	4 ♂ 1 ♀	3 ♂ 1 ♀	8 ♂ 7 ♀

* K. Grünberg, writing on the Lepidoptera of the Sesse Islands in the Victoria Nyanza, describes a male of this obviously intermediate form as *Pseudacraea impleta*. In the same paper (Sitzungsber. d. Ges. Naturf. Freunde, Nr. 4, 1910) *Planema macarista*, E. M. Sharpe, is redescribed as *vendita*, and *Pseudacraea hobleyi*, Neave, identified as *Ps. togoensis*, Bartel.—E. B. P.

Professor POULTON pointed out that the specimens captured on Dec. 3, 10, and 17 confirmed the conclusions derived from a study of Dr. Carpenter's earlier captures in the same island (Proc. Ent. Soc., 1911, pp. xci-xcv). Although Dr. Carpenter had found that the *Planema* models were more abundant in the central forest area of Damba Island, yet even here all except *Planema paragea* were outnumbered in his collection by the respective mimetic forms of *Pseudacraea*. The proportions of these mimetic forms differed, as they did in the jungle, from those of the mainland only twenty miles away; while on the island, in the forest as well as in the jungle, transitional forms were far more numerous as well as more truly intermediate than on the mainland. It was also noteworthy that out of four female *Ps. hobleyi* one should have borne the colouring of the male. The examples of *Pl. paragea* were all dark forms with the pale markings greatly reduced.

BARONIA BREVICORNIS, SALV.—Mr. A. E. GIBBS exhibited two specimens of the scarce butterfly *Baronia brevicornis*, and read the following note:—

"In our Transactions for 1893 the late Mr. Salvin described a butterfly which had been captured in Mexico. To receive it he erected a new genus which he called *Baronia* after the captor of the insect, Mr. O. T. Baron. It belongs to the *Papilionidae*, but is distinguished by its short antennae and peculiar neuration from *Papilio*. It seems to come nearest to *Parnassius* The insect was figured and again described by Mr. F. Du Cane Godman in the Supplement to the Rhopalocera in *Biologia Centrali Americana*. It is also figured by Seitz in the volume on American butterflies now in course of publication, and Dr. Jordan who writes the text says: 'Mr. O. T. Baron discovered this peculiar insect in the neighbourhood of the town of Chilpancingo, recently destroyed by an earthquake, where the butterflies were flying in June and July, at a height of 4,500 ft. He only took five specimens which are in the collections of Godman, Rothschild, and the Californian Academy.'

"I have recently acquired a pair from the same locality as the Salvin type specimens come from—the Sierra Madre district of Mexico—at an elevation of 1,000 metres—and as the insect seems to be rather rare in collections I thought they might be of interest to-night."

Aberrations of Central European Rhopalocera.—Mr. Douglas Pearson exhibited a drawer of aberrations of the genera *Melitaea* and *Erebia*, amongst which were some striking forms of *E. stygne*, *E. ceto*, and *M. varia*, as well as a remarkably variegated ♀ of *M. aurelia*, generally speaking the most constant of the group.

A New Suborder of Dermaptera.—Dr. Jordan exhibited on behalf of Dr. Malcolm Burr, a pair of *Arixenia* n. sp., found in vast numbers in a cave in Java, on bats' guano. These creatures are remarkable in that they differ in several essential features from the true earwigs, so that it has been necessary to form a new suborder for their reception. The only other known species was found in the gular pouch of a flying fox, but it is not certain that they are parasites.

Difference of Food and Habit in closely related Saw-flies.—The President drew attention to a note in the *Zeitschrift für wissenschaftliche Insekten-biologie* by Dr. E. Enslin, on closely related species of sawflies one of which was parthenogenetic and the other not. He said that *Croesus varus* and *latipes* have very similar yet distinguishable imagines, but quite different larvae, and live on different plants; the larvae of *varus* is green and lives on alder, that of *latipes* is black and lives on birch. Von Rossum reared *varus* imagines (all ♀ ♀) from alder, which produced a parthenogenetic next brood of larvae. These were fed on birch and became brown, and the resulting imagines showed a tendency to the coloration of *latipes*. The ♂ of *varus* is almost if not quite unknown, that of *latipes* is not rare. Von Rossum suggests that *varus* and *latipes* may be races of one species varying in characters according to their diet in the larval stage. It is curious that very many saw-fly larvae feeding on alder are almost exclusively known in the ♀ sex, while closely similar species living on birch (when bred artificially) always produce numerous males.

A discussion on the effects of food arose, in which Messrs. Waterhouse, Cockayne and Fenn took part. Dr. Chapman observed that among the Psychids there are several cases of closely related forms, perhaps of the same species, of which one is parthenogenetic and the other (usually the more southern) is not so.

Wednesday, March 20th, 1912.

Rev. F. D. Morice, M.A., President, in the Chair.

Election of Fellows.

The following gentlemen were elected Fellows of the Society:—Messrs. T. W. Allen, M.A., 30, Blenheim Gardens, Cricklewood, N.W.; Edward Stuart Augustine Baynes, 120, Warwick Street, Eccleston Square, S.W.; Gerald Bedford, Entomologist to the Union of South Africa, Dept. of Veterinary Science, Churchfelles, Horley, and Ondestepoort, Transvaal; Capt. Kenneth Alan Crawford Doig, R.A.M.C., M.R.C.S., F.R.C.P., Villa Sorrento, York Road, Woking; Messrs. Herbert L. Earl, 35, Leicester Street, Southport, Lancs.; C. Jemmett, Ashford, Kent, and South-Eastern Agricultural College, Wye, Kent; R. D'A. Morrell, Authors' Club, 1, Whitehall Court, S.W.; Charles A. Schunck, Ewelme, Wallingford.

Notice from Natural History Museum.

The Rev. G. Wheeler, one of the Secretaries, read a letter received from the Natural History Museum, S. Kensington, announcing officially that the Boundaries had been now fixed in accordance with the settlement of 1899.

Decease of a Fellow.

The death was announced of Mr. H. J. Adams, of Roseneath, Enfield.

Exhibitions.

A Coleopteron new to Britain.—Commander J. J. Walker exhibited specimens of *Claviger longicornis*, Müll. (with *C. testaceus*, Preyssl., for comparison), a species of *Coleoptera* new to the British list. They were taken under stones near Kirtlington, Oxfordshire, in May, 1906, and April, 1907, in nests of a small black ant of a species not determined, but suggested by Mr. Donisthorpe to be possibly *Lasius umbratus*, Nye.

Ants and Dipterous Larvae.—Mr. Donisthorpe exhibited specimens of *Microdon mutabilis* bred in his observation nest of *Formica fusca* from Porlock, also the nest itself with the ants and a live larva of *Microdon* taken at Porlock, April 27th, 1911, and pupa cases and lavae of the fly in spirit. He explained the food of the larvae which was unknown heretofore, and gave some account of the life history; he also showed a map of its distribution in Britain.

Mr. W. C. Crawley said that he had found one larva in a nest of *Myrmica ruginodis* instead of the usual host *Formica fusca.* This larva, which was only one-third grown when found, lived from April to August inclusive and reached full size. It was then attacked by the ants when its underside was exposed, and devoured by them.

Lepidoptera with the "Neptis" pattern, collected by C. A. Wiggins near Entebbe in 1909.—Professor Poulton exhibited 120 of the 130 insects in the following list—10 examples of *N. ophione* having been omitted for the sake of convenience. The exhibit had been arranged by Professor Poulton and Mr. C. A. Wiggins, during his visit to England in 1911. All the specimens had been captured in forests within a few miles of Entebbe, between May 23 and July 25, 1909. The captures were indiscriminate, so that the following list gives a fair idea of the true proportions in the period under review.

Neptidopsis ophione, Cram.	55
Neptis melicerta, Drury	30
,, *agatha*, Stoll	11
,, *metella*, Dbl.-Hew.	7
,, *nicomedes*, Hew., var. *quintilla*, Mab.	5
,, *nemetes*, Hew.	2
,, *saclava*, Boisd.	2
,, *nysiades*, Hew., ab. *continuata*, Holl.	2
,, *puella*, Auriv.	1
Deilemera leuconoe, Hopff.	14
,, *transitella*, Strand	1
Total	130

Professor Poulton said that the most astonishing thing about the list was the predominance of the *Neptis*-like Euryteline, *N. ophione.* Considering the overwhelming numerical superiority over all the species of *Neptis* except *melicerta*—and this contributed but little over half the number of *ophione*—together with the existence in Hayti of an allied Euryteline with a somewhat similar pattern, Professor Poulton, in opposition to his former view (Trans. Ent. Soc., 1902, p. 468), was inclined to think that the patterns of African species of *Neptis* had been influenced by *Neptidopsis.* There was no doubt about the resemblance between the two genera on the wing. In support of this conclusion Professor Poulton exhibited a specimen of *ophione* taken by Mr. C. F. M. Swynnerton, April 18, 1911, on the outskirts of Chirinda Forest (3,800 ft.), in South-east Rhodesia. The "paper" bore the note "Taken for *N. saclava* on the wing. Mistake not discovered till in the net.—C. F. M. S." Mr. W. A. Lamborn had also written as follows on the same subject :—

"Oni Camp, *Sept.* 19, 1911.

"When writing of *Neptis* last week I might have said that I always find it difficult to distinguish large forms on the wing from *Neptidopsis*, and I still catch *Neptidopsis* under the impression that it is *Neptis*, from time to time. Both have the same floating and apparently leisurely flight, but it is quicker than one thinks, and I find both equally elusive and difficult to catch."

Comparing the patterns of the species in this combination from Entebbe, at first sight, *agatha* appeared to present the nearest approach to *ophione.* On the other hand, the markings of *agatha* differed in their purer white from those of *ophione*, which were faintly tinged with yellow, as in *saclava*, *nemetes*, and other species of *Neptis.* The two first-named species, especially *saclava*, also resembled *ophione* in the prominence of the black submarginal markings on both surfaces of the hind wings (see also above). Among the other species, *metella* was an evident mimic of *melicerta*, although an even closer one of those species of *Neptis*—unrepresented in the exhibit—in which the white stripe running through the fore wing cell was continuous, and not, as in *melicerta*, divided at its distal extremity. There could be no reasonable doubt that *metella* was a mimic. To one unfamiliar with the species, it was a great surprise to see the under surface for the first time, and then to realise that the pattern of the upper side had given an entirely false impression of affinity. The three remaining species, *nicomedes*, *nysiades* ab. *continuata*, and *puella*, were closely similar, and would be indistinguishable upon the wing. The two Hypsid moths presented a rough approximation to the pattern of *agatha*.

NEPTIS SWYNNERTONI, A NEW SPECIES FROM S.E. RHODESIA —Professor POULTON exhibited the male and female types, described below by Mr. Roland Trimen, F.R.S., together with a specimen captured in the garden at Chirinda (3,800 ft.) on March 28, 1911, by Mr. C. F. M. Swynnerton. The "paper" bore the note "continually settling on the ground.—C. F. M. S." Two specimens of the closely allied *N. incongrua*, Butler, captured by Rev. K. St. Aubyn Rogers on Feb. 16, 1911, at Chawia, British East Africa (5,000 ft.), were also exhibited, so that they might be compared with the new form from the south. The far narrower bar of the hind wing of *incongrua*, together with the much smaller size of the principal fore wing marking, at once served to distinguish the two forms.

"*Neptis swynnertoni*, sp. nov. A near ally of *N. incongrua*, Butl.* *Exp. al.* (♂) 1″ 8‴; (♀) 2″ 0½‴. *Brownish-black, with pure-white markings.*

"♂. *Fore wing*: Four minute spots in discoidal cell and three extra-cellular ones beyond its extremity, disposed as in *incongrua*; in the interrupted discal series of spots of unequal size—the first (minute subcostal) spot is wanting, the second is smaller and narrower, but the third larger and rounder than in *incongrua*; the fourth and fifth are very much enlarged and confluent into a single conspicuous oblique elongate marking bisected by second median nervule; the

* Proc. Zool. Soc. Lond., 1896, p. 112, pt. VI, f. 2 (♀), and p. 826. This species was originally described from Nyassaland (♂ ♂) examples, but has since been found in British East Africa, two examples in the Hope Department having been taken by Rev. K. St. A. Rogers at Taita and Tuso (Kikuyu Co.) respectively (see also above).—R. T.

sixth is wanting; and the seventh (on inner margin) is very much smaller and not so sharply defined. *Hind wing*: median band considerably broader—especially in its median part—its inner edge much nearer to base, and curved instead of almost straight, and its first (subcostal) spot wanting. Cilia in both wings white between nervules. UNDERSIDE.—Warm ferruginous-brown, of a redder tint than in *incongrua*, with the fuscous neuration and linear internervular streaks more pronounced; white markings as on upperside, but discocellular and subcostal spots larger in the fore wing, where the inner marginal subcellular area is shining grey, much more glossy than in *incongrua*.

"♀. Like ♂, but with all white markings larger, and the first spot of discal series—subcostal, small, and sublinear in fore wing, but of moderate size and conspicuous in hind wing—present as in *incongrua*. UNDERSIDE.—Ground-colour paler and brighter than in ♂, with an ochreous-yellow tinge; white markings as on upperside.

"The differences pointed out, and especially the large oblique medio-discal single marking formed in the fore wing by the enlargement and complete union of the two largest spots of the discal series, and the much broader and somewhat unevenly curved (instead of straight) band in the hind wing, give this form a thoroughly distinct aspect from that of *N. incongrua*, and to a considerable extent approximate it in pattern, as far as the upperside is concerned, to *N. marpessa*, Hopff. [= *saclava*, Boisd.], a congener of very wide Ethiopian range; but the similarity does not extend to the hind-marginal areas, which in *swynnertoni* (as in *incongrua*) are of the simple unvaried black of the ground-colour, but in *marpessa* are marked with a series of darker spots succeeded by two series of indistinct whitish lunules. As regards the underside, *swynnertoni* and *incongrua* differ widely both from *marpessa* and from the rather numerous African group represented by *N. agatha*, Cram., in the complete want (except in the case of the minute discocellular and subcostal spots of the fore wing) of the numerous and elaborate minor paler and darker markings, and also in the rufous—or ferruginous—ochreous ground-colour; in both which respects, but especially in the latter, the two forms under notice, together with *N. exaleuca*, Karsch,* from Camaroon, and *N. woodwardi*, E. M. Sharpe,† from British East Africa, constitute a section apart from the other known Ethiopian ones, and approaching the group represented by the well-known Palaearctic species *N. lucilla*, Fab., ranging from Central Europe to Japan. It is remarkable that of these four forms, the extreme West African species, *N. exaleuca*, is, in the shape, disposition, and longitudinal extension of the markings, more like than any of the others to *N. lucilla*.

"The ♂ and ♀ of the new form here described were presented to the Hope Department by Mr. G. A. K. Marshall, who kindly informs me that both were taken—the ♀ by himself, and the ♂ by Mr. C. F. M. Swynnerton—in a remarkable isolated patch of heavy forest on the top of Mt. Chirinda (about 4,500 ft.), in the Melsetter District (formerly known as 'Gaza-land') in S.E. Rhodesia, situated quite close to the Portuguese border and about 150 miles by road south of Umtali. The ♂ was captured in March, and the ♀ on 18th October, 1905.‡

"It is a pleasure to associate with this interesting new form the name of Mr. Swynnerton, a naturalist who is a fellow-worker with Mr. Marshall in the richly productive region of Rhodesia.

"There is an obvious similarity between the narrow-banded *N. incongrua* and the common *Eurytela hiarbas*, Drury, § a

* Berl. Ent. Zeit., xxxix, p. 10, f. 5 (1894).

† Ann. and Mag. N. Hist. (7), iii, p. 243 (1899).

‡ Since the above was written the Hope Department has received from Mr. Swynnerton 3 ♂ ♂ and 2 ♀ ♀, taken in the same locality, but at a lower elevation, viz. 3,800 ft. The dates of capture of the ♂ ♂ are noted as respectively 1st to 6th March, 5th April, and 10th April, 1907, and of the ♀ ♀ respectively as 25th March and 13th April, 1907. These additional examples of both sexes agree very closely on both surfaces of the wings with the individuals above described—the only noticeable difference being in the smaller size of the inner-marginal white spot on the upperside of the fore wings. As regards size, however, the three ♂ ♂ have a rather larger expanse of wings, viz. 1″9–10½‴, and one of the ♀ ♀ a rather smaller expanse, viz. 1″ 11½‴.—R. T.

§ This resemblance was pointed out by Rev. K. St. Aubyn Rogers in Trans. Ent. Soc., 1908, p. 507. It is worthy of remark that the eastern and southern *hiarbas* bear a much narrower white bar than the western. Although the Entebbe specimens are western in character, as in so many other species, the forms of *hiarbas* from the parts of British East Africa

Nymphaline of a group not remote from that represented by the genus *Neptis*. *E. hiarbas* has a very wide Ethiopian range; and, as I have noted in 'South-African Butterflies' (I, pp. 260 and 270), it and the two commoner species of *Neptis* occurring in the same districts of South Africa, have much the same flight and habits, hovering rather slowly about the lower trees and shrubs, and often settling—the *Eurytela* being more partial to the stems and the *Neptis* to the leaves. I also called attention (*op. cit.*, p. 258) to the much closer resemblance existing between the Tropical-African *Eurytela* (*Neptidopsis*) *ophione*, Cram., and *Neptis melicerta*, Drury;* and in view of the mimetic relations which probably obtain between the two genera, it is interesting to bear in mind that Mr. Marshall some years ago found some evidence of the distastefulness of the conspicuous *N. agatha*. †

R. Trimen."

Two African Species of the Danaine genus Tirumala (Melinda) as Models, and one as a Mimic.—Professor Poulton exhibited *T. formosa*, Godman, and its mimic *Papilio rex*, Oberth., from the Kikuyu Escarpment, near Nairobi, British East Africa; the same Danaine, and the transitional *Papilio commixta*, Auriv., from Nyangori, at the N.E. corner of the Victoria Nyanza; *T. mercedonia*, Karsch, and *Papilio mimeticus*, Rothsch, from Buddu on the W. shore of the lake; and *T. morgeni*, Honrath, with three of its *Amauris* models—*psyttalea*, Plötz, *hecate*, Butler, and an undetermined species, probably new, from the Cameroons. The specimens of *formosa*, *mercedonia*, and their models were those figured in Plates XI and XII accompanying Mr. S. A. Neave's paper in Ent. Soc. Trans., 1906, p. 207, and it was

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where *Neptis incongrua* was taken by Mr. St. Aubyn Rogers, are thoroughly eastern in the narrowness of the bar. Chirinda is remarkable in the possession of a local form of *hiarbas* in which the bar is again broader, approaching, although without equalling, the western type. *N. swynnertoni* is, at the same time, distinguished from *N. incongrua* by its broader white markings. The western affinity of other Chirinda forms has been observed by Mr. G. A. K. Marshall.—E. B. P.

* See, however, p. xxvii, where other species of *Neptis* are associated with *Neptidopsis*. The stripe running through the fore wing cell of *melicerta* appears to separate its pattern from that of *ophione*.—E. B. P.

† Trans. Ent. Soc. Lond., 1902, pp. 384, 386, 387.

explained that, in the Hope Department, figured specimens illustrating the problems of bionomics were as far as possible always arranged side by side with copies of the respective plates. Professor Poulton said that, although the examples were well known, he had ventured to exhibit them, because the bionomic history of the three African species of the Oriental genus *Tirumala*, had never been so completely illustrated as in the drawer which he had brought to the meeting. There was something arresting in the sight of the actual species with their mimics and models, which was inevitably lost in descriptions and figures, however good. He drew attention to the fact that the deep reddish-brown colour of *mercedonia* was preserved, but little darkened, on that part of the under surface of the fore wing of *morgeni* which is covered by the hind wing in the attitude of rest, although elsewhere, on all visible parts of both surfaces, the tint had so far deepened as to present the closest likeness to the *Amauris* models. The pattern of the undetermined species of *Amauris* was more closely resembled than that of any other, although, in the form of the fore wings, *hecate* appeared to be the principal model. Professor Poulton pointed out that *Tirumala* passed from the condition of a model to that of a mimic at the point where it had left its original country furthest behind, and had penetrated most deeply into the area where the black and white species of *Amauris* were dominant.

A large Lepidopterous Pupa, probably Lycaenid, found in the leaf-nest of Oecophylla, in the Lagos district.—Professor Poulton exhibited the pupal shell and the dead pupa referred to by Mr. W. A. Lamborn in the following note upon the tree-ant *Oecophylla smaragdina*, F., race *longinoda*, Latr. Both pupae, which were evidently of the same species, were attached to the leaf by an expanded sucker-like base, similar to that of a much smaller pupa found in March, 1910, by Mr. Lamborn on the under side of a leaf 3 ft. from the ground, in the forest, 1½ miles E. of Oni. This pupa produced, on March 11, 1910, a male *Argiolaus*, of which the species has not as yet been identified. This specimen and its pupal shell were also exhibited.

"Oni Camp, *Feb.* 10, 1912.

"I have seen the ants using their larvae to weave silk in the manner described by Mr. H. N. Ridley, F.R.S., at Singapore (1890). They grip them dorsally and carry them to and fro, applying the larval mouth-parts to various points to fix the silk.

"When slightly alarmed these ants quiver violently so as to produce a rustling sound on leaves, and when still more alarmed the abdomen is uplifted and a drop of fluid is ejected to a distance of 5 or 6 inches.

"12/2/12.

"The ants are not thriving in captivity, and, as many of their larvae have died, I decided to 'board out' my Lepidopterous larvae all in one large nest. On opening one up last night, I found remains of a pupal shell and one large pupa dead—undoubtedly Lycaenid I should think from its resemblance to one sent last year. I am, however, puzzled on account of its large size; for I do not call to mind any Lycaenids large enough to correspond with the pupa, and if the larvae in my possession are of the same species, they cannot be a quarter grown. I send this dead pupa. The silk at the edge of the leaf bound it to the ants' nest."

The larvae referred to above were found by Mr. Lamborn in the leaf-nests of *Oecophylla*. Their form and habits were very remarkable, and Professor Poulton hoped to bring Mr. Lamborn's account before the Society when the imagines have been bred and identified.

THE SLUGGISHNESS OF TWO W. AFRICAN LYCAENIDAE OF THE GENERA EPITOLA AND HEWITSONIA.—Professor POULTON exhibited the three largest *Lycaenidae* captured by Mr. W. A. Lamborn, and suggested that the undetermined pupae in the nest of *Oecophylla* might possibly belong to one of them. He pointed out, however, that all three were placed among the *Lipteninae*, while the problematical pupa bore much resemblance to a smaller one which produced an imago of the genus *Argiolaus*, belonging to the *Lycaeninae*. The three large species were *Epitola honorius*, F., male and female, *E. posthumus*, F., male, and *Hewitsonia boisduvali*, Hew., male and female.

Mr. Lamborn's notes on the two females showed a remarkable degree of sluggishness.

Epitola honorius, F., female. "Observed 5 p.m. Jan. 18, 1912, feeding on secretion of Homoptera on green stem near Oni clearing; seen again at same spot on Jan. 19, about 8 a.m. and 3.30 p.m., and at the same hours on Jan. 20 and 21. Captured 3.30 p.m. Jan. 21."

Hewitsonia boisduvali, Hew., female. "This particular insect observed on twig, 1 mile E. of Oni, Oct. 21, 1911, feeding. It was seen each day in precisely the same position up to Oct. 26, when I took it. It was identified by the damage to the hind wings. The twig on which it was feeding bore a number of Homopterous insects, most of which fell off when I took the butterfly, but two remain on the twig now sent."

The twig, still bearing the two Homoptera, was exhibited with the butterflies. The specimen of *honorius* was perfect, while both hind wings of *boisduvali* were symmetrically torn. It was evident that the closed wings had been seized at the anal angle, and a wide and deep notch, ending in a narrow chink, cut in each of them. The form of the chink seemed to be inexplicable except on the supposition that the injury had been inflicted by the beak of a bird.

The remarkable sluggishness of these immense Lycaenids suggested strongly that they were specially protected, and that the under surface of *honorius*—beautifully mimetic of *Planema*—was to be explained on the Müllerian hypothesis. The same conclusion was supported by the extraordinary under surface of *H. boisduvali*, and by the position of the butterflies on twigs and stems. Although not specially referred to in these cases, Mr. Lamborn had frequently spoken of the striking conspicuousness of the *Lipteninae* when following their characteristic habit of feeding—probably always on the secretions of Homoptera—in an exposed position on twigs, etc. Professor Poulton had suggested that the *Lipteninae* were a specially protected group in Trans. Ent. Soc., 1902, p. 500.

Amauris egialea stroking the brands of the hind wings with its anal tufts.—Professor Poulton exhibited a male

Am. egialea, Cram., recently received from Mr. W. A. Lamborn. The "paper" enclosing the specimen bore the following note:—

"8 a.m. Half mile [from Oni clearing]; Jan. 30, 1912. Observed flying up and down. It then settled on upper surface of leaf and started to pass its brushes to and fro over its scent-patches, exactly as *Amauris niavius* did. Wings were rather over-flexed."

The latter statement was illustrated by a diagrammatic section which showed that the hind or outer margins of both wings were in contact with the surface of the leaf and thus below the level of the body. The observation was a most interesting confirmation of the conclusions to be inferred from Mr. Lamborn's earlier account of the behaviour of *Am. niavius*, L. (Proc. Ent. Soc., 1911, pp. xlvi, xlvii). Together with Mr. Lamborn's specimen, was exhibited a male of *Am. egialea* in which the brands of both hind wings had been entirely eaten out by ants, and a male of *Am. niavius* in which the right brand had been partially eaten. The injury was probably inflicted on the dead specimens by house ants. The *egialea* had been previously exhibited to the Society (Proceedings, 1907, p. x), but in view of this recent observation it was thought well to show it again.

These observations on the relationship between the anal brushes of male *Danainae* and the brands on their hind wings, were confirmatory of Fritz Müller's remarkable inference, published in the year 1877 ("Butterfly-hunting in many Lands." G. B. Longstaff, 1912, p. 619).

Dr. F. A. Dixey said that among Professor Poulton's series of exhibits, that illustrating Dr. Lamborn's valuable observation on *Amauris egialea*, confirming as it did a previous observation by the same naturalist, had for him a special interest. It was well known that the scent-distributing apparatus in Rhopalocera took the form sometimes of specialised scales scattered broadcast over the surface of the wings, as in many Pierines and Lycaenids; sometimes of scales or hairs collected into definite patches, as in other Pierines and in the subfamily to which Dr. Lamborn's *Amauris* belonged. That the patch near the costa of the hind wing in *Colias edusa* was really a scent-patch, the speaker knew from personal observation. In certain Pierines, as for instance *Catopsilia florella*, in addition to a *Colias*-like patch on the hind wing, there existed a tuft or fringe of hair-like scales near the inner edge of the fore wing. The close proximity of the latter to the former structure suggested that it might be used in some such way as the terminal tuft of the butterfly exhibited by Professor Poulton. The speaker had observed, as mentioned in his Presidential Address in 1910, that the scent-patches in Pierines were furnished with a special distribution of tracheae. The ultimate branches of these were difficult to trace, but in some instances they appeared to have an unmistakable connection with the sockets by which the scent-scales were articulated with the membrane of the wing. He thought at the time that he was the first to observe this peculiar connection of tracheae with the scent-patch, but had since found that he had been anticipated by Fritz Müller, who saw everything. Lt.-Col. Manders had also noticed it, though his observations on the point were at present unpublished. Dr. Dixey went on to say that he had put forward the suggestion that by the means of this tracheal supply, the products of the special secreting cells which had been observed (though not in actual connection with the scales of a scent-patch) by Weismann, Günther and others, might be propelled, as it were by a *vis a tergo*, into the scent-scale, and so, in a volatilised condition, into the outer air. In many cases of isolated scent-scales furnished with a proximal disc, an evident aperture existed in that part of the disc which was included in the socket. Through this the interior of the scale might be put into communication with the secretory apparatus lodged in the membrane of the wing. In these cases the escape of the odour into the open air doubtless took place through the distal fimbriae with which scales of this type were usually provided; but Dr. Lamborn's observation suggested that the anal tufts acted as mechanical dispersers of an odour produced elsewhere, rather than as themselves directly connected with a secretory apparatus. The fact that in *Catopsilia* not only the *Colias*-like patch, but also the tuft or fringe, possessed a special supply of tracheal branches, seemed adverse to the idea that the fringe, in this instance, acted as a mere scent-sprinkler; that is, if the speaker's interpretation of the presence of tracheae were correct. It would be interesting, in view of Dr. Lamborn's observations, to know whether the anal tufts in *Amauris* were in connection with any secreting cells or other similar apparatus. For this purpose no information could be expected from dried specimens, and it would be most desirable to have fresh material treated with proper reagents on the spot, and so sent home in a condition fitted for microscopic examination.*

Professor Kellogg of California, who was present as a visitor, called attention, in connection with Dr. Dixey's remarks, to a paper by Mr. B. Thomas, of Cornell University, on the scent-glands in the wings of butterflies. In this paper Mr. Thomas described certain unicellular glands at the base of the androconia, which presumably could be interpreted as the producers of the scent-stuff given off by the androconia. Professor Kellogg added that in sections of wings made by himself he had noticed similar glands. It would be difficult to prove the actual continuity of the glands and scales, because of the peculiar mode of attachment of the scales to the wings, viz. by the insertion of a bulb-like expansion of the pedicel of the scale into a small pocket or cup in the membrane, the base of the scale and the membrane being quite discontinuous.

Dr. Dixey, in thanking Professor Kellogg for his interesting observations, observed that the expansion of the pedicel was not really a bulb, but a disc.

Wednesday, April 3rd, 1912.

The Rev. F. D. Morice, M.A., President, in the Chair.

Election of Fellows.

The following gentlemen were elected Fellows of the Society:—Mr. Henry Hacker, Queensland Museum, Bowen Bridge Road, Brisbane, Queensland; Mr. Cyril Engelhart Latour, Port of Spain, Trinidad, British West Indies; Signor Orazio Querci, Macerata, Marche, Italy.

* Many of these points were more fully dealt with in Dr. Dixey's Presidential Address of 1910. [Ed.]

Appointment of Delegates.

At the request of the President, the Rev. G. Wheeler announced that the Council had been invited to elect Delegates to represent the Society at various functions, and that the following had been elected :—for the Centenary Celebration of the Philadelphia Academy of Natural Sciences, Professor Comstock and Dr. Holland; Professor Fernald, who had also been elected, was unable to attend; for the First Eugenic Congress, in July, Professor Bateson; for the 250th Anniversary of the Royal Society, in July, the President; for the International Congress of Entomology, in August, the President, the Rev. G. Wheeler, Secretary, and Messrs. G. T. Bethune-Baker, H. Rowland-Brown, and the Hon. W. Rothschild.

Exhibition.

Parasites on a Parasite.—Mr. G. T. Bethune-Baker exhibited a specimen of *Cyclopodia hopei*, Westw., a parasite on the Indian Flying-fox; this was itself parasitised by an Acarid of the genus *Gamasus*, there being no less than 17 of this small species on one specimen of *C. hopei*.

Discussion on Nomenclature.

There being no other exhibits and no papers to be read, the President said that he thought it would be a good opportunity to discuss the important subject of Nomenclature, and asked Mr. Durrant to give an account of certain generic names proposed by the late Mr. G. W. Kirkaldy for Hemiptera, to take the place of other pre-occupied names. Mr. Durrant gave them to the President to read, which he did amidst much laughter, the names, though disguised under such Greek-looking forms as *Ochisme*, *Marichisme*, etc., being in reality merely composed of the words "Florry kiss me," "Peggy kiss me," and so forth. The President observed that such names were impossible of acceptance, and merely tended to make Entomological nomenclature the laughing-stock of the scientific world. He feared also that if the strict law of Priority were to be insisted upon in names, it might soon be also in anatomical and kindred nomenclature; he mentioned a recent publication in which insects were divided into groups having two *calcaria* and one *calcaria* (!), and in which such expressions as "metapostscutum," "metaepimeron," etc., were employed, and said that it was monstrous that educated persons should for ever be bound by such forms of words, simply because the original giver of the names did not know what he was talking about. At the same time he counselled patience, saying that we could not expect in one generation to arrive at a permanent solution of so difficult a problem.

Mr. J. H. Durrant concurred with the President in the absolute impossibility of accepting such names; he then spoke of Mr. Kearfott's nonsense alphabets, *bana*, *cana*, *dana*, etc., etc., and congratulated Mr. Meyrick on his valiant attempt to dispose of them at a stroke.

The Rev. G. Wheeler said that it was a relief to hear two such eminent Entomologists agree that the laws of Priority must not over-ride everything. He said that while he admired and sympathised with Mr. Meyrick's attempt, published in the *Entomologist's Monthly Magazine*, he feared it was beyond the power of any individual to reject a series of names of this kind, and said that he intended, unless some one else was already going to do so, to move at the coming International Congress for the appointment of a permanent International Committee, such as Mr. Turner had already advocated before the Society, who should have power to deal with the question, and to whom all names should be submitted before they were held to have achieved publication.

Mr. G. T. Bethune-Baker, though strongly upholding the law of Priority on all ordinary occasions, was quite in favour of the idea of such a Committee, who should have power to alter the International Code if necessary.

Mr. C. O. Waterhouse gave, as an instance of the fatuity of adhering too strictly to the law of Priority, Meigen's paper on *Diptera*, dated 1800, of which only three copies were known to exist, which had remained unknown for more than a century, and which would, if followed, change some of the most universally employed names in the Order. Meigen had written much on the *Diptera* later, and had never referred to this paper, which it was in fact probable that he had wished to suppress, the three known copies having escaped suppression. Some German writers had accepted this paper, which would, if the example were followed, necessitate remembering a double set of names.

Mr. W. J. Kaye thought that Entomologists owed a certain amount of gratitude to Mr. Kearfott and Mr. Kirkaldy, because but for their *reductio ad absurdum* nothing definite would ever have been done in the matter. He was of opinion that an International Committee would be unworkable, and considered that a British Committee would be sufficient, leaving other nations to form their own.

The President, Mr. Bethune-Baker and Mr. Durrant pointed out, from different points of view, that no arrangement which was not international would have any chance of permanence. Mr. Durrant also remarked with regard to Meigen's paper on *Diptera*, that it was really unintelligible, except in the light of his later writings, no species having been mentioned in his genera, and on that account, if on no other, it ought not to have been accepted.

Mr. A. Sich, reverting to Mr. Kaye's proposal, suggested the possibility of an International Committee, with National sub-committees, who should deal with questions arising in their own country.

Mr. A. E. Cockayne pointed out a difficulty as to what could be done when a native of one country discovered and named a new species in another country. Which sub-committee should exercise control?

Mr. W. E. Sharp propounded a further difficulty, viz. that the validity of a name might involve the validity of a species, and asked Mr. Wheeler or Mr. Turner to explain how it was proposed to deal with this much wider question.

The Rev. G. Wheeler replied that he would not propose to deal with it at all; that such a Committee as he advocated would deal with nomenclature pure and simple, leaving the responsibility for the validity of the species with the specialists as at present. He added that if Mr. Sich's suggestion were adopted, Mr. Cockayne's difficulty could easily be met by a hard and fast rule, in whichever direction the International Committee thought well.

Mr. H. J. Turner said that it would be wiser, at first at any rate, to narrow the field of operation of the Committee as much as possible consistently with efficiency.

Dr. T. A. Chapman suggested that reference might be made to the Committee only in those cases where a name was challenged. He went on to refer to the suggestion which M. Oberthür proposed making at the Congress, that no name should be held valid unless accompanied by a good figure. While fully recognising the importance of a good figure, he held that such a setting aside of generally accepted names was out of the question.

Mr. G. T. Bethune-Baker fully agreed with Dr. Chapman on this question, and pointed out that the acceptance of this proposal would entail the sweeping away of a vast proportion of recognised nomenclature.

Mr. J. H. Durrant observed that the main point really resolved itself into the question "What is a name?"

The President suggested that the question should be re-opened at the June meeting, with a view to some definite step being taken by the Society.

Mr. Turner proposed that a small Committee be appointed to consider the subject of Nomenclature and report to the June meeting, with a view to the coming International Congress. This was seconded by Mr. A. E. Gibbs, and carried *nem. con.*

The following Fellows were proposed as forming the Committee, and the names being put from the Chair were unanimously accepted:—Mr. G. T. Bethune-Baker, Dr. T. A. Chapman, Messrs. J. H. Durrant, H. J. Turner, C. O. Waterhouse and Rev. G. Wheeler, with power to add to their number.

Wednesday, May 1st, 1912.

Mr. A. H. Jones, Vice-President, in the Chair.

Election of a Fellow.

The Rev. E. Adrian Woodruffe-Peacock, F.L.S., F.G.S. Cadney Vicarage, Brigg, Lincolnshire, was elected a Fellow of the Society.

The Seal.

In accordance with the vote of the Council, the CHAIRMAN announced that impressions of the Seal of the Society in wax could be obtained by Fellows at a cost of half a guinea.

Exhibitions.

ABERRATIONS IN AGLAIS URTICAE, VAR. ICHNUSA.—Mr. A. H. JONES exhibited three examples of *Aglais urticae*, var. *ichnusa*, out of about 100 bred specimens from larvae found in Corsica, showing the absence of scales in the centre of the wings, where the central spots are present in the type. These spots appeared also in one only of the Corsican examples.

VARIATION IN EUCHLOË DAMONE.—Mr. JONES also exhibited examples of *Euchloë damone* from Asia Minor, showing the difference in the depth of colour of the transverse black streak on fore wings and in the tone of colour of undersides; the Sicilian specimens, taken by Mr. J. Platt Barrett, being of a greenish-yellow, whereas the Asia Minor specimens are distinctly yellow.

A VERY SCARCE EGYPTIAN PIERID.—Dr. G. B. LONGSTAFF exhibited a series of twelve specimens (five males and seven females) of the rare white butterfly, *Pinacopteryx doxo*, Godart (*venatus*, Butler), from the White Nile, Lat. 7° N. to 5° N. Dr. Dixey had informed him that he knew of but four specimens in collections, viz. Godart's type, a female, at Edinburgh, taken in "Africa," two females in the British Museum, both from the White Nile district, one of them being Butler's type of *venatus*, and Dr. Dixey's type of the male in the Hope Collection, also from the White Nile.

BIRDS AND INSECTS AT THE EDGE OF FIRE.—Dr. G. B. LONGSTAFF stated that large areas of the reeds and papyrus on the White Nile which constitute "the Sudd" are annually burned. Many birds are attracted to these fires, amongst others Mr. A. L. Butler of Khartum had especially noticed various species of swallow. Dr. Longstaff had, on more than one occasion, seen a number of kestrels in the smoke to the leeward of a fire, and had once watched for some time a pair of bee-eaters (*Merops nubicus*) perch within a few feet of a fire on the windward side. He saw them fight for a large Orthopterous insect which was driven out. This *Merops*, a beautiful coppered bird with peacock-blue head and rump, was locally called the "fire-bird." The picture postcards exhibited showed four kites (*Milvus aegyptius*) hawking in the smoke.

Commander WALKER observed that he had seen the same thing occur in Australia, birds waiting for insects at the edge of a bush-fire and seizing them as they came out.

Dr. F. A. DIXEY congratulated Dr. Longstaff on his series of *P. doxo*, and observed that there was no doubt of the specific value of this insect, its scent-scales being quite distinctive.

SCARCE COLEOPHORIDS.—Mr. ALFRED SICH exhibited two specimens, with their cases, of *Coleophora trigeminella*, Fuchs., and one specimen of *C. badiipennella*, Dup., with its case for comparison. He said that *C. trigeminella*, first described in 1881, had lately been described as British by Mr. Bankes. Though it had been an inhabitant of Britain for many years it was not brought to light till 1906. This species resembles *C. badiipennella*, but is paler, and the case differs in having three valves and in being almost entirely formed of silk, spun by the larva; while that of *C. badiipennella* has only two valves and is composed of leaf cuticles joined by silk.

BRAZILIAN ITHOMIINES.—Mr. W. J. KAYE exhibited three small groups of Ithomiine butterflies that had been taken by himself in S. Brazil. One group consisted of *Heterosais nephele edessa*, *Ithomia drymo*, and *Leucothyris aquata*, all of which had been taken at Guaruja, near Santos, at the end of February and beginning of March 1910. On February 27 all three of the above species were caught in quick succession, but the total catch of all the species was very limited, and neither species was common nor could be said to be more dominant than another. The *Heterosais nephele edessa* was, however, usually looked upon as considerably rarer than the other two. The actual numbers of each secured (and every specimen was caught where possible) were *H. edessa* 3, *I. drymo* 4, and *L. aquata* 2. Another similar group but consisting of different species, and all belonging to different genera, was one made up of *Pseudoscada adasa*, *Pteronymia sylvo*, and *Hymenitis andromica andania*, all of which had been secured at Castro, in Parana, at close on 3,000 feet elevation. In this case also none of the species were found in abundance, the actual numbers being *P. adasa* 3, *P. sylvo* 1, *H. andania* 6. On March 11–12 all three species were secured in the same locality, and the *Hymenitis* continued to occur singly till the latter part of the month. Both the *Pseudoscada* and the *Pteronymia* are, however, frequently to be found in abundance, while the *Hymenitis* appears to be always decidedly less common. Mr. Kaye remarked that these groups of black and transparent Ithomiine species were always found in rather dark forest country, and it was possible that they were simply cases of syncryptic resemblance, rather than mimetic examples of a Müllerian Association, for these species were invisible at a very short distance, and they were all equally adapted to that end. A third small group that was exhibited consisted of a Danaine, *Ituna ilione*, and two Ithomiines, *Thyridia* (*Methona*) *themisto* * and *Dircenna dero*. All these were also from Castro. The *D. dero* was by far the commonest, but getting worn, while *P. themisto*, of which five were taken, was very fresh. Only two of the Danaine, *I. ilione*, were secured. The insects of this group were found on the margins of woods amongst rough scrub, and the causes of the resemblances were probably of a different nature. Natural selection here doubtless was at work to make these insects conform to a uniform pattern. While the small transparent Ithomiines were all but invisible at a short distance, these insects were conspicuous even at a considerable distance.

Professor E. B. Poulton, commenting on the exhibit, was of opinion that the forest species as well as the others were connected as members of a mimetic group.

Dr. Longstaff, speaking from personal experience, emphasised the invisibility of these Ithomiines on the wing, at a very short distance, in their native haunts.

New Mimacraeas.—Mr. Hamilton H. Druce exhibited ♂ and ♀ of the new *Mimacraea eltringhami*, captured by Mr. S. A. Neave in the Bugoma Forest, Unyoro, Uganda, and

* One *Aprotopos* (*Thyridia*) *psidii*, identical with the lower Amazonian form, and not at all like the usual S. Brazilian *A. hippodamia* (= *pytho*), was taken at Itarari, in similar country to Castro, but about 120 miles farther east, and 500 ft. lower elevation.

pointed out that the ♀ was almost an exact copy of *Planema poggei*, Dewitz; also another new *Mimacraea* which he proposed to name *costleyi*, after its discoverer Mr. Costley-White at Mlanji, Nyasaland, and which appeared to be allied to *M. marshalli*, Trimen, a specimen of which was also shown for comparison.

Mr. S. A. Neave described the capture of these specimens. This species in common with several others flies very high, and he said that it was often necessary to employ small native boys perched at the top of the trees and armed with nets.

Several Fellows commented shortly on this exhibit.

Butterflies from British Honduras and Guatemala.—Mr. A. E. Gibbs exhibited a drawer of butterflies from these localities, and made the following observations:—I recently received from Dr. Davis, of Belize, a small collection of butterflies collected in British Honduras and the neighbouring Republic of Guatemala, and I have brought up a few of the most interesting of them, with regard to some of which I have received valuable notes from the sender.

Papilio philolaus, Bsdv.—There are four specimens of this *Papilio* which exhibit considerable differences, two of them having the yellow transverse bands, common to both wings, very much more pronounced than in the other two specimens, which were altogether darker. It is well known that this variation exists in this species, and Rothschild and Jordan, in their "Revision of the American Papilios," suggest that the dark and pale specimens belong to different broods, and that it is a parallel case to the seasonal variations exhibited by the allied *Papilio marcellus*, Cr. (*ajax* auct.), of North America. It is an interesting point, and I wrote to Dr. Davis to see if he could clear the matter up, and he replied that he hardly thought that the differences could be seasonal, for, as far as he knew, the perfect insect only appears during the dry months of the year, Feb.–April. He had never seen a specimen when the rains became well established, *i.e.* at the beginning of June. "In this colony," he says, "it is a somewhat local species, but, where found, always in abundance, the favourite locality being the drying sands of rivers, close to the water's edge. Here they settle in myriads, each one with proboscis extended, and wings raised and incessantly vibrating. In company with various species of *Callidryas*, especially *C. philea*, *C. agarithe* and *C. argante*, and *Papilio androgeus*, *P. thoas*, *P. macrosilaus*, *P. salvini*, and *P. epidaus*, they settle in thousands all together, and the quivering of all these wings and the wonderful colours is a sight never to be forgotten for beauty. . . ." *Papilio philolaus* is a purely Central American insect, being found from Mexico to Nicaragua. In the Godman collection at South Kensington there is a long series showing a great amount of variation. A melanic form of the female is sometimes produced which is almost completely black, the pale bands being only visible as the faintest shadows.

Caligo memnon, Feld.—There is a specimen of this well-known Central American species. Dr. Davis writes: "There is another very handsome species, *C. uranius*, which is fairly common, and I hope to be able to send you one or two of these at no very distant date. The habit these have of settling on trunks of trees makes them very difficult to capture, and I usually find that they do not remain very long in good condition, owing, I suppose, to their large size and the extremely thick forest which is their usual habitat."

The collection embraced six species of the genus *Heliconius*, viz.—*H. ismenius telchinia*, Doubl.; *H. cydno galanthus*, Bates; *H. doris transiens*, Stgr.; *H. sapho leuce*, Doubl.; *H. petiveranus petiveranus*, Doubl.; *H. charithonia*, L. The first named, *H. telchinia*, is a brown species, with a striking resemblance to several other insects which fly in the same region. I have associated with Dr. Davis's specimen a *Mechanitis* (*M. doryssus*, Bates), also sent by him, and likewise *Melinaea imitata*, *Eueides zorcaon*, and the Danaine *Lycorea atergatis*, which, although not included in this collection, are found in Central America, the tint and pattern of the wings being very similar in these and other species, the general colour scheme having been called by Haensch the "*Lycorea* habitus." These butterflies afford a familiar illustration of Müllerian mimicry.

But to return to the species of *Heliconius* sent by Dr. Davis, I should like again to quote his letter. He says: "I am very glad that you were so pleased with *H. doris* and *H. leuce.* These are both rather difficult insects to capture, as their flight, though not rapid, is usually out of reach of the net. *H. petiveranus* is the common species here and varies most remarkably in size. I have seen specimens scarcely $\frac{3}{4}$ in. in expanse of wing, and again others $2\frac{1}{2}$ in. to 3 in. in expanse."

One other insect in the drawer calls for attention, namely the Lycaenid, *Eumaeus minyas.* It is a delightful little butterfly, and I wrote to my correspondent expressing my pleasure at receiving it. He replied: "It is a beautiful Lycaenid, I think, with its dark velvety-blue reflections. It is common enough where it does occur, but it is very local, and being weak on the wing is easily captured."

There are one or two notes in Dr. Davis's letter with regard to the localities in which he collects which may be of interest. "Belize itself," he tells us, "is a most wretched place as far as collecting goes. It is situated right in the centre of a huge swamp in which nothing grows but mangroves and a species of button-wood. The Lepidoptera are for this reason very badly represented in this locality. I always like to go into Guatemala for my annual vacation, for this is certainly a naturalist's paradise. From Puerto Barrios, the Atlantic port for Guatemala city, up the railway line one sees hundreds of varieties of the most interesting butterflies an the flowers by the side of the line. Of course it is impossible to leave the track and enter the forest, for there are no roads, and without an axe or machete no one could pass through the dense and thorny undergrowth."

I think we shall agree that it is most interesting and instructive to receive such notes as Dr. Davis has sent. They record the experiences gained in the field by a competent naturalist who has made careful observations on the insects about which he writes.

I append a list of the species received from Dr. Davis, B. H. signifying British Honduras, and G. Guatemala.

Danais plexippus, L., (B. H.); *D. cleothera*, Godt., (B. H.); *D. berenice*, Cr., (B. H.); *Aeria pacifica*, G. and S., (G.); *Mechanitis lycidice*, Bates, (G.); *M. doryssus*, Bates, (G.);

M. "*utemaia,*" Reak., (G.); *Dircenna euchytma*, Feld., (G.); *Pteronymia cotytto*, Guér., (Caledonia, B. H.); *Hymenitis oto*, Hew., (G.); *H. sosunga*, Reak., (G.); *Morpho peleides*, Koll., (Caledonia, B. H.); *Opsiphanes tamarindi*, Feld., (G.); *O. cassina fabricii*, Boisd., (Caledonia, B. H.); *Eryphanis aesacus*, H.-Schaff., (Caledonia, B. H.); *Caligo memnon*, Feld., (G.); *Heliconius ismenius telchinia*, Doubl., (Caledonia, B. H., and G.); *H. cydno galanthus*, Bates, (G.); *H. doris transiens*, Stgr., (G.); *H. sapho leuce*, Doubl., (G.); *H. petiveranus petiveranus*, Doubl., (B. H.); *H. charithonia*, L., (B. H., and G.); *Eueides aliphera*, Godt., (G.); *Colaenis phaerusa*, L., (B. H.); *C. julia delila*, F., (B. H.); *Agraulis juno*, Cr., (G.); *A. vanillae insularis*, May, (B. H.); *Euptoieta hegesia*, Cr., (B. H.); *Phyciodes theona*, Mén., (B. H.); *P. fragilis guatemalena*, Bates, (B. H.); *Junonia caenia*, Hb., (B. H.); *Anartia jatrophae*, L., (B. H.); *A. fatima*, F., (B. H.); *Catagramma lyca*, D. and H., (G.); *Gynoecia dirce*, L., (Caledonia, B. H.); *Peridromia guatemalena*, Bates, (G.); *Pyrrhogyra otolais*, Bates, (G.); *Mesosemia telegone*, Boisd., (Caledonia, B. H.); *Eumaeus minyas*, Hb., (B. H.); *Pieris josepha*, Salv. and G., (G.); *P. margarita*, Hb., (B. H.); *Callidryas philea*, L., (B. H.); *Phoebis argante*, F., (G.); *Aphrissa statira*, Cr., (B. H.); *Terias albula*, Cr., (B. H.); *Papilio iphidamas*, F., (Caledonia, B. H., and G.); *P. polydamas*, L., (B. H.); *P. philolaus*, Boisd., (B. H.); *P. thoas*, L., (Caledonia, B. H.).

A scarce Plecopteron.—Mr. G. T. Porritt exhibited specimens of *Nemoura dubitans*, Morton, taken by Colonel Nurse at West Stow, Suffolk, in June last, and for comparison specimens of *Nemoura inconspicua*, Pict., from Aviemore.

Life History of Nonagria nexa.—Mr. H. M. Edelsten exhibited stems of *Carex riparia* (received from the Hon. N. C. Rothschild from Berlin) to illustrate the life-history of *Nonagria nexa*, Hb., and made the following remarks:—

The Hon. N. C. Rothschild very kindly sent me last year some stems of *Carex riparia* which had contained larvae of *N. nexa*. It is very interesting to study the early stages of this species as it may have been overlooked in Britain. I do not know how the egg is laid, but probably in the same way as that of *N. typhae*, that is, placed within the cuticle of the leaf or stem. The ♀ is furnished with two spines or cutters very similar to those of *N. typhae.*

The first exhibit shows a stem of *Carex* split down the centre to show where larva has been feeding. The second shows entrance hole of larva just above the root; the withered and yellowish central leaves denoting the presence of the larva should be noticed. The third shows the puparium with an empty pupa case; just above the pupa, the spot where the larva has eaten away the inner lining of the stem, leaving a transparent "bruise" where the insect would emerge.

The pupa is of the usual Nonagriid type, but with a very slight "beak." The cremaster is furnished with two spines turning downwards and outwards.

Wilde describes the early stages as follows: "Lives from April to June in stems of *Carex* close to the root, ascends in July higher up the stem, and changes in a lightly spun puparium. The imago emerges in August and September."

A Scarce Thrips.—Mr. C. B. Williams exhibited a specimen of the male *Megalothrips nobilis*, Bagnall *Thysanoptera*), from Wicken Fen, taken April 11, 1912. This is the largest European species and, since first taken by Dr. Sharp in 1894, has not been recorded.

East African Tabanidae, with many hitherto unknown Males.—Mr. S. A. Neave exhibited some of the *Tabanidae* collected during his recent tour in East Africa, on behalf of the Entomological Research Committee of the Colonial Office. He called attention to the male individuals exhibited, and expressed the opinion that their rarity in collections was perhaps due to the fact that they were short-lived. Both sexes of the following species were represented: *Tabanus ustus*, Walk.; *T. biguttatus*, Wied.; *T. nyasae*, Ric.; *T. taeniola*, P. de B.; *T. fraternus*, Macq.; *T. fascinatus*, F.; *T. africanus*, Gray; *T. leucostomus*, Lw.; *T. atrimanus*, Lw.; *T. velutinus*, Surc.; *T.*, sp. nov.; *T. sharpei*, Aust.; *T. par*, Walk.; *T. thoracinus*, P. de B.; *T. maculatissimus*, Macq.; *T. pertinens*, Aust.; *T. gratus*, Lw.; *T. ditaeniatus*, Macq.; *T.* sp. nov.; *Aegophagamyia pungens*, Aust.; *Therioplectes*, sp. nov.; *Haematopota*, sp. nov.; *H. unicolor*, Ric.; *H.*, sp.

nov.; *H. denshamii*, Aust.; *H. decora*, Walk.; *H. hirta*, Ric.; *H. mactans*, Aust.; *H. similis*, Ric.; *H. fusca*, Aust.; *H. brunnescens*, Ric.; *Chrysops brucei*, Aust.; *C. centurionis*, Aust.; *C. distinctipennis*, Aust.; *C. funebris*, Aust.

Mr. G. A. K. MARSHALL observed that probably many of the Fellows present would hardly realise the importance of Mr. Neave's exhibit. Even amongst the English *Tabanidae* by no means all the males were known, and this sex was hitherto unknown in the large majority of the species then exhibited.

Mr. G. C. CHAMPION and Mr. J. E. COLLIN also commented on the value of Mr. Neave's discoveries, the latter observing that, with the knowledge of the habits of the male *Tabanidae* now placed at their disposal, it would be a more hopeful task to discover that sex in other species in which it was still unknown.

A CLUSTER OF OVA OF GONEPTERYX RHAMNI.—Mr. R. M. PRIDEAUX brought for exhibition seventeen ova of *G. rhamni* found in a cluster at Brasted Chart, on April 28, on a shoot of *Rhamnus frangula*, on a fairly large bush, whereon were a few other ova, singly or two or three together; but, close by, were other bushes of *R. frangula*, on which no ova at all could be found. Some of these bushes were in a more advanced stage of leafage than the one shown.

MIMICRY IN THE TROPICS CHIEFLY CHARACTERISTIC OF FOREST AREAS. THE BIRDS AND LIZARDS OF THE FOREST AND THE OPEN.—Professor POULTON said that he had long been struck, especially in the collections of butterflies received from Uganda and British East Africa, with the immense development of mimicry in Lepidoptera from the forest as compared with the open country. It was, in fact, quite rare to find any examples of mimicry at all among the species that frequent the open. A few examples were known among the woodland species, while a large proportion both of individuals and of species were mimetic in the forests. It occurred to him that probably this difference was to be accounted for by the difference between the insect-eating animals in these two types of locality, lizards being probably the great vertebrate insect-eaters of the open, birds of the forest. When, therefore, he found that Dr. R. C. L. Perkins, in his correspondence, suggested the same association between mimicry and forest areas, he determined to write at once to Africa and make special inquiry.

Mr. C. A. Wiggins of Entebbe replied, on Dec. 18, 1911, saying that he did not remember ever seeing a lizard in the true forest, but only in the glades, and that he had consulted with the Governor, Mr. F. J. Jackson, and found that their experience agreed. Mr. Jackson had kindly written the following letter on the subject :—

"Government House, Uganda,
"*Dec.* 18, 1911.

"Regarding lizards, I should say for every one you find in a forest, you find ten out in the open.

"Regarding insectivorous birds: the great majority, which include Shrikes (*Dryoscopus* and *Laniarius*), Trogons (*Hapaloderma*), Cuckoo-shrikes (*Campephaga* and *Graucalus*), Flycatchers (various), Warblers (various), Robin-chats (*Cossyphus*), Bulbuls (*Xenocichla* and *Andropadus*), are found in open forests, on the outer edge of thick forests, or forest glades. Most of the birds that are found in thick forest, *i. e.* well inside, frequent the tall tree-tops rather than the undergrowth. The Bee-eater (*Merops albicollis*), very common here, frequents tall trees in thick forests, rather than the open like most of the family.

"Exclusive of grain-eaters (Weavers, etc.), which feed their young mostly on insects, there are very many more species, at least fifteen to one, probably more, of insectivorous birds found in the forest than there are in the open.

"Frederick J. Jackson."

Mr. C. F. M. Swynnerton replied, December 22, 1911, describing the conditions in Chirinda forest, Gazaland, S.E. Rhodesia :—

"You ask whether birds are specially partial here to forest and lizards to open country.

"Our lizards *are* specially partial, apparently, to the sparse wooding of our open country, not but that there may be purely arboreal species in Chirinda (apart from *Rhampholion marshalli*) that have not yet come within my ken.

"Birds, however, are abundant in both types of country. Bird *species* are more plentiful in the open country, bird-population to the acre greater, probably, in the forest; but in this connection it must be remembered that the forest-birds have several 'upper storeys' to work, the forest trees running from 100 to 180, and exceptionally, 200 feet in height, against the 30 feet or so of the open woodlands,—and the view to take of this sort of thing must be a 'cubic' not a 'square' one! Again, owing to the greater density of the cover in the forest, the insect population is probably, taking the year round, relatively greater.

"I should imagine that there may be very little to choose between the forest and the veld in the matter of severity of selection. And that the veld-factors are capable of producing as good mimicry as the forest ones seems to be well shown in the *Danaida* combination.

"May not the phenomenon you refer to be, in part, dependent on the larval food-plant?

"Thus *Danaida's* food-plant here consists of various species of *Asclepias*, a genus that I have not found inside the forest. On the other hand the food-plant of *A. albimaculata* occurs only in forests or in dense thickets. I do not know those of our other *Danainae*, but, seeing that these belong to the same genus as *A. albimaculata*, it seems just possible that they may feed on the same or some closely allied plant with, perhaps, the same habitat. That is to say, each of the 'models' of our main local associations is perhaps confined to a large extent to its particular type of country by the fact that its larval food-plant is found there and there only, and it is natural to suppose that its future mimics may have been determined on the same basis.

"It is also interesting to note, in this connection, that *Danaida* here never enters the forest, while the various species of *Amauris* constantly wander away from it. All our *Danainae* appear to be sun-loving insects, none are shade-loving as are *Aterica* and *Euphaedra*; obviously therefore it is not this consideration that causes *Amauris* to make the forest their head-quarters. *P. dardanus* also often wanders far afield :—one of the best places I know for it is a *Bougainvillia* bush, a good 1,200 yards from the forest—and it is interesting that it can do this without entirely losing the protection of its *Amauris* models while at the same time invoking, in the person of its *trophonius* female, that of the dominant Danaine of the territory it is invading."

THE POWER OF SIGHT IN BIRDS.—Professor POULTON said that he had come across a few observations which supported the conclusion that birds possessed the extraordinarily acute and far-reaching vision required by the Batesian and Müllerian theories of Mimicry.

1. The distant appreciation of the colour of small insects appeared to be shown by—"An Experimental Investigation on the Range of Flight of Flies" by Dr. Copeman, Mr. Howlett and Mr. Merriman (Report Loc. Gov. Bd. on Public Health and Medical Subjects: New Ser., No. 53. Further Reports on Flies (No. 4), 1911, p. 8). In these experiments, conducted in 1910 at Postwick, about five miles east of Norwich, flies were liberated after being marked with various colours so that they could afterwards be identified. Yellow chalk was found to give the most satisfactory results, and under favourable circumstances remained perfectly recognisable for a week or, on occasion, for as long as ten days. As soon as these flies were liberated many of them were devoured by swallows, and the authors remark "it is interesting from the biological point of view, that they should readily take flies of a brilliant canary-yellow colour such as they can never have seen before. A few of these coloured flies that happened to drop into the water were also seen to fall a prey to fish." Dr. S. Monckton Copeman, F.R.S., had kindly sent a few further details concerning the behaviour of the swallows :—

"LOCAL GOVERNMENT BOARD, WHITEHALL, S.W.,
"*February* 9, 1912.

"The swallows seemed to know when we were going to let loose the coloured flies; for although on our arrival there might not be a swallow to be seen over the river, no sooner had we let loose one lot of flies than there were usually a number to be seen, flying up and down in front of the wharf-staging from which we dispatched our flies. When the second lot was loosed the swallows at once proceeded to retrieve the flies while the latter were crossing the river in various directions;—the swallows never seeming to pause, but retrieving the flies unerringly while themselves in full flight."

These interesting experiments showed the danger of a conspicuous colour when associated with palatability.

2. The far-reaching distance of birds' vision was indicated in an article to which his attention had been called by Dr. F. G. Penrose:—"Hawk-catching in Holland, I." in "Country Life" for August 7, 1909 (p. 185). The article described the ancient methods which are still practised at the Dutch village of Valkenswaard (Falcon's Heath). One important element was the use of a tethered great grey shrike to act as a sentinel. "Now as soon as any bird of prey appears—*even far beyond the ken of any human observer*—this sentinel shows evident signs of terror, which increase if the enemy should come nearer. Old Adrian Mollen, father of the great master of the art, used to say, that, by the gestures and sounds of alarm of the shrike, he could sometimes form a pretty correct guess as to the size and species of the hawk . . ." (p. 187). The words here printed in italics were good evidence of the great distance at which birds could recognise the details of form and movement.

3. The following observation was recorded by Professor Poulton:—"On July 29, 1910, at Wykeham House, Oxford, my daughter and I saw a flycatcher, sitting on the branch of an elm, rather over 30 ft. distant, make a dash after a specimen of *Tryphaena pronuba* that was flying inside a room towards and on to the inside of the window. We were standing inside the room and saw the bird dash itself against the glass within a few feet of us. The pair of small windows, the only ones in the room, are somewhat deeply recessed in the side of the house, and the observation offers convincing evidence of the power of a bird's sight in penetrating shadow at a distance."

4. The following observation, also made by Professor POULTON, shows that small birds will attack insects of great relative

size :—" Towards the end of June 1910, I saw a small robin flying with what was evidently a heavy load across the path of the Parks Road, Oxford, from the elm-trees on the west towards the Parks railing on the east. Just outside the railing it put the load down and began to peck it. I came near gently, and saw that it had captured a specimen of *Smerinthus tiliae*, L. I watched the bird peck the moth to pieces and eat the whole of it, except the wings. The observation was made just after heavy rain, which may have caused the moth to flutter or fall, and thus to attract the bird's attention."

Mr. S. A. NEAVE said with reference to Professor Poulton's interesting remarks on the prevalence of insectivorous birds in Uganda, that he had recently had an instructive experience near Entebbe. On January 12, 1912, at Gabunga's, near Entebbe, he had watched a wagtail, most probably *Motacilla capensis*, catching butterflies on a small patch of damp sand in the bed of a forest stream. The bird was so tame that he stood within 3 or 4 yards of it. In less than half-an-hour this bird captured and ate 19 butterflies and failed to catch many others. The butterflies eaten were nearly all small *Lycaenidae*, including *Tarucus telicanus*, *Polyommatus baeticus*, *Azanus* spp., many individuals, *Lycaenesthes* spp. (2 individuals), *Uranothauma* (?) *poggei* (1 individual), and a single *Terias*, probably *T. senegalensis*. The bird also seized, but rejected after tasting, a specimen of *Acraea pelasgius*. This individual, with one hind wing torn off, was subsequently procured. Except for the loss of the wing it appeared to be uninjured.

Mr. G. A. K. MARSHALL and Dr. G. B. LONGSTAFF also spoke on the subject, the latter giving an account of a struggle he had witnessed between a bird and a large grasshopper, in which the latter was eventually successful.

NEPTIS AND NEPTIDOPSIS IN THE LAGOS DISTRICT.—Referring to his recent communication (in these Proceedings 1912, p. xxvi) on the proportion of the species belonging to these two genera in the neighbourhood of Entebbe, Professor POULTON called attention to a statement received in a letter from Mr. W. A. Lamborn, dated March 22, 1912 :—" *Neptidopsis* would

I am sure outnumber all the species of *Neptis* put together at any season. I have not taken any more because I thought I had probably sent enough."

Eurytela Hiarbas and E. Dryope.—Professor Poulton said that his friend Mr. Roland Trimen, F.R.S., had pointed out to him that Mr. Lamborn's results published in these Proceedings (1912, p. xviii) are "confirmatory of Miss Fountaine's experience in Natal, given in Trans. Ent. Soc. Lond., 1911, p. 59. She records that although she had bred both forms indiscriminately from every variety of the larva, she nevertheless found that 'the ova laid by *E. hiarbas* always produced *hiarbas*, whereas those of a *dryope* ♀ invariably produced *dryope*.'"

Paper.

The following Paper was read:—

"On the Colour-Groups of the Hawaiian Wasps," by Dr. R. C. L. Perkins, M.A., D.Sc., F.Z.S., F.E.S.

Prof. Poulton, in introducing the paper, said that Dr. R. C. L. Perkins had illuminated a problem of the most fundamental interest and importance for the student of evolution. His work was of equal interest to the follower of systematics and of bionomics.

Dr. Perkins had inferred that the 102 species of *Odynerus*, the only indigenous wasps of the islands, had been derived from the ancient immigration from some unknown country, of a single yellow-banded species, and from the much later but still very ancient immigration of a single dark Asiatic species allied to *O. nigripennis*, Holmgr. The latter became extremely dominant, but it found the islands already occupied and only produced a group of 4 allied species, as against the 3 genera, the important structural groups and the 98 species which Dr. Perkins recognised in the descendants of the original immigrant. All the species attacked the larvae of Lepidoptera, and the immigration of these must of course have preceded the advent of the earliest ancestor of *Odynerus*.

Dr. Perkins showed in his paper how the 102 species had formed Colour-groups in which the constituent members were associated quite independently of affinity. Thus the species of a genus, or of a definite Structure-group within the genus, were found in different Colour-groups in the different islands, and sometimes even within the limits of a single island.

Although the species of *Odynerus* were the dominant members, some of the Colour-groups also contained bees, of which the 53 species in the single genus *Nesoprosopis*, were traced to a probable single Asiatic immigrant, allied to *Prosopis kriechbaumeri*, Först; and Fossores (*Crabronidae*), of which the 18 species and 3 genera were believed to have arisen from a single Asiatic invader, allied to *Crabro vagus*, L. The main Colour-group also included Ichneumonids.

In illustration of the paper, Prof. Poulton exhibited the specimens referred to in the following letters written to him by Dr. Perkins, Nov. 2 and Nov. 4, 1911, but here combined. The Colour-groups were arranged in the order of the islands, from Kauai in the N.W. to Hawaii in the S.E. The authors' names had been added by Prof. Poulton.

"Herewith I am sending a small box of Hawaiian Hymenoptera, showing the main colour-effects.*

"Colour-group A [= II of Kauai in Dr. Perkins's memoir.] —Black, wings dark, blue reflections, two white or yellow bands, second always broad. The examples selected are :—

Odynerus kirbyi, Dalla Torre . . . . Kauai.
Nesodynerus vittativentris, Perkins . . . Kauai.

"All the Kauai species, *whether open country or forest insects*, belong to this group, excepting one or two apparently recent arrivals from other Hawaiian islands, which are only slightly different in structure and appearance from *Odynerus sandwichensis*, de Sauss., of Group D.

"Group A is not *exactly* represented on the other islands, but a sub-group of pale-banded species on Oahu approaches it, and it is curious that the insects so coloured on all the islands except Kauai belong to the lowlands (open), or to the open country above the forest line, or to open spaces in forest regions.

* Dr. Perkins wrote Nov. 13, 1911 :—"The characteristic appearance of the various groups is far more remarkable in masses of specimens, such as I have in my cabinet drawers, than in a few isolated specimens."

"Kauai is remarkable for its distinctively marked species, practically all belonging to the one Colour-group.

"Colour-group B [= II of Oahu].—Black, peculiar shining fuscous wings, almost brassy, distinctive appearance in life, not blue. Examples :—

Odynerus dubiosus, Sm. . . . . . . Oahu.
Nesodynerus oblitus, Perkins . . . . . Oahu.
Nesoprosopis pubescens, Perkins, var., with blue iridescence. Rare . . . . . . Hawaii.

"Peculiar, as an extensive group, to Oahu. It is to be noted that *N. pubescens* is a unique case of dichromatism of the wings.*

"Colour-group C [= III of Oahu].—Sombre red markings, much appressed tomentum on body, *wings nearly clear hyaline.* Appearance very distinctive in life, having a peculiar fuscous look. Example :—

Odynerus oahuensis, Dalla Torre . . . . . Oahu.

"All the species are *Odynerus* proper, but very diverse in structure, the little Colour-group of six species, all peculiar to Oahu, representing three very distinct *structural* groups. There is nothing like them in colour on any other island. I have taken all six at the same spot and time on one occasion, and generally three or four are flying together.

"Oahu is remarkable for the diversity of its Colour-groups, all being represented, except that the pale-banded forms are not quite like those of Kauai, and the *sandwichensis*, Group D, has become the distinct *dubiosus*, Group B, above.

"Colour-group D [= III of Maui, etc.].—Species very numerous and diverse in structure but all are *Odynerus.*

"Black, with red markings, wings dark, blue reflections. I have sent two examples :—

Odynerus petrobius, Perkins . . . . . Molokai.
Odynerus sandwichensis, de Sauss. . . . . Maui.

* Judging only from this limited number of examples it appears that the typical *N. pubescens* more closely resembles the *Odyneri* of Group B, and the blue-iridescent var., those of E. Furthermore the example of *N. fuscipennis*, from Oahu, in Group E, might be more suitably placed in B. Both this specimen and *pubescens* (typical) are rather clearly distinguishable by the "brassy" appearance of their wings from the other members of E.—E. B. P.

"The wings of the latter are not so blue in some species, but the colour is much deeper when they are folded.

"Molokai, Lanai, and Maui are rich in these red-marked forms with dark wings.

"Colour-group E [= I of all the islands except Kauai].—This, the most dominant Colour-group, is black, wings infuscate, with blue, purple or steely reflections. *To see the iridescence at its best the insects should not be looked at in the box over white paper*, but held in the hand and viewed from above and in front. The colour of the wings is always conspicuous in life in this group, *i. e.* when the insect is flying, but in some it is less apparent after death.

"For this group I have selected :—

"DIPLOPTERA (*Eumenidae*).

Odynerus montanus, Sm.	Oahu.
,, *nigripennis*, Holmgr.	Oahu.
Nesodynerus rudolphi, Dalla Torre . . .	Oahu.
Odynerus molokaiensis, Perkins* . . .	Molokai.
Pseudopterocheilus congruus, Sm. . . .	Molokai.
Odynerus peles, Perkins	Hawaii.
,, *heterochromus*, Perkins . . .	Hawaii.

"FOSSORES (*Crabronidae*).

Hylocrabro tumidoventris, Perkins . . . }	Hawaii.
var. *leucognathus*, Perkins . . . }	
Xenocrabro atripennis, Perkins	Hawaii.
Nesocrabro rubrocaudatus, Blackb. and Cam. .	Hawaii.

"ANTHOPHILA (*Prosopidae*).

Nesoprosopis fuscipennis, Perkins . . .	Oahu.
,, *caeruleipennis*, Perkins . . .	Molokai.
,, *pubescens*, Perkins, typical . .	Hawaii.
,, *setosifrons*, Perkins . . .	Hawaii.

* This species is placed by Dr. Perkins in Group II of Molokai, Lanai and Maui (= IV of Oahu), but it certainly seems to fit extremely well into Group E, sent for exhibition (Group E = I of Molokai, Oahu, etc.). The particular specimen of *O. molokaiensis* exhibited was captured in Maui (Wailuku, Sept. 1901), the species having reached that island, Dr. Perkins considers, about 1896.—E. B. P.

"This large dominant Colour-group is not only exemplified by *Odynerus montanus*, but also by four other species, each of which represents a quite different Structure-group, and if there was any good classification of the heterogeneous mass forms called *Odynerus*, each would, in my opinion, represent a distinct genus. In addition to these and many other species the group contains *Nesodynerus rudolphi* and others, *Pseudopterocheilus congruus* and others, *Chelodynerus chelifer*, Perkins (not sent to you), various species of the three Fossorial genera, and of the Anthophilous genus *Nesoprosopis* —consequently representatives of nearly all the existing Hymenoptera of the Hawaiian islands.

"Hawaii appears to be tending to total blackness, owing to the predominance of this single Colour-group, the red of the red forms becoming duller or diminished, the bands of the banded forms more or less obsolete."

Prof. Poulton said that he had but few comments to make on Dr. Perkins's interesting and valuable paper, and, in fact, he felt considerable diffidence in making any suggestions at all on the work and conclusions of such a master of the Hawaiian fauna as the author had proved himself to be. Nevertheless he ventured to make a few remarks bearing upon the origin and present distribution of the Colour-groups in the islands and on one or two other points. Dr. Perkins had brought forward strong evidence for the conclusion that the first immigrant *Odynerus* was an ordinary-looking yellow-banded species—viz. one that had previously been an insignificant member of one of the largest and most widely distributed of the Aculeate combinations, containing many of the most formidable and dominant species, and bearing probably the simplest and most effective of warning patterns. The immigrant ancestor had behind it endless generations in the course of which its pattern had been rendered stable by selection ceaselessly exercised on some unknown continental area. Thus it was possible to understand the remarkable fact that so much of the original pattern should have survived or should still be revealed by reversion, at the close of a period long enough to have produced all the Eumenid Structure-groups in the islands except that associated with the later immigrant *O. nigripennis.* Prolonged isolation, in the Hawaiian islands, from all the other dominant bearers of the yellow-banded pattern also helped us to understand the ultimate loss of the original pattern in so many of the species.

The mention of this great dominant Aculeate pattern made it appropriate to refer at this point to a question raised by Dr. Perkins in his paper—"Why should Colour-groups be formed at all? Why is not the fact that an insect belongs to the Aculeates sufficient warning by itself?" It might be replied that the Aculeates themselves are probably avoided for different reasons and in different degrees, and that, for securing the advantages of Müllerian association, colour and pattern are probably the most easily recognised and remembered of all the characters that can be seen at a little distance when an insect is at rest. There was furthermore much, but not nearly enough, experimental evidence that insect-eating animals were greatly impressed by the *patterns* mimetic of the Aculeates. The methods of mimetic resemblance were varied—sometimes the likeness was in pattern and not in movement, sometimes in movement and not in pattern, but in the most perfect examples there was likeness in both.

Returning to the history of the Colour-groups in the islands, we probably found, in the effects of occasional and accidental inter-island migration, an answer to Dr. Perkins's further difficulty based on the number of the Colour-groups, especially on Oahu. Whatever may happen in the vast complexity of a tropical continental area, we should certainly have expected, as Dr. Perkins maintains, the persistence or formation of single Müllerian Colour-groups on each of these small islands, although we ought to be prepared for possible exceptions in groups of specially associated species, such as the six forming Colour-group III (= C) on Oahu, all of which were captured at one time and in one spot by Dr. Perkins. Such special associations may have all the effect of geographical isolation in encouraging the growth of special warning patterns. Leaving such possible exceptions on one side, we should expect a single Colour-group on a single island, but we should not expect the same group to be formed independently in different islands, and the mixture of groups was probably to be explained by accidental transport from one island to another.

This was, in fact, Dr. Perkins's interpretation of the existence of two Colour-groups on the most isolated of all the islands, Kauai ; for he remarks that "excepting two species (. . . probably recent derivations from similar forms on other islands) the Kauai wasps have become superficially all alike." Such complications are of course far more likely to occur in the central islands of the chain—nearer together and liable to receive immigrants from both directions.

The following was an attempt to reconstruct the history of the Colour-groups within the islands. It, in the main, followed Dr. Perkins's account, but included a few suggestions bearing on the mixture of the groups.

(1) The original yellow-banded pattern persisted at any rate in Oahu (the island nearest to Kauai), and probably throughout the islands, until after the Structure-groups had been formed and Kauai had received the immigrants which have produced its dominant banded Colour-group II (= A).

(2) The black Group I (= E) then arose in Hawaii, perhaps in consequence of the arrival from Asia of the second immigrant ancestor, *O. nigripennis*. On the other hand, in the specimens sent by Dr. Perkins, the wings of some of the *Odyneri* were so much darker and more iridescent than those of the *nigripennis* as to throw some doubt upon the hypothesis that the latter had acted as the model. After the group was formed, Hawaii became a centre for the occasional accidental dispersal of black species to Maui and further north-westwards to other islands ; or the spread of Group I may have followed the dispersal of the black-bodied, dark-winged *O. nigripennis*, which Dr. Perkins described as the most dominant and widespread species on all the islands except Kauai. That the black Group I is oldest on Hawaii was indicated by its almost complete dominance in that island.

(3) On Kauai, *O. nigripennis* became absorbed into the dominant Colour-group, giving rise to the yellow-banded *O. radula*, F. This species is as abundant on Kauai as *nigripennis* on the other islands, and Dr. Perkins suggests the possibility (among others) of a diaposematic relationship, the

other Kauai species gaining the dark iridescent wings of *O. radula*, the latter gaining their yellow bands.

(4) The red-marked Group III (= D) arose in Lanai, Molokai or Maui, soon became common to all three, and, by accidental transport, was carried to all the other islands. The members that reached Hawaii have been nearly absorbed into its one dominant black group. The two allied species on Kauai are the result of an inter-island immigration so recent that neither of the Colour-groups has affected the other.

(5) In Oahu, nearest to Kauai, traces of the original banded pattern were more evident (in members of Colour-group II (= B), and especially in IV) than on any other island except Kauai. The red-marked Group III arose under the influence of immigrants from Molokai, etc., while in other species (in Group II) the same character has tended to disappear, probably under the influence of the black Group I (= E), derived from Hawaii.

(6) It was not to be expected that the members of a Colour-group formed on any island, would, after reaching another island, always produce a group *exactly* like that in which they originated. The immigrants would be working upon different material, and would also be likely themselves to undergo changes of pattern. The peculiarity of the red-marked Group III (= C) on Oahu may perhaps be thus explained. Especially may changes be expected to occur in an appearance, like that of the wings, due to a uniform dark pigment combined with the "structural colours" of thin plates.

That there was undoubtedly a strong tendency to produce a single group on a single island was shown by the condition of Hawaii and Kauai, at opposite ends of the chain, and it was suggested that the same tendency existed in the other islands, but had been masked by the effect of accidental inter-island immigration.

Certain classes of facts established by Dr. Perkins, and described in his paper, were only intelligible on the hypothesis of mimetic approach due to selection by enemies attacking by the aid of sight.

(1) The persistence, in certain individuals belonging to the black Group I, of yellow bands on the under-surface where

they could not be seen. The same phenomena were found independently in the *Eumenidae* and the *Crabronidae*. Dr. Perkins, with whom these observations had been discussed, entirely agreed that, as evidence, they were very important indeed. He also stated that the yellow bands of the Kauai Group II are clearly visible in flight.

(2) Species belonging to the same Structure-group, and therefore closely related, were distributed among different Colour-groups. In like manner the Kauai Crabros resembled its dominant, banded Eumenids, and the Hawaii Crabros its black Eumenids.

These facts fell into line with those which had been observed in the mimetic associations of the same and other groups of insects in other countries; and this was equally true of the fact that the Hawaiian Colour-groups were especially characteristic of the forests. The difference between the development of mimetic patterns in Lepidoptera of the open country and those of the forest areas of Africa was extremely striking, and Professor Poulton had already been driven to the only hypothesis which Dr. Perkins could suggest as a possible explanation of the facts, viz. differences between the insect enemies in the two types of country (*see* pp. l–liii).

The only point in which his experience differed from that of Dr. Perkins was in the relative prevalence of variability and of mimicry in the two sexes of insects.

Dr. Perkins was by no means convinced of the validity of the Müllerian interpretation, and felt many difficulties, but, at any rate, he stated that he was unable to suggest any other explanation, and he had definitely abandoned the climatic solution, which many have found so alluring.

Prof. Poulton said, in conclusion, that he wished to make one remark on the bearing of the whole body of facts recorded in Dr. Perkins's memoir. He was aware that it was dangerous to limit the possibilities of future discovery, and to argue from the unknown to the non-existent. He realised that nearly every great discovery in Biology revealed something that lay close at hand although it was unseen. But, allowing for all this, he ventured to affirm that, if, in these little islands—closely examined as they had been for so long a period by so keen and discriminating a naturalist and one who had shown a life-long devotion to the Aculeates, not only as specimens, but as living beings—nothing except the Müllerian principle could be suggested as the cause of the Colour-groups, then it was far more reasonable to conclude that the insufficiency of the evidence was due to changed conditions brought about by man,* than to suppose that there existed in these restricted areas some set of causes hitherto unsuspected and unknown.

Wednesday, June 5th, 1912.

The Rev. F. D. Morice, M.A., President, in the Chair.

Election of a Fellow.

Mr. Henry Francis Carter, Assistant Lecturer and Demonstrator in Medical and Economic Entomology, Liverpool School of Tropical Medicine, University of Liverpool, was elected a Fellow of the Society.

Procedure.

The President announced that it was requested that for the future the names of intending exhibitors should be handed in at the beginning of the meeting, in order that they might be called upon from the Chair.

Report of the Committee on Nomenclature.

The Rev. G. Wheeler read the following Report :—

"Mr. President, Ladies and Gentlemen,

"The Committee appointed on April 3rd, 1912, 'to consider the subject of nomenclature, and report to the June meeting with a view to the coming International Congress,' has endeavoured to deal carefully and minutely with the matter entrusted by you to its attention.

"In accordance with the powers conferred on the members

* Dr. Perkins describes the immense changes that have taken place in the bird fauna within his own memory, and argues that, if the Colour-groups were formed by the Müllerian principle, it was under conditions that do not now exist.

by resolution of the Society, they added Mr. L. B. Prout to their number after their first meeting.

"Your Committee probably thus represented almost every form of divergent opinion on the subject of nomenclature, but nevertheless arrived at a unanimous report which they recommend to the Society for presentation to the International Congress.

"It will be evident that if these recommendations are adopted by the Society, and the suggestions of the Society by the International Congress, an opportunity will be afforded for putting before the International Committee the different views on matters of detail held by the members of your Committee, or by any other Entomologists.

"The Report, which is signed by every member of the Committee, is as follows:—

"The present independent and irresponsible methods of giving and adopting names having resulted in much unnecessary synonymy, and even graver abuses, the Entomological Society of London feels that the time has arrived when some check should be placed upon the practice, of more weight than that which can be exercised by any single individual, society, or publication, and would urge upon the International Congress the establishment of a permanent International Committee to deal with questions of nomenclature as affecting Entomology; to consider what elucidations, extensions or emendations, if any, are required in the International Code, and to confer with the International Commission of Zoological Nomenclature. The Entomological Society of London recommends that the International Entomological Committee, when formed, shall take such action as to ensure the adequate representation of Entomology on the International Zoological Commission. The Society also recommends that, considering the difficulty of frequent International meetings, the leading Entomological Society of each country be invited to appoint a Committee whose duty it shall be to deal with all questions arising in their own country, subject to reference to the International Committee; and suggests that the International Committee be composed of two, or three, members of each of the National

Committees, elected either by the Committees, or directly by the electing Societies.

"CHAS. O. WATERHOUSE, Chairman.
(Signed) G. T. BETHUNE-BAKER.
T. A. CHAPMAN.
JNO. HARTLEY DURRANT.
LOUIS B. PROUT.
HY. J. TURNER.
GEORGE WHEELER."

The PRESIDENT took exception to the form in which the Report was drawn up, as being in the name of the Society and not of the Committee. It was explained by several members of the Committee that as there was only one meeting of the Society before the Congress, it had been thought best to put it in such a form that the Society could adopt and present it without alteration in the wording, if they thought well to do so, in order to avoid unnecessary waste of time. Eventually Mr. G. A. K. MARSHALL proposed and Mr. H. ROWLAND-BROWN seconded that the Report be adopted.

Dr. G. B. LONGSTAFF proposed and Mr. R. W. LLOYD seconded as a preliminary amendment that the Report be received. This was carried, and the Report having been read again, the original motion was also carried almost unanimously.

Mr. BETHUNE-BAKER then proposed and Mr. DURRANT seconded that the Report be printed; this, and a further motion proposed by Dr. K. JORDAN and seconded by Prof. E. B. POULTON, that it be sent to Dr. Malcolm Burr, the General Secretary of the Congress, were carried unanimously.

Exhibitions.

A SCARCE DIPTERON.—Mr. J. E. COLLIN exhibited a series of thirteen specimens of *Physocephala nigra*, De G., the largest British species of the *Conopidae*, caught on Studland Heath (Dorsetshire), during the last week in May, when Colonel Yerbury, Mr. C. J. Wainwright and himself took some 24 specimens. He remarked upon the wide distribution of the species over almost the whole of Europe, while in Britain Colonel Yerbury had taken it in the extreme north-west of Scotland; though widely distributed, however, the species was always considered a great rarity, and its occurrence in such numbers had never before been recorded. The majority of the specimens were taken on the flowers of rhododendron, but others were found singly over a large area of the heath.

A NEW HYDROECIA.—Dr. T. A. CHAPMAN exhibited a specimen of *Hydroecia burrowsi*, Chpn., a new species that has turned up (from Vladivostock) since Mr. Burrows's paper on the group (Trans. Ent. Soc., 1911, p. 738); see Ent. Record, 1912, p. 109.

A BRED ALBULINA PHERETES.—Dr. CHAPMAN also showed a specimen of *Lycaena* (*Albulina*) *pheretes*, ♀, bred at Reigate from the egg, supposed to be the first (and only) bred specimen of the species (see Trans. Ent. Soc., 1912).

TWO UNCOMMON SUDANESE BUTTERFLIES.—Dr. G. B. LONGSTAFF exhibited *Calopieris eulimene* and *Teracolus pleione*, and read the following notes:—

Both sexes of *Calopieris eulimene* were described by Klug in 1829, from specimens taken at Ambukôl by Dr. Hemprich and Dr. Ehrenberg. Kirby gives its habitat as Arabia, but Ambukôl is on the Upper Nile, about half-way between Dongola and Abû Hamed, in Lat. 18° N.

In 1896 Mr. A. J. Cholmley, who was attached to Theodore Bent's expedition to the Red Sea, took five specimens at Ambaia Erba, north of Suâkin.

In 1900 or 1901 a single example was taken by a member of the Hon. N. C. Rothschild's expedition at Shendi, between Berber and Khartûm.

These are the only records that I have come across.

In February 1909 I picked up a single specimen in the western outskirts of Khartûm, and a few days later took seven others at Soba, on the Blue Nile, about fourteen miles above Khartûm. These were all males.

In February of the present year I took between Soba and Khartûm six more, three of each sex, mostly in indifferent condition. I did not meet with it south of Lat. 15° 30′ N.

Meanwhile, during the past winter, Mrs. Waterfield had been taking it from time to time at Port Sûdân, on the Red Sea, getting altogether perhaps a dozen. At the end of

February I myself visited Port Sûdân, and in the course of a week was fortunate enough to secure eighteen males and nine females. Unless I am greatly mistaken the larva should turn up on the desert Caper (*Capparis aphylla*, Roth.).

The purple gleam on the yellow apical spot, which adds so much to the beauty of the butterfly, is only present in the male.

It will be observed that the specimens from the Red Sea are larger and more strongly marked than those from the Blue Nile. The discal spot is in most cases larger, and there is more black about the apex. Moreover, the yellow nervures on the under-side of the hind wings are edged with black, this black edging being often visible on the upper surface. Klug makes no mention of this black edging, which I am disposed to associate with the heavy rainfall at Port Sûdân a few weeks before my visit, whereas Khartûm was suffering from drought. Mrs. Waterfield wrote to me when I was at Khartûm saying that butterflies had been much more plentiful since the rain, and more strongly marked.

Teracolus pleione is another of Klug's species, the types coming from "Arabia Felix," whatever that geographical expression may mean.

Petherick took it on the White Nile, and Mr. W. S. L. Loat in 1901 took a female at Kâkâ on the same river in Lat. 10° 40′ N. In February last I myself took two females near the same village. Colonel Yerbury found it at Aden, apparently in some numbers. Colonel Swinhoe (Proc. Zool. Soc., Lond., 1884, p. 436), says: "Of this very rare species I have a series from Aden." However, Mrs. Waterfield looks upon it as one of the commonest butterflies in the Park, at Port Sûdân. This park is little more than a piece of the desert scrub which has been railed in. On and about certain shrubs, a species of *Cleome* (Nat. Ord. *Capparidaceae*), *T. pleione* was so plentiful that I repeatedly had several in my net at once. A few turned up north of the harbour near the shore, but I did not meet with it in the desert to the west or south of the town. It is evidently a far more local insect than its near ally *T. halimede*, Klug.

It should be noted that the females from the White Nile differ from those taken on the shore of the Red Sea by approximating in colour to the males.

Colonel YERBURY observed that the yellow ♀♀ of *Teracolus pleione* were much brighter at Aden than those now exhibited.

EAST AFRICAN ASILIDS AND RHOPALOCERA.—Mr. S. A. NEAVE exhibited some specimens of the Asilid genus *Hyperechia*, representing three, perhaps four, species, all taken during his recent tour in East Africa. He also showed for comparison four common species of *Xylocopa*, bees to which the flies bore a marked superficial resemblance. These flies were usually found only in forested, or at least well-wooded localities, and usually settled on tree trunks, often high up on them, in contradistinction to many other *Asilidae* which usually settle on the ground. He thought that the great rarity of these insects in collections was due partly to their actual scarcity in nature, and partly to the fact that they were extremely difficult to capture on account of their wariness and powerful flight.

He also exhibited a remarkable new Nymphaline Butterfly, probably belonging to the genus *Pseudacraea*, taken on Mt. Mlanje, Nyasaland. He pointed out that it bore a marvellous superficial resemblance to *Amauris lobengula whytei*, Butler, the Danaine which occurred in the same place.

He further exhibited a number of unnamed *Lycaenidae*, principally from Uganda. Apart from the fact that many rare or unknown species were included amongst them, their chief interest was that they demonstrated the marked dominance of the Liptenine section of the *Lycaenidae* from that region, and thus accentuated the resemblance of the Uganda fauna to that of the Tropical West Coast of Africa.

Mr. S. A. NEAVE also referred to some interesting points, to which Prof. Poulton had called his attention, occurring amongst the butterflies recently collected by him in Eastern Uganda, particularly in the neighbourhood of Mount Elgon. The specimens of *Pseudacraea hobleyi* from this locality were remarkable for the fact that a large proportion of the females were coloured like the male, *i.e.* with an orange band in the fore wing instead of a white one, as in the typical form of the female common at Entebbe. He pointed out the extreme interest of this when coupled with the fact that one of the two *Planema* models, *P. macarista*, which has a black and white female, is not known to occur east of the River Nile, whereas the other, *P. poggei*, which has an orange band in both sexes, does so. It is true that in the present case no *Planema* of any species was actually taken during three days' collecting in a patch of forest on the Siroko River to the west of Mount Elgon, where the majority of the male-coloured females of *Pseudacraea hobleyi* were taken. At the same time Mr. Neave had recorded *P. poggei* from the Tiriki Hills and Nyangori near Kisumu, in the C. A. Wiggins collection at Oxford, and had himself taken the same species on the *east* side of Elgon, and also in North Kavirondo, where it was not uncommon. Dr. Jordan had also been kind enough to inform him, through Prof. Poulton, that there are Kavirondo specimens of *P. poggei* in the Tring Museum, but no *P. macarista*.

The following are the details of the Uganda localities, the full particulars of the country further east on the East African side of the border not being available at the moment.

August 1, 2, 1911, Busia, near the Sio River (the boundary between British East Africa and Uganda)—

2 *Planema poggei*, 1 ♀ *Pseudacraea hobleyi* (male coloured).
1 ♂ ,, ,,

August 12–14, 1911, Siroko River, west of Mount Elgon—
16 ♂ *Pseudacraea hobleyi*
9 ♀ ,, ,, (male coloured)
5 ♀ ,, ,, (typical).

Prof. Poulton commented on the importance of the colour change of these Pseudacraeas in this locality, tending as they did to become monomorphic.

Dr. Longstaff drew attention to the difference between the fauna of this locality and that of the White Nile.

Mr. G. A. K. Marshall also commented on the exhibit, especially on the Asilids.

Pieris napi and var. bryoniae.—Mr. H. Main exhibited series of *P. napi* and var. *bryoniae*, and read the following note :—

In June 1911, ova were sent me from Lapland by Mr. W. G. Sheldon from *P. napi* var. *bryoniae* females. The resulting pupae produced two males in August last, and the rest of the specimens emerged this spring. The two which emerged last summer have the green veinings on the under sides much less marked than in the spring ones. The others show a fair amount of variation both on the upper and under sides.

Dr. T. A. Chapman found in June 1911, in Glarus, Switzerland, typical *P. napi*, and also the var. *bryoniae*, flying together on the same ground in the Lintthal, and kindly sent me females of both forms.

From the typical females nothing but *P. napi* emerged from a large number of resulting pupae. Some emerged last August and the remainder this spring, the series showing the usual seasonal dimorphism.

From the *bryoniae* females a large number of pupae resulted, and three of them produced, last August, very strongly-marked specimens (females), very different from those which emerged this spring. I had always considered this form to be single-brooded, and had frequently bred large numbers with my late friend Mr. Harrison, all of which always emerged in the spring. These three have the same shape of wings as the summer emergence of the *P. napi*, the markings on the upper sides are also more pronounced, and the veinings on the under sides less pronounced than in the corresponding spring emergence specimens, as in the case of the two series of the typical *P. napi*.

Some of the males show a black spot on the disc of the fore wing. They can be separated roughly into two series, those with no yellow and those with more or less yellow on the under side of the wings. A parallel variation of the under sides occurs in the females, and their upper sides show a considerable amount of variation in the proportion of the dark scales on the area of the wings and along the nervures.

Coleopterous larvae.—Mr. K. G. Blair exhibited larvae of *Cebrio* sp. (? *gigas*, Fabr.) from Sicily, received from Mr. J. P. Barrett, per Mr. H. Main.

The larvae were dug up in a patch of potatoes in a garden at Messina, and he heard from Mr. Barrett that this patch alone, out of many others, was unhealthy and appeared diseased, as was the case also with some tomato plants which occupied the same ground last year; and it is probable that these larvae were the cause of the "disease." The ♀ beetle is apterous and subterranean in habit, which no doubt accounts for their very much localised occurrence.

The larvae show considerable resemblance to those of *Elateridae*, but are more cylindrical, and the prothoracic segment is much elongated in front of the first pair of legs. In addition, between the chin and the prosternum is a large membranous portion, which is folded in, out of sight, when the head is in the normal position, but the larva can throw its head right back, at the same time puffing out this membrane in a most peculiar manner. The actual use of this structure is uncertain; but it has been suggested that it is of use to the larva in burrowing in the earth.

Heredity in the female forms of Hypolimnas misippus.—In continuation of the breeding experiments referred to in the Proceedings, 1911, p. xliv, Prof. Poulton exhibited females of two families, reared in 1911, from female parents of the type form, by Rev. K. St. Aubyn Rogers, M.A., F.E.S. The first parent was captured at Rabai, near Mombasa, April 17: the emergence of the large family of nearly 200 butterflies took place while Mr. Rogers was away from home, and when he returned, on May 23rd, the great majority were irretrievably damaged. All the females were of the type form, and of these Mr. Rogers had sent the specimens which were in good condition, viz. the 16 exhibited to the meeting. At the same time it was to be noted that all 16 bore labels in Mr. Rogers's handwriting indicating emergence on May 16, 1911. In three of these the white patch on the hind wing upper surface, just beyond the cell, was distinct; in six it was slightly indicated; in two represented by scattered white scales. The patch was not borne by the parent. The second female parent was captured in the same locality on Nov. 29, 1911; the males were liberated, and the dates of emergence and forms of the females were shown in the following table, in which no mention is made of the white patch when represented only by scattered scales:—

Dates of emergence in 1911.	*Misippus* form of ♀.	*Inaria* form of ♀.	♂
Dec. 22 .		1 [escaped]	3
,, 23 .	13 [12 specimens received] Patch distinct in 4, slight in 3	5 Patch very slight in 1	31
,, 24 .	6 Distinct in 2	5	13
,, 25 .	8 Distinct in 3, slight in 1	5 Slight in 1	16
,, 26 .	5 Slight in 1	2	10
,, 27 .	3 Distinct in 1		
,, 28 .	3		
Totals .	38	18	73

Two or three males died, but are put down for the dates on which they changed colour preparatory to emergence.

These experiments confirmed the conclusions drawn from Rev. St. Aubyn Rogers's earlier work and stated in the Proceedings of 1911, p. xliv, that *misippus* was dominant and *inaria* recessive, although the proportions of the last family were neither 1 : 1 nor 1 : 3, but, on the contrary, very nearly 1 : 2. It was possible, as Mr. L. Doncaster had suggested, that the female had paired with more than one male.

The white patch which so commonly appeared, represented a patch of variable size which seemed to be always present on the under surface of the hind wing of the female. This under surface marking again represented the central part of the broad white bar crossing the middle of the male hind wing with which also corresponded the white patch on the upper surface, as might be seen by holding the insect up to the light. The white patch of the female appeared therefore to represent a marking that was very ancestral in the genus *Hypolimnas* and common to many of its species, including the remarkable *H. dexithea* of Madagascar.

The Tsetse-fly Glossina caliginea, Austen, rejected by a Monkey.—Prof. Poulton exhibited the fragments of a *Glossina* identified by Mr. E. E. Austen as a female of *G. caliginea*, Aust. The specimen had been bitten and rejected by a monkey under the circumstances described by Mr. W. A. Lamborn in the following paragraph written from Oni, March 24, 1912 :—

"Good breezes are now blowing, and so this afternoon we ran across the lagoon in the sailing boat and had tea in one of the creeks. Two *Glossina* were rather a nuisance, and one settled on the leg of one of the men, who killed it with a sharp slap so that it fell into the bottom of the boat. I was too busy to pick it up just then, but the female Mona picked it up, smelt it and put it in her mouth. She took it out very shortly, pulled off one wing and then bit the insect in two. She dropped the thorax, but put the abdomen in her mouth. It was only kept there a few seconds, and then she took it out, smelt it, deposited it on the seat, and ran away. I send the specimen. The Mona is very fond of *Tabanidae*, and had caught and eaten several in the house before we went out."

Mr. Guy Marshall had suggested to Prof. Poulton that the presence of fresh blood in the fly may have been distasteful to the monkey.

Families of Butterflies bred by W. A. Lamborn in the Lagos District.—Prof. Poulton exhibited the following families, and referred to the strong light which was thrown by them upon different biological problems :—

1. *Salamis cacta*, F.—The Oriental Kallimas were well known to exhibit the most remarkable variation in the colours and patterns of the under surface. It was generally believed that these individual differences, which appeared in the broods of both wet and dry seasons, would be found in the butterflies raised from the eggs laid by a single female, but so far as Prof. Poulton was aware this conclusion had never been tested by breeding. It was therefore very satisfactory that Mr. Lamborn had succeeded in rearing from a batch of small larvae found upon the upper surface of a single leaf, a family of *S. cacta*, allied to *Kallima* and showing the same kind of individual variation. The larvae were found in the forest

two miles E. of Oni Camp, on October 5, 1910, and the whole cycle of development evidently lay well within the limits of the wet season, which extended from about April 25 to November 15, 1910. The position and uniform size of the larvae, together with the dates of emergence, showed that Mr. Lamborn was dealing with a company hatched from a single batch of eggs. The twenty-nine butterflies exhibited the most remarkable differences of under surface—differences which could be grouped in four main classes, according to the tint of the ground-colour and according to the presence or absence of a large white patch covering in great part the basal half of the hind wing. There was furthermore in all four classes great variation in the mottling and in the development of the oblique veining on the basal side of the midrib-like stripe The pattern of the upper surface was remarkably uniform, and there was no doubt that all the appearances presented by the under were procryptic, as in *Kallima*. The dates of emergence, sexes and main classes of the twenty-nine individuals were set forth in the following table :—

DATES OF EMERGENCE IN 1910.	PURPLISH UNDER SURFACE.				GREENISH UNDER SURFACE.			
	With large white patch on H. W.		Without patch.		With large white patch on H. W.		Without patch.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
Oct. 27 .	1	2	4	2			5	2
„ 28 .	1	2		2	2	1		3
„ 29 .		1						1
Totals .	2	5	4	4	2	1	5	6

The table showed that the thirteen males emerged on the average rather earlier than the sixteen females, that the colour differences were unconnected with sex, that the two main classes were as nearly as possible equal, viz. fifteen purplish to fourteen greenish, but that the white patch was far more frequently associated with the purplish than with the greenish ground-colour—viz. seven out of fifteen to three out of fourteen.

2. *Hypolimnas* (*Euralia*) *anthedon*, Boisd., and *dubia*, Beauv.—The small family exhibited to the meeting had been bred by Mr. W. A. Lamborn from the eggs laid February 9, 1912, by a female *dubia*, with a pattern somewhat transitional towards that of *anthedon*. The parent, which was also exhibited, had been captured half a mile from Oni Camp on February 6, and died February 11. Of the seven offspring, three *dubia* and one *anthedon* emerged at about 11.30 a.m., March 8, having pupated March 2: one *dubia* and two *anthedon* emerged March 10. The proportion, as nearly as possible half and half, was most reasonably explained by supposing that the female parent was a heterozygote and the male a recessive (*anthedon*). The three *anthedon* offspring were all typical, while the four *dubia* were intermediate like the female parent. In order to appreciate the result it was necessary to state that the ordinary heterozygote of this species bore the pattern of the dominant *dubia*, and was not intermediate.

Further work was needed, but it appeared probable from the facts at present known that the intermediate pattern, which behaved in heredity just as a typical *dubia*, was not itself of composite origin, but rather a true intermediate which threw light on the origin of the dimorphism.

3. *Amauris psyttalea*, Plötz, and *A. bulbifera*, Grose-Smith. —Examples bred by Mr. Lamborn from two families of larvae were exhibited and both sets showed the most perfect transition between these two so-called "species" which have only been separated because the spots in the fore wing of one are connected by a bridge in the other. Both series showed a gradation from the complete bridge to its entire absence. One series consisted of four males and four females reared from eggs seen to be laid at 5 p.m. December 7, 1910, in an open space by a native village 1½ miles E. of Oni. The eggs hatched December 12, and four of the exhibited specimens pupated December 25, and emerged January 4, 1911; the other four on December 26 and January 5 respectively. The whole cycle fell well within the dry season, from about November 15, 1910, to March 15, 1911. The other series consisted of three males and one female bred from a company of larvae found

August 14, 1911, in Oni clearing. One imago emerged August 30, three on August 31, and the cycle evidently fell well within the wet season, from about March 15 to December 8, 1911.

The Breeding of Eurytela hiarbas, Drury: a Correction.—Prof. Poulton said that he had sent a proof of the Proceedings for 1912, pp. xviii, xix, to Mr. W. A. Lamborn, who had pointed out that *E. hiarbas* had been bred by him from scattered larvae and not, as stated, from a known female parent. Prof. Poulton wished to correct the mistake he had inadvertently made.

The Irritating Hairs of the Moth Anaphe infracta, Walsingham.—Prof. Poulton exhibited a specimen of the Eupterotid, or, as Aurivillius considers, the Notodontid moth *Anaphe infracta*, concerning which Mr. W. A. Lamborn had written from Oni Camp, April 22, 1912:—

"I cannot say when the common cocoon was formed other than it was in July, 1911. The moths undoubtedly possess urticating hairs. The female Mona was allowed to steal one. She smelt it, rubbed off the hairs and scales, then dropped it and in a few minutes was rubbing all four feet on the ground. I made some sympathising remarks with the result that she suddenly sprang on to my bare neck, and I have been troubled with skin irritation all the evening. I found too that an urticating line on my arm followed exactly where I allowed a moth to crawl up a few days ago. It came and settled there when I was reading."

Prof. Poulton said that Mr. A. H. Hamm had found hairs from the anal tuft of the exhibited specimen produced irritation on his hand and face. Mr. Eltringham had found that the hairs of the female but not of the male tuft were covered with minute excessively fine spicule-like teeth.

Mr. H. Eltringham contributed the following notes on this subject:—

In the first volume of "Lepidoptera," in "Allen's Naturalist's Library," there is a translation by Kirby of a paper by Piepers which originally appeared in the Proceedings of the Dutch Entomological Society. Kirby there states that his translation appeared in the Entomologist for November 1875, though I cannot find it in that publication. In the paper referred to, Piepers describes a small white moth which he refers to the genus *Scirpophaga*, alluding to it as one of the pests of S.W. Celebes, since, attracted by light it comes into houses, and frequently settles on the inhabitants. Wherever it touches the naked skin it leaves an intolerable itching. The author further states that this moth attaches to the walls of rooms masses of eggs covered with yellow down. This is the earliest reference I have been able to find to urticating hairs occurring in the perfect insect. I am indebted to my friend Commander Walker for kindly pointing it out to me. On hearing of Mr. Lamborn's discovery, or rather I should say of his monkey's discovery, I naturally thought of examining the moths *Porthesia similis* and *P. chrysorrhoea*. Reference is made to the urticating properties of these moths in Barrett's British Lepidoptera, where the author states that the irritation has been thought to arise from the long hair-like scales of the fore wing inner margin as well as from those of the anal tuft.

In the case of the larvae of these species the urticating properties are of course well known, and in order to appreciate the structure of the hairs in the moths I should first point out that in the case of the larva of *P. similis* there are two kinds of hairs, the first long and not very numerous, the second short, very minute, and exceedingly numerous. The long hairs are provided with irregularly placed, slightly curved spines. The small hairs are of a quite different and very peculiar structure. They vary in length from about ·18 to ·08 of a millimetre; they are very finely tapered towards the end by which they are attached, and the outer end, which is much thicker, is furnished with three or four large sharp barbs, similar projections of gradually decreasing size being profusely arranged along the whole length of the hair, or spicule, as it may be termed. These spicule hairs, which in the case of the processionary caterpillars have been described by Judeich and Nitsche, occur in enormous numbers, and I believe that to them is mainly due the inflammation which ensues from contact with the larva.

Now in the female moth, *P. similis*, microscopic examination of the hairs in the anal tuft shows that there are present three kinds of hairs. First, long thick hairs, having a smooth and innocuous surface. These are most numerous on the peripheral portion of the tuft, in fact all the hairs here seem to be of the smooth kind, but they occur also in considerable numbers throughout.

Secondly, there are great masses of very fine hairs which for a portion only of their length are covered with irregular sharp jagged processes. A bundle of these hairs, when highly magnified, presents much the appearance of a tangle of brambles. These hairs are quite different from the large hairs of the larva. Also it is to be noted that it is the basal end of the hair which is spiny, so that when the moth has made a tuft over its eggs the spiny part will be uppermost, and so in the position to be first touched by an enemy. Thirdly, and this seems the most remarkable fact, there are amongst the two kinds of hairs already described, great numbers of little spicule hairs apparently precisely similar to those found in such profusion on the larva. One is at first tempted to suppose that these may in fact be derived from the larval skin in the cocoon, but unless the moth in emerging deliberately thrusts aside the pupal skin and brushes that of the larva with its tail, it seems difficult to understand how it can acquire them from any external source, and it therefore seems probable that the moth can grow these spicules just as the larva does. I am taking measures to find out how these spicule hairs are acquired, but meanwhile there is no doubt that any small bird attempting to pick out the eggs from the tuft which protects them would first get a mouthful of some thousands of these irritating little objects.

The anal tuft of *P. chrysorrhoea* differs, in that there is in it a much larger number of smooth and inoffensive hairs, but as if to make up for the greater leaven of innocence, the long urticating hairs are covered with prickles over nearly their entire length, whilst the spicule hairs are lurking amongst them just as in *P. similis*. As one would expect, the analogous structure in the male moth contains neither spiny hairs nor spicules.

To return to *Anaphe infracta*, the urticating hairs of the female are of quite different structure to those in the two moths which I have described. They are of about three times the thickness of those in *similis* and *chrysorrhoea* and they appear to be covered with projections which may be described as resembling saw-teeth regularly arranged along their entire length.

There are no spicules so far as I have been able to discover. I may say that I am going into the whole matter more minutely and hope to have something more to say about it on a future occasion.

The cocoons of the African Lasiocampid moth Chrysopsyche varia, Walk.—Professor Poulton exhibited the imagines and cocoons of *C. varia* sent to him by Dr. G. D. H. Carpenter from Damba Island, 20 miles south-east of Entebbe. The larval skin was still projecting from some of the cocoons, and showing its blue spots. The larvae had spun up November 12, 1911, and the moths emerged December 13.

Dr. Carpenter had written, April 18, 1912, from Bugalla, one of the Sesse Islands:—

"The cocoons of Imago *D* 137 [*Chrysopsyche varia*] are particularly interesting. The larvae are gregarious, resting freely exposed on the tree trunk by day, at sunset going up in a procession to feed. When full-grown they are chocolate brown with blue patches and patches of glistening white short hairs—very conspicuous. The cocoon, when finished, has a hole at one end, *through which the larval skin is partly pushed out at pupation*, and projects, showing the bright blue patches. Now as the moth *makes* a hole at the *other* end for its exit, the only explanation is that the aposematic larval skin is made use of to protect the pupa! I know of no other cocoon in which a hole is left especially for the extrusion of the larval skin. The cocoons are not especially exposed, in fact I had to search to find them: they were in a sheltered nook under fallen branches and amongst projecting roots. I left the larvae on the tree as they would not eat in confinement, but just wandered round and round the box in single file, head to tail, forming a complete ring, and looking very absurd! Evidently they wanted the stimulus of climbing up the tree to make them eat."

Professor Poulton said he had no doubt that Dr. Carpenter's interpretation was correct. It required a very definite adaptation of instinct to produce the result. The cocoon had a very dense appearance, but it would be satisfactory to examine it *before* the extrusion of the larval skin and to watch the larva when spinning. It was by no means uncommon for procryptic colouring and habits to be combined with an aposematic second line of defence. He suggested that the use of the old larval skin might be compared with the still more elaborate instinct described by Portchinsky in a species of *Lina* (*Melasoma*)—he believed *L. tremulae*, F. The larva of this Chrysomelid beetle, when disturbed, extruded a spherule of milk-white fluid at the aperture of each gland-duct opening on the skin, and when disturbance ceased the fluid was again withdrawn into the body. Professor Poulton said that he had witnessed this procedure in the larva of a species of *Lina* at Lake Louise, in the Canadian Rockies, in the autumn of 1897, and had found it to be precisely as described by the Russian naturalist. Portchinsky stated that a store of the same fluid is contained in the old larval skin after pupation and that, when the pupa is irritated, it "sits up" and brings pressure to bear on the skin which still envelops its posterior segments. This pressure causes the fluid to appear at the old apertures, to be presently withdrawn by the recovery in the shape of the skin when the pupa sits down again. Professor Poulton said that he owed the translation of this observation from the monograph of the distinguished Russian naturalist to the late Professor W. R. Morfill, of Oxford.

Dr. T. A. Chapman remarked that the hairs covering the eggs of *Porthetria dispar* are also urticating. He also observed that there are other species of moths which extrude the larval skin, but in these cases it was from flimsy cocoons. Mr. J. H. Durrant also gave instances of this fact.

The warning colours of the Hypsid moth "Callioratis" pactolicus, Butl., in all its stages.—Professor Poulton exhibited the larvae, pupae and imagines of "*pactolicus*," sent by Dr. G. D. H. Carpenter. Two species belonging to the genus *Callioratis* had been recently recognised as *Geometridae*, and had carried off the genus into this family, leaving the true *Hypsidae*, *pactolicus* and its allies, at present without a generic name. The 2 black-and-white-ringed larvae and the 2 orange black-marked pupae has been collected on April 17, 1912, by Dr. Carpenter on the shore of Bugalla, Sesse Islands: the 32 imagines had been bred (June 1, 1911) from scattered larvae found on Damba Island. There was much variation in the development of the black bars crossing the fore wing, which, in the darkest specimen, were far more completely fused into a single band on the right side than the left. Dr. Carpenter wrote concerning the specimens, April 18, 1912:—

"I am sending you bottled specimens of the Hypsid moth 'pactolicus' larvae and pupae. They are common on the shore, where their yellow papilionaceous food-plant grows very plentifully. They are splendid examples of conspicuousness: the larvae are visible from far. The white is the purest Chinese white I have ever seen on a live creature! The pupae are freely exposed, hanging in a few threads just enough to support them. It is difficult to imagine an insect more conspicuous in all its stages. The moth has a very slow, heavy flight (like a "Cinnabar"), and if handled exudes a strong-smelling, rather bitter-tasting fluid from behind each side of 'the collar' of the thorax. I thought you might like to have these; they are in dilute alcohol with a little glycerine. I will try and photograph some *au naturel* next time the larvae appear in numbers. The brood of moths is just over."

The species *pactolicus* sent by Dr. Carpenter was closely allied to *bellatrix*, Dalm., which Mr. G. A. K. Marshall had seen caught and rejected by a young drongo (Trans. Ent. Soc., 1902, pp. 358–9). The specimen, which had lost most of its head, was now in the Hope Department.

Diurnal movements of Acraeine pupae.—Prof. Poulton said that he had received from Dr. G. D. H. Carpenter an account of curious changes of attitude observed in Acraeine pupae. The following statement formed part of the letter of April 18, 1912, already referred to:—

"Acraeine pupae (at least all that I have had) have a curious habit which I do not remember to have seen mentioned anywhere. They bend their body from side to side at more or less regular intervals of a day. Thus one day you see a pupa bent towards one side, and next day it is bent towards the other, remaining motionless in these positions. Perhaps, as some Acraeine pupae at any rate are of aposematic colours, it is an advantage to show by change of position that they are animate objects, and drive home the warning. I have never seen any other pupa that hangs by the tail adopt changes of attitude."

Pseudacraeas of the hobleyi group on the Sesse Islands in the Victoria Nyanza.—Prof. Poulton said that Dr. G. D. H. Carpenter had left Damba in December 1911, and after spending Christmas at Entebbe had gone in January to Bugalla Island in the Sesse Archipelago. The following extracts were printed from a letter written in February:—

"I am now quite settled, and am going to remain on Sesse. The fly have become very much more numerous lately, and are quite as numerous as I want. The change from Damba is very welcome, the scenery here being quite different. The island is mostly open grass land, rising some 200–350 feet above the lake, with patches and belts of forest here and there, and a belt of forest all along the coast. I went into this last Sunday, January 28th, and to my great delight found there representatives of all the *Planema-Pseudacraea* associations! So neither you nor I need regret that I have left Damba. *Ps. obscura* seemed almost more abundant than on Damba, and its model [*Pl. paragea*] too (by the way, this seems to have more yellow on it than the Damba specimens); and on the very first time I went there I caught the most *lovely* specimen of a *Pseudacraea* intermediate between *Ps. terra* and *Ps. obscura* —far better than anything I ever got on Damba. In what I now regard as my apprenticeship to the *Pseudacraeae* I certainly *was* misled, as you suggest, by the rudimentary vein closing the hind cell. But now I can, with a certain degree of confidence, distinguish them from their models on the wing and at rest. Pseudacraeas are *very* much more alert, and rarely rest with the complete 'abandon' of the Planemas. Moreover, *Ps. obscura* and *terra* have a curious shiny appearance about them, especially on the under surface, as if they had been varnished; and, in the 'cadaver,' I find very many points of difference. Pseudacraeas have much thicker bodies; the palpi are larger; the antennae have practically no club, only a gradual thickening; and the shape of the wings is slightly different."

The following notes were written February 25th :—

"I think you will be delighted that I have left Damba; for the disproportion between *Planema* and *Pseudacraea* is even greater here, so much so that I look on Pseudacraeas as nothing, but consider it an event to catch a Planema! Of Pseudacraeas; *terra* abounds, *obscura* is not quite so plentiful, but lovely intermediates between the two are nearly as common as the types. *Hobleyi* is, I think, the scarcest—at any rate the female. I have only seen three *Pl. paragea* (two of which I caught and send you), no *Pl. poggei* or *macarista*, and very few *tellus*. I have seen no *A. alciope* at all, but *Precis rauana* occurs though I have not succeeded in catching it. On February 25th I saw two male *hobleyi* pursuing a *terra* in a very suggestive manner, and a *terra* pursuing a female *hobleyi* which fluttered stationary in the air also very suggestively."

[The following sentence was extracted from a later letter written from Sesse on May 1st: "I have already told you that I have seen male *Ps. hobleyi* flirting with female *Ps. terra*, and *vice versâ*—both hovering flutteringly in the air. Since then I have seen a male *Ps. obscura* paying court to a female *Ps. terra* in the same way. This makes the observations complete! They were some 10–15 feet above the ground, and out of reach in every case. I am quite convinced that copulation and oviposition take place quite high up among the tree tops."]

"So far I have not succeeded in getting eggs, though I have kept four females full of ova: three have died without result, the fourth I have had for a week, and it is still living though it has hardly any wings left!"

Dr. Carpenter had also written in confirmation on April 27th :—"You will have seen from the first few I sent—which I hope to hear about in a week or so—how splendidly Sesse confirms the Damba records, the results being still more striking. I am so proud that I can supply such grand proof of the reality of the power of Natural Selection."

Prof. Poulton said that the Bugalla specimens of *Pl.*

paragea, Grose-Smith, a male and a female, were of great interest because of the extended pale markings, resembling those of the most extreme varieties obtained by Mr. Wiggins in the neighbourhood of Entebbe. The five specimens from Damba Island, mentioned in these Proceedings (1912, p. xxiii), were on the contrary very dark forms. Mr. Wiggins's darkest and lightest examples were exhibited December 6, 1911 (Proceedings, p. xci). An account of the Sesse Pseudacraeas would be given at a later meeting when more material had arrived, but in the meantime it might be stated that the intermediate varieties between *obscura* and *terra* were a large proportion of the whole, and that they formed the most complete transition from the one pattern to the other. Dr. Carpenter's observations on the courtship of the Pseudacraeas of the *hobleyi* group afforded interesting confirmation of Dr. Jordan's conclusions based on the structure of the male armature. *Pseudacraea kuenowi hypoxantha*, Jord., was present in Dr. Carpenter's captures on Bugalla, although absent from those on Damba. Prof. Poulton had now received the whole of the butterflies collected on this latter island, and explained that a few additions would require to be made to the lists of Pseudacraeas and Planemas published in these Proceedings (1911, pp. xci–xcv; 1912, pp. xix–xxiii). He hoped to bring a complete statement before a later meeting.

Papers.

The following papers were read:—

"Studies in the *Blattidae*," by R. Shelford, M.A., F.E.S.

"*Polyommatus alexius*, Freyer, a good Species," by T. A. Chapman, M.D., F.Z.S., F.E.S.

Wednesday, October 2nd, 1912.

Rev. F. D. Morice, M.A., President, in the Chair.

Election of a Fellow.

Miss Lily Huie, Hollywood, Colinton Road, Edinburgh, was elected a Fellow of the Society.

Death of Fellows.

The death was announced of the Hon. Fellow, Prof. L. Ganglbauer, of Vienna, and also of Messrs. R. Shelford, M.A., F.Z.S., E. A. Fitch, F.L.S., and G. H. Grosvenor, M.A.

Exhibitions.

An Aberration new to Britain.—Dr. Nicholson showed three specimens of *Adalia obliterata*, L., ab. *sublineata*, Weise, an aberration not as yet recorded from Britain. It differs from the type form in possessing black lines on the elytra, and is intermediate between the type, which is unspotted, and the ab. *fenestrata*, Weise, in which the elytra are almost entirely black. These specimens were taken on Box Hill.

Dark aberrations of Abraxas grossulariata.—Mr. G. T. Porritt exhibited various forms of the variety *nigrosparsata*, together with the type specimen of var. *nigra* of *Abraxas grossulariata*, all bred, with some two dozen other more or less similar specimens, from larvae and pupae collected from one garden at Huddersfield during the present year.

Coleoptera from Oxford.—Commander J. J. Walker exhibited series of the following rare species of British Coleoptera, recently taken in the Oxford district:—

Lathrobium pallidum, Nord., found in flood-refuse of the River Cherwell at Water Eaton, Oxon.

Apion annulipes, Wenck., ♂ and ♀ taken by sweeping roadside herbage (red clover, *Trifolium pratense*, predominating) near Enslow Bridge, Oxon.

Psylliodes luteola, Müll., by sweeping grass on the outskirts of Kirtlington Park, Oxon.

"Insect-catching Grass."—Commander Walker also exhibited on behalf of Mr. A. M. Lea, Govt. Entomologist at Adelaide, S. Australia, a specimen of the so-called Insect-catching grass (*Cenchrus australis*) from Cairns, N. Queensland, with several *Coleoptera*, belonging to various genera, adhering to the spinous awns.

Aberration of Pyrameis cardui.—Mr. R. M. Prideaux brought for exhibition a beautiful aberration of *P. cardui*, closely resembling one figured by Newman ("British Butterflies," p. 64), bred from a pupa found spun up on a thistle, July 16th, 1912, and which emerged the following day.

Mr. C. J. Gahan exhibited a small series of *Phromnia superba*, Melich, a dimorphic species of Homoptera of the sub-family Flatinae, taken by Dr. A. C. Parsons in Northern Nigeria, and read the following letter received from Dr. Parsons to explain the great interest attaching to the specimens :—

"*Haldon Terrace, Dawlish, S. Devon,*
"*26th August*, 1912.

"Dear Sir,—With reference to my interview with you last June and our conversation at the Museum concerning certain Homoptera that I brought from N. Nigeria.

"The following is an extract from a letter that I wrote to my wife on the subject.

"'. . . I sat down at once to describe to you an extraordinary instance of protective mimicry that came under my notice. You must know that this last trip I have been in the habit of collecting new flowers and then trying to paint them when I get into a camp. One afternoon I found that the particular flower which I wanted to paint was dead, so I went into the "jungle" to try and find another specimen. But my attention was soon arrested by a most beautiful dove-coloured pea flower of sorts. "I will not bother about that other flower" I said to myself "but pick this one instead." On suiting the action to the word all the blossoms of my "flower" flew up in a cloud of fluff about my head and then re-settled individually among the brushwood. To use one of your favourite expressions, my "flower" was composed of several very pretty moths "on tiptoe for a flight." I cannot call to mind another instance of insects combining in that sort of way for mutual protection. These moths, whose folded wings are the exact shape of the keel part of a pea flower, were all arranged on the bare stem of some darkish bush ; their heads were all pointing in the same direction and the colour graduated from green at the top of the twig to a deep dove colour that would indicate the oldest blossoms below. I was never so completely and so wonderfully taken in during my life, I well believe. I was able to catch about fifteen of the insects which I am sending to the Nat. History Museum, and I hope they will be able to reproduce what I saw.'

"The insects were taken in a village called PANDA, which lies about 40 miles north of KEFFI in the NASSARAWA province of Northern Nigeria. The place of capture was a patch of dense undergrowth at the edge of a jungle stream and close to the village ford. It was in the month of October that I saw the insects, and the time of day was about 5 p.m. The insects had selected a branch which was apparently leafless except at its extremity, and on this branch they occupied a length of some 9 inches : all the heads were pointing in one direction and that an upward one. I suppose that there were between 30 and 40 insects settled on the branch when I first saw it. After they had been disturbed they admitted of easy capture with a cap and all showed a tendency to re-assemble in the place where I first saw them, while none ventured far into the open.

"I have no recollection of seeing any flowers resembling in colour this pattern of insects, but racemes of leguminous flowers are a common feature in N. Nigeria.

"I could get no information on the subject from the natives.

"Finally, I should say that the insects have faded since their capture.

"Believe me,

"Yours truly,

(Signed) "ALLAN C. PARSONS, W.A.M.S.,

"Med. Officer, N. Nigeria."

Mr. Gahan said that Dr. Parsons' observations on this species were a strong confirmation of the account given by Prof. J. W. Gregory of a nearly related East African species in his book "The Great Rift Valley." He passed round a copy of the plate on which that species had been represented, and remarked that though it was undoubtedly inaccurate in showing the green insects at the top of the stem as being much smaller than the pink ones below, we now had no reason to doubt that these insects are at times to be found arranged in the manner shown on the plate, notwithstanding that Mr. S. Hinde had never seen them so arranged during the time he had them under observation (see Trans. Ent. Soc., 1902, p. 695). Prof. Poulton's suggestion that the insects are only arranged in the definite way described by Dr. Gregory, just at the period when they have reached the final stage, was in all probability correct, but it had yet to be proved correct; and in a matter so interesting it was greatly to be desired that someone on the spot would carry out further observations with a few to settling that point. Mr. Distant had described as a distinct species the pink form shown on Dr. Gregory's plate; but knowing what we did of the close association of the two forms, he thought it was quite evident the two were merely forms of a single species, especially as no difference in structure had been pointed out.

West African Homoptera.—Mr. W. A. Lamborn exhibited a series of twelve *Homoptera* of the genus *Flata*, all taken feeding on one plant, 70 miles E. of Lagos, on Dec. 1, 1912. The insects were dimorphic, and he stated that the pink and green forms were mixed as they rested on the plant. He had not observed in these the definite arrangement according to colour mentioned by Mr. Gahan, although he was acquainted with the same species.

Prof. Poulton observed that the insect probably had the instinct for congregating, though not of colour-arrangement, and that in the two known instances in which the green specimens were found above and the pink below they had probably come out in that order, and had not yet flown, and that when once disturbed they congregated again, but promiscuously.

Euchelia jacobaeae, L., captured and then abandoned by a Robin.—Prof. Poulton exhibited an apparently uninjured example of *E. jacobaeae* given him by Mr. Roland Trimen, F.R.S., who had made the following observation on June 20, 1912. The moth was flying slowly at midday in his garden at Fawley, Onslow Crescent, Woking, when a robin captured it on the wing and flew with it behind a bush. After about three minutes the bird flew away, and Mr. Trimen found the moth lying upon the ground. Although there was no obvious injury, except that one fore-wing was bent over and slightly rubbed, the insect seemed paralysed or almost dead. *E. jacobaeae* being, however, one of those moths that readily "feign death," and Mr. Trimen being anxious to preserve the specimen just as it was left by the assailant, he placed it without delay in a killing-bottle.

ABERRATIONS OF ALPINE LYCAENIDS.—Dr. T. A. CHAPMAN exhibited several unusual forms of some common "Blues" taken this year in the Valley of the Isère and at Courmayeur (country of the Centrones).

(1) *Polyommatus icarus*, ♂, from Courmayeur, in which the upperside makes a nearer approach to *P. escheri* than he had seen in the species. The colour of the blue, its variation of tint towards the margin, the encroachment of the black marginal line as in *P. escheri*, and the black lines along the veins were all marked.

(2) A specimen of *Agriades thetis* (*bellargus*), ♂, from Courmayeur, that had black spots round all four wings, being a marked example of the var. *punctifera*, an African form.

(3) An example of *Polyommatus hylas*, ♂, from Courmayeur, that was very pale, the blue becoming white against the marginal line.

(4) A specimen of *Hirsutina damon*, ♂, that was very possibly really a hybrid with *A. corydon*; the underside had marginal spots and lunules, much in excess of the faint traces sometimes present in *damon*; it was taken at Bourg St. Maurice.

(5) A specimen of *Polyommatus escheri*, ♂, in which the ground-colour of the underside was white, so that the white circles round the spots were lost in it. It might easily pass for a distinct species.

He said that the "blues" of this region are generally large and more than usually variable; and that it is also the headquarters in Western Europe of *Agriades alexius*, Frr.

SCARCE ANTS.—Mr. DONISTHORPE exhibited a number of ♂ ♂ of *Ponera coarctata* which he had swept at Box Hill, and remarked that no one living appeared to have taken ♂ ♂ in Britain. There were none in the British Museum or Oxford Museum collection, but one or two in the Saunders and Chitty collections. Also ♂ ♂, ♀ ♀, and ☿ ☿ of *Formicoxenus nitidulus*, taken in a nest of *F. rufa* at Weybridge. Mr. Bagnall had recorded the ♂ first for Britain in 1906 from Corbridge-on-Tyne. Subsequently Arnold and Hamm took the species in the New Forest in 1909. Adlerz discovered and described the ♂, which is wingless, in 1884. There is a specimen, however, in the Rothney Collection at Oxford, taken by Dr. Power in 1864, standing under the name of *Stenamma westwoodi*, ☿. He remarked that the food was not known, but that he had started a small colony in an observation nest, and found they would eat honey and devoured the larvae of *Leptothorax acervorum*, which came from the same nest. Also ♂ ♂, ♀ ♀, and ☿ ☿ of *Leptothorax tubero-affinis*, a form new to Britain, taken in some numbers in the New Forest by Mr. Crawley and himself in July.

Mr. Donisthorpe much regretted that his friend Mr. Crawley was not present to exhibit *Anergates*, but feared he was ill.

He then showed a ♂, and winged and deälated ♀ ♀ of *Anergates atratulus*, which had been found in the New Forest in July by Mr. Crawley and himself, the former having found the first specimens. He gave a short account of the habits of this interesting ant, which lives in the nests of *Tetramorium caespitum*.

Celastrina argiolus on a new Food-plant.—Mr. Hy. J. Turner exhibited, on behalf of the Rev. C. R. N. Burrows, a long series of bred *Celastrina argiolus*. He stated that the larvae had occurred each year for some time past in the garden at Mucking, feeding on Portugal laurel, attacking the flower buds in the early summer. The whole of the specimens were unusually large, and the females had the black border on the fore-wings, in most of the specimens, very considerably developed and of a deep black. Many of the females had a strong development of whitey-blue on the basal half of the costal area, and there was a tendency to develop a whitish suffusion in the discal area of the fore-wing. In one specimen this latter feature had developed into a bluish-white discal blotch definitely terminated by the black border exteriorly, but vanishing into the general blue area interiorly. The form closely resembled the Nearctic form *pseudargiolus*. He believed that the food-plant had not hitherto been recorded.

A CURIOUS ENTOMOLOGICAL PICTURE.—Mr. TURNER also exhibited a curious colour-print of an "Entomologist" published in 1830 in London, in which the whole of the figure was ingeniously made up of various species of the Insecta, only the face being human.

THE GENUS DIANTHOECIA.—Mr. L. W. NEWMAN exhibited specimens of *Dianthoecia*, bred from North Kent wild larvae, resembling exactly, both in size and coloration, *Dianthoecia capsophila* from the Isle of Man. This appeared to confirm the opinion of several leading men that *D. capsophila* and *D. carpophaga* are the same species. He also showed for comparison varied series of *D. carpophaga*; a pair of *D. capsophila* and *D. capsincola*.

COLIAS HECLA FROM FINMARK.—Mr. W. G. SHELDON exhibited a series of *C. hecla*, from the Porsanger Fjord, Arctic Norway, with specimens of the other orange species occurring in Europe for comparison.

A LIVING EARWIG.—Mr. W. J. LUCAS exhibited a living ♂ of *Labidura riparia* (the Giant Earwig), taken on the shore near Christchurch, Hants. They appeared to be getting scarce. He had visited the locality three times in August, and in all found a dozen specimens—♂, ♀, and nymphs. The one exhibited was taken on August 31, and had been fed on raw meat. As these earwigs change colour very much after death he also exhibited a drawing giving the colour of the living insects, and demonstrating how well they are protected by resemblance to the pale sand of the Hampshire coast.

PYRENEAN LEPIDOPTERA.—Mr. G. T. BETHUNE-BAKER showed specimens of *Hepialus pyrenaicus*, a species found not uncommonly on the higher parts of Mount Canigou, with the apterous female. Also a fine form of *Lycaena arion*, and a specimen of *Heodes hippothoe* that was at once radiated, obsolescent and asymmetrical.

ALPINE BUTTERFLIES.—Mr. DOUGLAS PEARSON exhibited a drawer of Rhopalocera from the Black Forest and the Swiss Alps, including an albinistic specimen of *Erebia lappona*, an unusually large ♀ of *Melitaea varia*, the large Black Forest form of *Colias palaeno, Brenthis pales* from Pontresina with underside hind-wings of a deep purple-red, and others.

EGG-LAYING OF EREBIA GLACIALIS.—Mr. J. A. SIMES read the following note:—"On the 15th July, 1912, I came across *Erebia glacialis* in some numbers on a scree slope below the summit of the Colette de Gily, Dauphiny, and sat down for a while to watch them. Shortly afterwards I saw a ♀ alight on a piece of loose rock on the slope, sun itself for a time and then proceed to walk slowly backwards until it reached the lower end of the rock. It then bent its abdomen underneath the slab of rock and deposited an egg on the lower surface of it. The slab measured roughly 9 inches by 4 inches and the broken part at the lower end was only about half an inch thick, although the bulk of the slab was considerably thicker. The only vegetation in the neighbourhood was a very fine-leaved grass, tufts of which grew here and there on the screes. The nearest plant was about a foot and a half distant from the slab on which the egg was deposited. I subsequently observed a second female behave in precisely the same manner, and eventually deposit an egg on the underside of a detached slab of rock on the scree slope."

Mr. H. ROWLAND-BROWN observed that if the larva were not hatched till the spring the egg might be placed in this way for protection, but as the larva had been known to hatch quickly and hibernate in that state this could not be the cause.

Mr. DOUGLAS PEARSON suggested that possibly the fact that they had to hatch quickly was the reason for their position, as the heat obtained from the sun beating on the slab might hasten them.

Dr. CHAPMAN was of opinion that this was quite possible, but thought it also possible that the species, unlike most of the genus, might hibernate as an egg, since they had only been known to hibernate as larvae in captivity, and so under unnatural conditions.

DELAYED EMERGENCE OF A BEE-IMAGO (OSMIA SP.)—The

President exhibited a species of *Osmia* and its cell, and read the following note:—"Three and a half years ago, in the early spring of 1909, I picked up beside a little stream at Jericho, and afterwards brought to one of these meetings for exhibition, a hollow stem of *Zizyphus spina-Christi*, containing a series of mud-cells which I conjectured to be the work of some rather large *Osmia* sp., possibly *tridentata*. I opened one and found in it a fat white larva, so I put the stem into a muslin bag, hung it up on a nail, and hoped that imagines would emerge in the coming summer. Nothing however occurred either in 1909, 1910, or 1911; and I took it for granted that the grubs had all perished. However to my surprise and pleasure I found on returning from the Oxford Congress this year, that one of the cells had produced an *Osmia* ♀ of a species which I had never seen before, but which, I think, must be the *Osmia indigotea* of Morawitz. I have brought the cell and the insect with me; but you will hardly be able to see by this light the pretty iridescent or sub-metallic coloration of its abdomen. It is known that *Osmia* spp. will sometimes wait through a year or more before emergence. F. Smith once received some *Osmia* cells from Scotland which produced nothing for some time; but ultimately bees appeared, after a year or so in the British Museum. This *Osmia*, however, has been extraordinarily patient; and I do not despair of finding something more in the bag next year."

Mr. C. O. Waterhouse observed that in cases of delayed emergence in bees, it was in the larval, not in the pupal state that they passed the interval, and that the larva was capable of existing thus for years without food.

Aberration of Brenthis selene.—Mr. H. Baker Sly exhibited a very dark example of *Brenthis selene*, having the under-wings clouded with dark brown all over, except for a slightly lighter shaded spot in the middle, and the upper-wings very heavily clouded with dark brown; it was taken in Worth Forest, Sussex, May 26, 1912. He also showed a specimen of *Epinephele janira*, one upper-wing having a white blotch at the tip, the under-wing on the same side also having a white streak, taken at Box Hill, August 11, 1912.

Papers.

The following papers were read :—

"The Life History of *Lonchaea chorea*," by A. E. Cameron, M.A., B.Sc.; communicated by H. S. Leigh, F.E.S.

"A few Observations on Mimicry," by W. J. Kaye, F.E.S.

Wednesday, October 16th, 1912.

The Rev. F. D. Morice, M.A., President, in the chair.

Portraits of Ex-Presidents.

The President stated that in pursuance of a suggestion approved by the Council, he had written to most of the surviving ex-Presidents of the Society for their portraits, and had already received several, viz. those of Lord Avebury, Dr. David Sharp, Dr. Alfred Russel Wallace, Mr. Roland Trimen, and Mr. C. O. Waterhouse. Photographs of the President and of the late Mr. G. H. Verrall had also been received, and Mr. J. H. Durrant had kindly presented portraits of Messrs. W. Kirby, W. Spence and H. T. Stainton, Presidents of an earlier day.

Thanks were voted to the donors.

Election of Fellows.

The following were elected Fellows of the Society :—Mrs. Ellen M. Waterfield, The Hospital, Port Sudan; Messrs. Patrick Alfred Buxton, M.B.O.U., Fairhill, Tonbridge, and Trinity College, Cambridge; Alfred Noakes, The Hill, Witley, Surrey; Norman Denbigh Riley, 94, Drakefield-road, Upper Tooting, S.W., and British Museum (Natural History), S. Kensington, S.W.; and Henry S. Wallace, 17, Kingsley-place, Heaton-on-Tyne.

Exhibitions.

European Butterflies.—Mr. E. B. Ashby exhibited a case of Rhopalocera from the French, Swiss, and Italian Alps and from Britain, including a specimen of *Gonepteryx cleopatra*, bred in captivity from an egg laid in England.

THE ORDER PROTURA.—Mr. C. B. WILLIAMS exhibited a specimen of an unascertained species of the *Protura* which he had taken in some numbers in peat from Hampshire by means of a Berlese funnel. This order of primitive insects, which was only discovered about six years ago, and was first recorded from England by Mr. R. S. Bagnall at the beginning of this year, is chiefly remarkable for the absence of antennae. In a few specimens which were kept alive for some days he had been able to confirm the interesting observation of Berlese, that they use their front pair of legs not as locomotive but as tactile organs, holding them out in front of the head when walking, as if to take the place of the missing antennae.

Mr. C. J. GAHAN asked whether anything was known of the feeding habits of this *Protura*, and Mr. Williams replied that he had only taken three alive, and these had only lived for two days, so he had not been able to make any further observations. The insects had some hairs on the front legs which were probably sensitive, and helped these limbs to take the place of antennae. Various other instances of similar adaptation were mentioned. Mr. J. E. COLLIN referred to the use of legs as feelers among the Diptera; Mr. DONISTHORPE to the mites found on the chins of ants, which wave their front pair of legs before their heads as if to take the place of antennae and are called *Antennophori*; Dr. LONGSTAFF to the Arachnid whip-scorpions which use their front pair of limbs as feelers.

The PRESIDENT observed that the antennae were really a highly complicated structure, and that it was hardly correct to speak of limbs taking their place, though they were doubtless capable of performing some part of their functions.

ARCTIC DRAGONFLIES.—Mr. W. J. LUCAS exhibited a specimen of *Somatochlora alpestris* from Porsanger Fjord, east of North Cape, taken at the end of June 1912. It occurs in the Swiss Alps, as well as in Scandinavia. Also a specimen of *Aeschna caerulea* (= *borealis*), from the same locality, taken July 13th. This species is British, occurring, but not commonly, in the Highlands of Scotland. Both specimens shown were taken in this northern latitude at sea-level. They were captured by Mr. W. G. Sheldon.

OCCASIONAL MIGRATION DUE TO EXCESSIVE DROUGHT AS A CAUSE

OF THE SPREAD OF BUTTERFLIES INTO NEW LOCALITIES.—Professor POULTON brought forward the following note on behalf of the Rev. K. ST. AUBYN ROGERS, and exhibited the two *Libythea* and the five *Asterope* (*Crenis*) therein mentioned :—

"The migration of butterflies is a subject of perennial interest and one on which many more observations are needed. It may perhaps be worth while to record a migration which took place at Rabai during the early part of 1911.

"The first species to be observed was *Catopsilia florella*, a species which is one of the best known migrants. The date on which the migration was first observed was March 12th, and it continued for some three weeks. At no time during this period were the migrants conspicuous for their large numbers, but every specimen of *C. florella* seen, appeared to have important business to the north, which urged it to keep moving steadily in that direction.

"Towards the end of this period I noticed that there were other butterflies joining in the movement, and on March 31st, I spent an hour in my garden capturing these. I found that *Atella phalantha* and the skipper *Andronymus neander*, the latter also previously recorded as a migrant, were represented in some numbers. However, the most interesting butterflies seen, as far as I was concerned, were *Libythea laius*, Trim., and *Asterope* (*Crenis*) *natalensis*, Boisd. Of these I captured two of the former and five of the latter in about an hour, and, as they were flying fast and high, it is evident that they must have been present in considerable numbers. The two species resemble one another on the wing, and when travelling fast are not easy to discriminate, but I am under the impression that the *Asterope* was proportionately more numerous than these figures would indicate. Now it is worth observing that neither of these species is common in the coast district of British East Africa, and I had not seen the *Libythea* since 1899, after a period of very prolonged and severe drought—conditions which were present, although to a lesser degree, in 1911. The *Asterope* I had only once previously taken in the district, although I think I saw it on another occasion. I have twice taken the *Asterope* in 1911, since March 31st, and have seen others, and I have also seen what I took to be a specimen of the *Libythea.* It remains to be said that the migration throughout was from S.S.W. to N.N.E., the wind being light from the E.N.E. Five days after March 31st the wind went round to the S.S.W. and blew strongly, the first heavy rains falling two days afterwards. This observation seems to indicate that butterflies which are usually non-migrants may be stimulated by abnormal conditions to become migrants, and that these occasional movements may enable the species to occupy new ground."

THE SPECIAL DEVELOPMENT OF MIMICRY IN FOREST BUTTERFLIES.—Professor POULTON brought forward a suggestion received from Mr. C. F. M. SWYNNERTON as to one of the causes which may have operated in the special development of mimicry in forest areas. The suggestion, which may be considered as a supplement to Mr. SWYNNERTON's earlier statement published in the Proceedings, 1912, pp. li–liii, was made in a letter written by him on May 25th of the present year. Mr. G. A. K. Marshall, who was familiar with the locality (Chirinda, S.E. Rhodesia) from which Mr. SWYNNERTON wrote, and to whom the paragraph had been submitted, regarded it as quite plausible and also novel :—

"I believe you are right in your view that the forest struggle for life 'is of a different kind.' Thinking it over after sending you my suggestion as to the possible dependence of such phenomena on the habitat of the model's food-plant, it struck me that a very frequently repeated observation of mine had perhaps a direct bearing on the point. It is that flying insects are often exceedingly difficult to recognise in forest as against veld. It is by no means easy at once to decide on the coloration of an insect seen flying in a blaze of light against a deep shadow or *vice versâ :* also they so frequently disappear behind foliage after having been in view for a few seconds only. Under those circumstances a mere trick of flight, or the smallest splash of colour in common, have often caused me to take the insect for something that is otherwise utterly unlike it, and such a hesitation would usually cost a bird the insect. In this way *incipient* mimics should stand a better chance in forest than in open country and be more likely to survive beyond the incipient stages. I had previously applied the observation in thinking out the value of merely incipient likenesses, but had not thought of its bearing on the 'forest *versus* veld' problem when I replied to your question."

EURYTELA HIARBAS, DRURY, AND E. DRYOPE, CRAMER.—Professor POULTON drew attention to a letter he had received nearly two years ago from Mr. G. F. Leigh, describing the breeding of *E. dryope* and drawing the inference that the species was distinct from *hiarbas.* Mr. Leigh had thus been led by his own observations to revise his earlier conclusions on the subject (Proc. Ent. Soc., 1909, p. xxxv). The letter, dated Nov. 26th, 1910, was written from Durban:—

"I have to report that, breeding *Eurytela dryope* from a wild female (I cannot give the form of the male), I reared 22 offspring, all of which were *dryope.* Apparently, therefore, the two species *E. hiarbas* and *E. dryope* are different. Mr. A. D. Millar has a captured specimen, intermediate between these two butterflies, and such a form may, I think, be the result of a pairing between *dryope* and *hiarbas.*"

MÜLLERIAN MIMICRY BETWEEN AUSTRALIAN BEES.—Professor POULTON exhibited on behalf of Dr. R. C. L. PERKINS a male of *Prosopis nubilosa*, Ckll., (*Prosopidae*), and of a species of *Halictus* (*Andrenidae*), captured by him in the Cairns district of North Queensland (July 1904). Dr. Perkins had pointed out to the speaker the extremely interesting manner in which the resemblance had been brought about, the hard glistening yellow mark on the black scutellum and post-scutellum of the *Prosopis,* and that on its lateral prothoracic tubercles being mimicked by a yellow pubescence occupying the same positions in the *Halictus.* The latter, having departed from the general appearance of its group, was clearly a mimic of the *Prosopis,* which bore a pattern also found in many allied species. The males and females of both model and mimic were alike, so that the resemblance would be equally striking between the females. Dr. Perkins had suggested that a resemblance brought about in this remarkable manner, by means entirely different from those employed in the model, was certainly inexplicable on the hypothesis of climatic influence.

This mimetic resemblance had been fully described by

Cockrell (Trans. Amer. Ent. Soc., xxxvi, p. 201, 1910) who stated that certain species of the Australian *Paracolletes* also resembled the same *Prosopis* models. "The yellow dorsal patch in the *Prosopis* is tegumentary, in the *Paracolletes* due to hair, but the superficial effect is the same. To my astonishment I find also an *Halictus* with the same coloration (the patch due to hair), so similar to *Paracolletes flavomaculatus* that I had no doubt of its being a close relative until I came to examine it in detail." This species was described (*l.c.*, pp. 201, 202) by Cockrell from three ♀ specimens, from Macleay, Queensland, as *Halictus paracolletinus*, and it was probable that the specimen exhibited was the ♂ of the same species.

A short discussion on the mimetic signification of this exhibit took place, in which the PRESIDENT, Prof. POULTON, Messrs. C. O. WATERHOUSE and G. A. K. MARSHALL took part.

A NEW SPECIES OF ARGYNNIS.—The Rev. G. WHEELER exhibited two specimens of a new *Argynnis*, discovered in June last by Mr. Harold Powell, F.E.S., at Lambessa in Algeria. He stated that during a recent visit to Mons. Charles Oberthür at Rennes he had seen a drawer of this species in which there was only one slightly aberrant specimen. Mons. Oberthür had given him four specimens of this species which on the underside somewhat resembled *A. adippe*, var. *chlorodippe* (shown for comparison) but the ♂s were entirely without the broad androconial patches on the nervures of the forewings on the upper side, present in all forms of *A. adippe*. Mons. Oberthür named it *auresiana*.

COCOONS OF NORASUMA KOLGA, H. DRUCE, SPUN UNDER NATURAL CONDITIONS.—Dr. W. A. LAMBORN observed that some cocoons formed by larvae of this species in captivity had been previously exhibited by Professor Poulton, which, however, did not present quite the same appearance as those formed under natural conditions. The specimens now exhibited were formed by wild larvae under leaves and were found in the clearing at Oni Camp. They gave a better idea as to the mimicry of Braconid cocoons by the formation of little bosses of yellow silk. He remarked that it is the rule to find several cocoons under one leaf frequently as many as twelve.

ANTS, AND A NEW MYRMECOPHILOUS SPECIES.—Mr. DONISTHORPE exhibited (1) a small incipient colony of *Camponotus ligniperdus* taken at Yvorne, Switzerland, October 8th, 1912. (2) Specimens of a Proctotrupid new to science, *Loxotropa donisthorpei*, Kieffer, taken in a nest of *Lasius flavus* at Blackgang Chine, Isle of Wight, September 9th, 1912. (3) A specimen of *Camponotus abdominalis* var. *atriceps*, Smdt., an American species, captured alive in his room on his return from Weybridge, September 6th, 1912. It seemed probable that it had come from the hotel at Weybridge, as he was told of the capture of other specimens there on his next visit.

Commander WALKER observed that one of the Australian species of *Camponotus* occurred constantly in houses, and was familiarly known as the "sugar ant."

Mr. DONISTHORPE also handed round a photograph of Professor FOREL, and of his house, where he had lately been Professor Forel's guest.

HYBRIDS AND SECOND BROODS.—Mr. L. W. NEWMAN exhibited (1) a long and varied series of the Hybrid *Smerinthus ocellatus* ♂ × *Amorpha populi* ♀, bred September 1912, out-of-doors, from pairing obtained June 1912, the larvae pupating in July and early August. There was considerable variation in the eye-spots, some being very pronounced and others obscure; several having a washed-out appearance and others being very brilliant, two or three being well flushed with pink scaling. (2) Living specimens of the Hybrid *Zonosoma pendularia* ♂ × *omicronaria* ♀ (*annulata*). Pairing took place July 1912; the larvae were sleeved out-of-doors on growing birch till September 15th, when they were not half fed, then brought into a hot-house (temperature 60° to 70°) and fed in glass-topped metal boxes; they at once grew very rapidly, pupating October 1st to 12th, and started to emerge on October 8th and continued to emerge every day since. The specimens showed characters of both species well, and vary somewhat in the quantity of pink coloration. (3) A living ♀ specimen of *Metrocampa margaritaria*, taken at rest in Bexley Woods October 14th, 1912, which points to a second emergence of this species. (4) A ♀ specimen of

S. ocellatus bred out-of-doors, on September 14th, from larva which pupated in June 1912.

MALACODERM LARVAE.—Mr. K. G. BLAIR exhibited larvae of two allied species of Malacoderm from Borneo, brought to the Natural History Museum by Mr. J. C. Moulton. The species to which these larvae belong are not yet known, although probably belonging to the family *Lycidae.* The larvae are found amongst moist rotten wood, but the nature of their food is uncertain.

Mr. C. J. GAHAN observed that from the mouth-parts it was probable that these larvae belonged to the Family *Lycidae.* Several attempts had been made to breed them but they had never developed, and it was possible that the ♀ at any rate never gets beyond this condition ; the ♂ is quite unknown.

Prof. POULTON remarked that Mr. Shelford had once had a larva which reached a soft stage apparently preliminary to some change, but that it had fallen a victim to an unfortunate accident.

NONAGRIA DISSOLUTA. — Mr. H. M. EDELSTEN exhibited specimens of *Nonagria dissoluta* and var. *arundineta* from East Kent, bred during August 1912, 75 per cent. from this locality being *dissoluta.*

Papers.

The following papers were read :—

"Notes sur quelques espèces des *Lucanides* dans les collections du British Museum et de l'Université de Oxford," par M. Henri Boileau, F.E.S.

"Synaposematic resemblance between Acraeine larvae," by G. D. H. Carpenter, B.A., M.B., F.E.S.

Prof. POULTON, in giving an account of Dr. Carpenter's paper, exhibited the specimens referred to by the author, and drew attention to the fact that there were considerable differences between the females in the different families of *Acraea alciope*, Hew., bred on Damba Island. A large proportion of the females in some of the families exhibited a strong development of fulvous pigment along the outer border of the white bar crossing the hindwing, rendering them conspicuously different from the females in which this feature was absent or nearly absent. There could be no doubt that the development of this colour in the hindwing was due to the appearance, by persistence or reversion, of the more ancestral pattern preserved in the females of the West Coast.

Wednesday, November 6th, 1912.

The Rev. F. D. Morice, M.A., President, in the Chair.

Election of an Honorary Fellow.

On the nomination of the Council, Dr. Emile Frey-Gessner. La Roseraie, Genève, Switzerland, was elected to the Honorary Fellowship rendered vacant by the death of Prof. Ganglbauer.

Election of Fellows.

Messrs. G. C. Bodkin, Govt. Entomologist, George Town, British Guiana; C. Talbot Bowring, Acting Commissioner of Customs, Wenchow, China; Frederick Lionel Davis, J.P., M.R.C.S. (Eng.), L.R.C.P. (Lond.), Belize, British Honduras; Dr. John Dewitz, Devant-les-Ponts, Metz, Lorraine; Howard Mountjoy Hallett, 13 Earl Road, Penarth, Glamorgan; A. D. Imms, D.Sc., B.A., F.L.S., Forest Zoologist to the Govt. of India, Forest Research Institute, Dehra Dun, U.P., India; Nigel Jardine, 2 Castle Street, Ashford, Kent; Harold H. King, Govt. Entomologist, Gordon College, Khartoum, Sudan; Jal Phirozshah Mullan, M.A., Asst. Professor of Biology, St. Xavier's College, Chunam Kiln Road, Grant Road, Bombay, India; Edward J. Paterson, Fairholme, Crowborough; W. Rait-Smith, 86 Gladstone Street, Abertillery, Monmouthshire; and Dr. Adalbert Seitz, 59 Bismarckstrasse, Darmstadt, Germany, were elected Fellows of the Society.

Portraits of Ex-Presidents.

The President announced that he had received portraits of Professor Raphael Meldola, and Mr. F. Merrifield since the last meeting, and thanks were voted to the donors.

Report of the Royal Society Celebrations.

The PRESIDENT read a report of the Royal Society's Celebration of their 250th Anniversary, which he had attended as the Delegate of the Entomological Society.

Exhibitions.

The Rev. G. WHEELER exhibited on behalf of the Rev. F. E. LOWE a series of *Brenthis pales* taken in the Heuthal, Bernina Pass, on June 24th, 27th and 28th, 1912. Some were of the var. *isis* and some of the ♀s of the ab. *napaea*, but the most remarkable were very pronounced examples of the ab. *suffusa*, Wh., both ♂ and ♀, some of the latter being almost completely black. The greater part of the Heuthal is damp, much of it marshy, and the ab. *suffusa* is found only in the wettest part. The fact that this ab. bears no resemblance to *B. arsilache*, which is also a marsh form, appeared to the exhibitor a strong confirmation of his opinion that *B. pales* and *B. arsilache* are distinct species. Mr. Wheeler had added the type specimen of ab. *suffusa*, and a ♂, ♀, and underside of *B. arsilache* for comparison. One of the ♂ specimens in Mr. Lowe's series corresponded with the ♀ ab. *cinctata*, Favre, the type specimen of which was taken by the late Mr. A. J. Fison on the Dent du Midi.

BLUE FEMALES OF POLYOMMATUS ICARUS.—Mr. WHEELER also exhibited on behalf of Mr. R. M. PRIDEAUX a series of unusually blue ♀♀ of *Polyommatus icarus*, taken in the spring of this year in the Westerham district.

A short discussion took place on the cause of this extreme coloration, in which Dr. T. A. CHAPMAN, Messrs. G. T. BETHUNE-BAKER and A. H. JONES, Commander WALKER, Prof. POULTON, Rev. G. WHEELER and Mr. T. H. L. GROSVENOR (who was present as a Visitor) took part, but it was postponed for the exhibition of further examples.

MELITAEA AURINIA.—Mr. L. W. NEWMAN exhibited a long series of *M. aurinia* bred from two batches of ova laid by North Cornwall ♀♀; the series comprised several hundred specimens and was exhibited to show the very small variation in such a large number of this variable species. Mr. NEWMAN also exhibited on behalf of Mr. G. B. Oliver a picked series of *M. aurinia* bred by the latter also from North Cornwall larvae, one specimen having the forewings almost devoid of scales so that the markings were obliterated, the hindwings melanic and well scaled; there was one albino specimen very lightly scaled, and several specimens with an abnormal amount of white markings on the forewings, producing a rayed appearance. Both series were bred this year.

A myrmecophilous African Lycaenid.—Mr. W. A. Lamborn exhibited two larvae and two bred imagines with corresponding pupa-cases of the Lycaenid butterfly *Euliphyra mirifica*, Holl. The larvae were found in a nest of the ant *Oecophylla smaragdina*, var. *longinoda*, no less than 19 being obtained from three nests close together. Numerous other nests were examined but no more larvae came to light. The pupae were similar to those exhibited by Professor Poulton at the meeting of the Society held on March 20th this year.

The Value of Photographs, even when greatly reduced, as a Record of Habits, Attitudes, etc.—Prof. Poulton exhibited a photograph of *Vanessa kaschmirensis*, Koll., taken in 1911 by Dr. C. William Beebe of New York at 12,000 feet on the Nepal-Sikkim boundary line in the Eastern Himalayas. Although the butterfly was reduced to an expanse of wing measuring one-tenth of an inch, it was quite possible, with the aid of a lens, to make out the pattern and to determine the species. The result showed that useful work, especially for bionomic purposes, might be done with a good camera even when reduction was carried to an extreme degree.

The production of the Spherical Structures on the Cocoons of the Tineid Moth Epicephala chalybacma, Meyr.—Prof. Poulton read the following letter, written May 27th, 1912, from Peradeniya, Ceylon, by Mr. E. E. Green, and exhibited the cocoons referred to therein:—

"Your note, on p. xcv of the Proc. Ent. Soc., 1911, has prompted me to send you the enclosed small cocoons of *Epicephala chalybacma*, Meyr. The curious little bubble-shaped structures along the dorsum of the cocoon may perhaps be produced in the same way as the bodies on the cocoons of *Deilemera antinorii*, viz. *ab ano*.

"Though the cocoons are extremely abundant in my garden, being attached to leaves of many kinds, to dead twigs, and even to sawn posts, I have never seen the larva at work or identified it in any stage. It is presumably a leaf miner at some part of its existence. I can only suppose that it migrates at night. I must have a search with a lantern."

Prof. Poulton in replying had expressed the hope that Mr. Green would study the subject further and try to find out the method by which the bubbles were produced. The observation was of all the more importance and interest because this species of Tineid was closely allied to *Marmara*, which produces similar structures upon its cocoon, as described in the Proceedings, pp. xcviii, xcix, 1911. There could be no doubt that the solution of the problem in *Epicephala* would provide the solution in *Marmara* also. Within the last few days Prof. Poulton had received the following paper and accompanying illustrations, dated August 16th, 1912, from Mr. E. E. Green.

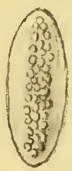
Note on the construction of the cocoon of the Tineid moth *Epicephala chalybacma*, Meyrick.

By E. Ernest Green, F.E.S.

The remarkable little cocoons of *Epicephala chalybacma* have been abundant in my compound at Peradeniya, Ceylon, for many years. They are attached to the leaves and stems of many different plants, to posts and railings, or to any material that may happen to be in the neighbourhood. These white cocoons are elongate, with a median ridge or crest composed of minute glistening globules, the nature of which has hitherto puzzled me. I could never find the caterpillars that were responsible for the structures. One particular post, that was constantly ornamented with the cocoons, has been watched—day and night—for some time. I naturally expected to find the caterpillars making the ascent. The ground at the base of the post was scanned minutely, but no wandering caterpillars were to be found. It really seemed that, if they did not come up from below, they must come down from above. One morning, after concluding my search, I instinctively glanced upwards, and there—sure enough—were several minute larvae, hanging by long silken threads from the overspreading branches of an "Inga-saman" tree (*Pithecolobium saman*). They had let themselves down from a height of 30 or 40 feet, and were swinging in the breeze. This part of the mystery was now solved. They hung suspended until the wind drove them against something solid, and there they immediately attached themselves and constructed their cocoons.

The caterpillar is small, but robust, measuring—when extended—about 6 mm. It is of a dull, pale, translucent green colour, with an irregular crimson band completely encircling each segment.

The construction of the cocoon is commenced immediately the caterpillar obtains a foothold. The position appears to be



Cocoon of *Epicephala chalybacma*, dorsal view; × 3.

A single globule and silken cord; × 25.

a matter of no consequence. The work is completed within two hours, which accounts for my failure to find uncovered larvae. After weaving a thin silken covering, the creature rests for a few moments, and a convulsive movement of the posterior segments is noticeable. Very soon a globular pellet—apparently composed of dried bubbles—is voided whole. The caterpillar then turns round inside the cocoon, rapidly attaches the globule to the roof of the cocoon by a stout silken cord, bites a small hole close to the point of attachment, and pushes the globule and cord up through this aperture. The rent is then quickly repaired. This is followed by another short pause, the evacuation of a second pellet, and a repetition of the previous performance, the second pellet being placed at the opposite extremity of the cocoon, in consequence of the caterpillar having reversed its position in the cocoon. The same movements are continued, until the complete crest of globules is in position, when the labours of the little animal are over, and it composes itself for pupation. The number of pellets probably varies, but—in one cocoon—I have counted more than forty of these little objects.

Peradeniya, Aug. 16, 1912.

Prof. POULTON said that it was extremely interesting that Mr. Lamborn's original discovery of the structures in the cocoons of the Hypsid moth *Deilemera antinorii*, Oberth., had thus led to the further discovery of this still more elaborate method of producing similar results. He pointed out the curious optical effect whereby, when the cocoons were looked down upon from above, the bubbles appeared to be inside the silken wall although they were really resting on the outside of it.

Mr. Green's account differed in several important particulars from that given by Mr. T. Bainbrigge Fletcher and quoted by Mr. E. Meyrick, F.R.S., in his "Exotic Microlepidoptera," vol. i, pp. 21–22. Among other differences Fletcher described the spheres as "apparently . . . found in the mouth" of the larva.

Mr. DURRANT made a few observations with regard to the allied genera *Marmara* and *Epicephala* (*Gracilariadae*). The life-history of *Marmara salictella* was discovered by Dr. Brackenridge Clemens so long ago as 1859 or 1860, but the genus had not been recognised until a few years since, when it was re-discovered by Mr. August Busck. Five species of *Marmara* are now known from the United States. It was interesting to find a similar habit in the same family in Ceylon.

THE WEST AFRICAN AGARISTID MOTH MESSAGA MONTEIRONIS, BUTLER, A MIMIC OF THE HESPERID PYRRHOCHALCIA IPHIS, DRURY.—Mr. J. A. DE GAYE, who was present as a visitor, showed examples of the above-named model and mimic captured by him under the following circumstances. One specimen of *Messaga monteironis*, Butl., from the Ikoyi Plain, Lagos, S. Nigeria, was caught at 6.20 p.m. on Jan. 30th, 1911, hovering over the flowers of *Anacardium occidentale.* On the same day and on the flowers of the same plant were caught two males of *Pyrrhochalcia iphis*, Drury, whose larvae feed on the leaves of *Anacardium occidentale.* The moth is a far better mimic of the female than the male Hesperid, the increased perfection of the likeness to the female being brought about by the white fringe at the apex of the fore-wing and the pale streaks which mark a sub-marginal section of all the nervures of both wings. The latter colouring probably produces on the wing a superficial likeness to the pale iridescent radiate streaks by which both wings of the female Hesperid are characterised. It is also noteworthy that the ends of the palpi of the *Messaga* stand out in front of the red head in a manner which strongly suggests the very characteristic appearance of the Hesperid. A similar difference in size between model and mimic is well known in many examples of mimicry.

A MYRMECOPHILOUS COLEOPTERON.—Mr. DONISTHORPE exhibited a specimen of *Thorictus foreli*, var. *bonnairei*, Wasm., a small beetle, fastened on to the antenna of an ant, *Myrmecocystus bicolor*, F. He remarked that all the *Thorictidae* were Myrmecophilous. They chiefly lived with *Myrmecocysti* and a few other ants. They fastened themselves by the mandibles to the scape of the antennae of their hosts with the head directed towards its base. Some species had yellow hairs and were licked by their hosts. An ant might have one or more *Thorictus* on each antennae, but only the ants in the interior of the nests had the beetles attached, as in the case of the *Acari* of the genus *Antennophorus* and their hosts.

Mr. Donisthorpe also exhibited a specimen of the Culicid *Harpagomyia splendens*, Meig., with the ant *Cremastogaster difformis*, Smith, from Batavia, where Jacobson had observed the fly being fed by the ant, and photographs of the living flies being fed by the ants.

He mentioned that both these myrmecophilous species had been kindly given to him by Prof. Forel.

LIVING COLEOPTEROUS LARVA.—Mr. H. M. EDELSTEN exhibited a living Buprestid larva (species uncertain) which had been found in Messrs. Allen and Hanbury's works at Ware in roots of sandalwood.

THE PIERINE GENUS PINACOPTERYX.—Dr. F. A. DIXEY made some remarks on the Pierine genus *Pinacopteryx*, illustrating them by exhibiting male and female specimens of most of the species, side by side with which were shown drawings made to scale of the plumules characteristic of each form.

He said: *Pinacopteryx* may be regarded either as a separate genus, or as a section of *Pieris*, the latter being the course adopted by Mr. Trimen in his work on South African Butterflies. It is a perfectly natural and circumscribed group, of which all the members are confined to the African Continent, with a species or two in Madagascar. The plume-scales with which the males are provided show a general family resemblance, together with interesting specific differences. Their most characteristic feature is the expanded base, either rounded or angulated, of the lamina. In the distal portion of the lamina, the sides run nearly or quite parallel. Some of the species of *Pinacopteryx* are not easily distinguished, and in certain public collections there is a good deal of confusion between different forms. In cases of difficulty, much help is afforded by an examination of the plume-scales.

In West Africa we have the large pale-yellow form *P. cebron*, Ward, which inhabits the Gold Coast, S. Nigeria and the Camaroons. Its scent-scale is long and tapering, with an angulated base. Further south comes *P. falkensteini*, Dewitz (Angola; Congo), also large, but white instead of yellow. The plume-scale is much like that of *P. cebron*, but shorter. It has an unusually large accessory disc.

P. orbona, Hübn., also from the W. Coast, looks like a small specimen of the last, but has a quite distinctive scent-scale, in which the basal expansion is much diminished. *P. vidua*, Butl. (Upper Nile and Br. East Africa) is somewhat like the last species. Its scent-scale, however, is very short, broad in proportion, and with a widely-expanded angulated base.

B. pigea, Boisd. (Natal), of which *P. alba*, Wallgrn., is the dry-season phase, has a plume-scale with regularly rounded base and rather small accessory disc. In N.E. Rhodesia, Nyassaland and German E. Africa occurs a form closely allied to *pigea*, but generally larger, and frequently showing in both sexes, but especially in the female, a considerable resemblance to *Mylothris agathina*; so much so that Mr. Neave says that he has often mistaken the females, when on the wing, for females of that species. This is the form referred to in Proc. Ent. Soc. Lond., 1907, p. lxv, though some of the statements there made require modification in the light of subsequent knowledge. A pair of this form from Fwambo are the types of Mr. Butler's *P. astarte.* The scent-scales are of the general *pigea* character, but longer and narrower than in the Natal representative of that species. Forms of the *pigea* group from British E. Africa and Uganda depart from the Central African type and approach the Natal *pigea* in size, in general aspect, and in the character of their scent-scales, though the latter have usually a more marked basal expansion. The resemblance to *M. agathina* also tends to disappear in specimens from these more northern regions. But in a *pigea* form from Toro (Uganda), which is perhaps to be identified with *P. rubrobasalis*, Lanz, the resemblance to *M. agathina* is once more considerable. That this is distinct from the ordinary *pigea*-form (which also occurs at Toro) is made probable by the fact that its scent-scale is peculiar in the attenuation of its basal expansion, thus contrasting markedly with the scent-scale of the allied insect inhabiting the same district. The basal flush and black marginal spots, so characteristic of *Mylothris*, are in this Toro *rubrobasalis* especially well marked. In these particulars it corresponds with Butler's *P. astarte*, but is readily separable from that insect by its inferior size and distinctive scent-scale.

P. dixeyi, Neave, also from Toro, is in both sexes very like a *Phrissura*. It is, however, clearly shown to be a *Pinacopteryx* both by its neuration and also by its scent-scales. These have the usual *Pinacopteryx* character, but are larger and longer than any in the *pigea* group, having a widely-expanded and rounded base, much like that of *P. liliana* shortly to be noticed. The outline recalls that of a chemist's flask with a very long neck.

In the small yellow species, *P. spilleri*, Spill. (Natal and British E. Africa), the scent-scale is rather short, with a widely-expanded and angulated base.

There remains the group of species headed by *P. charina*, Boisd. In all of these the accessory disc is large, the base is abruptly expanded, and the distal portion of the lamina has its sides parallel. The species of this group may be said to be geographical representatives. In *P. charina*, Boisd. (Cape Colony and Natal), the scent-scale is like a chemist's combustion-tube. In *P. simana*, Hopff. (N.E. Rhodesia; Portuguese, German and British E. Africa, and Uganda), the scent-scale is of similar character, but larger and also broader in proportion. *P. venata*, Butl., from the White Nile, has a shorter and broader scent-scale of the like pattern. The scent-scale of *P. liliana* (coast region of Mombasa) is very peculiar. It resembles in outline the thin glass flasks used in chemical laboratories, but its neck (which is much shorter than in *P. dixeyi*) has a decided list. The accessory disc is figure-of-eight shaped and unusually large. Some specimens of *P. liliana* are not easily separable from *P. simana*, though the latter is usually a smaller insect. A glance, however, at the scent-scales is sufficient to distinguish them at once.

The ordinary scales in *Pinacopteryx* are very often spatulate.

A word may be said in conclusion about the interesting butterfly named by Godart *Pieris doxo*. Godart's actual specimen was included in the Dufresne Collection, and is now in the Edinburgh Museum of Science and Art. The locality from which it came is quite unknown. An examination of the specimen, which I have lately been enabled to make by the kindness of Mr. Eagle Clark and Mr. Percy Grimshaw, has convinced me that it is certainly a female *Pinacopteryx*, but not, as has been thought, *P. venata*. It appears to me to be most probably a somewhat pale specimen of *P. simana*. It is very like examples of the latter from Uganda.

I may here draw attention to Mr. Grimshaw's paper on Godart's Lepidopterous and Olivier's Coleopterous types in the Dufresne Collection at Edinburgh. The paper, which is to be found in the Transactions of the Royal Society of Edinburgh, vol. xxxix, Part I, 1897, is perhaps not so widely known as it might be. It is accompanied by a plate in which are figured eight of Godart's and two of Olivier's types; the former including a representation of the type of *P. doxo*. A photograph of this specimen, now exhibited with specimens of *P. simana* ♀ for comparison, I owe to the kindness of Mr. Grimshaw.

PROTECTIVE RESEMBLANCE.—Mr. A. BACOT exhibited an Acridiine Orthopteron from the Benguella Plateau, taken by Dr. Chas. H. Martin, F.R.S., which bore a very perfect resemblance to the scorched grass stems, on one of which it was resting, the grass in this region being burnt off each season by the natives leaving charred tufts and stubble. Mr. Bacot also exhibited specimens of the Dipteron *Glossina palpalis*, var. *wellmani*, Austen, from Catumbella River.

GIGANTIC LARVAE.—Mr. ELTRINGHAM exhibited two specimens of an unusually large Lasiocampid larva which had been presented to the Hope Department by Mr. C. A. Foster, who took them in Sierra Leone. A similar larva had been illustrated in the "Entomologist" for May 1886, though this specimen was stated to have come from South Africa. It was unfortunate that Mr. Foster only obtained the larvae on the eve of his departure for England, so that he could not keep them alive. They were covered, in addition to the hairs, with long sharp spines, which made them very unpleasant to handle. The spines were quite smooth but very sharply pointed. Each larva was about seven inches in length. Prof. POULTON suggested that the larvae might perhaps be *Gonometa subfascia*, Walk., or *G. regia*, Auriv. The females of both these species had enormous bodies, and although the moths looked small beside the caterpillars, such apparent want of proportion was common among the *Lasiocampidae*.

Papers.

Commander WALKER communicated a paper by ROWLAND E. TURNER, F.E.S., on New Species of Fossorial Hymenoptera from S. Africa, chiefly *Elidinae*.

Prof. POULTON read a paper by G. H. D. CARPENTER, B.A., B.M., B.Ch., F.E.S., on The Life-History of *Pseudacraea eurytus hobleyi*, Neave, and in giving an account of Dr.

Carpenter's work read the following letter written by the author on June 16th, 1912, from Bugalla in the Sesse Islands.

"I feel I can almost say, as did Charles Kingsley, 'At Last!' To-day, being a sunny morning after many wet mornings (this month so far has been as wet as any of the three preceding, which is unusual) I went butterflying. I saw a few freshly emerged Pseudacraeas, and secured three *terra* which I send, hoping you will be able to set them in time for the Congress. Just as I was coming away I saw a beautiful *obscura*, whose large very pale areas indicated more than a touch of the female *hobleyi*. It was fluttering about from bush to bush, and was too shy to let me get near to catch it. At last it settled and hung from the underside of a leaf, and I was able to see it had a fairly distinct basal triangle. It remained motionless a few seconds, and though this attitude is exceptional for a *Pseudacraea* (they always rest on the upper side of a leaf with wings usually expanded), it never struck me what was up! I tried to catch it, but it flew off before I got within striking distance. It then occurred to me to look at the leaf and, to my inexpressible joy and excitement, there was a freshly-laid egg on the middle of the under surface, still moist with the secretion which fastened it to the leaf. The tree was a very small young specimen, only about six feet high, but it was the *same species* as that on which *Ps. lucretia* fed on Damba; and there was a small colony of these trees at that spot, which had hitherto escaped my notice. So if this egg produces a *Ps. terra* (and the chances are in favour of this, as *terra* is *much* the commonest here), you will have the proof you so ardently desire, seeing that the parent was a mixture of *hobleyi* and *obscura*! Any how, now that I know and have found the food plant, I may have better luck in getting a captive *Pseudacraea* to lay. There is just time for the egg, larva and pupa to develop before the Congress at Oxford is over, so that should the offspring be *terra* or *hobleyi* I will let you know. As of course there will be no time to *write* I will cable, just the one word, either *hobleyi* or *terra*. If it is *obscura* I won't cable, but will, of course, write. I feel that it will be such a splendid opportunity for making this result known, when you will be showing

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the Pseudacraeas with especial intent to prove their conspecificity by the intermediate forms."

Prof. Poulton explained that the cable with the word "terra" reached him on Aug. 19, nine days after the Congress had come to an end, and that he had published the discovery in a letter to "Nature" (Sept. 12, 1912, p. 36). The specimen itself had since arrived and was exhibited to the meeting, together with all the other bred specimens referred to in the paper, including the parents of families B, C and D. The pupal cases of the bred *Pseudacraeae* were also exhibited beside the butterflies which had emerged from them, and, for comparison, there was included a series of the pupal cases of *Pseudacraea imitator*, Trim., from Natal, presented to the Hope Collection by the late Mr. A. D. Millar, of Durban. It was seen that the two flat dorsal processes were rather less pronounced and the cephalic processes distinctly shorter in the pupae of the Natal form. Comparing Dr. Carpenter's pupae with the whole series of 31 Natal specimens, it was also seen that the apices of the two dorsal processes of the Uganda pupae tended to be directed backwards more strongly, and that the contour of the processes and of the segments between them formed a festooned outline instead of one that was nearly smooth. The cephalic processes of the Uganda pupae tended to turn upwards (viz. dorsally) at the tip, those of *imitator* downwards, while the two processes of the latter were more frequently separated. The Uganda pupae showed the darker pigmentation, but this effect was probably due to conditions. It was highly probable that this procryptic pupa is susceptible to the colours and degrees of illumination of its normal environment. The method of suspension from the edge, near the leaf-tip or near some angle of a partially eaten leaf, was similar in both forms.

It was not necessary to assume that differences of the kind described above imply specific distinction. Dr. Carpenter's description of the way in which the hollow cephalic and dorsal processes gained their shape in the fresh pupa was an indication that they were of no morphological significance but merely an adaptation which promoted the concealment of the pupa by making it more leaf-like.

The synonymy of the *Pseudacraeae* required considerable modification if we might assume from Dr. Jordan's researches and Dr. Carpenter's breeding experiments that the close allies of *Ps. eurytus.*, L., were an interbreeding community. Prof. Poulton had consulted Dr. Jordan on the subject and he had agreed that it would be desirable to introduce the term "f. mim." ("*forma mimetica*") for the diverse forms of such a species as *eurytus* or the females of *Papilio dardanus.* The following names would now express the relationship between the forms of *eurytus* in the Uganda district.

PSEUDACRAEA EURYTUS HOBLEYI, Neave.	CHIEF MODELS.
♂ f. mim. *hobleyi*, Neave.	♂ *Planema macarista*, E. M. Sharpe.
♀ f. mim. *tirikensis*, Neave.	♀ *Planema macarista*, E. M. Sharpe.
♀ f. mim. *poggeoides*, f. nov.	♂ ♀ *Planema poggei nelsoni*, Grose-Smith.
♂ ♀ f. mim. *terra*, Neave.	♂ ♀ *Planema tellus platyxantha*, Jord.
♂ ♀ f. mim. *obscura*, Neave.	♂ ♀ *Planema epaca paragea*, Grose-Smith.

The name *poggeoides* was suggested for female forms with the pattern of *tirikensis*, but a forewing colouring approximating to that of *hobleyi*. It would probably be found, when a long series was examined, that the orange bar of *poggeoides* was paler than that of *hobleyi*, just as *poggei nelsoni* was, in this respect, paler than *macarista* ♂. In addition to the above mimetic forms there were many intermediates, but these were usually so transitional that it was undesirable to give them names. To one of them, with a rather more definite pattern than usual—connecting *terra* with *hobleyi* and *tirikensis*—the name *impleta* had been given by Grünberg (see Proceedings, 1912, p. xxii, n.).

A paper on "Some Luminous Coleoptera from Ceylon," by E. ERNEST GREEN, F.E.S., was read by Mr. C. J. GAHAN, who in illustration of the paper exhibited male examples of *Harmatelia bilinea*, Walk., and males and a female of *Dioptoma adamsi*, Pasc., two of the species referred to. Also both sexes of a new species of *Dioptoma* which he proposed to name *Dioptoma greeni*. This species was found at higher altitudes in Ceylon than *D. adamsi*, and was distinguished from it by the colour and form of the elytra, these organs being entirely black in colour, and more elongate and less narrowed behind than in *D. adamsi*. The species had been obtained by Mr. Green at Maskeliya, and by Mr. Lewis at Dikoya and Bogawantalawa.

Wednesday, November 20th, 1912.

The Rev. F. D. MORICE, M.A., President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society: Miss MARGERY H. BRIGGS, B.Sc., 7 Winterstoke Gardens, Mill Hill, N.W.; Messrs. EDWARD BALLARD, Zomba, Nyassaland; GEORGE TREVOR LYLE, Bank House, Brockenhurst; Rev. J. W. METCALFE, The Vicarage, Ottery St. Mary; KURT Baron ROSEN, Zoologische Staatssammlung, Munich.

Nomination of Officers.

The Rev. G. WHEELER, one of the Secretaries, announced that the Council had nominated the following Fellows as Officers and Council for the Session 1913–1914: *President*, GEORGE T. BETHUNE-BAKER, F.L.S., F.Z.S.; *Treasurer*, ALBERT HUGH JONES; *Secretaries*, Commander J. J. WALKER, M.A., R.N., F.L.S., and the Rev. GEORGE WHEELER, M.A., F.Z.S.; *Librarian*, GEORGE CHARLES CHAMPION, A.L.S., F.Z.S,; *Other Members of the Council*, ROBERT ADKIN, JAMES E. COLLIN, JOHN HARTLEY DURRANT, STANLEY EDWARDS, F.L.S., F.Z.S., Harry Eltringham, M.A., F.Z.S., A. E. Gibbs, F.L.S., F.Z.S., Rev. F. D. Morice, M.A., Gilbert W. Nicholson, M.A., M.D., Hon. Nathaniel Charles Rothschild, M.A., F.L.S., F.Z.S., W. E. Sharp, J. R. le B. Tomlin, M.A., Colbran J. Wainwright.

Exhibitions.

West African Rhopalocera and Hymenoptera.—Mr. W. A. Lamborn exhibited (1) a small company of the Nymphaline butterfly *Euphaedra ravola*, Hew., which he had bred in August last from larvae found together under one leaf near Oni Camp, Lagos. He said that he had bred up altogether five other companies from larvae of this species, and all the imagines turned out to be precisely the same. The larvae were purple-coloured, with a broad horizontal fringe of hairy yellowish white bristles.

He showed also a single bred *Euphaedra themis*, Hübn., and stated though this butterfly looks almost exactly the same as *E. ravola* except for scarlet patches at the base of the wings, so that there has been some speculation as to whether the two might not be forms of the same species, yet the larva was quite different in colour from that of *E. ravola*, being pale green with the same fringe of horizontal bristles, and it fed on a different food-plant.

Other larvae which he had bred up presenting similar general characteristics were those of *Euphaedra ruspina*, Hew., *Euryphura plantilla*, Hew., *Catuna oberthüri*, Karsch, *C. angustata*, Feld., and *Diestogyna feronia*, Staud., all of which, except *E. ruspina*, with which he had not been successful, changed to a bright green colour about twenty-four hours before pupation.

In the case of the gregarious larvae, *E. ravola* and both species of *Catuna*, this colour change must have a procryptic effect. The bright purple larvae of *E. ravola*, the brown larvae of *Catuna angustata*, and the bluish white larvae of *Catuna oberthüri* were always found hidden to some extent under leaves, and the change in colour should be of great value as a means whereby they were rendered less conspicuous when it became necessary for them to wander in search of a spot suitable for pupation.

The pupae of all these butterflies were light green.

These various facts, indicating a close relationship between these species, afforded interesting confirmation of the soundness of their grouping by systematists, which was originally based on a study of the anatomical features of imagines.

(2) Two bred families of the Pierine butterfly, *Leuceronia argia*, Fabr., with the ♀ parent in each case. The ♀ parent of the first family was yellow without any orange flush at the base of the forewing. This family consisted of three males and nine females, five of which were yellow and four white, and all these females exhibited an orange flush at the base of the forewing on the upper and under sides. In the second family the female parent again was yellow without orange flush. There were only two female offspring, one of which resembled the parent exactly, whereas the other, a white variation, showed the orange flush.

The results in tabular form were as follows :—

Family I :—

Parent, captured May 26th, 1912, yellow without orange flush, laid ova May 26th, died May 27th.

Pupated.	Emerged.		
June 14	June 24	1 ♀	♀ white
,, 15	,, 25	2 ♂, 1 ♀	♀ yellow
,, 16	,, 26	3 ♀	2 ♀ yellow, 1 ♀ white
,, 17	,, 27	1 ♂, 4 ♀	2 ♀ yellow, 2 ♀ white

All the females, white and yellow alike, with orange flush.

Family II :—

Parent, captured April 16th, 1912, yellow without orange flush, laid ova April 17th to 19th, died April 20th.

Pupated.	Emerged.		
May 9	May 18	1 ♀	♀ white
,, 11	,, 19	1 ♂, 1 ♀	♀ yellow

One female white with orange flush, one female yellow without orange flush.

(3) An instance of the relentless war of species against species noticed so particularly in the Tropics. On February 2nd, 1912, he noticed a large Diplopteron hovering over a large ant, as if about to attack it, and the ant seemed prepared to give battle. The wasp discovered his presence and flew off before he could catch it, and thereupon the ant put its head inside the rolled-up leaf on which it had been crawling when threatened by the wasp and dragged out the pupa of a small moth. The ant was secured and the pupa was kept in the hope that the moth would appear, as only one wing-case had been punctured, but on February 7th a Tachinid fly emerged from the pupa. The pupa-case of the moth was so transparent that the puparium of the Tachinid could be seen within it. Another possible interpretation of the action of the wasp was that it had discovered the pupa at the same time with the ant. These predaceous wasps had a wonderful instinct for discovering the whereabouts of their prey. In the course of last year a wasp was seen to alight on a rolled-up leaf containing a larva of the Hesperid *Rhopalocampta forestan*, Cram. It bit into the leaf at once, without any preliminary investigation as far as could be seen, and proceeded to drag its victim out through the hole, shifting its grip from time to time so as to obtain a more convenient hold.

A SCARCE HEMIPTERON.—Mr. E. C. BEDWELL exhibited specimens of *Lasiosomus enervis*, H.S., one of the rarest of the British *Lygaeidae*. The species had been recorded from very few localities, and had only occurred singly hitherto. On September 25th last he discovered sixteen specimens at the roots of coarse grass in a very restricted space on the Culver Cliff near Sandown, Isle of Wight, and if he had not mistaken the species for an extra fine race of *Stygnus pedestris* he could easily have obtained more. Mr. E. A. Butler informed him that it must be a rare species on the Continent also, as he had never been able to obtain specimens. This species is an addition to the Isle of Wight fauna. Saunders (*Hemiptera Heteroptera*, p. 92) records the species from Darland Hill, near Chatham (Champion), and Weybridge (Billups).

MANTID OÖTHEÇAE.—Mr. O. E. JANSON exhibited specimens of a remarkable Mantid oötheca from Delagoa Bay that had been described by the late Mr. Shelford and figured in part iv of the Society's Transactions for 1909, from specimens from the Pascoe collection and now in the Oxford University Museum. Mr. Shelford appeared to have overlooked the fact that these same specimens had been exhibited by the late Mr. Pascoe at the Society's meeting on December 5th, 1883, and that they are figured in the Journal of Proceedings of that date (p. xxxv). On that occasion the late Prof. Wood-Mason expressed doubt as to their being Mantid egg-cases, and it was also suggested that the bladder-like outer covering was a protection against attacks of parasitic insects. The interest of the present exhibit was in the definite settlement of both these points of doubt, for these specimens were received in closed boxes, and during transit many of the eggs had hatched and the young larval Mantids were found dead in the boxes. In other cases the eggs had produced Chalcids, which Mr. C. Morley believes to be an undescribed species of the genus *Podagrion*, having an ovipositor of sufficient length to reach the eggs from the outer covering of the oötheca.

Those oöthecae from which the young had emerged had irregular, jagged-edged apertures having the appearance of being made by gnawing or rasping, as Mr. Shelford suggested, as a means of escaping from the tough, parchment-like envelope.

Mr. G. A. K. Marshall observed that he had seen Mantid oöthecae being formed entirely by the abdomen of the ♀ without aid from the legs; they were amorphous when first formed, and had a frothy appearance. The larvae on emerging drop by a thread to the ground.

Aberrations of Colias edusa.—Mr. E. C. Joy exhibited two aberrant specimens of *C. edusa*, bred in October last from Folkestone; the discoidal spot in the forewings of the male being orange instead of black; in the female specimen the black outer marginal border of the forewings is very deep, and entirely without the usual yellow spots.

Remarkable Larval Nests.—Dr. K. Jordan exhibited two nests of *Eucheira socialis* recently received from Western

Mexico. The caterpillars of this Pierine butterfly live gregariously in an opaque web of silk, which has an aperture at the lower end. Pupation takes place in the cavity of the nest, the pupae being suspended by the tail, as in the case of *Nymphalidae*. The species and its nest were described by Westwood in the Transactions of this Society in 1836, and the first description of the larva was published in 1901 by Dyar in the Proc. Ent. Soc. Washington, iv, p. 420, where the food-plant is stated to be a species of *Arctostaphylos*. The original nest was exhibited by Dr. Dixey some years ago at a meeting of this Society. *Eucheira socialis* is the only butterfly whose larvae are known to make a nest in which pupation takes place. (Cf. Trans. 1905, p. xix.)

Col. Yerbury observed that *Synchloë glauconome* occasionally pupates within an envelope, though not of so elaborate a construction.

Papers.

The following Papers were read :—

"Notes on Various Central American *Coleoptera*, with Descriptions of New Genera and Species," by G. C. Champion, A.L.S., F.Z.S., F.E.S.

"The Butterflies of the White Nile, a Study in Geographical Distribution," by G. B. Longstaff, M.A., M.D., F.E.S.

A considerable discussion took place on the subject of Dr. Longstaff's paper. Col. Yerbury observed that the Desert Region really extended from Cape Verd to Delhi, and that its insect fauna was much more closely connected with its flora than with its vertebrate fauna. Many of the Pierines, whose larvae fed on desert species of *Capparis*, were, as Dr. Longstaff had found on the White Nile, abundant where they occurred, but their distribution was patchy. He also observed that the desert fauna was not drawn from one region only, but from all those that surrounded it, and that all became modified on settling in the Desert Region.

The Hon. W. Rothschild said that he had lately been working through a large collection of desert insects, and that he could thoroughly endorse Col. Yerbury's observation that the Desert Region extends from W. Africa to India. He also remarked that the Egyptian flora was dependent on the Nile, and had consequently wandered out of its proper region. This would partly account for the presence of a desert fauna so far up the Nile as Dr. Longstaff had found it.

Several other Fellows also gave instances of species which had been found at widely different points of this extensive desert range.

Dr. F. A. Dixey remarked that a second species of *Papilio* had been taken on the White Nile.

Mr. G. A. K. Marshall observed with regard to the great number of specimens of *Teracolus* in comparison with the scarcity of individuals of other groups, that wherever this genus was abundant, even in other than desert areas, he had always found that there was very little else in the way of Rhopalocera.

Wednesday, December 4th, 1912.

The Rev. F. D. Morice, M.A., President, in the Chair.

Election of a Fellow.

Mr. C. A. Foster, Worcestershire Regiment, Beechwood, Iffley, Oxford, was elected a Fellow of the Society.

Obituary.

The President announced in a few sympathetic words the death of Mr. W. F. Kirby, formerly Honorary Secretary of the Society.

Nomination of Auditors.

The President announced that he had nominated as Auditors for this year's accounts the following six Fellows: *Members of Council*, Messrs. R. Adkin, H. St. J. K. Donisthorpe, and Stanley Edwards; *Fellows not on the Council*, Messrs. J. E. Collin, R. W. Lloyd, and C. O. Waterhouse.

Prof. Schulze's "Nomenclator."

The President read a letter forwarded from the Linnean Society asking for subscriptions towards the expenses of Prof.

Schulze's "Nomenclator animalium generum et subgenerum." He explained that the Society had no funds that could be drawn on for such a purpose, but pointed out the importance of the subject in case any individual Fellows should be willing to support the undertaking.

Offer from University College.

The SECRETARY read a letter from Prof. J. P. HILL of the Zoological Department of University College, London, saying that the Collection of British Lepidoptera formed by the late Mr. JOHN A. FINZI, F.E.S., had been presented to the College, and that he would be glad to afford facilities to any Fellow of the Entomological Society who wished to consult it, on presentation of a card signed by one of the Secretaries, between 2 and 5 p.m., on any day except Saturday when the College was in Session.

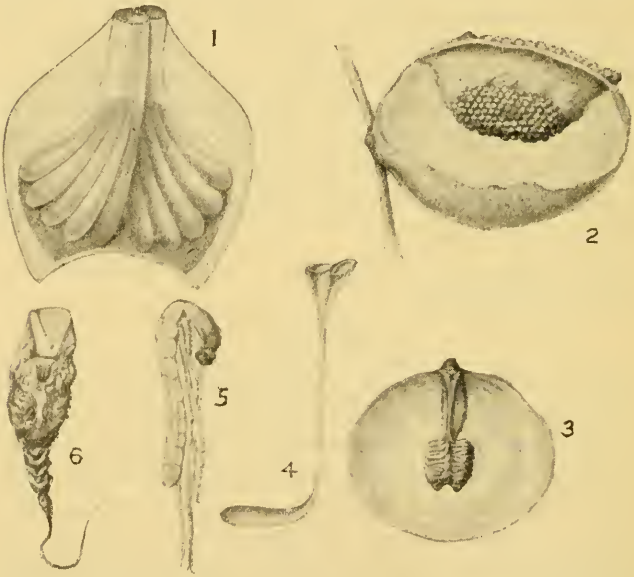
The SECRETARY was instructed to return thanks to him on behalf of the Society.

Exhibitions.

MANTID OÖTHECAE.—Mr. WATERHOUSE exhibited a diagram of the oötheca of a *Mantis* and read the following note:—

At the last meeting of this Society Mr. Janson exhibited and made some remarks on one of the spherical semitransparent oöthecae of a *Mantis* from Africa. Having since examined similar ones in the Natural History Museum, I thought some notes on them might be useful. The structure of the oötheca of *Mantis religiosa* has been very fairly described by Giardina (Naturalista Siciliano n.s., ii, p. 141), and Kershaw has given an excellent account of a Chinese species, *Hierodula saussurei* (Psyche xvii, p. 136). This latter consists of a number of flask-shaped sacks each containing a number of eggs. These sacks are placed alternately right and left, and in part one behind the other, the whole enclosed in a mass of frothy matter forming an outer case as shown in my diagram. At first sight the African one appears to be differently constructed, but on closer examination is found to be very similar. When viewed in transverse section the eggs are seen to be at right angles to the septum to which they are attached, but this is somewhat misleading. As a fact the separate egg receptacles are narrowed at the inner end and directed obliquely upwards towards the openings. The young Mantids unquestionably make their way out by these openings, but some doubt has been expressed as to this being possible in the African species, as the septum is as thin as a sheet of paper.

Shelford, in his description of these oöthecae in our Trans-



1. Section of an oötheca (Amazons). 2. Side view of African oötheca. 3. Transverse section of same. 4. A single egg-sack from same, showing connection with openings. 5. Larva of Mantid just emerging from oötheca (China). 6. Cast pellicle taken from opening of African oötheca.

actions (1909, p. 513), assumes that it is impossible, and has in consequence fallen into several errors. I find that the septum, thin though it be, is really double, and I could pass a pin between the two sheets and separate them. When the young Mantis is in the egg the head and prothorax are doubled down on the metasternum and abdomen. When it is ready to emerge it wriggles its way upwards to the opening, and it is not till it protrudes some way out of the opening that it unfolds itself, very much in the same way as an insect emerges from the pupa. It appears to me that the young larva of the African species would have no difficulty in making its way between the two sheets that form the septum, and that they really do so is proved by specimens in the Museum. In one of these cases in the Museum there is with it a batch of young Mantids, and there is no sign of any exit except by the top openings. In another similar oötheca a young Mantis which died on emerging has three of its legs still in the opening.

According to Brongniart the young Mantids, enclosed in a delicate pellicle, emerge from the openings and hang by two threads, and remain so for a day or two before they throw this off. I rather doubt this being so in all species. I believe many species throw off this pellicle as soon as they get to the openings. It may be that those in the Museum where this is the case are so because they have emerged under strange circumstances, but certainly the pellicles are often seen left in the openings. Some empty pellicles that I took from the openings of one of these transparent African oöthecae had a long single thread. The presence of these pellicles in the openings proves conclusively that the young Mantids make their exit there.

How these transparent oöthecae are formed is a great mystery. They are not uncommon, and perhaps if attention is called to them some one who may be fortunate enough to see one formed will write an account of it.

A short discussion followed with regard to the formation of the oötheca, in which Mr. GAHAN, Dr. CHAPMAN, Mr. JANSON, and the PRESIDENT took part.

MÜLLERIAN ASSOCIATIONS FROM COSTA RICA, VENEZUELA AND BRAZIL.—Mr. W. J. KAYE exhibited a number of butterflies with one moth belonging to the principal Müllerian Association as found in Costa Rica. Attention was especially drawn to the moth, a species of *Castnia* only recently discovered, and named by Mr. Schaus—*C. carilla*. This *Castnia* was particularly interesting from its small size and general Heliconine or Ithomiine outline. In colouring, while in some respects it was like the Pierine *Dismorphia sororna* ♀, in others it was more like the Nymphaline of the group *Eresia alsina*. It was pointed out that in Costa Rica the centre of this association was not a *Melinaea* such as was to be found northwards but an *Hirsutis*, viz. *H. pinthias*. It was true that *Melinaea imitata* and *Melinaea scylax* both occurred together with the accompanying forms of *Heliconius telchinia* and *clarescens*, as well as one or two others of the common members of the Northward Association, such as *Mechanitis doryssus* and *Dismorphia praxinoe*, but numerically *Hirsutis pinthias* was far commoner, and with the two *Heliconius* species *zuleika* and *formosus* together exerted a strong influence for the general scheme of colour of these three insects. It was further pointed out that the two actually closest species in outline and coloration were *Heliconius formosus* and *Dismorphia sororna* ♀, and these two species were both usually found in the heavier, darker forest, while all the other members of the group frequented the more open places. Besides the species already mentioned, the following were also shown: *Mechanitis isthmia*, *Ceratinia decumana*, *Dircenna klugii*, *Ithomia heraldica*, *Napeogenes amaru*, *N. tolosa*, *Callithomia hezia*, *Hyposcada adelphina* and *Thyridia melantho*.

A number of specimens, both set and unset, of the principal Müllerian group from Caracas, Venezuela, were also shown, to exhibit the far closer resemblance of the undersides than the uppersides, as was pointed out to be the case by the exhibitor in the Trans. Ent. Soc. 1907, p. 434, when dealing with the British Guiana group. The species exhibited were: *Lycorea atergatis*, *Heliconius anderida*, *H. metalilis*, *Melinaea lilis*, *Tithorea furina*, *Eueides huebneri*, *Mechanitis doryssus*, *Dismorphia broomeae* and *Charonias eurytele*, n. sub-sp.* In all of these, save in the *Dismorphia*, where it was only rudimen-

* *Charonias eurytele caraca*, n. sub-sp.

Forewing rich fulvous, with a marginal row of large yellow spots, which become smaller and more fulvous towards the inner margin. A large rectangular fulvous patch at end of cell, margined with black, except inwardly at centre where the black is formed into triangular patches. Beyond the cell a large square black patch, succeeded by a fulvous row of spots forming a band. Between veins 2, 3 and 3, 4 are two large fulvous spots surrounded with black. Hindwing fulvous, with a fulvous row of marginal spots set in a black band. An elongated black mark above cell. Underside of hindwing as above, but the marginal spots are white and much larger than above. Black patch above cell very large. Underside of forewing as above.

Habitat, Caracas, Venezuela.

tary, there were present on the undersides a marginal row of white spots to the hindwing, which on the upperside only showed clearly in *Lycorea atergatis*. In other respects the appearance was very similar above and below.

From the same locality but forming a small subsidiary group were: *Olyras crathis*, *Dircenna olyras* and *Athesis clearista*. The two former had been recognised as remarkably like one another from the time of their discovery, but the last of the three in the ♀, with wings closed, made a closer resemblance than the other two to one another, when also at rest. The case was especially interesting in that the *Athesis* on the upperside could hardly be called mimetic, particularly in the ♂, while the *Olyras* and the *Dircenna* were very much alike above. All these three species, as well as the species already mentioned in the principal group, occurred together.

From Santos, S. E. Brazil, were shown the principal members of the synaposematic group to call attention to a member of the group that had neither been mentioned by Mr. W. F. H. Blandford in the Proceedings of the Society for 1897, p. xxiv, nor had Mr. J. C. Moulton included it in his paper in the Transactions for 1909, pp. 591 *et seq.* The species was *Pericopis isse*, a Hypsid moth. Hübner's figure does not show the broad yellow streak in cell of hindwing, and as he gave no locality it is possible the insect from S. E. Brazil may be distinct. The insect has all the characteristics of the group, and on the wing the exhibitor mistook it for *Lycorea halia*, the slow flight coupled with the very similar coloration making them quite indistinguishable. The specimen was caught February 27th, 1910, and on the same day in the same place he also took *Heliconius narcaea*, *Eueides dianasa* and *Lycorea halia*. Included with these was a specimen of *Melinaea ethra* and one of *Tithorea pseudethra*. It was remarkable that both the last, although members of the *Ithomiinae*, were quite rare and very decidedly mimics and not models. Mention was made of the fact that Burchell, who spent about two years in Southern Brazil, only took one *M. ethra* and no specimens of either *T. pseudethra* or the moth *P. isse*.

In reply to a question from Prof. POULTON, Mr. KAYE said that the *Heliconius* was quite as common as the *Lycorea*.

METALLIC COLOUR IN CHRYSIDS.—Dr. G. B. LONGSTAFF exhibited a small box of Chrysids, and started an interesting discussion on the means by which the metallic coloration was produced, observing that coloration of this kind was probably always due to structure and not to pigment.

Prof. POULTON remarked that this metallic coloration in the Chrysids was always situated in chitin, that it was more probable that it was produced by thin plates than by fine lines, but might possibly be due to interference of light by extremely minute particles.

The PRESIDENT said that there were many more Hymenoptera besides the Chrysids which displayed metallic colouring; he had made many experiments on the subject and found that by transmitted light the actual colouring was, in all cases that had come under his notice, of a testaceous red, without any metallic appearance.

Mr. C. J. GAHAN, Mr. F. MERRIFIELD and Dr. T. A. CHAPMAN also joined in the discussion, the two latter referring to M. Pictet's experiments on the subject.

SERIES OF MELANARGIA JAPYGIA AND M. GALATEA FROM SICILY.—Mr. J. PLATT BARRETT exhibited series of these two species from Sicily. He read Kirby's and Lang's descriptions of *M. japygia*, and pointed out that the former made no mention of a marginal black border on the hindwing and that the latter expressly stated that there was none, whereas in all his Sicilian specimens this black border was prominent. His specimens of *M. galatea*, var. *syracusana*, Zell., were taken at the same time and place, the most striking difference being that in *galatea* there were three and in *japygia* four white blotches between the base and apex of the forewings.

Mr. A. H. JONES observed that the specimens of *M. japygia* were very near the Hungarian var. *suwarovius*, Hüb.

Mr. H. ROWLAND-BROWN expressed a doubt whether the specimens were *japygia* at all, but the Rev. G. WHEELER pointed out the difference in the darker band crossing the underside of the hindwing, the upper and lower parts of which are only joined by a corner in *M. galatea*, while the band is continuous in *M. japygia*.

A SCARCE ORTHOPTERON.—Mr. G. T. PORRITT exhibited a series of *Platycleis roeselii* taken by himself at Trusthorpe, on the Lincolnshire coast, this year.

The forms of Leuceronia argia, F., in the Lagos district of West Africa.—Mr. W. A. Lamborn supplemented his previous account of two families of bred *L. argia* by referring to a short series of females taken at Oni between April 1st, 1910, and January 25th, 1911, a period including a whole wet season and a part of two dry seasons.

Of the series, seven were captured in the wet season and three in the dry; but the orange flush, sometimes found at the base of the hindwing, was not due to climatic influence, as was demonstrated by the following table:—

April 1, 1910.	Dry season.	1 female, yellow, with orange flush.
May 31 ,,	Wet season.	1 female, yellow, without orange flush.
June 5 ,,	,,	2 females, both white, without orange flush.
,, 14 ,,	,,	1 female, white, with orange flush.
,, 26 ,,	,,	1 female, white, without orange flush.
July 6 ,,	,,	1 female, white, with orange flush.
Oct. 2 ,,	,,	1 female, yellow, without orange flush.
Dec. 28 ,,	Dry season.	1 female, white, without orange flush.
Jan. 25, 1911	,,	1 female, yellow, without orange flush.

Three families of Papilio dardanus, Brown, bred from known female parents in the Lagos district of West Africa (1912).—Mr. Lamborn referred to an account recorded by Prof. Poulton, in Proc. Ent. Soc. 1912, pages xiv–xvii, of three families of *P. dardanus* bred at Oni, and stated that he had since bred three more such families at the same place, each from a *hippocoon* female parent.

The females in each family were again all *hippocoon*, and it could be said generally that family IV resembled family I in the characteristics described, while families V and VI resembled families II and III.

Parent IV had a much larger white patch on the hindwing than V or VI, and the female offspring of IV inherited this character, as in parent I and its family (see pp. xvi, xvii).

The white spot in the forewing cell of the female offspring was very uniform throughout the families IV, V and VI, although a minute apical spot was separated off from the tip or distal end of the marking in one female of family IV, and in one of VI, but in no others. In one female of IV an hourglass-like constriction nearly divided the marking. As regards the sub-marginal band of the hindwing of the males, the numbers were not sufficient to render a good comparison possible; but there was no doubt that the males were, as a whole, more heavily marked than those of family I (see p. xvi). The sub-marginal band was almost continuous in the two males of family V, those of IV and VI being less heavily marked, but presenting much variation in the degree of development of the two gaps in the band.

The constitution of the families was as follows :—

Female parent, *hippocoon*, captured May 1, 1912; oviposited May 1 and 2; died May 4.

	Date of pupation, 1912.	Date of emergence, 1912.	No. of ♂ offspring.	No. of ♀ offspring. All hippocoon.
Family IV.	May 25.	June 5.		1
	,, 26.	,, 6.		4
	,, 25.	,, 7.	1	
	,, 26.	,, 7.	2	8
	,, 26 (about).	,, 8.	2	
	,, 26	,, 9.	1	
	,, 27	,, 9.	2	
	,, 27 (about).	,, 9.	2	1
		Totals ...	10	14

Female parent, *hippocoon*, captured June 18, 1912; oviposited June 18–19; killed by monkey June 21.

	Date of emergence, 1912.	No. of ♂ offspring.	No. of ♀ offspring. All hippocoon.
Family V.	July 30.	1	1
	Aug. 1.	1	3
	„ 2.		3
		Totals ... 2	7

Female parent, *hippocoon*, captured June 26, 1912; oviposited June 27; died June 28.

	Date of emergence, 1912.	No. of ♂ offspring.	No. of ♀ offspring. All hippocoon.
Family VI.	Aug. 10.		1
	„ 11.	1	1
	„ 12.	1	2
	„ 13.	2	1
	„ 14.		1
		Totals ... 4	6

Mr. Lamborn further stated that family IV had been the subject of a little experiment suggested by Prof. Poulton, who wrote out to him on March 12th, suggesting that shock of some kind—as for instance by the cooling down of the pupae by means of ice—might possibly result in the production of ancestral characteristics.

The larvae pupated as noted in the above table between the 25th and 27th of May, and at nine p.m. on May 30th the temperature of the box in which the pupae had been placed was reduced by ice to about 50° F., which temperature was maintained till the evening of June 2nd. The ice had given out on the morning of June 3rd, and the experiment was then brought to a finish owing to difficulty in obtaining a further supply. On examination of the female offspring in the Hope Department at Oxford, it was found that the hindwings in four out of the fourteen showed a very definite tendency towards the production of "tails." Furthermore, the hind margin of these wings, instead of being evenly rounded, presented, in differing degrees in the four specimens, a squarish outline with the rudimentary "tail" at the angle. Some of the specimens closely resembled the *hippocoon* figured by Prof. Poulton in Trans. Ent. Soc. 1906, pl. XIX, fig. 3, but in one specimen at least the undulation of the margin was far more reduced except at the "tail," and the appearance was therefore more square-like. Two females only out of all those comprised in the five other families showed a similar condition. These appeared in family I. Mr. Lamborn hoped to repeat the experiment on a larger scale, and carry it out more fully, in order to obtain conclusive evidence as to the effects of a lowered temperature upon this species.

Russian Parnassius apollo.—Mr. J. A. Simes exhibited a short series of *P. apollo* from the Government of Viatka, with a series from the Alps of Dauphiny and Switzerland for comparison. The Russian examples were characterised by their great size and by the similarity of coloration in both sexes, while the Alpine specimens showed a considerable degree of sexual dimorphism.

Families of Papilio dardanus, Brown, bred in Natal from female parents of the trophonius, Westw., form, by Miss M. E. Fountaine and Mr. G. F. Leigh.—Prof. Poulton said that, at his desire, Miss Fountaine had kindly prepared the following account of the extremely interesting family reared by her in 1909—the only Natal family at present known in which *cenea* is other than the most numerous of all the forms.

"On the 5th of January, 1909, in Stella Bush, near Durban, (Natal) I caught a very old ♀ specimen of *Papilio dardanus*, f. *trophonius*, which I kept, hoping to obtain ova. On January 7th, she laid 28 ova (one of which I am inclined to think must have escaped my notice the day before). And up to January 11th a few more were laid every day, till, the number having reached 45, I released the ♀, in the 'glades.' On January 10th, 1 larva hatched out, on January 11th, 27 larvae, each of the remaining 17 hatching on the 4th day after the egg was laid. When the caterpillars were still quite young I left Durban and went up country to a place called Dargle (4,400 feet) not without some anxiety for my little larvae, which had all made a good start and were doing remarkably well. It was much colder up at Dargle, and it rained almost every day, but I was fortunate enough to find plenty of their wild food-plant—*Vepris lanceolata*—growing in Kimber's Bush, about two miles distant from the hotel (and to which, thanks to the kind permission of Mr. Kimber, I had free access), so that I had not to resort to pillaging orchards for the leaves of orange and lemon, which also grew in the neighbourhood. The larvae grew as quickly and seemed to get on quite as well up here as down on the coast. The butterfly occurred in Kimber's Bush but was rather scarce, and I only saw males. On February 2nd 4 of the larvae (I had still nearly 40 of them) pupated, and 3 others were hanging up with that end in view. After that they went on pupating every day, until at last I had 38 pupae. The first emergence (1 ♂) took place on Feb. 19th; the next day, Feb. 20th, (2 ♂♂ and 1 *trophonius* ♀); Feb. 21, at Maritzburg (3 ♂♂); Feb. 22, (1 ♂ and 2 ♀♀ *trophonius*, and 1 ♀ *cenea*); Feb. 23, (4 ♀♀ *trophonius*, 2 of which were spoilt by emerging on the journey from Maritzburg to Donnybrook); Feb. 24, (3 ♀♀ *trophonius*); Feb. 25, (1 ♂); Feb. 26, (2 ♀♀ *trophonius*); Feb. 27, (1 ♂ and 2 ♀♀ *trophonius*); Feb. 28, (1 ♂); March 1, (2 ♂♂); March 2, (1 ♀ *trophonius*); March 4, (2 ♂♂ and 1 ♀ *trophonius*); March 5, (1 ♂); March 6, (1 ♂ and 1 ♀ *cenea*); March 7, 1 ♀ *trophonius* (deformed). Two others died in the pupa from the cold, but both were going to be *trophonius*.

"This makes a total of 37 (1 pupa having met with an accident), out of which 16 were ♂♂ (mostly of the broad-bordered summer form, though some of those that emerged in the cold at Donnybrook showed a slight inclination to narrower, more broken borders); and of the 21 ♀♀, 2 were *cenea* and 19 were *trophonius*."

Prof. Poulton stated that Mr. G. F. Leigh of Durban had written Oct. 5th, 1912, giving an account of an interesting family he had just reared from a *trophonius* ♀ captured in the

Durban district. The *trophonius* parent was exhibited to the meeting. The family was of the following constitution :—

11 males, 6 being very dark on the under surface; 4 *trophonius* females; 2 *hippocoon* females; 1 *leighi* female, a very fine and splendid specimen; and 9 *cenea* females.

The family thus bore a considerable resemblance to the much larger one bred by Mr. Leigh in 1910 from a *trophonius* female captured at Pinetown, Natal (Proc. Ent. Soc. 1911, pp. xxxiii-xlii). The fact that the *leighi* form had now appeared in a second family with *trophonius* parentage was of much interest.

Mr. Leigh also wrote in the same letter :—

"I have quite recently seen a male *dardanus* courting a female *Danaida chrysippus* in error, and so persistently indeed that I captured the specimens thinking I must have made a mistake and that the female was really the *trophonius* form."

FURTHER FAMILIES OF PSEUDACRAEAS OF THE HOBLEYI GROUP BRED BY DR. G. D. H. CARPENTER ON BUGALLA IN THE SESSE ARCHIPELAGO.—Prof. POULTON exhibited the two families and the leaves of the food-plant referred to in the following extracts from letters received from Dr. Carpenter. The history of the families he hoped might appear as part of an Appendix to Dr. Carpenter's paper in the Transactions. The numbers and letters referred to the figures of Dr. Jordan's plates.

"*Oct.* 14, 1912.

"I received Dr. Jordan's paper by the same mail as your letter and was amazed to see how the Western *eurytus* forms varied. I had not the least idea of it. Some of the forms I have seen here, and sent you, viz. one like 21A (which I take to show how *rogersi* arose), and a form like 14A or 15A, which I mentioned in my last letter. I did not know, also, that the form like *hobleyi* (24A) occurred in West Africa. It seems a strange thing that *imitator* does not vary. I should expect, if it did, to see the following slight variations in a long series.

"I. A trace of yellow in the subapical white area, *which is that of terra*, as shown very well by my beautiful bred specimen B_2, which, as I remarked before, showed very well how *imitator* could have arisen from a mixture of *terra*, *hobleyi*, and *obscura*.

"II. A trace of yellow suffusion on f.-w. inner margin (due to *terra*).

"III. A diffusing of the h.-w. pale area, instead of its being concentrated. I think B_2 shows that the pale h.-w. area of *imitator* was derived from *obscura*, tinted white by *hobleyi* influence.

"I much look forward to seeing the Natal and West African *eurytus* forms."

Prof. Poulton had examined the series of *Ps. imitator*, Trim., in the Hope Department, viz. 35 specimens bred in 1910 by the late Mr. A. D. Millar, and 3 females captured at Northdene, Natal, in 1896. He agreed with Dr. Carpenter that B_2 could be easily transformed into *imitator*. With regard to I. no trace of subapical yellow was seen in any of the white-marked females. All the markings of the males and of a small proportion of the females were pale yellowish white like the males of *Planema aganice*, Hew., while the majority of the females were white-marked like the female *aganice*. II. The inner marginal marking was always present, yellowish in the yellow-marked, grey in the white-marked specimens. III. The bar crossing the hindwing was always well defined like the model—sometimes, however, more band-like and straighter along its outer edge, often, on the contrary, following the contour of the hind margin of the wing and forming a quarter-circle concentric with it, as in *Planema aganice*.

"*Oct.* 17*th*.

"I am sending you two more series of synepigonic Pseudacraeas with full data, and pupal skins of each specimen, also a few leaves showing the curious way in which they are eaten by the young larvae."

Prof. Poulton said that he had submitted the leaves to Dr. O. Stapf, F.R.S., of Kew, who had replied that they agree very well with *Sideroxylon brevipes*, Baker, a Sapotaceous plant well known in Uganda and allied to *Chrysophyllum*, a food-plant of *Pseudacraea* in the Lagos district and Natal. A perfectly certain determination required fuller material, which it was hoped would soon be received from Dr. Carpenter.

Prof. Poulton had also received the following interesting note in a letter written on September 21st. The observation, as Dr. Carpenter said, threw light upon a difficulty which has often been stated.

"I caught a very nice *initial variety of Ps. terra* the other day. It had a very slight yellow suffusion of the black ground-colour along the costal margin of the forewing, and the black bar between the sub-apical and hind-marginal tawny areas was slightly thinned away. This specimen, however, *looked distinctly different*, both at rest and on the wing, which tends, I think, to show how the smallest variations may have selection value. This is always rather a stumbling block, so it was nice to see it actually exemplified."

THE COCOONS OF EPICEPHALA CHALYBACMA, MEYR.—Prof. POULTON showed an enlarged photograph of the cocoons of *E. chalybacma* upon the leaves of Tamarind, *Poinciana pulcherrima*, taken at Pusa on May 31st, 1911, by Mr. T. Bainbrigge Fletcher. The cocoons with their spheres were very beautifully and clearly reproduced. The photograph had been taken for Mr. E. Meyrick, F.R.S., who had sent it to Prof. Poulton for exhibition to the Society.

A RICHLY-COLOURED EXAMPLE OF PLANEMA ARENARIA, E. M. SHARPE, FROM THE SESSE ISLANDS IN THE VICTORIA NYANZA.—Prof. POULTON exhibited a male specimen of *Pl. arenaria*, taken July 15, 1912, by Dr. G. D. H. Carpenter on Bugalla, one of the Sesse Islands. *Pl. arenaria* had been shown by Dr. Karl Jordan to be a pale eastern geographical race of the fulvous *Pl. consanguinea*, Auriv., of the tropical west coast. It was therefore interesting to find such forms, tending towards an intermediate tint, in an island in the Victoria Nyanza. Dr. Carpenter had observed that they were not uncommon.

THE EFFECT OF HOT AND COLD CLIMATE UPON THE COLOURS OF CHRYSOPHANUS PHLAEAS, L.—Prof. POULTON exhibited thirty-seven examples of *C. phlaeas*, captured on the same bank at Cerne Abbas, Dorset, in the hot August of 1911 and in the cold August of 1912, by Dr. R. C. L. Perkins. Eight out of the fourteen males captured in 1911 were much darker than any of the eight males captured in 1912. The copper tint of the eight 1912 females was more brilliantly lustrous than in the seven 1911 females. It was interesting that the effects were similar in kind in the two sexes, although very different in degree, also that the females, in which the difference was but slight, were more uniformly affected than the males.

Polyommatus icarus Females.—Mr. T. H. L. Grosvenor, who was present as a visitor, exhibited a series of *P. icarus* females principally from various localities on the North Downs, arranged according to the year and emergence to which they belonged, with the intention of showing the seasonal dimorphism of the females of this species, and also with the idea of raising a discussion on the theory originated by the late Dr. G. G. C. Hodgson, as to whether the climatic or atmospheric conditions prevailing at the time of emergence, or at an earlier period of its existence, do, or do not tend to increase or decrease the sexual dimorphism. From his own experience among the Lycaenids during the past ten years, the conclusion was forced upon him that a hot summer produces as a prevailing form the brown type, with little or no blue scaling. One could not, of course, make a dogmatic statement to this effect, as assiduous selective collecting would always produce the blue form in greater or less numbers, whereas, in a cold wet summer the prevailing form was found to be more or less heavily scaled with blue. He could not quite agree with Hodgson that the sexual dimorphism is decreased or accentuated by the sexes approximating to an imaginary intermediate form, especially so in the species under discussion, where, if there were any tendency in this direction, the variation of the males would be so subtle that no reliable inference could be drawn. In the case of *Agriades corydon* this might be possible owing to the more decided variation of the males. In his own opinion a decrease of sexual dimorphism, or the contrary, could be produced by variation of one sex towards or receding from the type of the opposite sex.

He could not but regret that he had not access to Hodgson's extensive series for reference, but among his notes on the species were found the following statistics :—

Polyommatus icarus females in the collection with more than average blue; total 58 specimens :—

1904,	number of specimens	8 = 42 %
1905,	,, ,,	18 = 32 %
1906,	,, ,,	5 = 90 %
1907,	,, ,,	27 = 46 %

To which he would add from his own series :—

Total 72 specimens—

1908	75 %
1909	66 %
1910	72 %
1911	18 %

These figures, of course, proved little, owing to the varying numbers for each year, the small quantity, and the selective process to which, as cabinet specimens, they had been subjected.

The fact that Continental specimens show so little blue, was interesting, inasmuch as it agreed to a large extent with this theory, viz. that a cold season produces a bluer form, therefore the milder climate experienced on the Continent produces an almost unicolorous brown form.

RURALID ABERRATIONS.—The Rev. G. WHEELER exhibited, on behalf of Mr. R. M. PRIDEAUX, some aberrational forms of *Rumicia phlaeas*, and three ♀ "Blues," consisting of one very dark specimen of *Agriades corydon* and two of *A. thetis*, one being of the ab. *urania*, Gerh., and the other having the forewings dark and the hindwings symmetrically of a pale fawn-colour.

FEMALES OF AGRIADES THETIS AND POLYOMMATUS ICARUS.—The Rev. G. WHEELER also exhibited the specimens of *A. thetis* ab. *urania*, Gerh., to which he had referred at a former meeting. All were taken between Gomshall and Dorking and were first-brood specimens of this year. Their peculiarity consists in the ground-colour being of a dead black instead of brown, these particular specimens however having a considerable amount of blue scaling.

He observed that his own experience as to the blue females of *P. icarus* in England was directly opposed to that of Mr. Grosvenor, and in support of this view he exhibited a series of blue ♀s, most of them entirely blue, taken this spring at Notgrove in the Cotswolds, and for comparison the bluest ♀ he had taken there previously, in which the blue scaling was less than the least blue of this spring's captures. He explained that he did not suppose that heat as a rule tended to the production of blue ♀s of this species, since the ♀s in Switzerland showed only traces of blue, and those in Italy none at all, but his theory was that unusual climatic conditions gave an impetus to the very marked tendency to blue ♀s which was so characteristic of Britain, and which is in fact confined to these islands and to certain localities in Scandinavia.

Mr. H. Rowland-Brown expressed the opinion that sea-damp might have some effect in producing blue in the ♀s of this group of "blues," and instanced the case of the south-west coast of France in Charente-Inférieure, where the very brilliant and wholly blue ab. *coelestis*, and the ab. *syngrapha* which is blue up to the border, were the dominant forms of the ♀ of *A. thetis* and *A. corydon* respectively.

Species of the Genus Teracolus.—Dr. F. A. Dixey exhibited specimens of *Teracolus ephyia*, Klug, and some allied forms, together with drawings of their respective scent-scales. He remarked that *Teracolus ephyia* was originally described and figured by Klug from specimens captured at Ambukol in Nubia. The uppermost specimen in the exhibit was from Meroe on the Upper Nile, close to the place where Klug's specimens were taken. Next came a pair, ♂ and ♀, captured by Dr. Longstaff near Khartum. The exhibit included a specimen of *T. lais*, Butl., caught at Artesia in Bechuanaland by Prof. Poulton. This form might be regarded as the geographical representative of *T. ephyia* in South Africa. With regard to the scent-scales, it was interesting to observe that a fairly gradual transition in size took place from one extreme to the other of the geographical series. All these forms appeared to be somewhat rare. Prof. Poulton's specimen of *T. lais* was the only one in the Hope Collection with the exception of two caught by Burchell, probably in 1812. The British Museum contained only two, or at the most three, of *T. lais*, and only three specimens of *T. ephyia*.

Dr. G. B. Longstaff observed that many species of the genus look much alike on the wing, and that possibly *T. ephyia* may have been passed over as being inconspicuous among larger species.

Papers.

The following papers were read :—

"On some new and little-known Bornean *Lycaenidae*, with a revision of the Thecline genus *Thamala*, Moore." By J. C. Moulton, F.L.S., Curator of the Sarawak Museum.

"Descriptions of South American Micro-Lepidoptera." By E. Meyrick, B.A., F.R.S.

"Synoptic Table of the British species of *Aleuonota* and *Atheta*, Th." By Malcolm Cameron, M.B., R.N.

"Comparative Notes on *Chilades galba*, Led., and *C. phiala*, Gr.-Gr." By G. T. Bethune-Baker, F.L.S., F.Z.S.

"Notes on the Specific Distinction of certain species in the *orbitulus* and *pheretiades* section of the Genus *Plebeius*." By G. T. Bethune-Baker, F.L.S., F.Z.S.

Mr. Bethune-Baker exhibited the species referred to in the latter paper, and mentioned the conclusions to which he had come as to their specific value or otherwise.

ANNUAL MEETING.

Wednesday, January 15th, 1913.

The Rev. F. D. Morice, President, in the Chair.

Mr. J. E. Collin, one of the Auditors, read the Treasurer's Balance Sheet for 1912, showing a balance of £16 18*s*. 9*d*. On the proposal of the Rev. F. E. Lowe, seconded by Mr. H. Main, it was unanimously adopted.

The Rev. George Wheeler, one of the Secretaries, then read the following

Report of the Council.

During the past year the Society has lost one Honorary Fellow, Dr. Ludwig Ganglbauer of Vienna; the vacancy thus caused has been filled by the election of Dr. Emile Frey-Gessner of Geneva.

Eight ordinary Fellows have died during the year, viz. Messrs. H. J. Adams, Thos. Boyd, Edouard Brabant, Samuel J. Capper, E. A. Fitch, G. H. Grosvenor, W. F. Kirby and R. Shelford, and information has also been received of the death of Messrs. A. P. Buller and Thos. Turner who died so long ago as 1910. Eight Fellows have resigned and six have been removed from the list, our losses from all sources thus numbering twenty-five. Forty new Fellows have been elected during the year in addition to Dr. Frey-Gessner, and one name previously removed has been restored, these additions numbering forty-two in all, and exceeding our losses by seventeen, the Society now consisting of twelve Honorary and five hundred and eighty-four Ordinary Fellows, making altogether a total of five hundred and ninety-six, considerably the highest figure hitherto attained.

The Transactions for 1912 form a volume of seven hundred and fifty-four pages, and consist of eighteen papers by the following authors: the late Col. C. T. Bingham, F.Z.S., G. D. H. Carpenter, B.A., M.B. (two), Dr. T. A. Chapman, M.D., F.Z.S. (four), H. Eltringham, M.A., F.Z.S., E. E. Green, F. M. Howlett, B.A., E. Dukinfield Jones, F.Z.S., Dr. H. Karny, Lt.-Col. N. Manders, R.A.M.C., F.Z.S., Dr. R. C. L. Perkins, M.A., D.Sc., F.Z.S., etc., Dr. David Sharp, M.A., F.R.S., F.L.S., etc. (joint author with F. Muir), the late R. Shelford, M.A., R. Trimen, M.A., F.R.S., etc., and R. E. Turner. Two of these are important monographs each occupying a complete part, one relating to Lepidoptera, the other to Coleoptera; of the other papers nine refer to Lepidoptera, three to Hymenoptera, one each to Coleoptera, Orthoptera and Thysanoptera, and one especially to Economic Entomology. The Proceedings occupy one hundred and forty-four pages and contain a great amount of important information connected with the Exhibits at the Meetings, much of which is contained in letters and notes from Fellows of the Society pursuing methodical Entomological work in Central Africa, Ceylon, Hawaii, etc.

The Transactions are illustrated by 86 plates, consisting of 8 chromo-lithographs, 10 monotint and 2 black lithographs, 28 half-tone plates and 38 line-blocks. All the drawings except that of one of the chromos were given by the Authors, and in that case a sum of £10 was given by Mr. Feltham towards the entire cost of the plate. The cost of 1 chromo and 25 half-tone plates was given by Dr. Chapman, and that of one monotint lithograph by Mr. Eltringham. Of the two text figures occurring in the Proceedings, that illustrating Mr. C. O. Waterhouse's exhibit of a Mantid oötheca was given by the Exhibitor. In addition to these donations towards the cost of the plates the Royal Society has promised a grant of £60 towards the production of Part III, consisting of Dr. Sharp's monograph with its 37 plates.

The generosity of Mr. F. Merrifield, one of our ex-Presidents, again enabled the Council to offer a travel-grant. Only one application, however, was received, and this did not fulfil the one condition made by Mr. Merrifield, viz. that without the grant the recipient would be obliged to confine his collecting for the year to the British Isles.

The meetings have been very largely attended, the room on many occasions having been quite full, and the exhibits and discussions have reached a high level of importance; the latter, except when on matters of only momentary interest, have generally been fully reported in the Proceedings, the statements of speakers, where not supplied by themselves, being always submitted to them for correction before publication.

In the List of Fellows, published in Part V of the Transactions for 1911, a new departure was made by inserting after the names of Fellows a list of any Offices they have held in the Society, with dates. It is hoped that this will add materially to the interest of the list.

During the past session a collection of the portraits of former Presidents has been initiated, and a considerable number have already been received.

The Council has been invited during the past year to appoint Delegates for the International Congress of Eugenics, the Centenary of the Philadelphia Academy of Natural Sciences, the 250th Anniversary of the Royal Society, the 2nd International Congress of Entomology, and the International Congress of Comparative Pathology. On the last of these occasions the Society was not, however, actually represented, neither Prof. Newstead nor Prof. Theobald being able to attend, and the short notice given by the Congress to the Council making it impossible to find other delegates in their place.

The Society is also invited to be represented at the 9th International Congress of Zoology, which is to take place at Monaco in March next, from the 25th to the 29th. Reports from the delegates to the Royal Society's Celebrations and the International Congress of Entomology are appended.

The Treasurer reports as follows:—

The year ending 31st December, 1912, has been a very prosperous one, the total receipts being £971 4*s.* 11*d.*, against £699 12*s.* 11*d.* in 1909, £805 0*s.* 11*d.* in 1910, and £847 7*s.* in 1911 respectively. This continued prosperity arises from a general increase in all the items, especially in Admission Fees and sales of Transactions. On the other hand, the cost of valuable Papers published has been correspondingly heavy, but it must be borne in mind that £75 for 5 Life Compositions has been invested out of the above sum of £971 4*s.* 11*d.*, adding £102 12*s.* 2*d.* Stock to the sum already held.

The Librarian reports that forty volumes, the usual periodicals and publications of Societies, and an unusually large quantity of separata have been added to the Library during the past year, a list of which will be included in Part V of the Transactions. Four hundred and seventy-eight volumes have been issued for home use, as against a total of two hundred and ninety-five volumes the previous year. As usual, the Library has been well used for the purpose of reference.

Report of the Second International Congress of Entomology at Oxford, August 1912.*

The second International Congress of Entomology assembled on August 4th, and in the evening members were invited to an informal Reception given by Oxford entomologists in the Hall of New College, at which guides, badges (designed by Prof. Selwyn Image, M.A., F.E.S., Slade Professor of Fine Arts), and programmes for the sessions and excursions were issued.

The Congress was formally opened on Monday morning at 10.30, in the theatre of the Oxford University Museum which was placed at the disposition of members throughout the week by the kind permission of the Delegates, and besides rooms for the separate sections, a most convenient and comfortable writing-room was arranged for the use of members, and for the Press.

In his opening address the President, Prof. E. B. Poulton, M.A., D.Sc., F.R.S. etc., Hope Professor of Zoology, welcomed the Congress, laying special stress on the claim of the Oxford University Museum as a place of meeting, as the special scene of early encounters between "Darwinians" and the disciples of the older schools of thought; of Ruskin's teaching and of Westwood's labours in the cause of Entomology. He then proceeded to trace the evolution of the female

* A detailed Report of the Congress appeared in *The Times* of Wednesday, August 15th (by H. Rowland-Brown).

Papilio dardanus from Madagascar across the continent of Africa.

The address was followed by a paper by the Hon. N. C. Rothschild, M.A., F.E.S., on the subject of "Nature Reserves," in which he advocated the co-operation of naturalists and all nature-lovers to secure and maintain the fast-vanishing *primitive* areas of the United Kingdom.

In the afternoon, in the Economic and Pathological Section (President, Prof. L. O. Howard, U.S.A.; Vice-Pres., Prof. R. Newstead, F.E.S.; Secretary, Mr. H. Scott, M.A., F.E.S.), Sir Daniel Morris read a paper for Mr. W. A. Ballou, dealing with "Some Entomological Problems in the West Indies," and especially with the introduction of predaceous insects as the natural enemies of insect pests, etc., on cotton and sugar-cane. In the same section, on Wednesday, August 7th (President, Herr J. Jablonowski (Hungary); Vice-Pres., Mr. R. L. Perkins, F.E.S.; Secretary, Mr. J. C. Moulton, F.E.S.), the president gave a long and illuminating account, with lantern slides, of the methods employed for "The destruction of *Stauronotus maroccanus* in Hungary," and "The destruction of *Cochylis* and *Eudemis* in vineyards"; Mr. A. G. L. Rogers, M.A., F.E.S., outlined a scheme for "The necessary investigation with relation to Insect and Fungus Enemies of Plants, preliminary to Legislation," and Prof. F. V. Theobald, M.A., F.E.S., gave an account of the "Aphides attacking cultivated Peas, and the allied species of the genus *Macrosiphum*." On Thursday, the section sitting under the presidency of Dr. Gordon Hewitt (Canada), B.Sc., F.E.S. (Vice-Pres., M. V. Ferrant; Secretary, Mr. H. Rowland-Brown, M.A., F.E.S.), listened to an extremely interesting paper by Dr. Stephen A. Forbes, U.S.A., on "*Simulium* and Pellagra in Illinois," a summary of his studies of the species in relation to new cases of pellagra in asylums. An amusing discussion followed on a paper apparently designed to demonstrate the virtues of a new commercial specific for killing flies.

The second day's proceedings of the General Meeting and the Section devoted to nomenclature (President, Prof. E. B. Poulton, F.R.S.; Vice-Pres., Herr K. Kertész; Secretary, Dr. K. Jordan, Ph.D., F.E.S.) drew perhaps the largest and most interested audiences of the Congress. In the morning the Rev. G. Wheeler, M.A., F.E.S., and Mr. G. T. Bethune-Baker (delegates of our Society, with the President, the Hon. Walter Rothschild, F.R.S., and Mr. H. Rowland-Brown) introduced the subject of "Nomenclature with a communication from the Entomological Society of London," Mr. Bethune-Baker's remarks being as follows:—

"This question—having disturbed the minds of many entomologists here—was brought to a head by the publication of a paper in the E.M.M. for February 1912, by Meyrick, in which he published a list of no less than ninety-four new names as substitutes for a long series of new species described by Kearfott in 1907, and published in the Trans. American Ent. Soc., Vol. 33 (1907), and in the Canadian Entomologist for the same year; he also included three names of Busck's. The matter was discussed very fully at two meetings of the Ent. Soc. Lond., who appointed a sub-committee to consider the whole question and to report, and after the report the resolution I have moved was carried practically unanimously. Without considering the propriety of Meyrick's substitutions it was strongly felt that Kearfott's names were untenable, primarily for the reason that to the ordinary person they are quite unmemorable. It would not be possible for the ordinary worker to memorise ninety plays on the syllable "*ana*," without very serious effort and constant reference to the originals; in addition to this there are names such as *Enarmonia vana and wana; Eucosma sandana, xandana, zandana, vandana, wandana; Phalonia foxana, voxana; Eucosma vomonana and womonana*, and others somewhat similar. The sound of *Eucosma sandana*, spelt with an *s*, *x* or *z*, is absolutely indistinguishable in English and other languages, those beginning with *v* and *w* are indistinguishable in some languages, and it was felt some steps ought to be taken to prevent the recurrence of such a list of names. Besides these, Kirkaldy published a series of what many consider objectionable names, such as *Polichisme, Ochisme*, and it was considered that such names could only bring Entomological science into disrepute if they did not make it a laughing-stock to the scientific world. The resolution I have moved does not in any way conflict with those already passed at the first Congress. It will be seen that there is no desire to oppose the International Commission of Zoological Nomenclature, but rather a desire to strengthen their hands and to prevent, if possible, that Commission from departing from their own Code. I speak as an upholder of the Code, but I want it improved. It consists of rules and recommendations; the former are binding, the latter are not. I would like to eliminate many of the latter, and to make some new rules, but I do desire the Commission to adhere to their rules. This they do not do. For instance, Art. 25, The Law of Priority, runs as follows:—"The valid name of a genus or species can be only that name under which it was first designated on the condition: (*a*) That this name was published and accompanied by an indication, or a definition, or a description; and (*b*) That the author has applied the principles of binary nomenclature." I would ask the members of the Congress to remember (*b*). With this law before them the question of Meigen's genera of 1800 came under their view, when instead of settling the question absolutely, as it is really settled by Art. 25*b*, the Secretary of the Commission sent a letter to the members of the Commission asking whether the *Nouvelle Classification* of Meigen of 1800 should be given precedence over his *Versuch* of 1803, and the decision was that precedence should be given where valid. I submit, sir, that that decision is contrary to Art. 25. Meigen's 1800 classification is absolutely uninominal, and is, therefore, entirely contrary to section *b*, and consequently cannot be accepted. According to the Code Meigen's names can only be accepted from the date when the author applied the principles of binary nomenclature, i. e. 1803. This decision is therefore entirely contrary to the Code and cannot be accepted until Art. 25 is altered. At the present time there is a somewhat widespread movement to restrict the Law of Priority. This is not altogether unnatural from one point of view, but from the point of view of the Systematist I sincerely hope it will not be done. It is not unnatural for the pure biologist and general zoologist to desire to retain names that he remembers from his student days; the question, however, that I would ask is, Is it

Scientific? The Code was formed in order to obtain a stable nomenclature, and it is steadily working in that direction, but the end cannot be obtained in a decade. Nature works slowly and we had better follow her example. We have to deal with a vast amount of literature extending over one hundred and fifty years, and it is only as the Systematist in his monographs or other work investigates this mass of literature that stability will be obtained, for it should be remembered that it is the Systematist who must be in the end the final court of appeal, at least in the elucidation of species, and, therefore, in the elucidation of the names of species. It is said that changes of names bother those who are not specialists, but I have little doubt that the suggestion of 'nomina conservanda' in combination with the Law of Priority would be infinitely more perplexing, and it would be an open door for endless changes. The fact that the number of species and genera in Entomology far outweighs the number of living forms that belong to all other classes of the animal kingdom, is ample justification for the considerable extension of the powers and status of the Commission formed at our first International Congress as suggested by my resolution, and I trust this second Congress will approve of the Resolution * of the Ent. Soc. of London that I have the honour to move."

The Rev. G. Wheeler followed with a paper entitled "Suggestions for securing Simplification and Permanency in Nomenclature."

In the afternoon, M. Charles Oberthür, Hon. F.E.S., who was enthusiastically welcomed on his first visit to England, in a speech of glowing eloquence developed his proposition—

"Pas de bonne figure à l'appui d'une description, pas de nom valable"—

and after this was read a paper by Mr. L. B. Prout, F.E.S., "On the place of figures in descriptive Entomology," and an interesting and sustained discussion of the best means whereby something like order might be evolved out of the existing chaos of entomological nomenclature. Finally, after the question had been referred back to a special committee the following resolution was adopted—

* For the Resolution see Proceedings, p. lxvi.

(i) The Congress has elected the following International Committee on Nomenclature: N. Banks, C. J. Gahan, K. Kertész, F. Ris, S. Schenkling, H. Schouteden, Y. Sjöstedt, and K. Jordan (as Secretary).

The Executive Committee, in conjunction with the National Committees mentioned hereafter, is empowered to elect additional members.

(ii) The Congress commissions the International Entomological Committee on Nomenclature—

(*a*) to enter into communication with the Entomological Societies of the world with a view to forming National Committees on Entomological Nomenclature;

(*b*) in co-operation with the National Committees, to collect the opinions of Entomologists on questions of Nomenclature as affecting Entomology, and to consider what elucidations, extensions, or emendations, if any, are required in the International Code;

(*c*) to confer with the International Commission on Zoological Nomenclature and—

(*d*) to lay a report before the next Congress of Entomology.

(iii) The Congress further commissions the International Entomological Committee on Nomenclature to communicate these resolutions to the Secretary of the International Commission on Zoological Nomenclature, and to take such action as to ensure the adequate representation of Entomology on the International Commission on Zoological Nomenclature.

Other papers read, or communicated to the Congress by Fellows and Hon. Fellows of our Society were:—

Prof. E. B. Poulton, M.A., D.Sc., F.R.S.—
"Messrs. C. A. Wiggins, and Dr. G. H. Carpenter's researches in mimicry in the forest butterflies of Uganda."

Dr. R. C. L. Perkins, M.A., D.Sc.—
"The colour-groups of Hawaiian Wasps."

The Rev. K. St. A. Rogers, M.A.

"Mimicry in the two sexes of the E. African Lycaenid *Alaena picata*, E. M. Sharpe."

Dr. F. A. Dixey, M.A., M.D., F.R.S.—

"Scent Organs in the Lepidoptera."

The specialised scales which serve to distribute scent in many species may be either generally scattered over the wing-surface, or collected into patches. In the latter case there is a special supply of air tubes to the sockets of the scales.

Mr. G. H. Carpenter, B.Sc., B.M., B.Ch.—

"The Presence of Maxillulae in Beetle Larvae."

Demonstrates the presence of paired appendages (maxillulae) connected with the hypopharynx in certain larvae of the Coleoptera.

Dr. M. Burr, D.Sc., and Dr. K. Jordan, Ph.D.—

"On *Arixenia*, an aberrant genus of Earwigs, its habits, morphology and anatomy."

Mr. R. S. Bagnall.

(1) The Order *Thysanoptera*.

(2) The British *Protura*, a primitive and recently diagnosed order of Insects.

(3) A synopsis of the family *Aeolothripidae* of the order *Thysanoptera*.

(4) Exhibition of New British *Thysanura*, *Collembola*, *Thysanoptera*, *Mallophaga*, and *Myriapoda*.

(5) Exhibition of the *Thysanoptera* of the Hawaiian Islands.

Prof. R. C. Punnett, M.A., F.R.S.—

"The Polymorphism of *Papilio polytes*.

Mr. E. E. Green.

"A plea for the Centralisation of Diagnostic Descriptions."

Mr. H. St. J. K. Donisthorpe and Mr. W. C. Crawley—

"On the founding of Colonies by Ants."

Dr. K. Jordan, Ph.D.—

"On the viviparity of *Polyctenidae*."

Dr. T. A. Chapman, M.D.—

"Regeneration of the Legs in *Lymantria dispar*."

Effects of the parts being lost at different stages, and tendency to reduplication of parts.

Mr. Leonard Doncaster, M.A.—

"Sex-limited Inheritance in Insects."

An account of the inheritance of characters which show sex-limited transmission in the Moth *Abraxas grossulariata*, and the Fly *Drosophila ampelophila.*

Prof. J. H. Comstock—

"The Silk of Spiders and its Uses."

A description of the different kinds of silk spun by spiders and of the use of each kind. Illustrated by lantern slides made from photo-micrographs of silk and from photographs of webs.

Dr. Ernest Olivier—

"The necessity for the Latin tongue for Entomological descriptions."

During the session also the following exhibits were on view in the University Museum :—

Dr. F. A. Dixey.—Pierinae. Mr. H. Eltringham.—The African Species of the Genus *Acraea.* Prof. Poulton and Mr. A. H. Hamm.—Insects and their prey, with special reference to the Courtship of the Empidae. Prof. Poulton.—Mimetic Groups.

At the final General Meeting on the afternoon of Friday, August 9th, after Dr. Adalbert Seitz had discussed the problem, "How does the Insect see the World?" and Prof. V. L. Kellog (U.S.A.) had read a paper on "Distribution and Species-forming among Ectoparasites," the President reviewed the whole proceedings of the Congress, and was given a hearty and unanimous vote of thanks for his address, and for his services. It was then resolved that the next meeting of the Congress should be held at Vienna with Dr. Anton Handlirsch as President.

Meanwhile, during the week members of the Congress were entertained by Wadham, New College, Magdalen, and Merton, and an excellent café was erected in a large tent in the Warden's garden at the first-mentioned College, where luncheon, tea and light refreshments were served. On Wednesday, August 7th, the Congress was entertained by the Rt. Hon. L. V. Harcourt, M.P., at Nuneham House, the party proceeding thither by river; while another party of members, at the invitation of the President and Fellows of St. John's College, explored, and enjoyed an afternoon picnic in Bagley Wood, though both expeditions were to some extent marred by the rain.

The Banquet on Friday evening, in the Hall of Wadham College, was largely attended by members and their friends.

On Saturday, August 10th, the Hon. Walter Rothschild, F.R.S., entertained the entire Congress at luncheon, and in the Museum at Tring.

Of the sixty-six British and Foreign Government Departments, Universities, Institutions and Societies which sent Delegates to the Congress, twenty-eight were wholly or in part represented by Fellows of our Society.

The following Fellows of our Society were also present during the week: Mr. G. Arrow, Mr. A. Bacot, Mr. R. S. Bagnall, Mr. G. T. Bethune-Baker, Dr. M. Burr, Dr. M. Cameron, Prof. G. H. Carpenter, Mr. G. C. Champion, Dr. T. A. Chapman, Mr. J. E. Collin, Prof. J. H. Comstock, Mr. W. C. Crawley, Mr. E. M. Dadd, Dr. F. A. Dixey, Mr. L. Doncaster, Mr. H. St. J. Donisthorpe, Mr. H. H. Druce, Mr. J. H. Durrant, Mr. H. Eltringham, Miss M. E. Fountaine, Mr. C. J. Gahan, Mr. J. Gardner, Mr. A. T. Gillanders, Mr. G. C. Griffiths, Mr. G. H. Grosvenor, Dr. G. C. Hewitt, Mr. T. F. P. Hoar, Prof. S. Image, Mr. O. E. Janson, Mr. A. H. Jones, Dr. K. Jordan, Mr. E. G. Joseph, Mr. W. J. Kaye, Sir G. Kenrick, Dr. G. B. Longstaff, Mr. G. Lyle, Mr. H. A. Lyman, Dr. R. S. Macdougall, Mr. G. A. K. Marshall, Mr. G. Meade-Waldo, Rev. F. D. Morice, Mr. J. C. Moulton, Mr. S. J. Neave, M. Ch. Oberthür, Dr. E. Olivier, Dr. R. C. L. Perkins, Prof. E. B. Poulton, Prof. R. C. Punnett, Rev. K. St. A. Rogers, Hon. L. W. Rothschild, Hon. N. C. Rothschild, Mr. H. Rowland-Brown, Mr. H. Scott, Mr. N. S. Sennett, Dr. D. Sharp, Mr. A. Sich, Prof. F. V. Theobald, Prof. I. Trägardh, Mr. C. J. Wainwright, Comm. J. J. Walker, Rev. G. Wheeler, Mr. C. B. Williams; accompanied by the following ladies: Mrs. Bagnall, Mrs. Cameron, Mrs. Champion, Mrs. Comstock, Mrs. Dixey, Miss Jordan, Mme. Oberthür, Mrs. Perkins, Mrs. and Miss Poulton, Miss Rowland-Brown, Miss Swaine, Miss Walker, Mrs. Wheeler.

Prof. Poulton (the President), Dr. Burr, D.Sc. (General Secretary of the Congress), and Mr. H. Eltringham, M.A., and the late Mr. G. H. Grosvenor, M.A. (Asst.-Secretaries), gave invaluable assistance to promote the success of the Congress in their several departments.

H. R.-B.

Report of the Two Hundred and Fiftieth Anniversary of the Royal Society.

Proceedings at the 250th anniversary of the Royal Society were as follows :—

Monday, July 15.—The President, Council, and Fellows of the Royal Society held a preliminary and informal reception of the Delegates from 8.50 to 11 p.m. at Burlington House.

Tuesday July 16.—A short Commemorative Service was held at midday in Westminster Abbey, and the Dean (Bp. Ryle) delivered an address.

At 2.30 p.m. the formal Reception of Delegates and presentation of Addresses took place in the Great Library at Burlington House.

At 7 p.m. a Banquet was held in the Guildhall, the President of the Royal Society (Sir A. Geikie) in the chair. Speeches were delivered by the Prime Minister, the Archbishop of Canterbury, and others.

Wednesday, July 17.—The Duke and Duchess of Northumberland received the Fellows of the Royal Society, and the Delegates, at a Garden Party from 4 to 7 at Syon House.

At 9 p.m. a Conversazione was held in the Rooms of the Royal Society.

Thursday, July 18.—The Council and the Delegates were conveyed by special train from Paddington to Windsor, arriving at 2 p.m. They were met by Lord Esher and suite, and conducted through the State apartments and St. George's Chapel. Afterwards at 3.15 they were presented individually to their Majesties the King and Queen, and then joined the company assembled for the Royal Garden Party in the gardens of the Castle.

In the evening Delegates who were accompanied by their wives or daughters were entertained privately by Fellows of the Royal Society, and the others were invited to dine with the Royal Society Club (founded 1743).

Friday, July 19.—Two parties of Delegates visited respectively Oxford and Cambridge at the invitation of the Universities.

During the week much private hospitality was extended to Delegates and ladies accompanying them; arrangements were made enabling them to visit various places of interest in London and the neighbourhood; and the Royal Automobile Club invited them to become temporary honorary members for a period of fourteen days.

The Entomological Society of London was represented by the President as its Delegate, and others of its Fellows who were Delegates representing other learned Societies were—Prof. Comstock (Honorary Fellow), the Duke of Bedford, Prof. Meldola, and Prof. Poulton.

F. D. M.

Mr. A. Bacot proposed that the Council's Report be adopted. This was seconded by Dr. T. A. Chapman, and carried unanimously.

The President stated that since his decision last year he had come to the conclusion that the latest edition of the Bye-laws required some form of election of Officers and Council at the Annual Meeting, though it seemed impossible to follow them out exactly, as they apparently neither provided for nor contemplated an unopposed return of the Council's nominees. He would therefore put the Council's list to the Meeting and ask for a show of hands. The following were then declared elected unanimously: President, G. T. Bethune-Baker, F.L.S., F.Z.S.; Treasurer, Albert H. Jones; Secretaries, Commander J. J. Walker, M.A., R.N., F.L.S., and Rev. G. Wheeler, M.A., F.Z.S.; Librarian, G. C. Champion, A.L.S., F.Z.S.; Other members of the Council: R. Adkin, James E. Collin, J. Hartley Durrant, Stanley Edwards, F.L.S., F.Z.S., H. Eltringham, M.A., F.Z.S., A. E. Gibbs, F.L.S., F.Z.S., Rev. F. D. Morice, M.A., G. W. Nicholson, M.A., M.D., Hon. N. C. Rothschild, M.A., F.L.S., F.Z.S., W. E. Sharp, J. R. le B. Tomlin, M.A., Colbran J. Wainwright.

The President, the Rev. F. D. Morice, then delivered an Address, at the close of which Mr. C. J. Gahan proposed a vote of thanks to him for his services as President and for his Address, at the same time asking for its publication as a part of the Proceedings of the Society; this was seconded by Mr. C. Fenn, and carried unanimously.

The President having replied with a few words of thanks, Mr. G. Meade-Waldo proposed and Prof. Selwyn Image seconded a vote of thanks to the Officers of the Society for their work during the past year, which was also carried unanimously.

The Treasurer and both the Secretaries returned thanks, the former referring to the generosity with which Dr. Chapman had for years contributed towards the expense of the plates published in the Transactions.

ENTOMOLOGICAL SOCIETY OF LONDON.

Balance Sheet for the Year 1912.

RECEIPTS.

	£	s.	d.
Balance in hand, 1st Jan., 1912, and at Bankers ...	32	5	11
Subscriptions for 1912 ...	474	12	0
Arrears	26	5	0
Admission Fees	63	0	0
Donations	90	9	6
Sales of Transactions ...	143	2	3
Interest on Investments :— Consols ... ... £26 11 11; Westwood Bequest :— Birmingham 3 per cents. ... 6 15 4	33	7	3
Subscriptions in Advance	29	8	0
5 Life Compositions ...	78	15	0
	£971	4	11

PAYMENTS.

	£	s.	d.
Printing Transactions, etc.	409	13	1
Plates, etc.	254	1	6
Rent and Office Expenses	173	5	2
Books and Binding	56	8	5
Investment in Consols as per contra	31	10	0
Subscriptions in Advance as per contra carried to 1913	29	8	0
	954	6	2
Balance in hand and at Bankers	16	18	9
	£971	4	11

ASSETS.

	£	s.	d.
Subscriptions in arrear considered good	65	0	0
Cost of £1,207 3*s.* 5*d.* Consols. Present value at the price of 75¼ on 31st December, 1912, £908 7*s.* 11*d.*	1,122	18	0
Cost of £239 12*s.* 4*d.* Birmingham 3 per cents. Present value at the price of 82 on 31st December, 1912, £196 9*s.* 9*d.*	250	0	0
Balance in hand	16	18	9
Grant from the Royal Society	60	0	0
	£1,514	16	9

Additional Assets :—
Contents of Library, and unsold Stock.

LIABILITIES.

Cost of printing Parts 3, 4 and 5, and 3 Life Compositions (£47 5*s.*) received at the close of the year to to be invested.

Audited, compared with vouchers and found correct—

CHAS. O. WATERHOUSE.
R. W. LLOYD.
JAS. E. COLLIN.
HORACE DONISTHORPE.
R. ADKIN.
STANLEY EDWARDS.

Less total depreciation of £268 0*s.* 4*d.* in the value of the Securities.

A. HUGH JONES, *Treasurer.*
3rd January, 1913.

THE PRESIDENT'S ADDRESS.

Ladies and Gentlemen,

I think it might be reasonably questioned, whether I am bound, or even entitled, to deliver this Address at all. The wisdom of our ancestors, as embodied in our venerable Bye-Laws, has undoubtedly directed, that annually, on this occasion, the Society shall hear from its Council a "Report on its general concerns." But as to the further infliction on you, either now, or at any other time, of an Address from the occupant of this chair, I can find no enactment whatever, which either directs it, or even alludes to it as permissible. I dare not, however, be the first to break a custom, to which my predecessors have invariably conformed. You have been told that this Address shall be delivered; and, accordingly, delivered it shall be!

I am glad—though the practice is becoming monotonous—to begin with a word of congratulation to the Society on another year of undiminished activity, and an increasing Fellowship-roll. I doubt if its meetings have ever been better attended, or better supplied with interesting Exhibitions: and there can be no doubt that the Transactions for the Session 1912–13 will rank among the most important that have ever been issued. Still more do I congratulate you, that in this record there is nothing abnormal; it merely repeats that of many previous years, and there is every hope that it will continue to be repeated. The Society, in fact, may say with the Merchant of Venice—

> "Nor is my whole estate
> Upon the fortunes of this present year."

It is pleasant to think that in my last year of Office the ranks of the Society have had a remarkable accession of new

Fellows, and I am silly enough rather to envy my successor the pleasure, which I just miss, of congratulating you on an aggregate of six hundred. But it is a fact of much greater significance, that few of us can remember a year of retrogression in our numbers, and that they have increased since the beginning of the present century by more than forty per cent.

To myself and to others of our body the past year will be ever memorable in connection with one or more of the many important Scientific Congresses and Celebrations which have occurred in it, in this country, and also in America. Several of these drew together representatives of one branch or all branches of knowledge from every part of the world. Others were national only and so far (but only so far) less important, but otherwise hardly less interesting, and having the same general object of rendering service to Learning and honouring it in the persons of its representatives.

The coincidence within a single year of so many such gatherings—*e. g.* that the Royal Society, and also the time-honoured Academy of Sciences in Philadelphia, should have celebrated their respective foundations in the same summer—may probably have been more or less an accident. But the increasing frequency of scientific assemblages, and the interest which they create (and that not only in scientific circles), are surely symptomatic—indicating a growing sense of "solidarity" and community of interests among scientific workers, and a strengthening (not unconnected with this) of their position and influence as a "caste" in the civilised world. At each of these gatherings held last year the Entomological Society was invited to be represented. At five of them I was present myself, either as your appointed delegate, or by invitation addressed to me as your President: at another you were represented by distinguished Transatlantic Fellows: and at another by Professor Bateson. It was a remarkable experience to me to foregather, as your representative, with men of world-wide renown in every department of learning; and to be received in that capacity, not with consideration merely, but even—if I may say so—like an Ambassador of some Great Power! Looking back on these interesting recollections, I find that two facts stand out as having forcibly impressed themselves on my mind, and both must, I think, be as gratifying to you as to myself: (1) that, whatever may once have been the case, Entomology is now taken seriously outside Entomological circles; it is ridding itself of the stigma of Dilettantism, and winning recognition among the acknowledged Sciences; and (2) that the Entomological Society of London is looked upon, as having attained a position far above that which is suggested by its unpretentious title; as no mere local association of fellow-townsmen—even though the town be the capital of an Empire—but as representing, for practical purposes, the entire fraternity of British Entomologists. To how large an extent this is really the case, was brought home to many of us in another way at the Oxford Congress; where, from the Presidency downwards, practically all responsible positions committed to Englishmen were occupied by Fellows of the Entomological Society of London—and the same remark might be made, as to at least a very large majority of the exhibitors and the readers of Papers.

An announcement very recently made confirms the two points to which I have just alluded. Entomology has hitherto been treated by the authorities of the National Museum as a subdivision only under the Keepership of the Zoological Department. We are glad now, as Entomologists, to hear that in future it is to receive autonomy, and be elevated into the rank of a separate Department with an Entomologist as its chief; and as members of this Society we are glad to note also that the first occupant of the new office, Mr. C. J. Gahan, is a present Fellow and former Officer of our own.

Happily for myself and for you, it is no longer expected that a Presidential Address (according to the ideal recommended by one of my predecessors) should "review the Entomological work of the whole world for the past year." It is impossible for me to "review" (or even to acquaint myself with) all contributions made to it by our own Fellows—there is much that does not happen to reach me, and much that professedly confines itself to subjects with which I am wholly unacquainted. But it happens that this year I have read and re-read, and (for a wonder) could thoroughly appreciate, two works published by Fellows of our own, and each stating the author's connection with our Society on its title-page, and these works, I dare to say boldly, reflect credit on our Society. They are not only most important and original contributions to specialist knowledge, relating experiences uniquely possessed by their respective authors—so that neither could possibly have been produced by any other living writer—but fill also places in standard Literature, which were previously quite unoccupied, and which I believe they will permanently hold. I do not think I shall abuse the freedom of speech which is conceded to me by custom on this occasion, if I congratulate both the authors and the Society on the appearance within the year of two such works—calculated to interest not specialists only, but even the general public, in the subjects with which they deal, as *Butterfly-Hunting in Many Lands*, by G. B. Longstaff, and *The Humble Bee*, by F. W. L. Sladen.

I must now turn to a graver and less welcome topic. Since our last Annual Meeting death has removed from our Society Fellows who have left a name, and more than a name, behind them; and these losses must not be left unnoted to-night.

Obituaries.

Honorary Fellow.

Ludwig Ganglbauer, the eminent Viennese Coleopterist, Director since 1906 of the Zoological Department of the k.k. Hofmuseum, was elected in the same year an Honorary Fellow of our Society. For many years he had been conspicuously zealous and successful as a curator of the Hofmuseum's splendid collection of *Coleoptera*. In that Order (and especially in its Palaearctic representatives) he was an expert of the highest rank and celebrity. He enriched its literature with many important memoirs; and the four Volumes, which were all that he lived to issue, of his great work on *The Beetles of Central Europe* are universally recognised as the standard authority on the Families with which they deal.

The Ent. Mo. Mag. of last September gave many interesting details of the life and labours of this distinguished Naturalist, supplied largely by his colleague, Anton Handlirsch, and illustrated by a portrait, which revives in me pleasing recollections of the sole occasion on which I had the honour of meeting him, that of a brief visit paid in 1899 to his Department in the Hofmuseum.

Ordinary Fellows.

SAMUEL JAMES CAPPER, who died at Liverpool on Jan. 1st of last year, at the great age of 87, became a Fellow in 1890, and was also a Fellow of the Linnean Society; but his record as an Entomologist is more particularly connected with the progress of our science in the North of England, and especially with the Lancashire and Cheshire Entomological Society, which was practically founded by him in 1877, and over which he presided from that year till his death. To an earlier generation he was widely known as an energetic and most successful collector of British *Lepidoptera*. He is described by such as knew him personally—I regret that I had not that advantage—as a learned and enthusiastic naturalist, with personal qualities which contributed to the esteem and respect which he enjoyed.

THOMAS BOYD, who died (aged 83) on Feb. 2nd, was, with one exception, our "senior Fellow," elected in 1852. Thenceforth for some years his name figured repeatedly and prominently in the entomological serials of the day. Between 1853 and 1858 he added at least 11 n. spp. (all I believe *Micro-Lepidoptera*) to the British List, some of which were also "new to science." Why exactly an entomological career, which had commenced so brilliantly, should have closed (as appears to have been the case) abruptly and entirely, from that time forth, I do not know. Perhaps, as I have seen it suggested, his entomological pursuits were simply crowded out by other interests:—he was an expert also in Botany, Conchology, Microscopy, etc. But possibly it is more than a mere coincidence, that he closed his career as a writer in Entomological journals with a vigorous defence of Darwin, published in the *Weekly Intelligencer*, and protesting earnestly against the "scant measure of fair play" with which Darwin had been treated in that organ. The *Origin of Species* had very recently appeared: and a defender of Darwin might—though I know not if it was so in this case—have felt somewhat ill at ease in his relations with colleagues, who at that time, almost without exception, seemed to regard it as a duty to compass about the new doctrine with words of hatred, and shoot out their arrows (even bitter words) against its author. "No body of men," wrote Darwin some years later, "were at first so much opposed to my views as the London Entomological Society." Indeed, I fear it must be acknowledged, that the part taken in that great controversy by Entomologists in general, and the then representatives of our Society in particular, was not one on which we can look back with satisfaction; but it is a comfort to feel that, even in those days, there were a few (and not the least noteworthy) among our Fellows, who refused to join the "common cry." One of these we are now called upon to remember; let us remember him with respect, and not without a sense of gratitude!

Herbert Jordan Adams, together with his brother, the well-known Dipterist, became a Fellow in 1877. I regret that in this case, again, I cannot speak with the authority of personal acquaintance. But we probably all know that he formed a magnificent Collection of *Lepidoptera*, which is now treasured separately, as "The Adams Collection," in the Natural History Museum at South Kensington. An earlier formed British collection of the same Order was bequeathed to the Enfield Entomological Society, which he had helped to found. He was born in 1838, and died on March 1st last year.

Robert Walter Campbell Shelford became a Fellow in 1901, and served on our Council in 1907 and 1908. After obtaining Honours in the Schools of Natural Science at Cambridge, and teaching Biology for two years in the Yorkshire College at Leeds, he became Curator of the Sarawak Museum. The seven years spent by him in that capacity were a period of great importance both to the development of the latter institution, whose collections he greatly improved, and to his own education as a Naturalist. Returning to

England in 1905, he accepted employment in the Oxford University Museum, and undertook the much-needed re-organisation of its extensive collections of *Orthoptera*. Up to this time, both as an investigator and a writer, his activity had been distributed over a wide range of subjects; but thenceforth he was chiefly known as an expert on the Systematics of *Orthoptera*, on which (and especially on the *Blattidae*) he published, in our own Transactions and elsewhere, many important Memoirs. He also commenced a Monograph of these insects for the *Fauna of British India*, and another for *Genera Insectorum*. Five "fasciculi" of the latter have appeared; but of the former I understand that only a small portion was completed even in MS.

Before his death on June 22nd last, he had been engaged also with notes for a projected "Natural History of Borneo," and it is hoped that some of this work may yet appear posthumously.

Edward Arthur Fitch was born in 1854. Of late years he appears to have relinquished interest in Entomology. But he was formerly a very active and prominent member of our Society, elected Fellow in 1874, Secretary from 1881 to 1885, and member of the Council in 1879 and 1886. About the same period he joined the late Mr. Bridgman in compiling a useful Revision of the British *Ichneumonidae*; but for some reason the work stopped short after considerable progress had been made in its publication, and it was never resumed. Mr. Fitch was a Fellow also of the Linnean Society, and President for ten years of the well-known Essex Field Club. He died on June 28th.

George Herbert Grosvenor, elected Fellow in 1909, was Demonstrator in Zoology at Oxford, and Teacher of Economic Entomology in the School of Forestry. On September 4th, at the age of thirty-two, he was drowned on the coast of Cornwall while endeavouring to save the life of a companion. Scarcely a month before I had seen him, I believe for the first time, at the Oxford Congress, full of life and energy, assisting our colleague Mr. Eltringham in the Secretarial department. What I saw of him, little as it was, impressed me; but it would have done so more, if I had known that the bright and pleasant young Assistant-Secretary had already achieved a conspicuous place among scientific workers; that he had not only won the highest Honours that Oxford can bestow on a Science-student, but shown himself worthy of them by distinguished work in original research at Naples; and that he was organising a new and important branch of nature-study at Oxford, after personal investigation of its latest developments in America. All this, and much more, I have now learnt from a profoundly interesting account of his career and character—which, I hope, will be read as widely as it deserves to be—in the *Entomologist's Record* of October last.

The picture there given could only be marred, if I attempted to retouch it: and it is best that such lives should be chronicled by those who have been in closest contact with them. I will say merely that, as I read, I was reminded of certain lives, pronounced (it is said) by the wisest of the Greeks to have been entirely happy, yet not till they had been made perfect by a noble death. (*τελευτὴ τοῦ βίου λαμπροτάτη . . . τὸ ἀνθρώπῳ τυχεῖν ἄριστόν ἐστι.*—Herod., *Hist.* i. 30–31.)

William Forsell Kirby was born in 1844, and passed away on November 20th last. Having completed thirty years of conscientious and industrious service in the Insect Room of the Natural History Museum, South Kensington, he retired, according to its Regulations, in 1907. Previously, for twelve years, he had occupied a similar post in Dublin. He published at intervals (commencing so long ago as 1863 with a well-known and useful *Manual of European Butterflies*), a long succession of careful works on Insects of almost every Order, some of which arose directly out of his departmental duties, while others seem to have been labours of love. I am incompetent, even if I thought this a fitting occasion, to discuss these publications in detail. The *List* of the British Museum *Tenthredinidae* is almost the only one which bears (and that only to a limited extent) on my own particular studies. From a competent judge I hear that the *Revision of the Libellulina* (*Odonata*) was probably the best of Kirby's entomological works. The latest of them, I believe, was a *Synonymic Catalogue of the Orthoptera.*

Most of the above details, and also a remarkable notice of

Kirby's distinction in quite other fields of knowledge than that of Entomology, appeared—two days after his death—in the *Times* newspaper. He explored, and wrote as a specialist on, a great variety of subjects, ranging from Natural Theology and Biblical criticism, to the primitive Epic poetry and folk-lore of Finland and Esthonia, and the bibliography of the *Arabian Nights.* To think of him simply as an Entomologist gives a very one-sided and inadequate idea of his manifold activities, or of the position really held by him in the learned world. That, however, is the capacity in which he was known to most of us, and in which it is natural that he should be chiefly remembered to-night.

I pass on, therefore, to speak of his actual connection with our Society. It lasted over half a century, since his election as a Fellow was in 1861. Twenty years later he became Secretary; and after holding that responsible and laborious post till 1885, served for a year more on the Council. To the last, as many here will remember, he was a frequent and interested attendant at our Meetings.

His knowledge of entomological books was wonderful; and this (together with his interest in many branches of the science, and his position in the Museum) gave him frequent opportunities, of which he gladly took advantage, for rendering friendly help to all and sundry. I am tempted to dwell on recollections of my own—commencing with the day on which I first made acquaintance with the Insect-room, and received from Kirby precise and useful suggestions as to the books most likely to assist me in continuing a certain study, whose initial difficulties had almost inclined me to abandon it. But, instead, I will venture to quote an instance of his kindness towards a worthier recipient. Mr. Trimen allows me to tell you, that, when he published at Capetown the first Part of his *Rhopalocera Africae Australis*, Kirby (whom he had never met) wrote informing him of two new and important Continental books on African Butterflies, and enabled him to procure these works (which were afterwards of much service to him) on specially favourable terms. "And," adds Mr. Trimen, "this kindly act was the prelude to a long series of others, and to personal acquaintance of a cordial kind ever since."

Yet again—A young French naturalist, commencing a work, which is now the standard authority on its subject, wrote to Kirby, and asked—in ignorance of the Museum regulations—the loan of certain ancient "types." This of course was impossible; but what did Kirby? He replied, offering himself to examine and diagnose all the specimens; and to look specially into any question of their "characters," as to which his correspondent might wish information. And this he did—greatly assisting the author, and conferring also an obligation on all who use the book.

On these, and doubtless on many other like occasions, Kirby was thinking simply how he might best serve a colleague, but I believe that in some cases he may also have done real though undesigned and unsuspected service to the Museum itself. It is in every way to the advantage of such institutions that they should attract to themselves the interest and goodwill of a wide *clientèle* of outsiders, including experts, describers, travellers, explorers, and owners of great private collections (containing, it may be, authors' "types," unique specimens, and rarities of all kinds). And I say this, having in mind actual instances where cordial relations between officials of a Museum and an individual outside it have resulted in serious benefit to the Collections; and instances also of the reverse!

Edouard Brabant died at his native place, Cambrai, Nord, France, on November 29th, in his sixty-fourth year. He was an ardent Lepidopterist from his boyhood, and interested also—as I hear—in every branch of Natural History. He published several descriptions of *Noctuidae* from New Guinea. He was elected to our Fellowship in 1893.

Outside our own body the following Entomologists have passed away within the year, as well as others, doubtless, whose names have escaped my notice.

The Rev. Canon Thomas Blackburn of Adelaide, in S. Australia, but born in England, and one of the five original Editors of the Entomologist's Monthly Magazine. He was a foremost authority on Australian *Coleoptera*, and described many new forms. His "type"-specimens have recently been acquired by the Natural History Museum.

Peter Cameron, author of the celebrated *Monograph of the British Phytophagous Hymenoptera*, published in four volumes by the Ray Society. He was formerly a pioneer in the study of British *Hymenoptera*, and almost the sole investigator of certain obscure and difficult groups. His later writings have been very copious, but consist, I believe, almost exclusively in descriptions of new genera and species of Exotic Insects.

George Masters, a well-known Anglo-Australian coleopterist, Curator of the University Museum at Sydney. Albert James Fison, an English resident in Switzerland, and collector of Swiss *Lepidoptera*. William Rickman Jeffrey, a veteran Lepidopterist, whose name appears in the Supplement to the first published List of English Entomologists (Ent. Ann. 1857), and who aided Buckler in his study of Lepidopterous Larvae. Professor John Bernard Smith, New Brunswick, U.S.A.—distinguished in Economic Entomology, and also as an expert on the *Noctuidae*. H. E. Rudolf v. Bennigsen of Berlin, Coleopterist. Professor Meinert of Copenhagen, who had been in charge of the *Arthropoda* in the Collections of the University. Professor Th. Goetschmann of Breslau, Microlepidopterist. Dr. Shuguroff, a young Russian Orthopterist. Arnold Wullschlegel of Martigny, a well-known Lepidopterist.

The remainder of this Address I devote, as has been usual of late years, to a "Special" subject, and entitle it—

Secondary Sexual Characters of European and Mediterranean Aculeate Hymenoptera.

Secondary sexual characters have been defined by Darwin * as those which are "attached to one sex, but not directly connected with the act of reproduction." On this occasion I

* *Origin of Species* (Popular Edition), p. 111, also *Descent of Man*, (Second Edition), p. 207.

shall ask leave to use the term in a somewhat narrower sense, excluding (1) all concealed or *internal* characters, *i. e.* such as cannot be examined without dissection of specimens, and (2) characters which, though "attached to one sex"—in the sense that, in a particular species or group of species, one sex only exhibits them—seem clearly not to have been developed independently in it as an adaptation to its special bionomy, but to have come to it by Inheritance simply—as may be inferred from the possession of like characters by most other organisms of the same ancestry whatever be their surroundings and habits. Thus, inasmuch as Insects of all kinds and both sexes normally possess wings and ocelli, I shall not treat as a sexual character the presence of these structures in a ♂ Insect whose ♀ lacks them. To take an actual instance of this—*Mutilla europaea* ♂ has wings and ocelli, not because it is a *male*—not, therefore, as a character arising out of its *sex*, but simply because it is a normal Insect. Contrariwise, the absence of wings and ocelli in the ♀ of the same species is strictly a *sexual* character, an actual modification and alteration of the structures normally inherited in the group to which it belongs, and one which we have reason to think is adapted to the habits of that particular sex in that particular species. On the other hand, a spur-like appendage which is attached to the hind femur in ♂♂ only of *Panurgus calcaratus* (a Bee), which is not normally characteristic either of the Class or the Order or the Family or the Genus including that species, and which may be reasonably thought to serve a useful purpose in that sex exclusively of that particular insect—this and similar structures, attached to one sex only and demonstrably not merely inherited by it, may be set down without hesitation as simply and solely sexual characters. I do not think that this is a "distinction without a difference," but one always to be borne in mind in reasoning on the significance of characters in which the sexes differ. Such characters may be in any particular case either sexual *in their origin*, or sexual only in the sense that they are *in fact* limited to one sex because the other sex has lost them.

Among Aculeate Hymenoptera some of the best modern authorities include the *Chrysids*, and I should not have been sorry to do so here; but I find that the four groups *universally* reckoned as Aculeate (namely *Ants*, *Fossors*, *Wasps*, and *Bees*) will more than occupy all the time at our disposal. Indeed I am not sure that it would not have been wiser for me to exclude the Ants also, and limit myself to the more homomorphic trio of *Fossors*, *Wasps*, and *Bees*. But I did not realise this until my work had proceeded so far that it seemed too late to start afresh on a new plan. Accordingly, by "Aculeate Hymenoptera" I mean, for present purposes, (1) Ants, (2) Fossors, (3) Wasps, and (4) Bees.

It may make what I have to say more intelligible on a first hearing if I reverse the order which I should have preferred if this had been, not an Address, but a Monograph, and state first the general impressions left on my mind after as complete a survey as I have been able to make of the various ways in which the sexes of Palaearctic Aculeates differ, and afterwards some of the facts—not, of course, all, but such as seem to me the most curious or otherwise interesting—on which those impressions depend. Few, if any, of these facts are actually new, though at present they are for the most part recorded only in systematic works which none but specialists are likely to have consulted. And I may add that though I can claim no originality for my observations, at least they rest upon "Autopsy," *i. e.* except where I state the contrary, you may take it that I have examined the phenomena in actual specimens, and generally in long series of specimens, and that I am acquainted with almost all the Insects to be mentioned, in nature, and generally in life, and not merely in literature.

(1) I remark, first, that, whenever we know the life-history of both sexes of an Insect belonging to any of these groups, there is generally an obvious *probable explanation, on the ground of Utility*, to be given of the characters of *one* sex; and that the sex—whichever it be—which shows the useful characters, is the sex which, in that respect, has departed furthest from what Darwin calls "the type," *i.e.* from the normal characters of its ancestors and nearest relatives. Accordingly, the phenomena, as I interpret them to myself, quite support

what I suppose to be the orthodox view—namely, that the "characters" of an organism are partly a simple (practically unmodified) inheritance from its ancestors, and partly modifications of that inheritance which are beneficial to it in view of its bionomic requirements.

(2) My next generalisation is, that male and female modifications of structure usually *differ in their apparent object.* Those of the ♂ most commonly indicate adaptation to one single duty of that sex, viz. pairing, or rather to the preliminaries of pairing. But I never receive such an impression from examining secondary ♀ characters. These seem always adapted towards the subsequent activities of an insect which has "paired" already—as *oviposition, preparation of a receptacle* for the egg, *provision of aliment* for the larva, etc. They are beneficial to her, not as a candidate for matrimony, but as a mother and nurse by anticipation; in short, for certain *post-nuptial duties* peculiar to her sex.

When I first began to think of the matter I had no expectation that I should find any such regular distinction between the characters of the two sexes. But, on reflection, the thing seems likely *a priori.* There is, perhaps, just *one* Activity which (except in the case of some *Social* species, e. g. *Apis mellifica* *) is practically quite identical and provided for by similar "characters" in both sexes of every Aculeate. Its males and females *feed themselves* alike, visiting the same favourite flowers and extracting their juices in the same manner, any differences that may exist in this respect being generic (or occasionally specific), but not sexual. Hence, though the mouth-parts of all Aculeates are much modified for this activity, and the modifications differ considerably in different genera, and to a less extent in different species of the same genus, they hardly ever yield a *Sexual* character. But almost all their other instincts belong to one sex only. It is the ♂ only—and this is almost his only duty!—which seeks

* Describing the difference between a Hive-bee Drone and his Queen and Worker-sisters, Mrs. Comstock remarks: "His tongue is so short that he must needs eat from honey stored in a cell or be fed by his sisters, since he could not possibly extract honey from a deep flower."—*How to keep Bees*, p. 35. (An exception which may be said to prove the general rule!)

and courts a mate: it is the ♀ only which oviposits, nidificates, and procures and stores food (animal or vegetable) for its young. So it seems quite natural that the sexual modifications of ♂ structures should point as a rule to pairing, and those of the ♀ to the duties which are subsequent to it.

(3) Protection *of the individual* (*e. g.* Cryptic and Aposematic Coloration, etc.) seems to account for a few, but only a very few, of the strictly sexual characters of Aculeates. Wallace appears to go further than this, and to imply that in this group there is no need and no development of protective characters at all; for he remarks that "the two sexes of the stinging Hymenoptera are equally well coloured," * and, again, that "there is not a single instance recorded in which any one of them is coloured so as to resemble a vegetable or inanimate substance." † Neither of these statements, as it seems to me, and as I shall presently try to show, is true without exception. But the exceptions (at any rate as far as *Sexual* characters are concerned) are undoubtedly few; though one at least, which I shall discuss later, appears to me both certain and striking.

(4) Not only in their apparent *purpose*, but in several other respects, the secondary sexual modifications of structure of Aculeate ♂♂ differ remarkably, as it seems to me, from those observable in ♀♀ of the same group.

They differ (*a*) in being more *diversified*, less restricted to particular parts of the body, and more various in themselves: (*b*) in being more *paradoxical*, i. e. departing further from the normal characters of the group: (*c*) in being more *sporadic*, *i. e.* appearing (so to speak) suddenly, here and there, in particular species or small groups, and often (when they occur similarly in more cases than one) shared by this or that species, not with its nearest congeners, but with insects much more distantly related to it; whereas characters distinctive of females generally run more or less uniformly and continuously through whole genera or even larger groups, and are very seldom peculiar to the ♀♀ of a single species: (*d*) in being for the most part *altogether unrepresented in the other sex;* whereas ♀ characters are mostly little more than augmentations of some

* *On Natural Selection*, p. 114. † *Ibid.*, p. 72.

feature existing, rudimentarily at least, in the ♂♂ also, and some of the few ♀ characters which can really be called paradoxical, and which stand in evident relation to definitely female activities, appear, after development in that sex, to have been transmitted more or less completely to the other sex also.

(5) A rule which Darwin has described * as one of "high generality," and as "applying very strongly to Secondary Sexual characters," is stated by him as follows:—"A part developed in any species in an extraordinary degree or manner in comparison with the same part in allied species tends to be highly variable." I cannot satisfy myself that this rule applies, at all generally, to the Sexual characters of the Aculeates. Some of the most paradoxical ♂ characters of antennae, legs, etc., are anything but variable:—they agree through long series of specimens literally to a hair. Nor can I see, that the excessively developed pollen-bearing ♀ apparatus in certain genera of Bees (*Dasypoda*, *Bombus*, *Apis*, etc.) is at all more variable than the corresponding parts in *Prosopis*, *Sphecodes*, etc., which are scarcely modified at all for that purpose. Exceptionally, I admit, certain paradoxical characters, both of ♂♂ and ♀♀ (as the genal spines in some *Andrena* ♂♂ and the abnormally developed mandibles of *Osmia latreillei* ♀), are extremely variable. But, on the whole, I do not find that there is any correspondence, in this group, between the greater or less *abnormality* of secondary sexual characters and their *variability* in individual specimens.

(6) Nor do the sexual characters of Aculeates appear to me to follow another rule laid down in the *Origin of Species*,† viz. that "the secondary differences between the two sexes of the same species are generally displayed in the very same parts of the organisation in which the species of the same genus differ from each other." For instance, the most obvious secondary difference between the *sexes* of any *Vespa* or *Halictus* species is the much greater length of the ♂ antennae. But in separating *species* of *Vespa* or *Halictus* from one another the antennae scarcely help us at all: the characters useful for

* *Origin of Species* (Popular Edition), p. 111.
† *Ibid.*, p. 115.

that purpose are such as are common to both sexes (colour, pilosity, puncturation, etc.). Again, in many species of *Anthophora*, *Eucera*, etc., the middle legs of the ♂♂ differ extraordinarily from those of their females; but in other ♂♂, and in all the ♀♀, the characters of the middle legs are in no way remarkable, and are seldom, if ever, employed to distinguish one species from another.

I do not mention these apparent exceptions to Darwin's rules with any idea of questioning the general applicability of the rules themselves to the Animal Kingdom as a whole. But it certainly seems to me, that the case of the characters now under consideration presents a remarkable exception to them, and one which I ought not to leave unnoticed.

I have now to attempt such a description as the time at our disposal will permit, of the phenomena—or rather of some of the phenomena—summarised in the above generalisations. Merely for the sake of convenience I shall divide them roughly into Structural and Coloration-characters, and subdivide the latter according as they appear in the integument, or the pilosity, or elsewhere; but I do not attach importance to this classification, for Colour is really dependent in many cases on facts of Structure, and even where actual pigment is present (which is not always the case) the colour-effect produced does not always entirely depend upon it.

However, commencing with *characters independent of colour*, such as would generally be reckoned as Structural in the strictest sense of the word, let us take, first, one which runs throughout the whole group, and, in fact, appears to have originated before the separation of the Hymenoptera from other Arthropodous animals,—*the greater size of the Female.*

Female Aculeates are almost always larger than their males, but (except in some Ants) hardly paradoxically so. In fact, in many genera the difference is slight, and hardly to be appreciated except in long series of both sexes.

This general rule has become well known, because it had the good fortune to attract the notice of Darwin, to whom it was communicated (as he tells us) by Frederick Smith. He cites (also on Smith's authority) four cases of exceptions to it among the Aculeates:—viz. *Apis mellifica* (the Hive Bee); *Anthidium manicatum, Anthophora acervorum* (Solitary Bees); and *Methoca ichneumonides* (a Fossorial Wasp, which was formerly reckoned among the Ants). He then proceeds as follows:—"The explanation of this anomaly is that a marriage-flight is absolutely necessary with these species, and the male requires great strength and size in order to carry the female through the air." *

For the credit of Hymenopterists I am sorry to say that the specialist consulted by Darwin did not state the facts correctly. The ♂♂ of the Hive Bee and of *Anthophora acervorum* are *not* larger than their ♀♀! † The premises being partly wrong, it is not surprising if the conclusion be unsatisfactory: and I must own that Darwin's explanation—if indeed it be Darwin's, and not, like the premises, received by him from F. Smith—appears to me quite untenable. If he had had the complete facts before him, I feel sure he would have concluded, that—certainly in *Anthidium* and almost certainly in *Methoca*—the character selected by Nature was not *largeness in the male* but *smallness in the female:* and that the explanation of these exceptions to the general rule had nothing to do with the so-called "marriage-flight."

First let me state the actual facts.—In two Fossorial Genera, viz. *Methoca* and *Myrmosa*, and also in several species of the allied genus *Mutilla*, the size of both sexes (but the ♂♂ especially) differs much in individuals, but the ♂♂ on an average are certainly far larger than their ♀♀, and the latter (as compared with average ♀♀ in the same Family) are generally rather dwarfish insects. Again, in *Anthidium manicatum*, and also in most of the larger (but N.B. *not* in the smaller) species of the same genus, the ♂♂ vary in size enormously, but the ♀♀ very little;—the largest ♀♀ are about as large as the smallest ♂♂, but their maximum size never reaches the *average* size of the other sex.

Prima facie these facts seem to me to suggest, that great

* *Descent of Man* (Second Edition), p. 279.

† Of course the Hive-bee Drone is larger than the *Worker*, but his true Female (the Queen) is larger still. The sexes of *A. acervorum* (i.e. *pilipes*) differ little in size, but on comparing a long series of both sexes I find the ♀♀ on an average a little larger than their ♂♂.

size is undesirable in the Females, but that the size of the Males is unimportant.

Now as to the "marriage-flight." This is certainly not a monopoly of these particular species. The phenomenon commonly known as a "marriage-flight"—the soaring together of both sexes high into the air—has often been observed and described, more especially in the case of *social* Hymenoptera (*e.g. Formica, Myrmica*, etc. (Ants), *Vespa* (Wasps), *Bombus* and *Apis* (Bees), but we do not find that it involves in any such case an increase of size in the ♂. Take the Ants—the ♂♂ in some Genera, e. g. *Formica*, are about as large as their ♀♀, but more often smaller—sometimes (*e.g.* in *Lasius*) paradoxically so, and in no Genus (I believe) larger. Take the Wasps and Bees—the ♀ is the larger sex both in *Vespa* and *Bombus*: of *Apis* I have already spoken. If it be assumed that a "marriage-flight" like that of the Social Aculeates is an absolute necessity to *Myrmosa*, *Methoca*, etc., then, since the ♀♀ of these insects are apterous, great size and strength might no doubt be an advantage to their ♂♂. But (1) we have almost no evidence as to the details of pairing in these comparatively rare insects; (2) in many of the species nearest to them the ♀♀, though apterous, are as large and strong as their ♂♂, and (3) a "marriage-flight" cannot be necessary to *Mutillidae* as such, for in some of them both sexes are apterous! Again, in *Anthidium* there seems no more reason why the ♂♂ should be specially adapted to carry the ♀♀ through the air, than in any of the Genera nearest to it (*Osmia*, *Megachile*, etc.) where certainly no such adaptation occurs. *Anthidium* ♀♀ are strong and rapid flyers, and if a "flight" were necessary, they could quite well take their share in it. But I even doubt if such a "flight" occurs at all! I have never seen anything like it, though I have often seen *Anthidium* spp. pairing. The ♀ hovers in the air like a *Syrphid*: the ♂ pounces on her, and the two generally come tumbling into the herbage, and remain there (unless my memory deceives me) till they part. There is absolutely, so far as I know, nothing of so special and distinctive a character about the pairing of *Anthidium*, as to necessitate a reversal of the normal proportion in size between the sexes.

But in the special nidificatory habits of *Anthidium* ♀ I see a very good reason why (in the *larger* species especially) there should be *a limit to the magnitude of the* ♀♀. These insects nidificate, not in holes excavated by themselves, which might be of any size, but at the bottom of ready-made tubes of more or less equal and fixed dimensions,—the empty shells of certain particular snails, or the hollow stems of certain particular plants (e. g. *A. manicatum* has been recorded as utilising the hollow stems of *Heracleum* for this purpose, and lining their interior with down scraped from some woolly plant). It would clearly be convenient for a ♀ with such habits *not to exceed a certain size:* but for the ♂ this would matter less, since he need never enter such tubes again after his first emergence from one as an imago. *His* possible size is probably only limited by that of the particular stem in which he has been reared! If the species were naturally a large one, a reduction in the average size of the ♀♀ might well arise by Variation and become fixed by Selection. But in the smaller species such reduction would probably be needless, and would therefore not occur. And this is exactly what seems to happen. (It may be noted, also, that in the various spp. of *Stelis*, which seems to be a smallish parasitic offshoot of the *Anthidium* stock, the ♀♀ are usually larger than their ♂♂.) So I believe that here we have, not a ♂-character, but a ♀-character to be explained, and that, as usual, it is to be explained by the *post-nuptial duties* of that sex.

Probably the case is not very different with the ♀♀ of *Methoca*, etc. These insects generally occur running among sand, broken ground, stones, roots of plants, etc., and disappearing suddenly into any crack or crevice that they meet with, as though in search of some hidden object. They are believed to feed their young with larvae which they find in their researches underground. *Methoca*, I am assured on good evidence, attacks the larva of the Tiger-Beetle *Cicindela*. Such habits would be favoured by the absence of wings and somewhat diminutive size, as they are in the Worker Ants, among which the *Mutillidae* were formerly reckoned. But to the ♂♂, who visit flowers and need never traverse narrow passages, Wings would be an advantage not to be surrendered, and Size comparatively a matter of indifference.

I will now ask your attention to a number of ♂ characters, all of which seem to me explainable as facilitating the preliminaries of pairing. These preliminaries are summed up under four chief heads in a passage in Darwin's *Descent of Man*, which I will try—retaining as nearly as possible his actual words—to condense into a single sentence. *Throughout the highest sub-kingdoms of animals, the Arthropoda and the Vertebrata, we find males provided with special organs for Discovering, Reaching, Charming, and Securing the females.* Of these four categories I think that the first and third (Discovering and Charming) have played by far the most important part in modifying the structures of ♂ Aculeates. It may be, and it probably *is* the case, that the extreme swiftness of flight and general agility and mobility of many ♂♂ in this group has been developed as an advantage to them in Reaching their partners; but I can quote no instance in which the characters either of their legs or their wings show any obvious special modification for that purpose. There are a few instances of ♂♂ in the *Scoliidae* and *Tiphiidae* (Fossors) whose alar neuration is slightly more complete than that of their ♀♀. But the mechanical consequences, if any, of these differences are quite uncertain; and I have reasons for thinking, that in these cases the ♀ neuration has been reduced, rather than that of the ♂ augmented. Some ♂ legs, again, are abnormally long —front-legs in a group of *Gorytes* spp. (Fossors), middle legs in many *Anthophora* spp. (Bees), etc., etc.—but I do not believe that in any of these cases they enable the ♂ to "Reach" his ♀ more quickly. *Securing* the ♀—*i. e.* seizing her, and retaining her when seized—may perhaps (as Darwin has suggested) account for certain paradoxical leg-characters, *e. g.* the extraordinary front-legs of *Crabro cribrarius*. But I confess to grave doubts whether these and many similar eccentricities (not to say *malformations*) of particular leg-joints in ♂ Bees and Fossors would not rather diminish than increase their efficacy as grappling-instruments. And besides, all that I have seen or heard from other eye-witnesses convinces me that it is normally not with the *legs*, but with the *mandibles*, that a ♂ Aculeate seizes and secures his mate. Now, if we examine the various forms of ♂ mandibles in Aculeates, we find that they are sometimes more or less paradoxical; but it is generally difficult to recognise in them any clear special adaptation to the function of seizing a ♀. It is true that in some cases, e. g. *Ammophila*, the great length and sharpness of the ♂ mandibles might suggest such an adaptation; and I have in my collection a ♂ *Ammophila* actually holding a ♀ in this manner. But the Ant *Formicoxenus* ♂ grasps his mate exactly in the same way; and his mandibles are, on the contrary, quite absurdly short and truncate. (When they are closed, their tips scarcely meet across the mouth!) So that the suitability of these organs to act as a forceps cannot apparently be measured by their length or sharpness. Again, a "tooth" or spinose process on the lower side of the mandibles is sometimes a ♂ character (*Andrena apicata*, *fucata*, *lapponica*, etc.), and this might conceivably improve their *grip* in certain cases. But the phenomenon is not a very common one, and, as well as the cases of unusually long and sharp ♂ mandibles, may possibly be connected (as Darwin explains the latter in *Ammophila*) with the pugnacity of rival ♂♂ (cf. stags' horns, boars' tusks, etc.). I do not, however, remember to have myself ever seen them so used, but only for holding the ♀.

Charming, taken in a very wide sense, as including all ways in which a ♂ may dazzle, or fascinate, or attract, or establish an understanding with a ♀, by appealing to some sense or susceptibility peculiar to that sex in a particular species, might account (as it seems to me) for almost any one of the ♂ characters hereafter to be described. Some of them, however, consisting in exceptional size or complexity of structures which are known to be sense-organs, might come more naturally under the category of *Discovering*.

For instance (1) the eyes of ♂ Aculeates are generally larger than those of their ♀♀, *e. g.* in most Ants, in several *Bombus* spp. as *confusus* and *mendax* (Bees), in *Tachytes* and *Tachysphex* spp. (Fossors). They, consequently, sometimes appear very prominent and convex in the frontal view; sometimes they approach very near to each other at the top of the head (making the so-called "frons" or forehead much narrower than in the ♀); and sometimes they actually *meet* there, forming (in the frontal view) a complete arch. This occurs in the ♂ of *Apis* (the Hive Bee) and also in those of two Fossorial Genera, viz. *Astata* and *Homogambrus*. The ♀ eyes of all these insects are normal.

(2) The ♂ antennae (also, of course, sense-organs) are generally longer than those of the ♀♀, and have further almost always one more joint (13, as against 12, in Fossors, Wasps, and Bees; but the numbers vary in various Ants). It is, by the bye, rather curious that neither in the Sawflies, nor the Chrysids, and perhaps in no Hymenopterous groups outside the Aculeates, is a difference in the number of these joints a Sexual character.*

In several cases, e. g. *Scolia* (Fossors), *Vespa* (Wasps), *Eucera* and *Halictus* (Bees), the antennae of the ♂, though not otherwise abnormal, are inordinately long as compared with those of the ♀, distinguishing the two sexes of most species at a glance. But many ♂ antennal-characters are thoroughly paradoxical. The last joint is sharply *inflexed* and becomes a sort of hook in some Wasps (*Odynerus* spp. of the Groups "*Ancistrocerus*" and "*Lionotus*," also *Eumenes*, etc); it is sickle-shaped in *Sphecius*, and some spp. of *Bembex* and *Stizus*, also in *Didineis* (Fossors), and in certain *Osmia* spp. (Bees). Three or more joints at the apex of the ♂ antenna are rolled up into a knot-like entanglement in *Dinetus* (Fossors), *Odyneri* of the group "*Hoplopus*" (Wasps), and *Systropha* (Bees); again the middle joints, or some of them, are strangely excavated, denticulated, produced into spinose processes, tuberculate, clothed with curious pilosity, or otherwise eccentric, in ♂♂ of various Genera or Species, these peculiarities being so constant in each species as to be absolutely relied upon by systematists. Such phenomena are prevalent both in Bees and Fossors, but especially in the latter. Again, in many *Prosopis* ♂♂ (Bees) the "scape" or basal antennal-joint is extravagantly dilated, and often (as though to call attention to it) peculiarly coloured, in front, but not behind! Lastly, one Pompilid Genus or Subgenus, viz. *Clavelia*, has the ♂ antennae "pectinate," a character almost unparalleled among

* See Note A. at the end of the Address.

Aculeates, but not rare in Sawflies, and occurring also in certain ♂♂ of Lepidoptera and Coleoptera, which (I am told) are known to have extraordinary powers of discovering their ♀♀.

In these, and indeed in all cases, the antennae of ♀ Aculeates are practically quite simple; or, if in the least abnormal, their characters are evidently not Sexual but Generic.

There can be little doubt that most, if not all, of these ♂ antennal-characters increase the efficiency of the antennae as sense-organs, and enable their possessors to discover the ♀♀ at a greater distance. The latter never seek their ♂♂, and therefore neither require nor possess antennae or eyes specially adapted for discovering them.

But inasmuch as some Hymenoptera (*e.g.* Ants) certainly use their antennae not only to *receive* sensations but to *impart* them, it seems not impossible that paradoxical formations of these structures might also render communications made through them more persuasive to ♀♀ possessed of certain specific sensibilities, just as some peculiarity in the larynx of a ♂ Vertebrate might give his voice a particular quality or *timbre* which might be agreeable to the ear of his ♀. (Cf. the Songs of Male Birds.)

(3) Now as to characters in the ♂ legs. These in the Ants are not conspicuous. But in many species of all the other families they are so diversified, and often so extraordinary, that it is quite impossible to discuss them adequately when time is limited.

We find that in ♂♂ of one species or another of Bees, Wasps, or Fossors, and sometimes pretty similarly in species belonging to different groups, practically every joint of every leg may be distorted into some eccentric but unvarying shape, twisted, flattened, paradoxically lengthened or shortened, armed with tooth-like tubercles, spurs, spines, etc., excavated beneath, drawn out at the apex into a sort of tongue- or finger-like process, etc., etc. In connection with these phenomena, or apart from them, really startling pilosity-characters appear in many cases, making even normal structures look quite monstrous. I can only pick out a few examples at random, and leave the rest to be imagined.

Several spp. of *Crabro* and *Bembex* (Fossors), *Megachile*

(Bees), etc., have some of the middle joints of the front legs (tibiae, metatarsi, etc.) extravagantly *dilated* (often "shield-like"), they may be also curiously *fringed*, and are often *coloured* very strangely, or so *thinned* as to become almost membranous. The *front* coxae in some *Cerceris* spp. (Fossors), and likewise in various spp. of *Megachile* and other genera of Bees, are produced spinosely at the apex. The same is the case with the *middle* coxae of certain *Odynerus* spp. (Wasps). In other *Odynerus* spp. the middle femora are excavated beneath so as to appear in certain positions tridentate; the middle tibiae in some Fossors and Wasps are eccentrically narrow at the base and dilated near the apex. The middle metatarsus in *Sphecius* (a Fossor) appears, in all known species, outrageously deformed. The same joint, and the middle tibia also, are most eccentrically constructed in one group of *Eucera* spp. (Bees). *Bembex* spp. have often the middle femora sharply denticulate along the lower margin. In *Nomia* and *Anthophora* (Bees) the *hind* legs often show monstrous dilatations, incrassations, and distortions of particular joints. Certain *Stizus* spp. have a fine hair-like spine depending from the hind femur. *Panurgus calcaratus* has a stout spur-like appendage under the same joint, and its congener *P. dentipes* is similarly armed, but on the hind *trochanter*. Thorn-like teeth or tubercles occur on the front femora of one *Odynerus* (*caroli*), the hind tibiae of another (probably undescribed), and one or other of the leg-joints in various Bees (e. g. *Eucera* and *Anthophora* spp.). Some *Anthophora* spp. again have the middle tarsi very elongate, and either their basal or apical joint, or both (but never any other), carries in front or behind (or both in front and behind) a sort of fan formed of rigid hairs, recalling in its outline and general appearance the tip of a peacock's tail-feather. There is a somewhat similar character in the apical joint of the *front* tarsi in *Gorytes fairmairei* ♂ (a Fossor).

In many Genera, and perhaps in some species of all Genera, this strange group of characters is entirely unrepresented. But whenever they occur, their forms are so constant and characteristic in every case, that they are practically infallible guides to a specific "determination."

How exactly each of these characters is beneficial, can often only be conjectured. But as none of them exist, or are even indicated, in the ♀♀, I feel little doubt that they all relate to the one specially male duty, viz. Pairing.

I have long been convinced that *hairs* of insects are frequently *sensitive*, and that, accordingly, limbs exhibiting *pilosity*-characters which would otherwise seem inexplicable, may probably be not locomotive* organs simply, but receptive of sense-impressions, and communicative of information subsidiary to that received from eyes, antennae, palpi, etc. In that case many ♂ leg-characters would come under Darwin's Category of "Finding the ♀." Others, as the tooth-like and thorn-like processes, might help to grapple † and "secure" her. But this, as I have said, appears to be mainly the work of the *mandibles*. And I suspect that both antennae and legs may be much employed in (and adapted for) various *caressing* or invitatory actions, which are agreeable to the ♀, or at any rate have influence over her, somewhat as an Aphid stroked by an Ant's antennae consents to produce her honey-dew—whether charmed or pestered into consenting, who shall say? Not knowing what may be the special susceptibilities of this or that ♀ Aculeate, I can only offer vague conjectures. But it seems *possible*, at least, that some paradoxical feature in the antennae or legs of the ♂ might appeal persuasively to the ♀'s sense of sight, or touch, or to some other sense, which we Vertebrates do not possess and cannot definitely conceive. And if so, the character would come under the Category of "*Charming*."

Male Aculeates have certainly in some cases a power of influencing their ♀♀ by appealing to special sensibilities in the latter. It has long been observed that the ♂♂ of some Bees (e. g. *Bombus* and *Psithyrus* spp.) emit agreeable and characteristic scents, and Mr. Sladen's recent observations make it clear that these odours are recognised and enjoyed by

* That legs of insects are not always merely locomotive organs seems certain. It is stated on good authority that some *Orthoptera* have *auditory* organs in the legs; that some *Diptera* undoubtedly use their front-legs as *feelers*; that some *Coleoptera* have amazingly long front-legs, unsuitable for walking and not applied to that purpose, but held aloft and brandished about *like antennae*, as the insects move: etc.

† See Note B. at the end of the Address.

♀♀ of their own species. He finds * that this fragrance proceeds from the head; but its use is no doubt analogous, though the manner of production differs, to that of the scent-scales in certain ♂ Lepidoptera, which have been made familiar to most of us by the investigations of Dr. Dixey and Dr. Longstaff.

(4) Another curious group of ♂ characters occur in the ventral-plates, and the apical and subapical dorsal-plates, of the abdomen. Some of these, however, are not external characters, the plates exhibiting them being "telescoped" out of sight; and others are so evidently connected with the structure and position of the Reproductive organs that I will not now discuss them. But some even of the *basal* ventral-plates are paradoxically formed in many Aculeate ♂♂, *e.g.* spp. of *Palarus, Stizus* and *Bembex* (Fossors), *Masaris* (Wasps), *Osmia*, *Eriades*, and *Halictoides* (Bees). Also, the apical *dorsal*-plates show strange characters (teeth, spines, excisions, foveations, etc.) in some ♂♂ of Bees and Fossors, as *Cerceris, Anthidium, Osmia, Megachile, Eriades,* and especially *Coelioxys.* Their ♀♀ show no such characters. (But it may be remarked that in the *Chrysids* we find similar characters occurring as a rule in both sexes equally, a fact for which, so far as I know, no explanation has ever been suggested—nor can I suggest one.)

The ♂ abdomen in Aculeates normally shows one more fully chitinised dorsal-plate than that of the ♀ (7 against 6). This, like the corresponding difference in the number of antennal joints, is not characteristic of Hymenoptera generally. For in Sawflies the ♀ shows one more dorsal-plate than the ♂ (8 against 7), and in Chrysids there are generally three such plates only in both sexes, except in *Cleptes* (♂ 5, ♀ 4) and *Parnopes* (♂ 4, ♀ 3). This is rather a question of the "telescoping" of segments one within another than of their actual number, and can hardly be discussed without reference to internal characters and the structure of the Reproductive System, so I pass it over, and proceed to consider external characters peculiar to females.

(1) Their sense-organs (eyes and antennae) generally show

* Sladen, *The Humble Bee* (Macmillan, 1912), p. 13.

no such characters at all, except in a *negative* sense, *i. e.* in being obsolete or obsolescent. Some ♀ Ants (as *Dorylus*) have neither oculi nor ocelli, and the latter are wanting in many workers (= imperfect females) of this group, and in the ♀♀ of most *Mutillidae*. All these creatures are apterous and live much underground, so that partial or even total blindness may be no great disadvantage to them. The antennae of most ♀ Pompilidae curl up in a peculiar fashion after death; but so, to some extent, do those of the ♂♂, though less so—perhaps only because they are stouter and less tapering at the apices. The actual joints which curl thus are perfectly simple, and cannot be called paradoxical in either sex.

(2) In the mandibles, however, we find certain more or less striking special developments, which may be called real sexual characters of a positive kind, and in these we can often recognise a probable adaptation to duties which the idle ♂ escapes. Some ♀ Aculeates have to excavate burrows in substances at least as hard as wood, chalk, and sandstone—it is even recorded that one Bee has been known to perforate a leaden bullet. In such cases one would expect and one finds mandibles developed for strength and sharpness, and occasionally reinforced by special "processes" either on themselves, or on the parts adjoining (genal horn-like projections, dilatations of the mandibles at their base, etc.). Again ♀♀ of *Scolia* spp. have enormous jaws, which at first sight might seem *raptorial*—designed to carry off the large *Cetonia*-larvae on which they feed their young. Fabre, however, tells us that in fact these insects do not *carry off* larvae, nor form burrows for their reception. But the strong development of their mandibles becomes quite intelligible, when we learn from the same author, that *Scolia* ♀♀, though they do not make burrows *of their own*, perform even severer work of a similar kind, by boring (almost like moles) in various directions through hard soil in search of buried *Cetonia*-larvae, and ovipositing on them when and where they find them. Other Aculeate ♀♀ use their mandibles raptorially, dragging about victims often much larger than themselves, and in a few cases (*Bembex*) crushing and mangling them to some extent with the same organs. Leaf-cutting Bees which also excavate hard wood

(*Megachile* spp.) need and possess jaws modified to act as "scissors" and also as "chisels" or "gouges." Wasps procure material for the "paper" of which they form their cells by gnawing off and carrying away fragments of wood from posts and palings, etc., etc. Many of these entirely ♀ occupations require not only special development of the mandibles, but of the muscles which move them, and consequently of the size of the whole head: and of this we find frequent instances both in Bees and Fossors (spp. of *Osmia*, certain *Halicti*, many *Scolia* and *Cerceris* and *Philanthus* spp., etc.). It is, however, only by exception that the characters actually become paradoxical.

Another cause tending perhaps in some cases to increase the size of the ♀ head, is a greater development of the *brain* in that sex, corresponding to the much greater complexity and variety of the ♀ instincts. Ants, whose ♂♂ (as compared with their ♀♀) are generally "microcephalous idiots," may be a case in point. The following fact is curious and apparently isolated. I cannot explain, but ought not to ignore it. The *female only* of a single *Cerceris* (*komarovi*) has the back of the head, behind the eyes, armed with a thorn-like tooth. Something similar occurs in *males* only of a Crabronid sp. (a *Lindenius*), and in *both sexes* of another Crabronid (*Hoplocrabro quadrimaculatus*).

The curious elevation and projection of the clypeus in certain *Cerceris* ♀♀ (*ferreri*, *labiata*, *conigera*, etc.), suggesting sometimes a pick and sometimes a spade or shovel, seem likely, as well as the adaptations of mandibles already mentioned, to assist the insects in their digging operations. The same may explain the so-called "horns" on the faces of some ♀ *Osmiae* (*rufa*, *tricornis*, etc.).

(3) The legs of ♀ Aculeates show in various groups characters which obviously indicate the special industries of ♀♀ in that group, but generally consisting rather in modifications of the pilosity ("spines" as well as "hairs" being included in that term) than of the actual shapes of joints, such as we have encountered in the case of many males. Beginning with Industrious Bees, we have a number of Genera in which the actual leg-joints differ little in the sexes,

but the pilosity of certain of these joints is immensely developed *in* ♀♀ *only* to form a brush or "scopa" for accumulating pollen. In the highest of such Bees (the Social Genera) we find also paradoxical modifications of the joints themselves (especially the tibiae and metatarsi of the 3rd pair) which would be unintelligible, if we did not know that they were employed for this particular industry. But, strange to say, many of these latter characters appear in both sexes, though they must be almost useless except to the ♀♀. H. Müller asserts that in *Bombus* the pollen-collecting apparatus developed in the ♀ is transmitted from that sex to the ♂, and this statement greatly interested Darwin who wrote * to him, "What an admirable illustration you give of the transference of characters acquired by one sex—namely, that of the ♂ of *Bombus* possessing the pollen-collecting apparatus." Really, however, the transference is incomplete; for *Bombus* ♂ does not possess what Mr. Sladen † has recently shown to be an essential part of the ♀ and ☿ pollen-collecting apparatus, viz. the so-called "auricle," or dentiform process which arms the base of the metatarsus. The case of the Hive Bee *Apis* is more curious still. For here neither the Male nor the Female leg, but only that of the Worker, possesses an *auricle*, or a true pollen-basket (*corbicula*). In this Genus the Division of Labour has been carried further than in *Bombus*. Its Queen is, as Mr. Sladen puts it, a "mere machine for laying eggs," and never gathers pollen at all. Her legs, which are practically identical with those of the male, are in fact, just as in the latter sex, a fraud! They have the general appearance of a "pollen-collecting apparatus," but lack details which are essential to it. The Workers, however, *have* such an apparatus, differing hardly at all from that of *Bombus*: which, being normally sterile, they cannot have developed for themselves, but must have received from their parents (Drones and Queens). From these facts a curious conclusion appears to follow, namely that (*a*) a structure was developed in the ♀♀, and afterwards transmitted in part to the ♂♂, of the stock from which

* *More Letters of C. Darwin*, Vol. II., p. 97.
† *The Humble Bee*, p. 22.

both *Bombus* and *Apis* are offshoots; (*b*) the ♂♂ of both the latter Genera have inherited the imperfect structure of the ♂♂ in the parent-stock; (*c*) the ♀ of *Bombus* has retained the *complete* structure, and transmits it to her Worker offspring; and (*d*) the ♀ of *Apis* has ceased to develop it in herself, but retains it as a *latent* character, since she transmits it to her offspring.

The legs of ♀ and ☿ Ants and Wasps show no striking characters. Their sole use seems to be for locomotion, and if modified at all (as by abnormal elongation) the advantage gained no doubt is simply *speed*. But in Fossors the ♀ legs are often evidently indicative of their habits. Species which, like Pompilids, fly little, but run and skip over herbage in pursuit of wingless prey (spiders, etc.), which they afterwards drag into their burrows, often have the legs (especially the hind-pair) remarkably elongated. Others which prey on flying or leaping victims (Diptera, small Lepidoptera, Orthopterous and Hemipterous "nymphs," or even other Hymenoptera), fly more, and run less, both in seeking and bearing home their prey. In such (e. g. *Bembex*, *Tachytes*, *Oxybelus*, *Astata*, etc.) the legs are mostly short, but stout and armed with many short stiff spines which may act perhaps as grappling-instruments. Again, practically all *Fossorial* ♀♀ have much work to do in clearing sand, sawdust, and débris of all kinds, out of their burrows; and many of them are assisted in this work by possessing a sort of "rake" of long subequal spines (called the "pecten") on their front-tarsi; and other spines, or serrations, or rasp-like denticulations, on the *hind-tibiae* especially, but also on these and other parts of all the legs. *Ammophila* ♀♀ at work can be seen to carry out armfuls (as it were) of sand; and wood-boring *Crabronidae* kick out backwards a stream of fine sawdust, as they penetrate into a stump or a paling. Thus, in one way or other, all these leg-characters in the ♀♀ seem accommodated to *maternal industries;* and if present (as sometimes happens) in the ♂♂, are attributable, probably, either to Inheritance simply, or to Transmission, or to Adaptation for Pairing.

(4) The ♀ abdomen presents few conspicuous Sexual characters in Aculeates of any kind. Its dorsal apex will

sometimes distinguish a ♀ as belonging to a particular genus or species (e. g. *Coelioxys*); but when it differs conspicuously from that of the ♂, it is generally because it is *simpler* (nearer the "type" of its group), so that it is really the ♂ which shows the Sexual character.

Probably the clearest and most important case of a true sexual ♀ character in the abdomen is the development in certain Bees (*Osmia*, *Megachile*, *Anthidium*, etc. = the sub-family of the "*Gastrilegidae*") of *extreme pilosity on its ventral surface*, which answers the same purpose as the pilosity of the hind-legs in other Bee-genera—viz. to form a brush for accumulating pollen. But even this is only an augmentation of the specific pilosity inherited by both sexes.

I know no case of paradoxical teeth, spines, etc., such as often occur in ♂ ♂, on the dorsal apex of any ♀ Aculeate; and only one (which I have read of but not seen) of such characters being conspicuously developed on the *ventral* surface of a ♀ abdomen. This is the case of a Fossor (*Stizus gynandromorphus*, Handlirsch); and as only a single specimen seems to have occurred, and its ♂ is unknown, one is tempted to suspect it may be a monstrosity.

The difference as to the number of visible segments in the ♂ and the ♀ abdomen has been mentioned already; and if this difference, and the simpler structure of the dorsal and ventral apical segments of the ♀, be excluded, I do not know that any important Secondary Sexual character occurs in the abdomen of any ♀ Aculeate, except the ventral pollen-brush of the *Gastrilegidae*, and possibly the spine-like last ventral segment of *Coelioxys* ♀, which perhaps facilitates its parasitical ovipositions.

(5) *Apterous* Aculeates occur only among the Ants (whose workers are always in this condition), and in one group of Fossors (the *Mutillidae*). All European and Mediterranean *Mutillidae* have wingless ♀ ♀; and I have already given reasons for thinking that this character, as is usually the case with ♀ characters, is an advantage to the ♀ ♀, in fulfilling their duties as mothers-in-prospect. Very rarely ♂ ♂ of this group (in certain spp.) exhibit the same character, and I suppose that, in such cases, the character has probably been

transmitted to them from ♀ ancestors, just as *Bombus* and *Apis* ♂♂ have assumed to a certain extent the leg-characters originally developed in their ♀♀.

But this will not explain the winglessness of certain ♂ Ants, viz. the rare and curious parasitic Genera *Anergates* and *Formicoxenus*, and also (as Mr. Donisthorpe informs me) one species of the industrious Genus *Ponera*; for in all these the Queens (or fertile Females) are winged, and this is the case with all Queen-Ants except those of *Dorylus*—at least all are *born* winged, though *after the marriage-flight* they actually break off and disencumber themselves of the wings which thenceforward are useless to them. Supposing that in a few anomalous Genera like *Anergates*, etc., there is *no* marriage-flight, this might account for the ♂♂ being apterous, for it seems to be only on that occasion that Ants require wings at all; but then one would expect the ♀♀ to be apterous likewise (unless indeed the latter were much larger than their partners, which does not seem to be the case—at any rate André describes *Anergates* ♂ as being of the same size as the ♀!). I know, however, so little about the real habits of these insects, that it is useless for me to discuss the matter further. The first certain captures of *Anergates* in this country were made only last year by two of our Fellows, Messrs. Crawley and Donisthorpe, who met with them in the New Forest, and I am glad to have the opportunity of calling attention to this exceedingly interesting discovery.*

I come now to *Colour*-characters and first those of the integument. Here a distinction may frequently be drawn between (*a*) a darker ground-colour which, except in a few metallically-coloured species (blue, green, violet, etc.) and in some very pale southern forms, is *either* black (or at least fuscous) throughout, *or* a combination of red and black, the former colour occurring chiefly in the form of a more or less variable broad band or belt across the abdomen; and (*b*) certain bright markings of white or yellow, which diversify and as it were encroach upon the ground-colour, and are often called in descriptions the *pictura flava vel albida.* These may either occupy a whole segment, or other definite

* See Mr. Crawley's note in the *Entom. Record*, Sept. 1912, p. 218.

area of the exoskeleton (*e. g.* the clypeus, the humeral tubercles, the scutellum, etc.), or—and this is generally the case when they appear *on the abdomen*—take the form of mere spots or stripes, the latter often running along the margin of a segment, but occasionally crossing its middle.

Aculeates whose integument is unicolorous are generally black; but some workers of Ants, even in this country, and a few sub-tropical desert-haunting forms in all groups are entirely pale yellow or testaceous; and there are also some practically unicolorous Fossors, Bees, and Wasps which are distinctly "metallescent," *e. g.* spp. of *Sceliphron*, *Osmia*, *Ceratina*, *Halictus*, etc.

Whatever be the ground-colour of an insect, black, red-and-black, yellow or metallescent, it may or may not be diversified by a paler *pictura albida*: whether it be so or not, or to what extent it be so, depends generally on the species, but sometimes, as we shall see presently, upon the sex.

Also it depends chiefly on the species, but in certain cases on the sex, what the *ground-colour* is. There are species in which one sex is black, the other red-and-black: or in which both sexes are red-and-black, but one shows more red than the other. Again, where both sexes are metallescent, there may be a difference in the particular metallic colouring of the two sexes. And to a certain extent these phenomena seem to follow, as I shall try to show, certain rules.

It is, therefore, not without exception that we can admit Wallace's generalisation, quoted above, that "the two sexes of the stinging Hymenoptera are equally well-coloured"; though I think it must be allowed that sexual difference plays a very minor part in determining the general style of their coloration.

Summing briefly what has been said, I would suggest that we may roughly divide the insects under consideration into (1) black, (2) red-and-black, (3) pale, and (4) metallic forms, and again into (1) forms *with* "*pictura albida*," which will include all the black-and-yellow (wasp-like) species, and (2) forms *without it*, including not only entirely black or metallic species, but red-and-black insects like *Sphecodes* and other similarly coloured Bees and Fossors, provided that they have no *white* or *yellow* markings. And I believe that any one who has had frequent opportunities of collecting and observing Aculeates in many parts of the Palaearctic region, and has noticed what kind of localities particularly coloured species haunt, and to what extent similarly coloured species in different groups occur in company with one another and with similarly coloured forms belonging to other Orders, will feel sure as I do—that in some way or other most of their colours are Protective—*Cryptic* or *Aposematic* as the case may be, and sometimes, perhaps, *Cryptic* in some surroundings and *Aposematic* in others (for it depends entirely on the surroundings whether strongly contrasted markings catch the eye or confuse it—*at*tract attention or *dis*tract it.*) This applies evidently to the two very common types of Aculeate coloration black-and-yellow (*Wasp-like*) and black-and-red (*Sphecodes-like*). These, as I can say from personal observation, occur frequently in all sorts of localities, forming regular *Müllerian associations.*† At the same time I am convinced that, in some surroundings, these same markings are as certainly *Cryptic* as the stripes and spots of the great *Felidae*, whose habits as well as their colours ("si parva licet componere magnis") are not very unlike those of the predaceous Fossors. Before quitting this point, which (though connected with my proper subject) must not detain me too long, I should like to say that I think these insects are not so much qualified for entering into *Synaposematic* groups by the fact that the ♀ possesses a sting, as by some nauseous taste or smell (perhaps connected with Formic acid?) which *both* sexes possess. As Professor Poulton has shown, *stingless* ♂♂ do sometimes not only enter into, but form centres of, such groups. And in this connection I may mention Mr. Sladen's interesting observations, that (1) when a male Humble Bee is caught in the fingers, its usual pleasant fragrance is "now blended with an odour like that of sting-

* It is difficult to doubt that the nauseous black-and-yellow larvae of the Cinnabar moth are protected by *Synaposematism* (cf. Poulton, *Colours of Animals*, p. 170). Yet I have often collected Aculeates on flowers of Ragwort without noticing at first that the leaves of the same plants were literally swarming with these gaudy caterpillars. Again, a Sawfly with wasp-like colours, e. g. *Strongylogaster cingulatus* ♀ is certainly less conspicuous when resting on bracken than an all-black one like *Selandria morio* (cf. Poulton, *l. c.*, pp. 25–26).

† Cf. Poulton in Trans. Ent. Soc., 1904, p. 645 etc. Cf. also Proc. Ent. Soc., 1909, p. lxix.

poison emitted in fear," * and (2) that a dog, if a Humble Bee be presented to him, "will turn away in disgust, although he will readily snap at a fly." † Besides, except in the case of *Social* Bees, the sting is only exceptionally a really formidable weapon. Many Fossors hardly use the sting at all except for paralysing their prey, and if they fight, prefer to trust to their mandibles. This has been noticed especially in *Philanthus*. Professor Poulton tells me, that he has seen a fight between Workers of true Wasps "conducted solely by means of the mandibles, and aimed at cutting off the abdomen of the opponent." The sting of some wild Bees, e. g. *Andrena*, is quite negligible, and even that of the Hive Bee has no terrors for such birds as *Merops apiaster* and *persicus*, or (according to Hoffer) for swallows, or for the Fossor *Philanthus*, or the Dipteron *Asilus*, or (according to Butler's observations quoted ‡ by Wallace) for lizards and frogs, which swallow them "in utter disregard of their stings."

No one, I should think, who has collected in the deserts of Algeria, Egypt and Palestine can doubt, that the very pale colours and shimmering silvery or golden pruinosity, so common in all groups of Hymenoptera in such localities and practically there only, are Cryptic characters, rendering the insects which possess them inconspicuous and almost invisible § among the glittering sands and pale vegetation which they haunt. Here at least, contrary to the rule laid down by Wallace, we have stinging Hymenoptera coloured so as to resemble—or at any rate so as not to contrast with—"the inanimate and vegetable substances" which normally surround them.

But to return to *colour-characters which differ in the sexes*. This, I think, is not often the case with "metallic" colours (as blue, green, violet, etc.) which are due, not to pigment, but to interference. Such colours, however, are exceptional in the Palaearctic Fauna, and I hesitate to say much of them without knowing how far they yield sexual characters in Exotic

* Sladen, *The Humble Bee*, p. 13. † *Ibid.*, p. 115.

‡ *On Natural Selection*, p. 122.

§ Professor Poulton tells me of a remark made to him by the late E. Saunders that the silvery or golden faces of such insects (♂ ♂ especially) peeping out or emerging from holes in the glaring sand would surely be effective in concealing them.

Aculeates. Still I have noticed cases where as in the beautiful *Osmia ferruginea* (= *igneo-purpurea*) the colours of the ♀ are decidedly richer and more intense than those of the ♂, and others in which the ♂ is greenish (aeneous) and the ♀ dark blue or violet (*Osmia caerulescens*, *panzeri*, *versicolor*, etc.). But oftener there is little difference in the colour of the sexes, *e. g.* in *Sceliphron targionii* and *omissus* (Fossors), and the majority of *Ceratina* spp. (Bees).

On the contrary, in the red-and-black (pigmented) forms, whether with or without *pictura albida*, there is an undoubted tendency for the ♀ to be the *redder* insect.*

Thus, looking through my own collection, I find the ground-colour of the abdomen black in all my ♂♂, and more or less largely red in all my ♀♀, of the following species:—

Pompilus unicolor, *Salius notatulus*, *Calicurgus hyalinatus*, *Sapyga quinquepunctata* and *similis*, *Elis* sp. ?, *Sphex pruinosus*, *afer*, *tristis*, *Gorytes niger* (if I have associated the right ♀ with this ♂), *Palarus humeralis* (here the "red" is rather "orange"), *Entomosericus concinnus*, *Paracoelioxys rufiventris*, *Paradioxys* sp. ?, *Phiarus abdominalis*, *Ammobates biastoides* and *rostratus*, *Biastes brevicornis* and *truncatus*, and nearly every species of *Myzine*. In many other cases—far too many to enumerate —I find the abdomen of both sexes more or less red, but more so in the ♀♀ than in the ♂♂. And again in many other cases and particularly in species of *Andrena* and *Prosopis* I find that individual specimens of either sex may be black-and-red or black entirely, but that the melanic forms are commonest among males.

Against these instances I can quote very few indeed of the reverse phenomenon—(only one or two *Mutillidae* and *Halicti*).

Red *on the thorax* is rare in Aculeates, but occurs in some ♀ Ants (*e.g.* several *Formica* spp.), and Mutillids, also in ♀ *Nomada* spp. (of the *ruficornis* group, etc.), and in the sub-

* I am not as yet prepared to say, whether there is any such tendency in ♀ ♀ of other groups than that now under consideration, or in cases when the comparative *redness* or *blackness* of an insect is a question of its pilosity and not of its integument. In some of the latter cases the rule, if it exists, is certainly broken. Thus in *British* (though not in *Continental*) forms of two common *Anthophora* spp. the pilosity of the ♀ ♀ (except their scopæ) is black, while that of the ♂ ♂ is fulvous. So that here the ♀ cannot be said to be "the *redder* insect."

tropical Bee *Anthophora erubescens.* In all these except the Mutillids the ♂ thorax is entirely black. The same phenomenon is quite common in Sawflies (many *Dolerus* spp., some *Bleunocampids*, *Eriocampa ovata*, etc.). I find no case of the reverse, *i. e.* none where the ♂ and not the ♀ has the thorax rufescent.

Also, *on the head*, red is comparatively infrequent; but where it occurs, it is generally in the ♀ that I have noticed it—*e. g.* many Ants, most of the large *Scoliidae*, *Nectanebus fischeri*, several *Cerceris* spp., and the Bee *Anthophora erubescens.*

Here, again, I can quote no instance of the contrary. It would appear that, assuming such coloration to be Protective, it is the ♀ generally which receives the protection. However, there are ♂♂ which enjoy it *as well as, or nearly as well as, their females;* for a more or less red abdomen is usual in both sexes of *Sphecodes*, and not uncommon in *Andrena* and *Osmia*; it is also frequent in both sexes of many *Fossors*, both among the *Pompilidae* and the *Sphegidae.*

I believe that in some cases these *red* colours are due to a sort of immaturity, the insects which emerge *before their pigmentation is fully developed* being redder than those which have been more patient. In England *Andrena hattorfiana* commonly emerges in the late summer and is quite black in both sexes. But F. Smith noticed that in certain very hot and early summers the ♀♀ were apt, as on the Continent, to be red. And in South Europe (Greece, Corfu, etc.) I have taken long series of it in April in which *all* the ♀♀ and many of the ♂♂ were red. Possibly a sudden heat-wave may bring the species out abundantly at a time when some only of the ♂♂ and none of the ♀♀ have coloured up properly. And this may conceivably apply to other cases of *red-bodied* ♀♀ occurring with *black-bodied* ♂♂. Most of my own specimens above enumerated were taken in hot spring-weather in Mediterranean districts.

Now as to *pictura albida.* This, on the contrary, though it occurs in both sexes, distinctly predominates (especially when it occurs on the face and the front-parts of the body generally) not in the ♀♀, as rufescence does, but in the ♂♂.

Thus it is almost universal in some genera of Bees and frequent at least in others that the ♂ face should be largely white or yellow, while that of the ♀ is either entirely black (*Andrena* usually, *Eucera* and *Anthophora* sometimes), or with the white or yellow much diminished and sometimes (*Prosopis* usually, *Anthidium* sometimes) reduced to mere spots. Again in many Wasps a completely yellow clypeus is a ♂ character. The sexes of Fossors differ less in this respect; but even there on the whole the ♂♂ have the face more brightly coloured.

Again the scape or basal joint of the antenna is often white or yellow in front in ♂♂, while it is black in their ♀♀. The whole under- (or front-) side of the ♂ antenna is often paler than that of the ♀. And very conspicuous white or yellow front-tarsi (sometimes also front-tibiae) is sometimes a male character both in Fossors and Bees (*e.g.* in several species of *Crabro* and *Megachile*).

The difference of colour in the ♂ and ♀ face is particularly remarkable in the Bee-genera *Andrena* and *Prosopis*. British *Andrena* spp. most commonly have their faces black or at least fuscous in both sexes. But some of our own species, and a very large number of those occurring round the Mediterranean, have the clypeus or even the whole face white or yellow; and these colours (except in stylopised specimens) hardly ever occur in their ♀♀.* Again, in *Prosopis* the ♂ face is almost invariably white, while that of the ♀ shows at most a pair of small spots or streaks between the clypeus and the eyes. In just one species (*cornuta*) both sexes have the face entirely black; but here *the ♂ only* has an enormously dilated yellow "scape," which produces quite an equivalent for the usual sexual contrast. In *Halictus* nearly all males exhibit *pictura albida* on the clypeus, but only at its apex: while the ♀ clypeus is, I believe, invariably immaculate.

Though "pictura albida" on the *front of the body* is usually a ♂ sexual character, on the *abdomen* it generally occurs, if at all, equally (or nearly so) in both sexes, though there are exceptions to this (the ♂ only exhibiting it) both among the Fossors (as *Myzine*) and the Bees (as some spp. of *Nomada*). In the latter situation, I believe it is generally a Protective character (Synaposematic); but in the former, I suspect that,

* I have only seen two *Andrena* spp. (one from Greece, and one from Palestine) with any white or yellow on the face of the unstylopised ♀.

like most ♂ secondary characters, it is in some way an adaptation facilitating pairing. The colours of the face, front-legs, etc., would be those which would be most prominent in the aspect of a ♂ approaching a ♀, while those of the abdomen would display themselves more conspicuously to most of the insect's possible enemies—for nearly all these would attack it from *above* and not from *in front*. Whatever be the exact impression produced on the feelings of an *Andrena* or *Prosopis* ♀, as she witnesses the approach of her bright-fronted suitor, whether actual admiration or merely surprise and curiosity, it is at least probable that her notice would be attracted by the spectacle, and that thus, so to speak, the ice would be broken, and the road paved for further overtures.

While both in Fossors and true Wasps yellow and other bright markings on the integument of the abdomen are extremely frequent, they are decidedly unusual among Palaearctic Bees, except in particular Genera (e.g. *Anthidium* and its Parasite *Stelis*, *Nomada*—also a parasitic Genus,— *Camptopoeum*, and *Nomioides*). Much more frequently in this Family striking colour-characters are produced, not by the integument (which is commonly immaculate), but by the Pilosity, and as to this two general remarks may be made, (1) that in Aculeates bright and conspicuous colours appear as a rule *either* in the integument *or* the pilosity *but not in both at once*, and (2) that to a certain extent corresponding types of coloration are produced by these two methods, and probably have the same bionomic value. Professor Poulton lately exhibited at a meeting of our Society a remarkable case of two Australian Bees, a *Prosopis* and a *Halictus*, with a similar and very characteristic coloration, produced in the one case by integumental pigments, and in the other entirely by the Pilosity. Other if less perfect examples of this sort of mimicry might be pointed out in all groups of Aculeates. Thus, while in some *Crabronidae* and *Andrenidae* the ♂ clypeus is made white or yellow by pigmentation of the chitin, in others the same effect is simulated by a clothing of silvery or golden hairs. The abdomen of *Bombus lapidarius* is made red-and-black by hairs only, that of *Sphecodes gibbus* or *Andrena scita* by colours in the actual integument. Patterns of *white or yellow spots*, *streaks or broad bands on a dark ground* are produced in some Aculeates (e.g. *Mutillidae*, *Melecta* and *Crocisa* spp., *Halictus scabiosae,* etc.) mainly by the pilosity, in others (as *Crabronidae*, *Cerceris* spp., *Nomada*, and *Anthidium*, as well as in most Wasps) by staining of the body itself. Although most of these Pilosity-characters are probably Protective and not Sexual, some, I think, are pretty clearly of the latter sort. Among such may be probably reckoned the conspicuous white tuft of hair on the clypeus in several ♂♂ of *Andrena*, and the silvery faces of some ♂ Fossors, though it is true that in other cases in this Group the character is nearly equally well developed in both sexes. In one remarkable instance a character peculiar to ♀♀ appears to be Sexual and Protective also. I refer to the glittering white or yellow round spots of dense pilosity (arranged almost like the "pips" on dice or dominoes!) which occur on the abdomens of females only in many species of *Mutilla*, and are the more conspicuous because the actual integument in all these species is, in that sex, entirely black. The number and disposition of these spots vary according to the species, and are much relied upon as specific characters, but so far as I know they are absolutely confined to ♀♀. It seems practically certain that these spots are a case of Warning-colours (Aposematic). The insects must be anything but an agreeable morsel to most Insectivora. Their integument is excessively hard, and their juices probably very unpalatable; for it is difficult to pin them, and when pinned they exude a great deal of what is commonly called "verdigris" (= *oleate of copper* according to the late Dr. Knaggs). Also they sting terribly. And lastly, being apterous they are exposed to dangers which their ♂♂ can escape by flight. Hence there is good reason that they should exhibit special Danger-signals, lest they should be mistaken for some unobjectionable insect of another kind.

But I have already occupied more of your time than the occasion justifies, though I am far from having exhausted my subject, or even alluded to certain branches of it, which I should wish to discuss if it were possible—as the pigmentation of Aculeates' eyes which is sometimes different in the two sexes, and has hardly been noticed except in a few records made by

Mr. Eaton in Algeria—the staining in certain cases of the wings, and also their iridescence, which however could hardly be discussed without consideration of such phenomena in Exotics—and others which I regret my inability to treat satisfactorily, *e.g.* the chemical and physiological causes determining Colour-characters, which have been studied in Lepidoptera by such experts as Professors Meldola and Poulton and others.

I will therefore end by offering to the Society my thanks for two years' peaceful enjoyment of a position, not only the most distinguished, but in several ways the most agreeable and interesting, that I have ever occupied, or can ever expect to occupy. I have to thank, also, my fellow-Officers and colleagues in the Council for all that they have said and done to encourage and assist me in discharging duties not indeed actually onerous, but at any rate responsible; and, finally, to welcome with sincere congratulations and good wishes our able and popular colleague, Mr. Bethune-Baker, to whom I now resign this Chair.

NOTES.

A. Mr. Waterhouse, since the above was written, has called my attention to the *Mymaridae*, where the ♂ antenna has generally *several* more joints than the ♀; (often 13 as against 9!). See p. clxxxi.

B. Dr. T. A. Chapman has *seen* the ♂ *Odynerus spinipes* "imprison the wings of the ♀" between his (tridentate) middle femora, and (excavated) middle tibiae. E. M. M. 1870, p. 214. See p. clxxxiv.

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