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OF
LONDON
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LONDON:

PRINTED FOR THE SOCIETY BY WEST, NEWMAN AND CO.,
54, HATTON GARDEN, LONDON, E.C.

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31ST DECEMBER, 1885.

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- 1861 † SAUNDERS, G. S., *Cumberland House, Mount Sion, Tunbridge Wells*.
- 1865 SCHAUFUSS, L. W., Ph.D., M.Imp.L.C.Acad., &c., *Dresden*.
- 1881 SCOLICK, A. J., *Albion Lodge, Putney*, S.W.
- 1875 † SEALY, Alfred Forbes, *Cochin, South India*.
- 1864 SEMPER, George, *Altona*.
- 1862 SHARP, David, M.B., *Bleckley, Shirley Warren, Southampton*.
- 1883 SHAW, A. Eland, 13 *Lanhill-road, Paddington*, W.
- 1883 † SHELLEY, Capt. George E., 13 *Rutland Gate*, W.
- 1847 SHEPHERD, Edwin.
- 1884 SHUTTLEWORTH, Edmund, 6 *Hall-road, Hamilton-terrace, St. John's Wood*, N.W.
- 1877 SLATER, John Wm., 36 *Wray-crescent, Tollington Park*, N.
- 1883 SMITH, Frederick W., *Hollywood House, Dartmouth Point, Blackheath, Kent*.
- 1869 SMITH, Henley Grose, 20 *Finsbury Circus*, E.C.
- 1885 SMITH, Sidney Philip, *Danes Inn, Strand*, W.C.
- 1885 SOUTH, Richard, 12 *Abbey-gardens, St. John's Wood*, N.W.
- * † SPENCE, William Blundell, *Florence*.
- 1848 † STAINTON, Henry Tibbats, F.R.S., F.L.S., F.G.S., &c., *Mountsfield, Lewisham*, S.E.
- 1862 STEVENS, John S., 38 *King-street, Covent Garden*, W.C.

- 1837 STEVENS, Samuel, F.L.S., *Loanda, Beulah Hill, Upper Norwood, S.E.*
- 1882 SWANZY, Francis, *Stanley House, Granville-road Sevenoaks.*
- 1884 SWINHOE, Lieut.-Col. Charles, F.L.S., F.Z.S., *India.*
- 1876 SWINTON, A. H., *Binfield House, Waterden-rd., Guildford.*
- 1856 THOMSON, Jas., *12 Rue de Presbourg, Place de l'Etoile, Paris.*
- 1882 TODD, Richard, *5 Princes-terrace, Bayswater, W.*
- 1859 † TRIMEN, Roland, F.R.S., F.L.S. (Curator of South African Museum), *Cape Town, Cape of Good Hope.*
- 1869 VAUGHAN, Howard, *11 Ospringe-road, Brecknock road, N.W.*
- 1866 VERRALL, G. H., *Sussex Lodge, Newmarket.*
- 1876 WAKEFIELD, Charles Marcus, F.L.S., *Belmont, Uxbridge.*
- 1870 WALKER, Rev. Francis Augustus, D.D., F.L.S., *Dun Mallard, Cricklewood, N.W.*
- 1878 WALKER, J. J., R.N., *23 Ranelagh-road, Marine Town, Sheerness.*
- 1863 † WALLACE, Alfred Russel, F.L.S., F.Z.S., &c., *Nutwood Cottage, Frith Hill, Godalming.*
- 1866 † WALSINGHAM, Thomas de Grey, Lord, M.A., F.L.S., F.Z.S., &c., *Eaton House, Eaton-square, S.W.*
- 1866 WARD, Christopher, F.L.S., *Savile-road, Halifax.*
- 1869 WATERHOUSE, Charles O., *British Museum, South Kensington, S.W., and Ingleside, Avenue Gardens, Acton, W.*
- * WATERHOUSE, George R., F.Z.S., &c., *Curton Lodge, Werter-road, Putney, S.W.*
- 1869 WEBSDALE, C. G., *78 High-street, Barnstaple.*
- 1845 WEIR, John Jenner, F.L.S., *Chirbury, Beckenham, Kent.*
- 1876 † WESTERN, E. Young, *27 Craven Hill Gardens, Bayswater, W.*
- * WESTWOOD, John Obadiah, M.A., F.L.S., &c., HONORARY LIFE PRESIDENT, *67 Woodstock-road, Oxford.*
- 1882 WEYMER, Gustav, *58 Kleeblattstrasse, Elberfeld, Rhenish Prussia.*
- 1868 † WHITE, F. Buchanan, M.D., F.L.S., *Annat Lodge, Perth, N.B.*
- 1865 WHITE, Rev. W. Farren, *Stonchouse Vicarage, Gloucestershire.*

- 1884 WHITE, William, *Morden House, 55 Highbury Hill, N.*
1882 WILLIAMS, W. J., *Zoological Society, Hanover-square, W.*
1874 WILSON, Owen, *Cwmffrwd, Carmarthen.*
1881 WOOD, Theodore, *Freeman Lodge, St. Peter's, Thanet.*
1874 WOOD-MASON, James, F.G.S. (Curator of the Indian
Museum), *Calcutta.*
1862 WORMALD, Percy C., *10 Cromwell-avenue, Highgate, N.*

1865 S. YOUNG, Morris, *Free Museum, Paisley.*
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THE
TRANSACTIONS
OF THE
ENTOMOLOGICAL SOCIETY
OF
LONDON
FOR THE YEAR 1885.

I. *Monograph of British Braconidæ.* Part I.
By the Rev. T. A. MARSHALL.

[Read March 4th, 1885.]

PLATES I.—VI.

THE object of the present work is to furnish entomologists with short but sufficient descriptions of our native *Braconidæ*. Since the publication of Haliday's admirable "Essay on the classification of Parasitic Hymenoptera," &c., in the 'Entomological Magazine,' nothing in a connected form has been attempted on this subject, and the want of some manual comprising recent discoveries has no doubt been mainly the cause of the indifference with which British collectors have treated this group of insects. The discoveries of the last fifty years, both in new species and in the biology of those previously known, are so numerous and interesting that they cannot fail, if conveniently presented, to attract a considerable class of observers. The number of lepidopterists who breed their specimens is very large, and contains many men of inquiring minds who would gladly know something of the curious parasites that so often frustrate their labours; while the advantage which would accrue

to entomological science from the assistance of such a host of well-placed observers has often been pointed out.

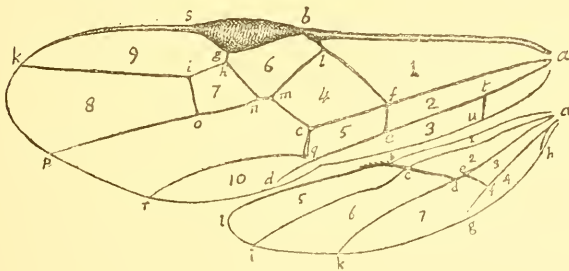
A minute account of the anatomy and physiology of these insects is beyond the scope of the present essay, and must be sought in the works of Gravenhorst, Nees von Esenbeck, Curtis, Westwood, &c. But such particulars as are necessary to distinguish the *Braconidæ* from other parasitic Hymenoptera, and to understand their descriptions, may here be concisely stated.

The *Braconidæ*, Ichneumonones adsciti, or supplementary Ichneumons, are closely related, in structure and habits, to the genuine Ichneumons. They consist of about twenty-six groups or subfamilies, connected by a few common characters, and yet so widely separated by others as to show that links in the series are missing, and to render their linear arrangement impracticable. They are, however, all distinguished from the true Ichneumons by wanting the *exterior discoidal transverse nervure* in the fore wings; and by having the *first cubital areolet* generally, though not always, separated from the *prædiscoidal*; in the Ichneumons these two areolets are never distinct. With the exception of one subfamily, the *Aphidiides*, they are further remarkable for the absence of a real articulation between the 2d and 3d abdominal segments. In the language of Strauss Durekheim, these two segments are united either (1) by *juxtaposition* without imbrication, in which case a suture is visible, but there is no joint to permit the flexure of the abdomen; or (2) by *coalition*, the segments being soldered together, without any trace of a suture, and equally without power of movement. When the junction of these two segments is visible, it is called the *suturiform articulation*. In many descriptions (as in those of *Microgaster* by Wesmael) the 2d and 3d segments are spoken of as one; but this is inconvenient, and is not here adopted. The *suturiform articulation* affords the means of referring to the *Braconidæ* certain forms like *Dimeris* and *Chasmodon*, which, having no wings, would not otherwise be easily recognised. Imperfect articulation of the segments is further developed in some of the subfamilies, and reaches its maximum in the *Chelonides*, most of which have the three segments that are visible from above soldered together. The *Aphidiides*, on the contrary, have all the segments loosely articulated, and are able to bend the abdomen beneath them so as to

project beyond the head, on which account they have been called *Flexiliventre*s; their wings, however, sufficiently distinguish them from the true Ichneumons. I have placed them last on account of differences which forbid their being approximated to any other group. It is not quite certain whether they should not constitute a primary division equal in value to the rest of the *Braconidæ*.

The neuration exhibits much greater variety than that of the Ichneumons, and its value in generic division is consequently higher. The technical terms necessary for this important part of the subject must now be explained.

HORISMOLOGY OF WINGS OF THE BRACONIDÆ.



FORE WING.

<i>Areolets.</i>	<i>Longitudinal Nervures.</i>	<i>Transverse Nervures.</i>
1. præbrachial.	<i>ab.</i> costa and subcosta united.	<i>hn.</i> 1st intercubital.
2. pobrachial.	<i>afc.</i> præbrachial.	<i>io.</i> 2d „
3. axillary, sometimes divided.	<i>aed.</i> pobrachial.	<i>cm.</i> interior discoidal, or recurrent.
4. prædiscoidal.	<i>ghik.</i> radius.	<i>lj.</i> præbrachial transverse.
5. podiscoidal.	<i>gh.</i> 1st abscissa.	<i>fe.</i> pobrachial transverse.
6. 1st cubital.	<i>hi.</i> 2d „	<i>tu.</i> axillary transverse.
7. 2d „	<i>ik.</i> 3d „	
8. 3d „	<i>lmnop.</i> cubitus.	
9. radial.	<i>qr.</i> anal.	
10. anal.	<i>sk.</i> metacarpus.	

HIND WING.

<i>Areolets.</i>	<i>Longitudinal Nervures.</i>	<i>Transverse Nervures.</i>
1. costal.	<i>ab.</i> costal (obsolete).	<i>ed.</i> præbrachial.
2. præbrachial.	<i>acb.</i> subcostal.	<i>ef.</i> pobrachial.
3. pobrachial.	<i>aed.</i> præbrachial.	
4. anal.	<i>afg.</i> pobrachial.	
5. radial.	<i>bl.</i> metacarpus.	
6. cubital.	<i>ei.</i> radius.	
7. discoidal.	<i>dk.</i> cubitus.	
8. axillary.	<i>ah.</i> anal.	

In descriptions the wings are supposed to be extended at right angles to the body, as in flight. Between the costa and subcosta lies the *costal areolet*, which in the fore wing is contracted to a vanishing point by the junction of the two nervures; in the hind wing it is distinct, although open above, the costa being obsolete. The enlargement at *b*, just before the stigma, formed by the ends of the costa and subcosta, is the *parastigma*. The recurrent nervure, or interior discoidal, is called *interstitial* when the point *m* coincides with *n*; *rejected*, when it falls into the 1st cubital areolet (as in the fig.); and *erected*, when it falls into the 2d. Similarly the pabrachial transverse is *interstitial* when it joins the præbrachial at the point *f*; and the anal nervure, when the point *g* coincides with *c*. In the hind wing the radial areolet is *petiolated* when it is remote from the præbrachial; and *contiguous*, when the two areolets touch at the point *c* (as in the fig.); near *b* is a row of several small hooks by which the wings are united during flight.

The number of species in which the wings are undeveloped is small in the *Braconidæ*, compared with the other parasitic groups of Hymenoptera. The apterous species known are the female *Pambolides*, *Spathius pedestris*, Wesm., ♀, *Chasmodon apterus*, Nees, ♂ and ♀; the species with abbreviated wings are *Ganychorus ambulans*, Hal., *G. aptenodytes*, Marsh., *Panerema inops*, Först., and *Diaspasta contracta*, Hal.

In counting the joints of the antennæ, the minute 1st joint, or *radicle*, immersed in the head, is to be disregarded. The 1st joint will therefore be the *scape* (of authors); generally long and stout. This is succeeded by what appears to be a very short joint, but in reality consists of two, soldered together; these two, for the sake of convenience, are reckoned as one, in accordance with the method originated by Gravenhorst, and followed by Wesmæl, Haliday, and others.

It may be useful to define a few terms of frequent occurrence in descriptions.

The *face* is that portion of the front of the head which lies between the antennæ, the clypeus, and the eyes.

The *front*, or forehead, extends from the antennæ to the foremost ocellus.

The *vertex* is the space between the foremost ocellus

and the *occiput* (the concave, vertical, hinder surface of the head), and is bounded on either side by an imaginary line drawn from the inner margin of the eye.

The *stematicum* is the space on the vertex (generally triangular), in which the ocelli are situated.

The *genæ*, or cheeks, are the sides of the head between the eyes and the occiput, and are limited above by the vertex.

The parts of the body in general are formed as in the *Ichneumonidæ*. The head varies greatly in shape from the very broad short head of *Microctonus boops* to the elongate suborbicular head of *Histeromerus mystacinus*. The antennæ with rare exceptions are filiform or setaceous (clavate in *Rhopalophorus clavicornis* and *Aspidogonus diversicornis*) and multiarticulate; the number of joints ranging from 10 in *R. clavicornis* and *Trioxys brevicornis*, or 11 in several species of *Trioxys* and *Ephedrus*, and in *Chremylus rubiginosus*, ♂, to upwards of 60 in many *Rhogadides*, reaching to 71 in *R. procerus*. The antennæ are mostly unicolorous, but are ringed with white in *Heterogamus dispar*, ♀, and *Helcon annulicornis*, ♀, white at the base in *Perilitus albicornis*, ♀, and pale in several species. In a few cases they are hairy (*Aspidogonus diversicornis* and *Microctonus plumicornis*) and occasionally geniculate (*Streblocera*, *Eutanycerus*, and *Rhopalophorus*). The antennæ of the females are shorter, stouter, and usually with fewer joints, than those of the males. The number of joints is determinate in a few groups, as the *Microgasterides* and *Blaeides*; more commonly it varies to a small extent, even in individuals of the same species. The disk of the mesothorax commonly exhibits a trilobed appearance, being divided by two superficial furrows converging towards the scutellum. The 3 lobes correspond with large interior bundles of muscles, and their external appearance or absence should be noticed. The sculpture of the metathorax is often an important character. Sometimes it is divided by one or more carinæ or raised lines into compartments, but less regularly than in the Ichneumons. The first abdominal segment is either petiolated, subsessile, or sessile, smooth or rugulose: the legs are like those of the Ichneumons, the trochanters are biarticulate, and all the tarsi 5-jointed. The terebra is of variable length, either entirely concealed, as in *Chelonus*, or longer than the body, as in *Vipio*. *Bracon penetrator*,

Smith, from Japan (which, however, is not a true Bracon) has the body $\frac{3}{4}$ inch long, while the terebra attains the extraordinary length of $6\frac{3}{4}$ inches.

Great pains have been taken to collect information respecting the parasitism* of these insects. A number of bred specimens, amounting to some hundreds, has been kindly contributed by various entomologists, Bignell, Billups, Bridgman, Cameron, Fitch, J. E. Fletcher, W. H. B. Fletcher, and others. In all such cases no labour has been spared to identify species correctly. The names of lepidopterous victims are taken from 'The Entomologist Synonymic List of British Lepidoptera,' by R. South, London, 1884. For notes and references derived from published works, as those of Ratzeburg,

* Parasitism is a somewhat vague term, but may be divided into the *incomplete*, as that of the cuckoo, &c., and the *complete*, as in the case of hymenopterous insects. A complete parasite is an animal which lives inside or upon the body of another larger than itself, devouring its substance and causing it to perish. The Ichneumonids in general are well known to be internal parasites; yet Brischke's observation respecting *Oncophanes* reported by Ratzeburg and to some extent confirmed by Bignell, tends to the conclusion that at least some of the *Braconidæ* are external complete parasites. Whatever doubt may be considered to attach to this circumstance, we must hesitate still more to receive the accounts published of the occurrence of *Braconidæ*, otherwise known to be parasites of Lepidoptera, among spiders' eggs. These are minute bodies, and any larger insect preying upon them must be external, and must devour many; in which case it is no more a parasite than any other carnivorous creature. Hence Brischke's statement that he has bred the large *Microgaster deprimator*, Nees, from spiders' eggs, seems inadmissible. Ruthe conjectured the same *Microgaster* to be a parasite of *Bombus terrestris*, L. It is hard to believe that whereas the other larvae of the genus are so organised as to breathe and live by suction within the body of a caterpillar, surrounded by humidity and protected from atmospheric influence, this one alone should live in the spider's nest exposed, preying upon eggs, without being subject to the conditions of parasitism. *Pezomachus*, however, may readily be quoted as a received example of an Ichneumon bred from spiders' eggs; in which case it must be an external feeder, and not a true parasite. It is, however, much more commonly and certainly obtained from the cocoons of *Microgaster*, being then distinctly an internal parasite. The history of *Pezomachus* is not yet cleared up, nor can we deny (whatever difficulty may exist) that it has proceeded from spiders' nests. It behoves future observers, however, to make very sure that the supposed spider's nest is the genuine work of an araneid, and to verify the species. For *Apanteles congestus*, Nees, and other *Microgasterids* make nests of cocoons which have often been mistaken for the work of spiders, and the breeding of *Pezomachus*, *Hemiteles*, &c., from these is a common occurrence.

Brischke, Giraud, &c. (where no means of verification exist) the present writer cannot be responsible; they are quotations which depend upon the authority of others. They have, however, been as far as possible scrutinised, and many rejected as being, from different causes, inadmissible, or the reasons for disputing their accuracy have been stated.

In the identification of minute similar species, it is, as a general principle, safer and easier to trust to good descriptions than to the inspection of preserved specimens. In many cases, however, the value of types is indisputable, and large resources of this kind are available to the enquirer. The general collections of Stephens and Ruthe are in the British Museum, together with types of *Aphidiides* and *Microgasterides* deposited by Haliday. The Hope Museum at Oxford contains many named specimens from Wesmael and Förster, to which were added, in 1884, some of Haliday's from Trinity College, Dublin. Gravenhorst's collection still exists at Breslau; that of Nees von Esenbeck at Bonn, in small glazed boxes; Wesmael's at Brussels; Van Vollenhoven's at Leyden; Förster's remains in Europe unsold, while that of Curtis is less conveniently placed in Australia.

The earliest arrangements of the *Braconidæ*, those of Nees von Esenbeck and Haliday, were based upon the palmary system, and of them it is unnecessary to say more than that they exhibit in a high degree the disadvantages of that method. Haliday's system, published in the 'Entomological Magazine' (vol. i., pp. 261—266), still has its value as a remarkable collection of acute observations, but fails as a linear arrangement; insects of the same genus, owing to the arithmetic of the palpi, being found in widely different places; the group of *Dacnusa*, e. g., appears no less than four times over. The Generic Synopsis of the same author, appended to vol. ii. of Westwood's "Introduction," supplies no general system, but gives only brief outlines of the genera. Wesmael, unacquainted with Haliday's writings, divided the *Braconidæ* into three principal groups. I. *Cylostomi*. These have the clypeus notched or emarginate on its lower edge, and the labrum so withdrawn as to form a sort of palate to the oral aperture; the mandibles are too short to cross each other, but, only touching at the points, they form, with the clypeus, a somewhat circular opening. II. *Clidostomi*. The clypeus is not, or hardly,

emarginate, but rounded or produced; the mandibles cross each other at the points, and the mouth appears closed, or the aperture left is very small. III. *Exodontes*. The mandibles are not only too short to meet at the points, but they are curved outwards on each side of the head, unlike those of any other insects, and useless for every purpose to which such organs can be applied. These divisions, however, are insufficient for the extent of the subject, and the second is a jumble of dissimilar forms, being nothing else than the remainder after the subtraction of the first and third. The more recent system of Förster (Verh. pr. Rheinl., 1862, pp. 225—288) embodies everything of value in the works of his predecessors, arranged in an order of his own, founded upon the general appearance of the animals, and in that respect perhaps as satisfactory as the subject permits. There exists another variation of this system, published by Reinhard in Taschenberg's Hym. Deutschlands, 1866, pp. 78—91. This, being written to suit the plan of a special work, deals chiefly with genera, arranged in a different sequence from that of Förster; for higher divisions recourse must be had to the latter writer. His synoptical table has been severely criticised, and is undoubtedly liable to many objections, not the least of which is that the difficulty of its application is very deterring to beginners. In the following attempt at simplification, we shall depart in some respects from the German method. The divisions termed by Förster *subfamilies* are those chiefly to be attended to, as they are, or are supposed to be, founded upon nature, and of equal value. The other headings, taken from Wesmæl and Haliday, are here only used as guide-posts, and for the purpose of catching the eye. Excluding Förster's *Pachylommatoideæ*, as belonging to the *Evaniideæ*, we will treat the *Braconideæ* under six divisions, each including a number of subfamilies.

- (10) 1. Suturiform articulation rigid, connate.
 (9) 2. Mandibles in the usual position, touching or crossing at the points.
 (4) 3. Clypeus emarginate, forming with the mandibles a semicircular opening .. I. CYCLOSTOMI.
 (3) 4. Clypeus not so emarginate, fitting closely to the mandibles.
 (6) 5. Abdomen above without sutures, segments 1—3 forming a solid shield; or with 2 superficial sutures at most, but still exarticulate II. CRYPTOGASTRES.
 (5) 6. Abdomen showing the usual sutures.
 (8) 7. Second cubital areolet minute, as in the *Ichnemonidae*, often imperfect .. III. AREOLARI.
 (7) 8. Second cubital areolet large, quadrangular, or wanting IV. POLYMORPHI.
 (2) 9. Mandibles with the points turned outwards V. EXODONTES.
 (1) 10. Suturiform articulation, as well as the rest, flexible, allowing the abdomen to be curved forwards under the thorax.. VI. FLEXILIVENTRES.

I. CYCLOSTOMI, *Wesm.*

- (4) 1. Occiput not margined, or only faintly at the sides.
 (3) 2. Pobrachial areolet as long as the præbrachial 1. *Braconides*.
 (2) 3. Pobrachial areolet shorter than the præbrachial 2. *Exothecides*.
 (1) 4. Occiput margined, distinct from the vertex.
 (6) 5. Abdomen petiolated 4. *Spathiides*.
 (5) 6. Abdomen sessile or subsessile.
 (10) 7. Fore wings with 2 cubital areolets; or the ♀ apterous.
 (9) 8. Head cubical; abdominal segments discrete; ♀ winged; hind wings of ♂ with a stigma 5. *Hecabolides*.
 (8) 9. Head transverse; abdominal segments after the 1st connate; ♀ often apterous; hind wings of ♂ without a stigma .. 6. *Pambolides*.
 (7) 10. Fore wings with 3 cubital areolets.
 (12) 11. Head cubical, not contracted behind the eyes 7. *Doryctides*.
 (11) 12. Head transverse, more or less contracted behind the eyes.
 (14) 13. Anal nervure interstitial 8. *Hormiides*.
 (13) 14. Anal nervure falling into the podiscoidal areolet.
 (16) 15. Abdomen subpetiolated, nearly smooth; terebra elongate; thyridia of segments 2—3 invisible; small gnat-like species 3. *Rhyssalides*.

- (15) 16. Abdomen sessile, almost always rugose, except the apex; terebra concealed or short; thyridia of segments 2—3 visible; large robust species 9. *Rhogadides*.

II. CRYPTOGASTRES, *Wesm.*

- (2) 1. Fore wings with 2 cubital areolets; belly concave from end to end, with sharply defined edges 10. *Sigalphides*.
 (1) 2. Fore wings with 3 cubital areolets; belly concave; edges reflexed; body rugose 11. *Chelonides*.

III. AREOLARI, *Wesm.*

- (2) 1. Mesothoracic sutures invisible; radial areolet ample, reaching the apex of the wing 12. *Microgasterides*.
 (1) 2. Mesothoracic sutures distinct; radial areolet minute, remote from the apex of the wing 13. *Agathidides*.

IV. POLYMORPHI,* *Wesm.*

- (4) 1. Abdomen petiolated.
 (3) 2. Fore wings with 2 cubital areolets .. 14. *Euphorides*.
 (2) 3. Fore wings with 3 cubital areolets .. 15. *Perilitides*.
 (1) 4. Abdomen sessile or subsessile.
 (10) 5. Fore wings with 2 cubital areolets.
 (7) 6. Axillary areolet of the fore wings closed 16. *Calyptides*.
 (6) 7. Axillary areolet of the fore wings open.
 (9) 8. Radius straight, its first abscissa long, distinct; terebra ♀ straight 17. *Blacides*.
 (8) 9. Radius curved, its first abscissa short, subobsolete; terebra ♀ decurved .. 18. *Liophrouides*.
 (5) 10. Fore wings with 3 cubital areolets.
 (12) 11. Radial areolet very short, the metacarpus not longer than the stigma 19. *Ichneutides*.
 (11) 12. Radial areolet elongate, the metacarpus longer than the stigma.
 (14) 13. Hind femora incrassated, sometimes toothed; head subquadrate, vertex excavated, the fovea containing the middle ocellus 20. *Helcontides*.
 (13) 14. Hind femora simple; head transverse, vertex not or hardly excavated, the middle ocellus not placed in a fovea.
 (16) 15. Abdomen linear, longer than the thorax 21. *Macrocentrides*.
 (15) 16. Abdomen ovate, not longer than the thorax.

* Wesmael's division *Polymorphi*, containing heterogeneous groups, has rightly been objected to as unscientific. Its use here is merely to indicate the subfamilies which do not enter into any of the other divisions.

- (18) 17. Occiput margined, distinct from the vertex; axillary areolet with an incomplete transverse nervure 22. *Diospilides*.
 (17) 18. Occiput not margined; axillary areolet with no vestige of a transverse nervure 23. *Opiides*.

V. EXODONTES, *Wesm.*

- (2) 1. Fore wings with 3 cubital areolets (rarely apterous or subapterous) 24. *Alysiides*.
 (1) 2. Fore wings with 2 cubital areolets .. 25. *Dacnusesides*.

VI. FLEXILIVENTRES, *Hal.*

- Hind wings with only 2 longitudinal nervures; præbrachial areolet often incomplete; pobrachial areolet wanting 26. *Aphidiides*.

I. CYCLOSTOMI.

I. BRACONIDES.

As regards British species, the characters coincide with the single genus

BRACON, *Fab.*

Fab., *Piez.*, 102 (1804); *Wesm.*, *Mém. Ac. Brux.*, 1838, p. 7; *Först.*, *Verh. pr. Rheinl.*, 1862, p. 235.

Mandibles bidentate, touching at the points, and enclosing, with the emargination of the clypeus, a somewhat circular opening. Maxillary palpi 5-, labial 3-jointed. Antennæ with a variable number of joints, even in the same species, from 14 (♀) to upwards of 40 (♂ ♀); 3d joint longer than the 2d. Occiput not margined. Mesothoracic sutures distinct. Metathorax not areated, sometimes carinated. Abdomen sessile, with 7 visible segments. Sutureform articulation distinct, sinuated or straight. Terebra ♀ exerted, of variable length. Cubital areolets 3, the 2d trapezoidal; recurrent nervure rejected; præbrachial and pobrachial areolets of equal length; pobrachial areolet of the hind wings minute.

The second subfamily, *Exothecides*, is closely allied, and was only separated by Förster as an afterthought, at the end of his *Generic Synopsis*, *lib. cit.*, p. 279. In the *Exothecides* the pobrachial transverse nervure is everted, whereby the pobrachial areolet becomes longer than the præbrachial. The genus *Cæloides*, *Wesm.*, is easily mistaken for *Bracon*, having the pobrachial transverse nervure similarly interstitial; but the occiput is margined, the 3d joint of the antennæ is not longer than

the 2d, and the front is deeply excavated above the antennæ,—characters which suffice to relegate it to *Doryctides*.

Förster's genus *Iphiaulax*, Verh. pr. Rheinl. 1862, p. 234, contains a few European and many exotic forms, separated from *Bracon* on the ground that their abdomen is marked by several oblique or transverse impressions. It is here mentioned because *I. impostor*, Scop., Ent. Car., 287, the *B. denigrator*, Fab., Piez. 109, a species of Southern Europe, has been wrongly supposed to be British. The mistake originated in confusing three different insects, *B. denigrator*, L., *B. denigrator*, Fab., and *Proterops nigripennis*, Wesm. Only the last is British, and to it must be referred the figure given by Curtis, B. E., lxix, and the specimen existing in the cabinet of Stephens.

The *Braconides* constitute a group of great and unknown extent in tropical regions, embracing the largest and most highly coloured of the Ichneumonones adsciti. Some of these are also found in Southern and Central Europe, but in our climate none of the superior forms occur. The small British species have been totally neglected by our writers; the number of them is not yet ascertained; their determination is difficult; their transformations and parasitism very imperfectly understood. The facts we have collected tend to show that they infest in their earlier stages insects of several different orders, Coleoptera, Hymenoptera, Lepidoptera, and Diptera. Their motions are slow, and their flight feeble, notwithstanding an ample provision of wings. They generally lurk in shady places, resorting occasionally, during the hours of sunshine, to umbelliferous flowers, for the purpose of basking or feeding. Their predominant colour is black, often diversified with rufous or yellowish markings; some, however, are almost wholly testaceous. Those with dark wings uniformly exhibit underneath the stigma a whitish angulated streak, ending in a spot, which often renders some of the nervures, and especially the 1st intercubital, decolorous. The males are not easily identified when separated from their partners: they are usually smaller, with longer antennæ, and exhibit the specific characters with less distinctness.

Nees v. Esenbeck (Mon., i., pp. 49—126) described 80 European species of his genus *Bracon*, divided into

four sections, of which the last alone contains genuine species according to modern views. Of the 54 therein comprised, 3 belong to *Vipio*, Latr., and several more to *Iphiaulax*, Först., *Neoneurus*, Hal., *Cœloides*, Wesm., *Doryctes*, Hal., and *Dendrosoter*, Wesm. The number of real Bracons remaining is not easily ascertained, but it is very nearly as follows: spp. 27—50, and probably spp. 66, 69, 70, 73 and 74, making 30; several of these, however, evidently comprise different insects under the same name. Wesmael (Nouv. Mém. Ac. Brux., 1838, pp. 10—57) described 48, of which all but the first (*nominator*, Fab.) are genuine. Of these 47, 14 are supposed to be reproductions of the Neesian species, including varieties with fresh names; so that the actual additions made by Wesmael are reduced to 33. Of his 47 species, 25 are here introduced as British, with 1 from Nees, 2 from Ratzeburg, and 10 new, making 38. The material at our disposal, brought together by the kindness of contributors whose names are hereinafter recorded, is considerable; but there can be no doubt that many more native species remain to be discovered.

TABLE OF SPECIES.

I. Second cubital areolet distant from the exterior margin by twice its length, measured along the cubitus; anterior side shorter than the interior.

- (2) 1. Abdomen punctulato-rugulose; antennæ, ♀ 25-, ♂ 27-jointed, longer than the head and thorax 9. *stabilis*, Wesm.
 (1) 2. Abdomen smooth; antennæ, ♀ 14—17-, ♂ 20—26-jointed, not longer than the head and thorax 10. *brevicornis*, Wesm.

II. Second cubital areolet distant from the exterior margin by about its own length, measured along the cubitus; anterior and interior sides subequal, or the anterior longer.

SECTION i. Segments 1—4, or more, or all the segments, sculptured; rugulose, aciculated, or punctulate.

- (12) 1. Suturaform articulation sinuated.
 (9) 2. Metathorax not carinated, or with only an inchoate carina at the apex.
 (4) 3. Abdomen, after segment 1, wholly testaceous 2. *lectus*, Wesm.

- (3) 4. Abdomen, after segment 1, not wholly testaceous; partly black.
- (6) 5. Wings blackish; stigma black; terebra ♀ as long as the body 4. *minutator*, Fab.
- (5) 6. Wings hyaline; stigma pale; terebra ♀ shorter than the body.
- (8) 7. Antennæ ♂ 29-jointed; terebra ♀ as long as the body; stigma fusco-testaceous 1. *pectoralis*, Wesm.
- (7) 8. Antennæ ♂ 40-jointed; terebra ♀ much shorter than the body; stigma luteous 3. *erythrosticktus*, n. s.
- (2) 9. Metathorax carinated from base to apex.
- (11) 10. Head and thorax black; coxæ black; 4 posterior femora more or less black 6. *longicollis*, Wesm.
- (10) 11. Head and thorax partly testaceous; coxæ testaceous, often with a black spot; 4 posterior femora testaceous 5. *fulvipes*, Nees.
- (1) 12. Suturiform articulation straight.
- (14) 13. Head and thorax varied with testaceous; terebra ♀ $\frac{1}{2}$ abdomen 7. *variegator*, Nees.
- (13) 14. Head and thorax entirely black; terebra ♀ $\frac{1}{2}$ abdomen 8. *nigratus*, Wesm.

SECTION ii. Segments* 1—3 sculptured; the rest smooth.

- (2) 1. Abdomen conspicuously black and testaceous 11. *erraticus*, Wesm.
- (1) 2. Abdomen black, except the narrow margins of segment 1, or 1—2.
- (4) 3. Metathorax carinated (sometimes sub-obsolete); suturiform articulation straight 21. *Satanas*, Wesm. ♂.
- (3) 4. Metathorax not carinated; suturiform articulation sinuated 12. *exarator*, n. s.

SECTION iii. Segments 1—2 sculptured; the rest smooth.

- (4) 1. Wings blackish, or fuscous.
- (3) 2. Abdomen testaceous, with or without a few round discal spots 13. *triangularis*, Nees.
- (2) 3. Abdomen black, testaceous at the base and sides 14. *Roberti*, Wesm.
- (1) 4. Wings hyaline, or only slightly infuscated.
- (6) 5. Disk of the mesothorax, partly or entirely, testaceous 15. *levigatus*, Ratz.
- (5) 6. Disk of the mesothorax black.
- (12) 7. Abdomen testaceous in the middle, black at the base and apex.

* Cf. sp. 16, *B. mediator*, Nees, ♂.

- (9) 8. Coxæ rufo-testaceous 16. *mediator*,* Nees.
 (8) 9. Coxæ black.
 (11) 10. Femora and tibiæ infuscated .. 17. *Vectensis*, n. s.
 (10) 11. Femora and tibiæ testaceous .. 18. *fuscicoxis*, Wesm.
 (7) 12. Abdomen black in the middle, often bordered with testaceous; or entirely black, except the narrow margins of segments 1—2.
 (16) 13. Abdomen black, bordered with testaceous at the base and sides.
 (15) 14. Femora testaceous 27. *discoideus*, Wesm., var.
 (14) 15. Femora chiefly black 19. *tornator*, n. s.
 (13) 16. Abdomen entirely black, except the narrow margins of segments 1—2—(3).
 (18) 17. Segment 2 with a yellowish dot on the lateral margins 20. *guttiger*, Wesm.
 (17) 18. Segment 2 without a yellowish dot on the lateral margins.
 (20) 19. Metathorax carinated 21. *Satanas*, Wesm., ♀.
 (19) 20. Metathorax not, or very incompletely, carinated.
 (24) 21. Femora testaceous.
 (23) 22. Terebra less than $\frac{1}{2}$ abdomen .. 22. *fraudator*, n. s.
 (22) 23. Terebra $\frac{2}{3}$ abdomen 23. *epitriptus*, n. s.
 (21) 24. Femora black.
 (26) 25. Segment 2 rugulose only at the base; wings subhyaline 24. *larvicida*, Wesm.
 (25) 26. Segment 2 entirely rugulose; wings infumated 25. *pretermissus*, n. s.

SECTION IV. All the segments smooth.

- (24) 1. Tarsi simple, not incrassated.
 (7) 2. Palpi testaceous.
 (4) 3. Abdomen entirely black, except the narrow margins of segments 1—2, not easily seen 26. *colpophorus*, Wesm.
 (3) 4. Abdomen not entirely black, partly and conspicuously testaceous.
 (6) 5. Abdomen black in the middle, bordered with testaceous 27. *discoideus*, Wesm.
 (5) 6. Abdomen testaceous in the middle, black at the base and apex .. 28. *regularis*, Wesm.
 (2) 7. Palpi blackish.
 (9) 8. Wings hyaline; terebra ♀ longer than the body 29. *caudatus*, Ratz.
 (8) 9. Wings fuscous or fuscescens; terebra ♀ shorter than the body, except in sp. 37, *atrator*, Nees.

* The ♂ of *B. mediator*, Nees, often has the 3d segment rugulose, and so belongs to Section ii.

- (13) 10. Legs testaceous, rarely with some black portions.
- (12) 11. Abdomen* black, testaceous at the sides; terebra ♀ $\frac{1}{2}$ abdomen .. 30. *terebella*, Wesm.
- (11) 12. Abdomen testaceous, only segment 1 black; terebra ♀ more than $\frac{3}{4}$ abdomen 31. *otiosus*, n. s.
- (10) 13. Legs black; tibiæ sometimes testaceous at the base.
- (17) 14. Segments 2—7 black and testaceous.
- (16) 15. Suturaform articulation straight; terebra ♀ as long as the abdomen 32. *variator*, Nees.
- (15) 16. Suturaform articulation sinuated; terebra ♀ $\frac{1}{2}$ abdomen 33. *degenerator*, n. s.
- (14) 17. Segments 2—7 entirely black, except the margins of segments 1—2.
- (21) 18. Terebra ♀ shorter than the abdomen.
- (20) 19. Length, $1\frac{1}{2}$ lin.; antennæ ♀ 25—27-jointed 34. *osculator*, Nees.
- (19) 20. Length, $\frac{1}{2}$ —1 lin.; antennæ ♀ 20—22-jointed 35. *obscurator*, Nees.
- (18) 21. Terebra ♀ longer than the abdomen.
- (23) 22. Terebra ♀ as long as the thorax and abdomen 36. *anthracinus*, Nees.
- (22) 23. Terebra ♀ longer than the body .. 37. *atrator*, Nees.
- (1) 24. Tarsi incassated, especially the 4 posterior 38. *barypus*, n. s.

1. *Bracon pectoralis*, Wesm.

Bracon pectoralis, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 12, ♂ ♀.

Testaceous; antennæ and pectus black; abdomen above wholly rugulose; suturiform articulation wide, deeply crenate, strongly bisinuated; wings subhyaline; terebra ♀ about as long as the body. ♂ ♀. Length, $1\frac{1}{4}$ — $1\frac{1}{2}$; exp. of wings, $3\frac{1}{2}$ lin.

Var. 1, ♀. Mesothorax, metathorax, and abdomen at the base, varied with black.

Var. 2, ♂. Occiput, thorax above and beneath, metathorax, and scutum of 1st abdominal segment, black; scutellum and a discal patch on the mesothorax pale testaceous; segments 2—3 in the middle indeterminately, and all segments after the 4th, fuscous; stigma fusco-testaceous; legs pale, 4 anterior tarsi at the apex, and hind tarsi entirely, fuscous.

The only English specimen at hand is a ♂ belonging to var. 2. Antennæ 29-jointed. Palpi testaceous. Metathorax smooth. Abdomen oval, shorter than in most males of this genus; segments

* A var. of *B. terebella*, Wesm., has the abdomen entirely testaceous.

1—3 more coarsely sculptured than the rest; segment 1 black, not shining, much depressed in the middle, the margins elevated; sides beyond the scutum testaceous; segments 2—3 with a medial fuscous blotch, in which the rugosity is most apparent. According to Wesmael, the stigma is rather vaguely defined on its inner edge, especially towards the base, owing to the absence of a nervure in that place. More specimens might perhaps elucidate the author's meaning, which, as applied to this insect, is at present obscure. Notwithstanding this, the identification of the species is in no way doubtful.

Bred by Fitch from *Alucita hexadactyla*, L., July 8th. Wesmael examined four specimens taken near Liège.

2. *Bracon letus*, Wesm.

Bracon letus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 13, ♀.

Bright testaceous; a spot on the occiput, pectus, metathorax, and 1st abdominal segment, black or blackish; abdomen wholly rugulose; suturiform articulation well marked, crenate, bisinuated, emarginate in the middle; wings hyaline, stigma fuscous; terebra ♀ as long as the abdomen. ♀. Length, $1\frac{1}{2}$; wings, $3\frac{3}{4}$ lin.

Antennæ 27-jointed (according to Wesmael, 26-), black. The British specimen has a brown spot on each side of the mesothorax at the base of the wings, from which a fascia extends round the scutellum, covering the upper part of the metathorax, which is gibbous and smooth. First abdominal segment infuscated on the scutum. Ocelli bright red.

Colour more fulvous than in the preceding; the rugulosity of the abdomen finer and more uniform, not coarser at the base of the segments. The females are sufficiently distinguishable by the length of the terebra; in the present species the vertex is more transverse, the legs and wings shorter in proportion.

The ♀ here described was formerly in Walker's collection. Wesmael had only one ♀ from Liège.

3. *Bracon erythroctictus*, n. s.

Testaceus; antennis, stemmatico, occipite, mesothoracis lobis, metathorace, abdominis vitta interrupta, tarsisque apice, nigris; abdomine supra subtiliter transversim rimuloso (in ♂ fere punctulato); articulatione suturiformi crenulata bisinuata; alis subhyalinis, stigmatibus luteo. Terebra ♀ abdominis dimidio æqualis, vel paulo longior.

Testaceous; antennæ, stemmaticum, occiput, lobes of the mesothorax, metathorax, an interrupted longitudinal stripe on the abdomen, and tarsi at the tips, black; abdomen above minutely and transversely rimulose (in the ♂ almost punctulate); suturiform articulation crenulate, bisinuated; wings subhyaline, stigma luteous; terebra half as long as the abdomen, or a little longer. ♂ ♀. Length, $1\frac{1}{2}$; wings, $3\frac{1}{2}$ lin.

♀. Antennæ black, 34—38-jointed; radicle testaceous. Palpi pale. Disk of mesothorax, and scutellum, black. Metathorax rugulose, not canaliculated. Scutum of the 1st abdominal segment black, rugose, with a basal depression; tubercles placed much before the middle. Second segment with a triangular black rugose spot, like the scutum of the 1st, of which it seems to be a continuation; segments 3—6 have each a larger, transverse, black patch, leaving only the lateral margins, and the sutures narrowly, testaceous. Terebra as long as the hind tibia, or half the abdomen. Wings subhyaline, stigma luteous.

♂ similar; antennæ 40-jointed, much longer than the body; the 1st joint testaceous. Disk of mesothorax with the interstices between the lobes testaceous; scutellum black only at the base. Metathorax smooth, with two longitudinal carinæ uniting at the apex. Spots upon segment 3—6 smaller than those of the ♀, paler, and not contiguous.

Var. ♂. Less than 1 line long. Antennæ broken. Genæ and face, abdominal segments 1—2, at the sides, the latter very broadly, and the legs, testaceous; the rest of the abdomen pitchy. Bred by Fitch July 8th.

Resembles *B. tenuicornis*, Wesm., *Nouv. Mém. Ac. Brux.*, 1838, p. 42, yet the differences of sculpture and colour are too great to allow it to be referred to that species. Neither can it be *B. scutellaris*, Wesm., *lib. cit.*, p. 14, for the antennæ are much too long, and the terebra too short. A specimen which I took in Corsica differs in being a trifle smaller, with shorter (30-jointed) antennæ, and the terebra as long as the abdomen.

I took both sexes together in a marsh near the sea, Milford Haven. Several specimens have since been bred by Fitch at Maldon, in June and July, from galls on the couch-grass, *Triticum repens*, but it is not yet known upon what insect they are parasitic. Bred from similar galls by Moncreaff and thought by Walker to be *Wesmael's tenuicornis* (*Entom.* v. 240, 451).

4. *Bracon minutator*, Fab.

Bracon minutator, Fab., Piez., 110; Nees, Mon., i., 70, ♂ ♀.

Braco minutator, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 15, ♀.

Black; orbits more or less, lateral margins of abdomen, belly, and tibiæ at the base, testaceous; wings fuscous, paler towards the tips, with a hyaline streak behind the black stigma. Abdomen rugulose on segments 1—2, afterwards punctulate; suturiform articulation notched in the middle, deep, crenulate. Terebra as long as the body. Length, ♂ $1\frac{1}{2}$; wings, $3\frac{1}{4}$: ♀ 2; wings, $4\frac{3}{4}$ lin.

♀. Head black; labrum, mandibles, and orbits, more or less rufescent. Metathorax smooth and shining. Abdomen above black, lateral margins and 3 apical segments almost entirely testaceous; punctulate, subcarinated; segments 1—2 rugulose; 1 subquadrate, margined; 2 longer than 3. Belly testaceous. Antennæ 29—34-jointed. The ♂ is smaller, with the abdomen more oblong; antennæ (in two specimens) 29-jointed; otherwise like the ♀.

Described from 5 males, 3 females. A large species, and easy to recognise. First indicated as British by Curtis, with his usual accuracy ('Guide,' 2d ed., column 115) where it is marked as contained in his collection. Wesmael possessed 2 females. A ♀ was taken by E. A. Butler, at Battle, Sussex; a ♂ by me, Sept. 1st, at Nunton, Wilts; others by Fitch, at Maldon. Elisha bred 2 females, in July, from *Argyrolepis zephyrana*, Tr. Brischke reared it from *Bembecia hylæiformis*, Lasp. (not a British sp.). According to him (Schrift. nat. Ges. Danz., n. s., v. (3) 135) the cocoons are light brown, cylindrical, filling up the bore made by the larvæ.

5. *Bracon fulvipes*, Nees.

Bracon fulvipes, Nees, Mon., i., 74, ♂ ♀.

Braco fulvipes, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 26, pl., fig. 3 (wing).

Black; mandibles, face, orbits more or less, legs, and abdomen, rufo-testaceous; a variable black longitudinal dorsal stripe more or less covering the segments; metathorax rugulose, longitudinally carinated in the middle; abdomen transversely and finely aciculated; wings nearly hyaline, stigma fuscous; terebra ♀ $\frac{2}{3}$ — $\frac{3}{4}$ of

the abdomen in length. Length, ♂ $1\frac{1}{2}$; wings, ♂: ♀ $1\frac{1}{2}$ — $2\frac{1}{4}$; wings, ♂— $4\frac{1}{2}$ lin.

Var. 1, ♀. Metathorax almost smooth; middle and hind coxæ black or testaceous. Rare.

Var. 2, ♀. Head rufo-testaceous, stemmaticum black.

Var. 3, ♀. Orbits of the eyes entirely black.

Var. 4, ♂. Head black, only the mouth and apex of the genæ rufo-testaceous.

Var. 5, ♀. Second segment of the abdomen with two additional black spots, covering the thyridia.

Antennæ ♀ 29—37-jointed, as long as the body, sometimes ferruginous beneath towards the apex. Colours variable: sometimes the prothorax is testaceous; the mesothorax may be bordered with the same colour, its disk longitudinally marked with two lines, or its sides may be testaceous. On each side of the base of the rugulose metathorax is a small smooth space: the longitudinal carina is sometimes indistinct. Abdomen elongate-oval, not very shining; segments 1—2 covered with rugulosity crossing each other irregularly; the following segments transversely aciculated. Segment 1 black, 2 rufo-testaceous with a medial black spot, quadrate, or rounded behind. The 3 next segments have usually larger rectangular black patches, forming a continuous band as far as the 5th inclusive: these vary considerably, and are liable to be diminished to mere disconnected streaks. Legs rufo-testaceous, the last joint of the tarsi blackish; hind coxæ sometimes black at the base. Wings hyaline, or very slightly tinted; stigma and nerves blackish; but the stigma is sometimes pale in the ♀ (according to Wesmael, and in one British specimen).

The ♂ is similar, but smaller; antennæ 34—40-jointed, longer than the body. The black abdominal stripe is usually dilated posteriorly, covering the entire apical half of the abdomen, except a narrow margin all round. Not to be confounded with the ♂ of *mediator*, Nees, sp. 16, which has the abdomen smooth after the 3d segment, segments 2—3 entirely testaceous, &c.

The ♀ is most likely to be confused with *longicollis*, Wesm., sp. 6.

The length of the terebra given by Nees is two-fifths of the abdomen, which corresponds with most of the British specimens, although in some it is rather longer. Wesmael, in his diagnosis, states it to be as long as the abdomen, but subsequently admits that it is sometimes shorter. It is variable, within certain limits, but does not in this country attain the length exhibited by the Belgian specimens.

Generally distributed. Devonshire, Kent, Essex, Norfolk, London district; Yorkshire; Glen Lyon, Clober, Scotland.

6. *Bracon longicollis*, Wesm.

Bracon longicollis, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 28, ♀.

Elongate, black; mandibles, sides of the abdomen wholly, or the basal half, belly, and legs, testaceous: middle and hind coxæ, and claws, black: middle and hind femora more or less infuscated at the base; metathorax subelongate, with a medial longitudinal carina (often obsolete); 2d and following abdominal segments very finely aciculated, somewhat shining; wings subhyaline; terebra $\frac{1}{4}$ as long as the abdomen, the valves stout, subclavate. ♂ ♀. Length, $1\frac{1}{2}$; wings, $3\frac{1}{3}$ lin.

Var. ♀. Carina of the metathorax obsolete: posterior femora with a fuscous line above and below, their tibiæ fuscous in the middle. Length, $1\frac{1}{4}$; wings, $2\frac{4}{5}$ lin. Two specimens taken by Bignell.

Antennæ ♀ 29—33-jointed, as long as the body; palpi black; mandibles testaceous. Parallel to the metathoracic carina are a few rugulosities. Abdomen elongate-oval, black; the lateral margins of segments 1—3—4, sometimes of all, together with the belly, testaceous. Segment 2 always finely rugulose, and generally the rest, but the sculpture of these is frequently so minute that they appear shining. Wings not quite hyaline, with an obsolete whitish mark under the fuscous stigma.

The undescribed ♂ has 32-jointed antennæ, longer than the body. Metathorax indistinctly carinated, but with some longitudinal wrinkles. Sculpture and colours of the abdomen as in the more strongly marked females; segment 2 aciculated. Fore femora and tibiæ slightly infuscated; middle and hind femora black, their tibiæ tipped with black, and the tarsi fuscous.

Easily distinguished from the preceding species. It is smaller; the head and thorax are uniformly black, the femora marked with the same colour; the terebra is shorter; and it shows no disposition to run into varieties.

Wesmael's estimate of the length of the terebra $\frac{1}{3}$ — $\frac{1}{2}$ of the abdomen, is again somewhat too great for the British specimens.

Generally distributed; Leicester, St. Albans, London district, Devonshire, Sussex, Essex, Norfolk, &c.

7. *Bracon variegator*, Nees.

Bracon variegator, Nees, Mon., i., 89; Wesm., Nouv. Mém. Ac. Brux., 1838, p. 33, ♂ ♀; Cur. Morton's Cyclop. Agric., s. v. *Bracon*; Farm Ins., 370.

Black, varied with yellow; abdomen broadly ovate, subdepressed, granulated throughout; segment 2 subcarinated, with a shallow fovea on each side; wings fuscous, subhyaline at the apex; terebra $\frac{1}{4}$ or $\frac{1}{3}$ of the abdomen. ♀. Length, $1\frac{1}{3}$ — $1\frac{1}{2}$; wings, 3 lin.

Antennæ ♀ 18—20-jointed, shorter than the body; palpi blackish; mandibles yellow. Face yellow with a large triangular black spot; orbits and vertex yellow, stemmaticum and occiput black. Thorax black, except a spot on each humeral angle, another beneath the wings, and a large *square* patch on the mesothorax extending over the scutellum; the latter, however, is more or less black at the base. First abdominal segment with yellow lateral margins; belly yellow with two longitudinal rows of black spots. The following segments have sometimes the lateral borders testaceous, and in one specimen segment 2 is almost wholly of that colour, the prominent parts of the surface being blackish. Sutureiform articulation bisinuate, crenulate, and notched in the middle; strongly marked, as are the two following sutures, especially at the sides. Segments 3—5 rather punctulate than rugulose, somewhat shining. A smooth medial line is visible in certain lights upon segments 2—5. Legs varied with fuscous and testaceous; coxæ black. Wings with an obsolete whitish fascia; stigma large, ovate, fuscous; 2d cubital areolet as long as the 3d, measured on the cubitus.

♂, according to Wesmael, similar; antennæ 23—24-jointed in the two British specimens; fore legs black, testaceous at the base.

The antennæ, and the length of the 2d cubital areolet, distinguish this species from *B. brevicornis*, Wesm., which it superficially resembles. The *square* yellow patch on the mesothorax is characteristic, and the description given by Curtis, *l. c.*, unmistakable.

Described from six females, one in Walker's collection, the others found in old jackdaw-nests, in company with *B. stabilis*, Wesm., sp. 9. Also taken by Fitch not uncommonly at Maldon. According to Curtis it is a parasite of *Endrosis fenestrella*, Scop.; the ♂ ♀ were likewise captured by him late in August on Hampstead Heath. Two males in bad condition, but apparently of this species, were bred by Elisha from *Lithocolletis torminella*, Freyer. Kawall obtained it in April—May from cones of *Pinus abies* tenanted by *Anobium abietis*,

Fab., and *Coccyx strobilella*, L. He considered it a parasite of the former; but it came more probably from the *Tortrix* (Stett. Zeit., 1855, p. 231).

8. *Bracon nigratus*, Wesm.

Bracon nigratus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 34, ♂ ♀.

Black; palpi blackish; fore femora towards the apex, their tibiæ at the base, or entirely, and posterior tibiæ at the base, testaceous; segment 1 obscurely yellowish at the sides, 2—3 each with an obsolete reddish patch at the basal angles, or more or less obscurely rufous, or wholly black. Wings funato-hyaline, stigma and nervures fuscous; 2d cubital areolet narrow, a little shorter than the 3d. Metathorax smooth. Abdomen with segments 1—3 rugulose, dull; the rest more shining; suturiform articulation straight. Terebra $\frac{1}{4}$ of the abdomen. ♂ ♀. Length, ♂, 1—1 $\frac{1}{3}$; ♀ 1 $\frac{1}{3}$; wings, 2 $\frac{1}{2}$ —3 $\frac{1}{3}$ lin.

Antennæ ♀ 31—32-jointed. Belly at the base yellowish, varied with black. Abdomen suborbicular, not longer than the thorax, covered with fine rugosity, becoming finer posteriorly, so that the 4th and following segments are more shining and nearly smooth. Posterior femora (in one specimen) testaceous beneath. Rufous spots on segments 2—3 more distinct than in the ♂. Antennæ ♂ 29—31-jointed (in three examples) longer than the body. Smaller than the ♀; abdomen narrower, the rufous spot diffused, indistinct.

Four specimens; a female taken by Bignell in Devonshire; two males by me near Abergavenny, and a third at Niton, Isle of Wight.

9. *Bracon stabilis*, Wesm.

Bracon punctulator, var. b., Nees, Mon., i., 88, ♂ ♀.
Bracon stabilis, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 25, ♂ ♀.

Bracon stabilis, Ratz., Ichn. d. Forst., iii., 38, ♂ ♀.

Black, head varied with testaceous; lateral margins of 1st abdominal segment, and belly, yellow; anterior tibiæ and tarsi more or less, anterior femora sometimes at the apex, and hind tibiæ at the base, testaceous; wings blackish, paler towards the tips, stigma dark brown, unicolorous; 2d cubital as in the following species; terebra ♀ $\frac{1}{2}$ the length of the abdomen, which is ovate, depressed, and rugulose throughout. Length, ♂ 1—1 $\frac{1}{2}$; wings, 2 $\frac{1}{3}$ —3 $\frac{1}{2}$; ♀ 1 $\frac{1}{3}$; wings, 3 $\frac{1}{3}$ lin.

Antennæ ♀ black, together with the palpi, 25-jointed, and $\frac{3}{4}$ as long as the body. Mandibles, orbits narrowly, two spots beneath the antennæ (sometimes obsolete), margins and under side of the abdomen, yellowish. Legs black, 2d joint of trochanters, apex of femora, and base of tibiæ, testaceous. The tibiæ sometimes testaceous with a black line in front, and middle and hind femora entirely black. Abdomen rugulose above, becoming rather punctulate towards the apex; segments 2—3 more coarsely rugose at the base, and the 2d sometimes with a faint longitudinal carina.

The ♂ is similar, but with more yellow on the face; antennæ 27-jointed, as long as the body. Abdomen rather punctulate than rugulose; segments 2—3 not more coarsely sculptured than the rest; the two apical segments almost smooth.

Common on umbelliferous flowers, and may also be beaten from furze, thatch, &c., in spring; Fitch finds it on windows. Taken in Cadder Wilderness near Glasgow; Leicestershire; Worcestershire; Hainault Forest; Devonshire; Essex. Abundant in old jackdaw nests in a church-tower in Northants, together with *Bracon variegator*, Nees. In the same nests *Attagenus pellio*, L., and some *Tineæ* were also common, of which the Bracons were perhaps parasites. Ratzeburg records that Nördlinger bred this species from ash-bark, with *Hylesinus crenatus*, Fab. W. H. B. Fletcher bred two males and two females, June 6th, from *Gelechia mulinella*, Zell.

10. *Bracon brevicornis*, Wesm. (Pl. I., figs. 1 a, 1 b).

Bracon punctulator, var. β bis, Nees, Mon., i., 88, ♂ ♀.

Bracon brevicornis, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 23, pl., fig. 2 (wing).

In Catalogue of Ichneum., p. 96, dele syn. *Bracon variegator*, Cur.

Black; head, thorax, and scutellum varied with testaceous; femora at the apex, tibiæ and tarsi more or less, 1st abdominal segment at the base and sides (often the 2d also in the ♂), and belly, testaceous; wings brownish, hyaline at the apex, stigma sometimes bicolorous; 2d cubital areolet very small, separated from the exterior margin by twice its own length, measured on the cubitus, which becomes obsolete a little beyond the 2d cubital areolet; terebra ♀ $\frac{1}{3}$ the length of the abdomen, which is obovate, depressed, shining, and very finely punctulate. Length, $1\frac{1}{4}$ — $1\frac{1}{2}$; wings, 3 lin.

Antennæ ♀ unlike those of any other species, not longer than the head and thorax, stout, 14-jointed in two British specimens

(17-jointed according to Wesmael). Palpi, mandibles, and head testaceous; occiput, stemmaticum, and a facial spot, black; above this spot is a small black longitudinal carina. Thorax black, with the disk testaceous, and black stripes on the mesothoracic lobes; scutellum testaceous, more or less black at the base and apex. Abdomen ♀ ovate, depressed; 1st segment testaceous, with a black, smooth, triangular scutum; the 2d and following segments black (according to Wesmael often narrowly margined at the sides with testaceous), somewhat shining, almost invisibly punctulate. Legs black, apex of femora, fore and middle tibiæ and tarsi more or less, and hind tibiæ at the base, testaceous; sometimes the fore coxæ are testaceous, and all the femora black only at the base. Stigma fuscous, with a testaceous spot at the base, which is sometimes obsolete.

Antennæ ♂ 20—26-jointed according to Wesmael, 21-, 21-, 23-jointed in three British specimens, almost as long as the body; black spot on the face sometimes reduced to a mere transverse line, or the head is black with the orbits and genæ testaceous; scutellum sometimes black, with the lateral margins testaceous, or entirely black. Abdomen more oblong than that of the ♀; segment 1 often pale, with a central black spot; 2d often pale, with some obscure markings. One ♂ has the right antenna 22- and the left 23-jointed.

This species, notwithstanding variations of colour, is easily recognised by the structure of the 2d cubital areolet in both sexes, and by the antennæ of the ♀, which are much shorter and stouter than those of *stabilis* ♀. Both sexes may be also distinguished from *stabilis* by their abdomen, which is shining and almost smooth; that of *stabilis* is dull and ruguloso-punctulate, except towards the apex.

I once reared the ♀ from galls of *Andricus terminalis*, Fab., found near London; and on October 26th, 1884, W. F. Kirby bred six males, one female, from *Ephestia elutella*, Hüb. Brischke obtained a ♂ from *Dioryctria abietella*, Zinck. A ♂ was bred by S. Webb at Dover, Aug. 10th, from *Myelois ceratoniæ*, Zell.

11. *Bracon erraticus*, Wesm.

Bracon erraticus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 35, ♂ ♀.

Black, with black palpi; mandibles, usually some spots on the head, sides of the abdomen at the base, belly at the base, fore

femora at the apex, fore tibiæ wholly, middle and hind tibiæ at the base, testaceous; abdominal segments 2—3 finely rugulose, the following segments almost entirely smooth; wings obscure; terebra ♀ as long as the abdomen. Length, ♂ $1\frac{1}{4}$; wings, 3; ♀ $1\frac{1}{2}$ lin.

Var. 1, ♀. Orbits broadly, disk of mesothorax in front, and margins of abdomen all round, testaceous. Antennæ 30-jointed. Segments 4—5 very finely rugulose.

Var. 2, ♂. Head entirely black, except the mandibles.

♀. Antennæ 29—32-jointed. An orbital spot under the eyes, another on the vertex, and an intermediate spot on each side, testaceous. First abdominal segment with the lateral margins narrowly testaceous; segments 2—3 more broadly, the border becoming attenuated hindwards, and often continued along the 4th segment. Anterior half or two-thirds of the belly also pale. Segments 2—3 finely rugulose longitudinally, 3 sometimes nearly smooth, the rest showing hardly any traces of sculpture. Wings with a hyaline streak under the stigma.

♂ similar; antennæ 37-jointed, in one specimen; orbits often almost entirely testaceous. Segments 2—3 more rugose and less shining; segment 4 with some distinct rugosities.

Bignell has taken in Devonshire four females and two males; one of the latter being var. 2. Elisha bred two males from *Eupæcilia ciliana*, Hüb., July 31st. Brischke obtained a ♂ variety from *Bembecia hylæiformis*, Lasp.

12. *Bracon exarator*, n. s.

Bracon punctulator, var. β , Nees, Mon., i., 88 (e collectione Desmarestiana). ♂ ♀.

Niger, capitis picturis, abdominis segmento 1mo lateribus, ventre, femoribus anticis apice, tibiis anticis fere totis, intermediis basi anguste, posticis latius, testaceis; abdomine ovato, subdepresso, segmentis 1mo et 2do totis, 3tio basi, rugulosis; cæteris lævibus nitidis; terebra abdominis fere longitudine; alis infuscatis, lineola hyalina, stigmatè nigro.

Black; orbits partially, 1st abdominal segment at the sides, belly, fore femora at the apex, fore tibiæ almost entirely, intermediate narrowly at the base, hind pair more broadly, testaceous; abdomen ovate, subdepressed, segments 1—2 wholly, 3 at the base, rugulose; the rest smooth and shining; terebra about as long as the abdomen; wings infuscated, with a hyaline streak, stigma black. ♀. Length, $1\frac{3}{4}$; wings, $3\frac{3}{4}$ lin.

Nearly allied to *stabilis*, Wesm., but differs in having the 2d

cubital areolet of normal length, in the sculpture of the abdomen, and the greater length of the terebra. Antennæ ♀ 31-jointed, as long as the body, and, like the palpi, black; mandibles testaceous. Orbits rufo-testaceous on the vertex, which colour is interrupted beneath, leaving only two or three obscure spots. Metathorax transversely rugulose in the middle, and obsoletey canaliculated. Abdominal segments 1—2 rugulose, the 3d more finely at the sides and base, with a smooth medial line; the rest smooth: segment 2 obsoletey carinated.

This does not seem to be the typical *B. punctulator*, Nees, in which the segments after the 3d are not smooth, the terebra is only as long as the 5th and following segments, &c. In any case the name *punctulator*, under which are comprised several distinct species, must be rejected.

A single ♀ captured by Bridgman at Brundall, Norfolk, Sept. 15th.

13. *Bracon triangularis*, Nees.

Bracon variator, var. *a*, Nees, Mag. Ges. Berl., 1811,
p. 8, ♀.

B. triangularis, Nees, Mon., i., 81, ♀.

Black; palpi concolorous; mandibles testaceous; orbits sometimes dull rufous; abdomen fulvous, segment 1, or a spot upon it, and sometimes a spot on segments 2—4, black or piceous; legs black, narrowly rufous at the articulations, and the apex of the lower trochanters. Wings more or less dark fuscous, with a hyaline streak. Metathorax smooth. Segment 2 rugulose in the middle of the base; suturiform articulation bisinuated. Terebra as long as the abdomen. ♀. Length, $1\frac{3}{4}$ — $2\frac{1}{4}$; wings, $3\frac{1}{2}$ — $4\frac{1}{2}$ lin.

Antennæ 30-jointed (in one specimen) somewhat shorter than the body. Metathorax with vestiges of a carina, and a basal impression. Abdomen elongate-oval, rather longer than the head and thorax; segment 1 with a piceous spot in the middle, 2 with an oval, piceous, rugulose, basal spot (forming an imperfect scutum like that of the 1st) and on each side, a small linear impression; 3—4 each with a larger, transverse, subrectangular piceous spot. No doubt these marks are variable; the specimen described by Nees had segment 1 black, margined, and longitudinally depressed, fulvous at the apex; 2 with a black triangular basal spot, which was punctulato-rugose at the base. Terebra straight, the valves black, hardly ever longer than the abdomen. The wings are described as black; those of the British specimen are subfuscous.

Bracon megapterus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 22, ♀ is so described as to include the present species, except that the terebra is only two-fifths of the abdomen.

B. triangularis, Nees, was first recorded as British by Curtis (Guide, 2d ed., 1837, column 115) and as contained in his collection. The specimen above described was sent by Fitch. Brischke bred it from *Bembecia hyleiformis*, Lasp., a Sesiid not known as British.

14. *Bracon Roberti*, Wesm.

Braco Roberti, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 37, ♀.

Black; abdomen testaceous, with the 1st segment, a round rugulose spot at the base of the 2d, and a row of contiguous patches on segments 3—7, forming a broad band, black; suturiform articulation straight; wings blackish, with an angulated whitish mark underneath the stigma: terebra ♀ as long as the abdomen. Length, ♂ $1\frac{1}{2}$; wings, $3\frac{3}{4}$: ♀ 2; wings, $4\frac{2}{3}$ lin.

Antennæ ♀ 36-jointed, as long as the body; palpi black. Metathorax smooth, not carinated. First abdominal segment with the lateral margins testaceous; segment 2 testaceous, with a black rugulose subtriangular basal spot, not reaching the hind margin; 3—7 with larger, transverse patches, covering the disk except the lateral margins, which, with the belly, are testaceous. Abdomen, after the 2d segment, entirely smooth.

The ♂ has the antennæ about 38-jointed, as long as the body, and differs from the ♀ only in size, and in having the knees obscurely pitchy.

This species has the facies of *B. variator*, Nees, but differs in being much larger, with rugulosities at the base of the 2d segment.

Rare. I took the ♂ in North Devon, Braunton Burrows; and the ♀ in a similar sandy situation, Freshwater Bay, Pembrokeshire. Wesmael only knew a single ♀ taken by Robert near Liége.

15. *Bracon lævigatus*, Ratz. (Pl. I., fig. 1).

Bracon scutellaris, Ratz., Ichn. d. Forst., ii., 41, ♂ ♀ (not of Wesm.)

B. lævigatus, Ratz., lib. cit., iii., 39.

Testaceous, variable; head, thorax and abdomen more or less diversified with black or pitchy; antennæ black, or fuscous, pale

at the extreme base; legs testaceous, claws black; tarsi, and sometimes hind tibiæ at the apex, fuscous. Wings hyaline, stigma fuscous; apical nervures decolorous. Body entirely smooth and shining, except the 2d abdominal segment, which is more or less aciculated; suturiform articulation sinuated. Terebra longer than the abdomen; valves black. ♂ ♀. Length, ♂ $1\frac{1}{4}$; wings, ♂ 3; ♀ $1-1\frac{3}{4}$; wings, ♀ $3-5\frac{1}{4}$ lin.

The following are the principal varieties of the ♀:—

Var. 1. Stemmaticum, occiput, metathorax, 1st abdominal segment, an aciculated spot on the 2d, and two smaller spots on each of the 3d and 4th, black. Length, $1\frac{3}{4}$ lin.

Var. 2. Vertex and occiput, 3 bands on the mesothoracic lobes, metathorax, segment 1, and a dorsal band reaching nearly to the anus, black. Length, $1\frac{1}{4}$ lin.

Var. 3. Head black or pitchy; orbits rufescent; mesothoracic lobes, metathorax, and segment 1, black; the remaining segments pitchy above; segment 1 at the sides, suturiform articulation, and anus, testaceous. Length, $1\frac{1}{4}$ lin.

Var. 4. Like the last, but all the dark parts pitchy; abdomen pitchy-testaceous. Length, 1 lin.

The colours of the ♂ are more uniform. Head testaceous or pitchy; stemmaticum, or vertex, or both, and occiput, 3 stripes on the mesothoracic lobes (of which the middle one is abbreviated hindwards), metathorax, and abdomen above, black; segment 2 testaceous with a black discal spot, or entirely pitchy; hinder margins of the 3d and following segments narrowly pale.

Antennæ of both sexes slender, and longer than the body; those of the ♂ 26—29, of the ♀ 20—32-jointed; the large females of var. 1 have the greatest number of joints. Abdomen as long as the head and thorax; segment 1 longer than its apical breadth, margined, smooth, elevated towards the apex, narrowed towards the base, and there excavated; segment 2 aciculated, the rest smooth. The differences of size and colour between the largest and smallest ♀ are such that, if their origin were unknown, they would be taken for distinct species.

Described from four males, seven females. Two females are in Parfitt's collection. The remaining nine specimens are part of a greater number bred by Fitch at Maldon from the willow-galls of *Nematus pedunculi*, Hart., during June, July, and August. According to Ratzeburg, Heyer reared them from similar galls on *Salix aquatica*, and Brischke a single specimen from *Salix aurita*.

16. *Bracon mediator*, Nees.*Bracon mediator*, Nees, Mon., i., 69, ♀.*Bracon mediator*, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 39, ♂.

Black; mouth, legs (with coxæ), and abdomen, rufo-testaceous; scutum of 1st segment, and 4 last segments entirely, black; segment 2 rugulose at the base, 3—7 smooth; wings subhyaline, stigma blackish; terebra ♀ as long as the body. Length, ♂ $1\frac{1}{3}$ —2; wings, $3\frac{1}{2}$ — $4\frac{1}{2}$; ♀ 2—3; wings, $4\frac{1}{2}$ — $5\frac{3}{4}$ lin.

Antennæ ♀ 33-jointed, scarcely shorter than the body; mandibles and palpi testaceous. On each side of the vertex is a subobsolete rufous spot, often wanting. Metathorax shining, with an inchoate apical carina, from which branch out on either side a few rugosities. Second abdominal segment rugulose, except the hind margin; sometimes there is a small black spot in the middle of the base; suturiform articulation slightly sinuated; segments 3—5 rufo-testaceous, the rest black.

The ♂ is similar; antennæ 36—40-jointed, as long as the body; segments 2—3 rugulose; 4th black with the base rufo-testaceous, or rufo-testaceous with the sides and apex black; even the 3d is sometimes black at the apex.

Described from 18 males and 6 females. The latter vary considerably in size; one is very large as compared with the rest, being 3 lines long, or 5 lines including the terebra; this is the largest British *Bracon* I have seen. *B. fuscicoxis*, Wesm., is distinguished from this species by being generally smaller, having black coxæ, a shorter terebra, &c.

I am indebted to Bignell for a knowledge of the habits of this species, which is a parasite of *Trochilium crabroniforme*, Lewin, feeding on the wood of the sawfly. Thirty-three specimens, all males, bred from an osier-stem, two years old, in Yorkshire, were sent to Bignell in June, 1884, by Harwood, of Colchester. They emerged from the 7th to the 12th of the month. Four of these specimens were sent to me. Some years ago I used to find both sexes commonly in an osier-bed near Aylestone, Leicestershire, now destroyed. Cameron has taken them frequently in Cadder Wilderness near Glasgow; and Fitch near Maldon. Cocoons brown, of loose texture, filling the cavity occupied by the larva of *Sesia*; each cocoon is about $3\frac{1}{2}$ lines in length.

17. *Bracon Vectensis*, n. s.

Niger, palpis fuscis, abdominis segmento 1mo lateribus, 2do toto, 3tio maximam partem, femoribus anticis, tibiisque omnibus, piceo-flavis, tibiis posterioribus apice fuscis. Alæ fumato-hyalinæ, stigmatate nervisque fuscis. Metathorax lævis. Abdominis segmentum 1mum longius quam latius, marginatum, nitidum, basi excavatum, apice aciculatum, sicut 2dum; cætera lævia; articulatio suturiformis recta.

Black; palpi fuscous; segment 1 at the sides, 2 entirely, 3 for the most part, fore femora, and all the tibiæ, pitchy or dull yellowish; posterior tibiæ fuscous at the apex. Wings fumato-hyaline, stigma and nervures fuscous. Metathorax smooth. Segment 1 longer than broad, margined, shining, excavated at the base, aciculated at the apex; 2 also aciculated; the rest smooth; suturiform articulation straight. ♂. Length, 1; wings, $2\frac{1}{4}$ lin.

Antennæ 26-jointed, stout, longer than the body. The pale parts are dull ochreous, without any tinge of red: segment 3 is mostly pale, but the sides and apex are indeterminately blackish; the following segments entirely black.

The single specimen was taken at Niton, Isle of Wight.

18. *Bracon fuscicoxis*, Wesm.

Bracon fuscicoxis, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 32, ♂ ♀.

Black, with pale palpi; mandibles, abdomen in the middle, and legs, testaceous; the coxæ black; metathorax carinated; 2d abdominal segment rugulose at the base, within the area of a black spot; wings subfuscous, stigma brown; terebra ♀ $\frac{1}{2}$ as long as the abdomen. Length, ♂ $1\frac{1}{4}$; wings, ♂: ♀ $1\frac{1}{2}$; wings, $3\frac{3}{4}$ lin.

Antennæ ♀ 27—29-jointed, as long as the body. Metathorax subrugulose, with a distinct longitudinal medial carina. First abdominal segment black, lateral margins narrowly testaceous; 2d testaceous, with a medial, obtriangular, rugulose, black spot; 3d wholly testaceous, or with an indeterminate blackish spot on the hind margin; segments 2—3 almost microscopically punctulate, the rest smooth: segments 4—5 black, with testaceous lateral margins, 6—7 wholly black, shining. Belly testaceous. Wings with a vestige of the usual whitish fascia.

The ♂ is similar; antennæ 37—38-jointed in three specimens, (according to Wesmael, 30-jointed).

Described from four females and three males. Taken in Leicestershire, and both sexes together at Nunton,

Wilts; by Fitch at Maldon; by Bridgman near Norwich; and by Cameron in Scotland (Possil, Rannoch).

19. *Bracon tornator*, n. s.

Niger, ore, palpis, abdominis lateribus plus minus, femoribus anticis apice, tibiis iisdem totis, trochanteribus inferis, rufo-testaceis; coxis nigris; tibiis posterioribus basi flavidis, apice nigris; metathorace lævi, apice carinato; alis fumato-hyalinis vel subhyalinis; terebra abdominis fere longitudine.

Black; mouth, palpi, sides of abdomen more or less anteriorly, fore femora at the apex, their tibiæ entirely, and the lower trochanters, rufo-testaceous; coxæ black; posterior tibiæ yellowish at the base, black at the apex; metathorax smooth, carinated at the apex; wings fumato-hyaline or subhyaline; terebra about as long as the abdomen. ♂ ♀. Length, ♀ $1\frac{2}{3}$; wings almost 4 lin.: ♂ $1\frac{1}{2}$; wings, 3 lin.

Antennæ ♀ 29-jointed (in three examples) a little shorter than the body. Metathorax smooth, with an inchoate carina at the apex. Abdomen ovate, as long as the head and thorax, broadly sessile; segment 1 black, rugulose at the base, its apical tuberosity large, orbiculate and smooth; lateral margins narrowly yellow: segment 2 smooth, except sometimes a few minute longitudinal wrinkles in the middle of the base; the rest of the abdomen smooth. Segment 2 testaceous, with a black longitudinal band; segment 3 with a larger, transverse, black patch, rounded in front; segment 4 black with the lateral margins testaceous; the remaining segments entirely black. Belly testaceous. Sutureform articulation straight. In a second ♀ the testaceous border of segments 2—3 is narrower, and does not reach segment 4; the fore femora have a black streak at the base. A third ♀ in Fitch's collection differs in having the wings fuscous.

♂. Antennæ 31—33—35-jointed, in three examples; longer than the body. Fore femora black at the base. Sides of the abdomen broadly testaceous, that colour extending almost to the apex, and over the disk, so as to leave a medial black, sub-interrupted band. Smaller, but otherwise similar to the ♀.

I found one ♀ in Leicestershire, and another at Nunton, Wilts. Parfitt sent a ♂ for examination, probably from Devonshire; two were taken by me at Rannoch; and two are in Fitch's collection.

20. *Bracon guttiger*, Wesm.

Bracon guttiger, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 19, ♂ ♀; Ratz., Ichn. d. Forst., ii., 40.

Black; mandibles and palpi testaceous; circular space between clypeus and mandibles unusually large; legs testaceous, varied with black; 1st abdominal segment pale at the sides, 2d with a yellowish spot on each lateral margin; belly testaceous, with transverse black lines interrupted in the middle; wings subhyaline; terebra ♀ $\frac{1}{4}$, or sometimes $\frac{1}{3}$, as long as the abdomen. Length, 1—1 $\frac{1}{2}$; wings, 2 $\frac{1}{2}$ —3 $\frac{1}{2}$ lin.

Antennæ black, 27-jointed in both sexes, those of the ♀ as long as the body, of the ♂ longer. Metathorax shining, with a few rugosities, and traces of a medial carina. Second abdominal segment longitudinally rugose, the apical margin, and all the following segments, smooth: 8th segment of the ♀ (protruded in one specimen) whitish. Suturiform articulation slightly bisinuated, emarginate in the middle. Legs dull testaceous, with black coxæ; middle femora with a black line above, or nearly all black; hind tibiæ, and all the tarsi, fuscous at the apex. In the ♂ the 3d abdominal segment has a minute yellowish spot on each side, like the 2d; otherwise similar to the ♀.

Var. ♂ ♀. Abdominal segments 2—3 with a transverse testaceous band.

According to Ratz., *lib. cit.*, 41, parasitic on *Coleophora laricella*, Hüb., emerging early in June. Taken by Wesmael in May and June. Rather common in England; Earham, Brundall, Norwich; Nunton, Wilts, &c.

21. *Bracon Satanus*, Wesm.

Bracon Satanus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 30, ♂ ♀.

Elongate, black; fore femora at the apex, fore tibiæ, posterior tibiæ at the base, and tarsi more or less, testaceous. Wings subinfuscated, stigma and nervures blackish. Metathorax generally, but not always, carinated. Abdomen oblong, the sides parallel to near the apex; segment 2 (and base of 3 in the ♂) longitudinally rugulose; the rest shining, with some shallow scattered punctures. Terebra $\frac{1}{2}$ the length of the abdomen, or somewhat less; valves stout, subclavate. Length, ♂ 1 $\frac{1}{2}$; wings, 3 $\frac{1}{2}$: ♀ 1 $\frac{3}{4}$; wings, 4 lin.

Var. 1, ♂ ♀. Smaller; terebra $\frac{1}{3}$ abdomen. Length, 1—1 $\frac{1}{4}$ lin. Wesm.

Var. 2. ♂. Posterior femora fusco-testaceous. Length, $1\frac{1}{2}$ lin. Wesm.

Var. 3, ♀. Segments 2—3 at the sides, and the tibiæ entirely, testaceous; terebra more slender, $\frac{1}{2}$ abdomen. Length, $1\frac{1}{2}$ lin. Wesm.

Antennæ ♀ 33—36-jointed, as long as the body; palpi blackish, mandibles testaceous in the middle. Metathorax with some wrinkles on each side of the carina. Abdomen shining; segment 1 narrowly testaceous at the sides; 2 longitudinally rugulose, with a faint medial carina, the hind margin smooth; suturiform articulation slightly sinuated in the middle. Wings with an obsolete white mark under the stigma. The ♂ is similar, with 37—39-jointed antennæ, longer than the body; 4 anterior tarsi sometimes testaceous, with the last joint black.

The largest of the British species with a black abdomen, and not common. Wesmæel's three varieties have not yet occurred here. He possessed altogether fifteen specimens taken near Brussels. Described from a fine pair taken, the ♂ by Fitch, the ♀ by Bridgman: Cameron has captured several in Scotland, at Glenelg, and Cadder Wilderness, near Glasgow; and I took a ♂ and four females near Abergavenny.

22. *Bracon fraudator*, n. s.

Niger, palpis obscuris; ventris basi pallida; ore, orbitis supra obsolete, segmentorum 1—2 marginibus, pedibusque, rufo-testaceis; coxis et trochanteribus superis nigris; tarsis cum tibiæ posticarum apice fuscis. Alæ hyalinæ, nervis fusciscentibus, stigmatibus testaceo, fusco marginato. Metathorax aciculatus, basi lævis, medio leviter impressus, carina etiam media inchoata. Abdomen ovatum, depressum, capiti thoracique longitudine æquale, segmentis 1—2 aciculatis, cæteris lævibus; segmento 1mo subquadrato, marginato; articulatione suturiformi medio vix subsinuata. Terebra abdominis dimidio brevior.

Black; palpi dusky; belly pale at the base; mouth, orbits above indistinctly, sides of segments 1—2, and legs, rufo-testaceous; coxæ and upper trochanters black; tarsi, and tips of hind tibiæ, fuscous. Wings hyaline, nervures pale fuscous, stigma testaceous bordered with fuscous. Metathorax aciculated, except at the base, with a medial impression and the commencement of a carina. Abdomen ovate, depressed, as long as the head and thorax; segments 1—2 aciculated, the rest smooth; segment 1 subquadrate, margined; suturiform articulation faintly sinuated. Terebra shorter than $\frac{1}{2}$ abdomen. ♀. Length, $1\frac{1}{2}$; wings, 3 lin.

Antennæ 29-jointed, rather shorter than the body. Resembles *terebella*, Wesm., but as the metathorax and abdomen are not smooth, the terebra longer, &c., it must be for the present recorded as distinct.

A single specimen taken by Cameron at Clober, Scotland.

23. *Bracon epitriptus*, n. s.

Niger, mandibulis piceis, palpis pallidis; metathorace lævi; abdomine nigro vel (in minoribus) piceo, segmenti 1mi lateribus apice, 2di macula utrinque laterali, ventre, pedibusque, pallide testaceis; segmento 2do basi aciculato, articulatione suturiformi recta. Alæ fere hyalinæ, stigmatibus nervisque fuscis. Terebra abdomine triente brevior.

Var. 1. Duplo minor, pedibus ♂ fusco variis, ♀ pallidioribus, coxis piceis.

Var. 2. Segmento 3tio ♀ rufo-piceo.

Black; mandibles pitchy, palpi pale; metathorax smooth; abdomen black or (in small specimens) pitchy; segment 1 at the sides posteriorly, a spot on each side of the 2d, belly, and legs, pale testaceous; segment 2 aciculated at the base, suturiform articulation straight. Wings subhyaline, stigma and nervures fuscous. Terebra $\frac{1}{3}$ shorter than the abdomen. ♂ ♀. Length, 1—1 $\frac{1}{2}$; wings, 2 $\frac{1}{3}$ —3 $\frac{1}{2}$ lin.

Var. 1. Only half as large; legs ♂ varied with fuscous; coxæ pitchy.

Var. 2, ♀. Segment 3 rufo-piceous.

Antennæ ♀ 24—28-jointed, slender, as long as the body. Metathorax smooth, often impressed in the middle. Abdominal segments 1—2 aciculated, the apex of the latter, and the rest, smooth; abdomen oblong-ovate, acuminate posteriorly, as long as the head and thorax. Legs pale testaceous, coxæ black, or piceous; femora sometimes above, and hind tibiæ at the apex, infuscated. Stigma large; 2d intercubital transverse vein in the ♀ decolorous. The ♂ is rarely as large as the ♀, generally much smaller, and narrower; antennæ 26—31-jointed, longer than the body: 4 posterior femora, and hind tibiæ, often infuscated, and the abdomen, or the whole body, piceous.

The smaller individuals of both sexes have fewer joints in the antennæ, and are paler in colour; the males have hardly any aciculation on the 2d segment.

Described from 27 specimens, 9 males, 18 females, differing in size and development, but apparently all of one species. The ♂ is not *vitripennis*, Ratz. (iii. 37),

which has 23-jointed antennæ, and is said to be so like *discoideus*, Wesm., as to pass for a variety; nor can the ♀ be considered *pellucidus*, Ratz. (*l. c.*), the terebra of which is only $\frac{1}{3}$ — $\frac{1}{2}$ of the abdomen, and the antennæ 23—26-jointed. Both of Ratzburg's species, however, are insufficiently described. The small males are very like those of *discoideus*, Wesm., but the latter may be known by their dusky wings; the females are easily distinguished.

A common species, but hitherto, as it seems, overlooked. Taken in the London district, Northants, Yorkshire, Devonshire, and Wilts. I have always supposed it to have some relation to willows; and this is confirmed by the breeding of a ♂ by Bignell, Sept. 3rd, from a gall of *Hormomyia capree*, Winnertz.

24. *Bracon larvicida*, Wesm.

Bracon larvicida, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 41, ♀.

Black, with pale palpi; mandibles, lateral margins of abdominal segments 1—2, and sometimes 3, but often the 1st only, obscurely testaceous; belly entirely, or at the base, and legs, testaceous; middle and hind coxæ black; 4 posterior femora, or only the hindmost, more or less infuscated; segment 2 rugulose at the base; wings subhyaline, stigma fuscous; terebra ♀ rather more than $\frac{1}{2}$ the length of the body. ♀. Length, $1\frac{1}{4}$; wings, $2\frac{3}{4}$ lin.

Antennæ ♀ 25-jointed, stout, black or fuscous, about $\frac{3}{4}$ as long as the body. On each side of the vertex is an obscure, orbital, reddish spot, and a similar one below each eye, all sometimes wanting. Second abdominal segment rugulose on its basal half, the rest of the abdomen smooth. In one specimen the 2d segment is almost entirely piceous. The pale margins of segments 2—3 are sometimes obliterated. Suturiform articulation straight. Metathorax smooth, with an imperfect carina, widely interrupted in the middle.

Three females taken in N. and S. Devon.

A small ♀ from Leicestershire, only 1 line long, which I formerly supposed to be a distinct species, is probably only a variety of *larvicida*, with the 4 posterior tibiæ infuscated at the apex.

25. *Bracon prætermissus*, n. s.

Bracon immutator, var. 2, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 16, ♂ ♀; antennæ 22—26-jointed (not of Nees).

♀. Niger, nitidus, palpis pedibusque concoloribus, geniculis omnibus, posticis latius, et segmentorum 1—2 lateribus, testaceis. Alæ infunatæ, stigmatè nervisque nigricantibus. Metathorax fere lævis. Abdomen ovatum, segmentis 1—2 scabriculis, illo marginato, cæteris lævibus, nitidis; articulatio suturiformis vix medio emarginata. Terebra abdomine vix paulo brevior. ♂ simillimus, sed segmento 3tio, immo etiam 4ti basi, tenuiter aciculatis.

♀. Black, shining; palpi and legs also black, all the knees, the hind ones more broadly, and the sides of segments 1—2, testaceous. Wings infumated, stigma and nervures blackish. Metathorax almost smooth. Abdomen ovate, segments 1—2 aciculated, the former margined, the rest smooth and shining; suturiform articulation scarcely emarginate in the middle. Terebra very little shorter than the abdomen. ♂ very similar, but the 3d segment, or even the base of the 4th, is finely aciculated. ♂ ♀. Length $1\frac{1}{4}$ — $1\frac{1}{2}$; wings, 3— $3\frac{1}{4}$ lin.

Var. 1, ♀. Legs testaceous, only the posterior femora above, and the tarsi, black: segment 2 entirely black; antennæ 32-jointed.

Var. 2, ♀. Segments 1—2 almost smooth; antennæ 32-jointed.

Antennæ ♀ 24—32-jointed, as long as the body. Metathorax shining, smooth, with a few minute transverse wrinkles, and at the apex an inchoate carina. Segments 1—2 at the sides, 2 more broadly, and 3 at the basal angles, testaceous, as well as the anterior half of the belly; segments 1—2 exarated in the ♀, the rest smooth; in the ♂, segments 3—4, the latter only at the base, are still more finely sculptured. ♂ similar, as large as the ♀; antennæ 32-jointed, longer than the body.

Bracon immutator, Nees, Mon., i., 76, differs in having the abdomen fulvous, varied above with black, and the terebra as long as the abdomen, or longer. Hence I cannot think that Wesmael's *immutator* is the same species, and still less the varieties. The form which occurs in England is constant, as above described, and has every appearance of being a good species.

Common; described from 1 ♂ taken by Bignell; 4 females by myself in September at Nunton, Wilts; and 1 ♀ (var. 2) May 30th, by Fitch at Maldon.

26. *Bracon colpophorus*, Wesm.

Bracon colpophorus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 46, ♀.

Black; mandibles at the apex, palpi, sides of segment 1, or 1—2—3, femora at the apex, fore tibiæ entirely, posterior at the base, testaceous. Wings dark fuscous, with a hyaline streak. Body entirely smooth and shining. Suturiform articulation almost straight. Terebra about $\frac{1}{3}$ abdomen. ♂ ♀. Length, $1\frac{1}{3}$; wings, $3\frac{1}{2}$ lin.

Entirely black above, except the margins of segments 1—3 (only of segment 1 in British examples), and very shining. Antennæ 28-jointed in one ♀ (25-, according to Wesmael), as long as the body. Belly testaceous, darker posteriorly. Wesmael gives the length of the terebra differently in two places, as $\frac{1}{3}$ and $\frac{2}{3}$ abdomen; the former appears to be more correct. The ♂ is similar; antennæ 30-jointed.

Fitch has taken both sexes at Maldon, and I have a ♀ from St. Albans. The *B. colpophorus* ♀ of Ratzeburg (Ichn. d. Forst., iii., 72) is doubtful, for he describes the wings as only a little infuscated, and further compares it with his *B. pellucidus* (see sp. 27 infra, ad fin.). It was bred by Bach from pods of *Errum hirsutum*, tenanted by *Apion craccæ*, L., and *Apion difficile*, Hbst.

27. *Bracon discoideus*, Wesm.

Bracon discoideus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 45, ♀; Ratz., Ichn. d. Forst., ii., 38, iii., 36, ♂ ♀.

Black; mandibles, palpi, lateral margins of the abdomen narrowly, belly, and legs, testaceous; hind coxæ, hind tibiæ at the apex, and hind tarsi, black or blackish; metathorax smooth; wings subfuscous, with a whitish spot below the stigma; terebra ♀ nearly as long as the abdomen. Length, ♂ 1; wings, $2\frac{1}{2}$; ♀ 1— $1\frac{1}{4}$; wings, $2\frac{2}{3}$ — $3\frac{1}{2}$ lin.

Var. 1 ♀. Hind coxæ testaceous. Rare.

Var. 2 ♀. Second abdominal segment with a few rugosities at the base.

Antennæ ♀ 25-jointed, nearly as long as the body. The narrow testaceous border of the abdomen sometimes disappears after the 3d segment. The entire disk of the abdomen is always black and shining, with a few short pale hairs. Some examples have a few rugosities at the base of the 2d segment, which must be regarded as exceptional. Squamulæ and radices of the wings testaceous; stigma and nervures blackish.

The ♂ here introduced has 28-jointed antennæ, longer than the body; the 1st abdominal segment is narrowly edged with testa-

ceous at the sides, the rest are piceous-black without paler margins, but with a few scattered hairs: the hind coxæ are black, the others being testaceous; the hind femora are infuscated, as in one of the females.

Described from 5 females and 1 male. Common. London district, Yorkshire, Northamptonshire, Devonshire, &c.

Bred plentifully in July by Ratzeburg from the rolled-up leaves of the aspen, formed by *Rhynchites betuleti*, Fab.; by Reissig from poplar leaves rolled up by *R. populi*, L.; by Brischke from the galls of *Nematus viminalis*, L. Giraud states it to be a parasite of *Balaninus pyrrhoceras*, Marsh.

Bracon vitripennis, Ratz., Ichn. d. Forst., iii., 37, is closely allied, and probably exists in England. Like *B. discoideus*, but with hyaline wings; legs testaceous; hind coxæ, and apex of hind tibiæ, with their tarsi, blackish. Abdomen suborbicular, lateral margins and belly testaceous. Antennæ ♂ 23-jointed. Reared from willow-galls (Weidenrosen) of *Salix alba*, *fragilis*, and *aurita*, produced by *Cecidomyia rosaria*, Loew, by Brischke, according to Ratzeburg; but not mentioned by Brischke himself; cf. Schrift. nat. Ges. Danzig, n. s. v. 3, 135, 178.

Bracon pellucidus, Ratz., *lib. cit.*, iii., 37, ♀, is another kindred species, likely to be found in this country, and perhaps the ♀ of *vitripennis*, Ratz. Length, 1 line; terebra $\frac{1}{3}$ — $\frac{1}{2}$ abdomen; wings hyaline; antennæ 23—26-jointed; abdomen on each side of the base with a pale pellucid spot. Legs pale, hind tibiæ infuscated; or fore tibiæ at the base, and the 4 posterior almost entirely black. Parasitic in *Psyche*-cases on alder-leaves, &c. *B. osculator*, sp. 34, infra, seems hardly to differ from *pellucidus*, except in the colour of the wings.

28. *Bracon regularis*, Wesm.

Bracon regularis, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 44, ♂.

Black; mandibles pale; palpi dusky testaceous; abdomen ♀ rufo-testaceous, segment 1 and a patch on 3, 4, 5, black; of the ♂ only the base and apex black; legs rufo-testaceous, posterior coxæ, hind tibiæ at the apex, and tarsi, black. Metathorax and abdomen smooth and shining; suturiform articulation straight. Wings fuscous, paler beyond the stigma, before which is a whitish streak;

squamulæ pitchy or testaceous. Terebra as long as $\frac{1}{3}$ of the abdomen. ♂ ♀. Length, $1\frac{2}{3}$; wings, $3\frac{3}{4}$ lin.

♀. Antennæ 32-jointed, as long as the body, which is entirely smooth and shining. Metathorax with an imbricate carina at the apex. Segment 1 subquadrate, margined, elevated in the middle, black, bordered laterally with yellow; the other segments rufo-testaceous, 3—5 each with a black discal spot, forming a continuous band; in another specimen these spots are much diminished, and fuscous, segment 2 having likewise a round fuscous spot. Hind tibiæ sometimes not darker at the tips.

♂. Antennæ 35—37-jointed, longer than the body. Abdomen rufo-testaceous, with the 1st segment, the 6th in the middle or almost entirely, and the 7th, black; segments 3—5 immaculate. Sometimes the hind coxæ are testaceous with the base black, and the 4 anterior tarsi testaceous. Otherwise like the ♀.

Described from 2 males, 2 females; the latter were not known to Wesmael, but their correspondence with the other sex is too complete to be doubted.

Wesmael possessed 4 males taken in June near Brussels. I found a ♂ at Niton, Isle of Wight, and another in Northamptonshire. The females were taken by Fitch at Maldon.

29. *Bracon caudatus*, Ratz.

Bracon caudatus, Ratz., Ichn. d. Forst., ii., 40, ♀; iii., 38, ♂.

Black; mandibles partly pale, palpi fuscous with pale articulations; metathorax short, abruptly sloping, and, like the abdomen, smooth; suturiform articulation straight; abdomen testaceous, with a large black discal patch, leaving a pale margin all round; legs pale, coxæ, tips of the hind tibiæ, and all the tarsi, fuscous; wings ample, subhyaline, stigma brown; terebra ♀ longer than the body, or about 4 times the length of the hind tibiæ. Length, ♂ 1; ♀ $1\frac{1}{3}$; wings, $3\frac{2}{3}$; terebra, $1\frac{1}{3}$ lin. long.

Resembles *B. caudiger*. Nees, Mon., i., 77, but has a longer terebra, and is sufficiently distinct. Antennæ ♀ 29-jointed, longer than the body. Abdomen short-ovate, not quite so long as the head and thorax; the black patch on the disk, according to Ratzeburg, is variable, sometimes terminating with the 3d or 4th segment; the legs also are more or less black or testaceous.

Antennæ ♂ 32-jointed. The black on the abdomen is more extended than in the ♀, covering the last three segments. Legs fusco-testaceous, hind coxæ and hind tarsi blackish.

A ♀ was taken near Norwich by Bridgman, May 24th. The species is now first noticed as British. Reared abundantly by Reissig, Tischbein, and Brischke from galls of *Andricus terminalis*, Fab., that had been kept during the winter, making its appearance, with many other parasites, at the end of May. Walker records a specimen of a *Bracon* which he bred in March, and 6 more in May, from the same galls collected near Southgate (Zool. iv. 1456).

The following species (or variety?) should also be found in England. *B. longicaudis*, Ratz., Ichn. d. Forst., iii., 38. Abdomen wholly pale, except the 1st segment; terebra longer than that of *B. caudatus*. ♀. Length, $1\frac{1}{4}$; with the terebra, $2\frac{3}{4}$ lin. Bred by Nördlinger at the end of May from galls upon young oak-shoots (the species not mentioned). *B. caudiger*, Nees (Mon., i., 77, 103, ♀) is stated by that author to have been found July 4th, by Gravenhorst "in Silesiæ quercu," and with *caudatus*, Ratz., forms a section of the present genus with a speciality for oak-galls, and furnished, like *Callimome*, with an unusually long ovipositor, to enable them to reach the inhabitants of those excrescences.

30. *Bracon terebella*, Wesm.

Bracon terebella, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 57, ♀.

Black; mandibles, lateral margins of the abdomen narrowly, belly, femora at the apex, and tibiæ at the base, testaceous; metathorax and 1st abdominal segment smooth; wings subfuscous; suturiform articulation subsinuated in the middle; terebra ♀ $\frac{1}{4}$ abdomen. ♀. Length, $1\frac{1}{2}$; wings, $3\frac{3}{4}$ lin.

Var. 1, ♀. Smaller, antennæ 28-jointed, hind femora with the apical half testaceous, terebra $\frac{1}{3}$ of the abdomen. Length, 1 line.

Var. 2, ♀. Abdomen and legs entirely rufo-testaceous. An old specimen from Walker's collection. Length, 2; wings, 4 lin.

Antennæ ♀ 28—32-jointed, as long as the body. Metathorax and abdomen entirely smooth. Underneath the stigma is the usual whitish mark, shaped like a hammer.

Distinguished from *B. colpophorus*, Wesm., to which it comes nearest, by the longer antennæ, the testaceous margins of the abdomen, the somewhat lighter wings, and the colour of the legs.

Described from 4 females. Rannoch, Scotland; Hainault Forest; Pré Wood, near St. Albans. Bred by Brischke from capsules of *Campanula rapunculoides* and *persicifolia*, galled by *Gymnetron campanulæ*, L.

31. *Bracon otiosus*, n. s.

Ater, nitidus, palpis nigris, mandibulis abdomine pedibusque testaceis; segmenti I mi disco, coxis, trochanterum basi, femorum anteriorum linea, terebræque valvis, nigris; tibiis apice, tarsisque totis, fusciscentibus. Alæ subfusæ, stigmatæ nervisque fuscis, squamulis nigris. Corpus totum læve, nitidum. Terebra abdomine paulo brevior.

Deep black, shining; palpi black; mandibles, abdomen, and legs, testaceous; disk of segment 1, coxæ, base of trochanters, a line on the anterior femora, and valves of the terebra, black; apex of tibiæ, and all the tarsi, fusciscent. Wings pale fuscous, stigma and nervures darker, squamulæ black. Entire body smooth and shining. Terebra a little shorter than the abdomen. ♀. Length, $1\frac{3}{4}$; wings, 4 lin.

Antennæ 25-jointed, shorter than the body. Abdomen as long as the head and thorax; segment 1 rather longer than broad, tuberculated on each side of the base, testaceous, with a large, shining, elevated, black, apical spot; in one specimen entirely black; the rest of the abdomen bright testaceous; suturiform articulation hardly sinuated.

Described from 3 specimens in Fitch's collection. The abdomen is coloured as in *B. piger*, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 48; but that species has black, stout legs, and the antennæ 32—33-jointed. Another nearly related species seems to be *B. palpebrator*, Ratz., Ichn. d. Forst., i., 47, pl. vii., f. 8, the face of which, below the antennæ, and the orbits, are testaceous.

32. *Bracon variator*, Nees.

Ichneumon guttator, Panz., F. G., xcii., 8 (not the fig.)

Bracon variator, Nees, Mon., i., 79, var. *c*; Ratz.,

Ichn. d. Forst., iii., 31.

Braco variator, Wesm., Nouv. Mém. Ac. Brux., 1838,

p. 52, ♂ ♀.

Black, smooth and shining; abdomen elongate-ovate, rufo-testaceous, with a dorsal band of black variable spots; belly, and hind tibiæ at the base (seldom all the tibiæ), rufo-testaceous; head transverse, vertex narrow; wings blackish, with a subobsolete

hyaline fascia; terebra ♀ as long as the abdomen, or a little longer. Length, ♂ 1—1½; wings, 2½—3½: ♀ 1¼—1¾; wings, 3—4 lin.

Antennæ ♀ 27—30-jointed, shorter than the body: mandibles testaceous or black, palpi always black. Metathorax and abdomen smooth. Segment 1 testaceous with a black scutum (sometimes partly testaceous); 2—7 testaceous, each more or less filled up with a black spot; that on the 2d is the smallest, and generally rounded, the following are rectangular and transverse, leaving always at least the lateral margins testaceous. Sutureform articulation straight. Legs black, with the knees, and base of the tibiæ (often only of the hind pair), rufo-testaceous. Second cubital areolet equal to the third, measured along the cubitus.

The ♂ is similar; antennæ (in two examples) 32-jointed.

It would serve no purpose to exhibit the numerous colour-varieties given by Nees, collected in various parts of Europe, and some of which may be suspected of belonging to different species. Those taken in England will be found in general to agree with the above diagnosis. The absence of rugosity, the black wings and legs, with the long terebra, are characters easily appreciated. *B. Roberti*, Wesm., looks like a large variety, but is distinguished by the rugosity of the 2d segment.

Described from 2 males and 5 females. Found on umbelliferous flowers, especially in the South of England; Isle of Wight, Dover, Milford Haven, London district, &c. Cameron has taken it in Cadder Wilderness near Glasgow. It is doubtful whether this *Bracon* is a parasite of certain small Curculios (*Cionidæ*), or of flies of the genus *Trypeta*. Reinhard bred var. *c.* of Nees from the swollen capsules of *Campanula teucrium* tenanted by *Gymnetron campanulæ*, L.; some emerged in autumn, and others in the following spring (Stett. Zeit., 1855, p. 105); Brischke and Giraud obtained it from the same source (Ratz., Ichn. d. Forst., iii., 31; Brischke, Schrift. nat. Ges. Danzig, n. s. v. 3, 136). In Holland it is said to have been bred from dried flower-heads of *Senecio*, and was supposed to be parasitic on a *Trypeta* (S. v. Voll., Pinac., p. 38). Other species of *Bracon* have been reared from *Trypeta* or its allies; thus Perris bred *B. flavator*, Fab. (?) from *Senecio aquatica*, inhabited by *Tephritis marginata*, Fall. (Ann. Soc. Fr. (5), iii., 72); Giraud records *B. nigripedator*, Nees, from *Urophora solstitialis*, L.; and Fitch once obtained a *Bracon*, now lost, from galls of *Centaurea* inhabited by the same fly.

33. *Bracon degenerator*, n. s.

Niger, nitidus; segmenti 1mi lateribus, pedibusque testaceis, coxis nigris, femoribus tibiisque posterioribus infuscatis; articulatione suturiformi late sinuata; alis fusciscentibus, litura obsoleta hyalina, anticarum nervo pobrachiali transverso vix interstitiali; terebra abdominis apice compressi trientem æquante.

Black, shining; sides of 1st abdominal segment, and legs, testaceous, coxæ black, posterior femora and tibiæ infuscated; suturiform articulation broadly sinuated; wings somewhat fusciscent, with an obsolete hyaline streak; pobrachial transverse nervurè of the fore wings hardly interstitial; abdomen compressed at the apex; terebra $\frac{1}{3}$ of its length. ♀. Length, 1; wings, $2\frac{1}{2}$ lin.

Antennæ 28-jointed, as long as the body and the terebra together. Metathorax and abdomen smooth; the latter soft, shrivelled after death, leaving pale interstices between the segments, elevated posteriorly, compressed, and truncated. Four anterior tarsi at the apex, and hind tarsi altogether, fuscous. Pobrachial transverse nervure not exactly interstitial, subevected, showing a tendency towards the *Exothecides*. This, however, may be merely accidental.

One ♀ taken in Leicestershire.

34. *Bracon osculator*, Nees.

Bracon osculator, Nees, Mon., i., 84, ♂ ♀ and var. a ♀.
Braco bisignatus, Wesm., Nouv. Mém. Ac. Brux., 1838,
 p. 56, ♀; S. v. Voll., Pinac., pl. xxiv., f. 7 (male
 abdomen).

Black, shining; palpi blackish; mandibles, 1st abdominal segment at the sides, a streak at the basal angles of the 2d, the knees, and often the fore tibiæ entirely, flavo-testaceous. Wings fusciscent, stigma and nervures black. Body entirely smooth and shining. Segment 1 not margined, elevated in the middle. Terebra $\frac{1}{3}$ — $\frac{1}{2}$ the length of the abdomen. ♂ ♀. Length, $1\frac{1}{3}$; wings, 3 lin.

I have not seen the ♂, which Nees in no way distinguishes from the ♀. Antennæ ♀ 25—27-jointed, as long as the body. Belly flavo-testaceous, with 2 or 4 round black spots near the base, and sometimes behind them 2 longitudinal black bands extending to the anal segment. The legs are variable; the fore tibiæ may be entirely, and the others more or less broadly at the base, testaceous. According to Nees and Wesmael, the abdomen during life exhibits pale sutures, and looks as if

banded with black and yellow. The former writer also states that the 2d segment is obsoletely carinated, and has two faint punctures at the base,—characters which are not visible in the English specimens, nor noticed by Wesmael. The orbits are liable to be sometimes testaceous. The smooth abdomen and general aspect bring this species near to *B. variator*, Nees, but it has a much shorter terebra, longer and more slender antennæ, and the abdomen above entirely black, except the sides of the 1st segment. It also resembles *B. guttiger*, Wesm., in colour and size, but the abdomen of that species is not wholly smooth.

Bignell has taken 4 females in Devonshire. Wesmael possessed 5, captured near Brussels and in the Campine. W. H. B. Fletcher has bred a ♀ from *Coleophora cæspitella*, Zell.

35. *Bracon obscurator*, Nees.

Bracon obscurator, Nees, Mon., i., 83, ♂ ♀.

Braco obscurator, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 55, ♀.

Black; smooth and shining; palpi blackish; mandibles, sides of segment 1, base of the belly, tibiæ more or less broadly at the base, and femora at the extreme apex, testaceous. Wings dusky hyaline, 2d cubital areolet not shorter than the 3d. Terebra shorter than the abdomen. ♂ ♀. Length, $\frac{1}{2}$ —1; wings, $1\frac{3}{4}$ —2 lin.

Antennæ ♀ 20—22-jointed, shorter than the body. Trochanters and femora sometimes dull testaceous, tibiæ of a clearer colour, the posterior tipped with black, and their tarsi blackish; or the legs are entirely blackish, with the extreme base of the hind tibiæ pale. Segment 2 is not absolutely smooth, but the aciculation is hardly visible, and the insect may well remain near its allies in this section, where it was placed by Wesmael. In one ♀ the terebra is rather longer; but still shorter than the abdomen. The ♂ is smaller than the ♀, with 23-jointed antennæ, but otherwise similar. This species much resembles *anthracinus*, Nees, and *atrator*, Nees, but the terebra is shorter, the 2d segment less shining, the wings more nearly hyaline, and the 2d cubital areolet not shorter than the 3d.

A ♀ in Fitch's collection was bred from *Æcophora fulviguttella*, Zell.; and Bignell reared both sexes together, May 28th, from *Homæosoma sinuella*, Fab.

36. *Bracon anthracinus*, Nees.

Bracon anthracinus, Nees, Mon., i., 81, ♀.

Bracon anthracinus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 54, ♂ ♀.

Black, smooth and shining; mandibles, and lateral margins of segment 1, testaceous; wings fuscous at the base; 2d cubital areolet shorter than the 3d, measured along the cubitus; maxillary palpi very long; terebra ♀ as long as the thorax and abdomen. Length, ♂ $\frac{1}{2}$ —1; wings, $1\frac{3}{4}$ —2: ♀ 1— $1\frac{1}{4}$; wings, 2— $2\frac{3}{4}$ lin.

Antennæ ♀ 18—21-, ♂ 18—23-jointed, and not longer than the body. The narrow testaceous margins of the 1st abdominal segment hardly visible in dried specimens; belly black, sometimes pale at the base; base of the hind tibiæ occasionally testaceous; wings sometimes hyaline. The ♂ only differs in wanting the terebra.

Described from 7 males and 11 females. Frequent on umbelliferous flowers, and is generally distributed, extending into Scotland.

37. *Bracon atrator*, Nees.

Bracon atrator, Nees, Mon., i., 82, ♂ ♀.

Black, smooth and shining; mandibles piceous; abdomen oblong, very shining; an obsolete spot on each lateral margin of the 1st segment, and belly at the base, luteous; wings obscurely hyaline; terebra ♀ longer than the body. Length, 1 line.

Var. 1. Belly almost entirely, hind tibiæ at the base, and 2d joint of trochanters, rufous; wings obscure. ♂ ♀. Length, $1\frac{1}{2}$ lin.

Var. 2. Sides of the abdomen at the base more broadly testaceous. ♀.

Var. 3. Antennæ ♀ shorter than the body, 19-jointed. ♂ similar; mandibles sometimes obscurely testaceous; antennæ 18-jointed in two examples, 15- in another. Length only $\frac{1}{2}$ line. ? *Bracon parvulus*, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 55.

I am unable to speak with certainty of this species, the specimens I formerly possessed having perished. The females are distinguished from those of *anthracinus*, Nees, by the terebra, which is longer than the body. Taken in flowers, like the preceding, near Leicester.

38. *Bracon barypus*, n. s.

Ater, nitidus; mandibulis, abdominis medio, pedibusque rufis; palpis, coxisque posticis basi supra, fuscis; tarsorum articulo ultimo, præsertim posticorum, incrassato, nigro. Alæ fuscæ, stigmate fusco utrinque testaceo, nervis fuscis. Terebra abdominis vix trientem superans, valvis crassioribus, pilosis, truncatis.

Deep black, shining; mandibles, abdomen in the middle, and legs, rufo-testaceous; palpi and hind coxæ above at the base, fuscous; last joint of all the tarsi, especially of the hind pair, incrassated, black. Wings fuscous, nervures and stigma fuscous, the latter testaceous at both ends. Terebra scarcely longer than $\frac{1}{3}$ of the abdomen; valves stout, pilose, truncate. ♀. Length $1\frac{1}{2}$; wings, $3\frac{1}{4}$ lin.

Elongate, like a *Doryctes*. Head subhemispherical; antennæ as long as the body with the terebra, slender, filiform, 37-jointed: clypeus and mandibles testaceous, the latter tipped with black. Metathorax produced, carinated throughout its length, smooth and shining. Abdomen as long as the head and thorax, attenuated posteriorly, and subcompressed at the apex; segment 1 half as long again as its apical breadth, which is less than double that of the base, aciculated, bicarinated, the lateral margins not membranaceous, black; 2, 3, and base of 4, rufo-testaceous, 2 with a fuscous spot at the base; all the segments except the 1st smooth and shining; suturiform articulation subobsolete; thyridia of segment 2 distinct. Hind coxæ with a large fuscous basal spot above; the rest of the short, stout legs rufo-testaceous, except the last joint of the tarsi, which, together with the claws, is black, pale at the base: the fore tarsi have the last joint somewhat incrassated, the middle and hind pairs more strongly, resembling those of *Acrodactyla* among the *Ichneumonidæ*, and unlike any other *Bracon*. Wings narrow, fuscous, squamulæ, nervures, and middle of the pale stigma, fuscous; stigma surrounded by a subtestaceous spot: 1st abscissa of the radius clouded with fuscous.

Notwithstanding its general appearance this is a true *Bracon*; the occiput is not margined, and the pobra-chial transverse nervure is exactly interstitial. The incrassated tarsi distinguish it from all the preceding species.

My unique specimen was taken by sweeping herbage near Niton, Isle of Wight, July 26th, 1884.

II. EXOTHECIDES.

Pobrachial transverse nervure everted. Recurrent nervure rejected (except in *Bathystomus*). Suturiform articulation obsolete, segments 2—3 being connate (except in *Phanomeris*).

This division is formed of portions of the genera *Colastes*, Hal., and *Exothecus*, Wesm., the remaining species of which are associated by Förster with the *Rhyssalides*. The character by which the *Exothecides* are separated from the *Braconides* is easy to be seen; in the former the pobrachial transverse nervure is everted, in the latter, interstitial. From the *Rhyssalides* they are less obviously distinguished by the absence of a well-marked occipital margin, though in *Phanomeris*, according to Haliday, the occiput is *finely* margined. The species are few in number, only five being known to us as inhabiting England, all described by Haliday under *Colastes*; but according to the Försterian system they now belong to four distinct genera.

TABLE OF GENERA.

- | | | | | |
|-----|---|----|----|-------------------|
| (2) | 1. Suturiform articulation distinct | .. | .. | i. PHANOMERIS. |
| (1) | 2. Suturiform articulation obsolete. | | | |
| (4) | 3. Radius originating beyond the middle of the stigma | .. | .. | ii. XENARCHA. |
| (3) | 4. Radius originating from the middle of the stigma. | | | |
| (6) | 5. Recurrent nervure everted | .. | .. | iii. BATHYSTOMUS. |
| (5) | 6. Recurrent nervure rejected | .. | .. | iv. RHYSIPOLIS. |

i. PHANOMERIS, Först.

Först., Verh. pr. Rheinl., 1862, p. 235.

Suturiform articulation distinct, sometimes crenate. Occiput scarcely, or not at all margined. Radius originating from the stigma somewhat before the middle. Pobrachial areolet of the hind wings less than one-half the length of the præbrachial. Mesothoracic sutures very fine, impunctate. Two species:—

- | | | |
|--|----|----------------------------|
| Segment 2 aciculated at the base; wings hyaline | .. | 1. <i>catenator</i> , Hal. |
| Segment 2 hardly aciculated at the base; wings infumated | .. | 2. <i>fragilis</i> , Hal. |

1. *Phanomeris catenator*, Hal. (Pl. I., fig. 2).

Colastes catenator, Hal., Ent. Mag., iv., 93, ♀ (1836).
Exothecus abnormis, Wesm., Nouv. Mém. Ac. Brux.,
 1838, p. 74, ♀.

? *Bracon dimidiatus*, Nees, Mon., i., 108, ♀.

Black, shining; antennæ at the base, palpi, legs (and lateral margins of the ♀ abdomen narrowly) pale testaceous; stigma fuscous; 1st abdominal segment, base of the 2d, and the suturiform articulation, rugulose; terebra $\frac{1}{4}$ of the abdomen. ♂ ♀. Length, $1\frac{1}{2}$ — $1\frac{3}{4}$; wings, 3— $3\frac{1}{2}$ lin.

Head and thorax smooth, shining, with whitish pubescence. Antennæ about 33-jointed, fuscous, testaceous at the base. Metathorax thickly punctulate, pubescent, with some smooth spaces. Abdomen oblong-ovate, somewhat pitchy-black, a little longer, but hardly wider, than the thorax: segment 1 obconic, longer by about one-half than its breadth at the apex, the tubercles minute, medial, rugulose, with a longitudinal carina which is bifurcate in front: the other segments shorter, slightly decreasing in length; 2d rugoso-striated at the base, the lateral and hind margins smooth; 3d and following smooth, ciliated before the apex with whitish hairs; lateral margins of segments 2—5 testaceous in one example, in another piceous; tarsi at the apex, and hind tarsi entirely, sub-fuscous; wings hyaline, squamulæ ferruginous, nervures paler than the fuscous stigma. ♂ smaller; abdomen linear, piceous in the middle of the disk; antennæ 34-jointed.

Taken by Haliday in Ireland, and by Walker in England. I captured the male and 2 females at Nunton, Wilts. Bred by Brischke from *Phænusa rubi*, Zadd.

Wesmael's description of *Exothecus abnormis* agrees sufficiently with the above, except that the terebra is stated to be equal to about one-sixth of the abdomen. There appears nevertheless little doubt that both he and Haliday had the same species under observation. Nothing hinders this from being *Bracon dimidiatus*, Nees, except the colour of the abdomen, which Nees states to be rufous on its apical half. The specimens taken in England have the abdomen inclining to piceous, and may possibly be merely a dark variety. In Ruthe's collection *B. dimidiatus*, Nees, is doubtfully identified with *E. abnormis*, Wesm.

2. *Phanomeris fragilis*, Hal.

Colastes fragilis, Hal., Ent. Mag., iv., 56, ♀.

♀. Black; palpi and legs dull testaceous; wings infumated; terebra very short. ♂. Hind coxæ, femora above in the middle, tibiæ at the tips, and tarsi, infuscated; segment 2 striolated at the base. ♂ ♀. Length, $1\frac{1}{2}$; wings, $2\frac{1}{2}$ lin.

♀. "Head a little narrower than the thorax, subglobose, very smooth; antennæ about as long as the body, slender, 24-jointed; thorax elongate, attenuated before and behind; prothorax narrow; mesothorax very smooth, the sutures rudimentary; metathorax somewhat scabrous; abdomen oblong, lanceolate, 1st segment very short, somewhat scabrous, or roughened with punctures, not carinated; the remaining segments very smooth, fusco-piceous; terebra very briefly exerted; legs ochreous; wings narrow, infumated, stigma and nervures fuscous, the former elliptical, lanceolate, receiving the radius in the middle; præ- and pobrachial nervures approximated in the middle; pobrachial areolet of the hind wing shorter than $\frac{1}{2}$ the præbrachial."—Haliday.

The ♂ has 31-jointed antennæ; mesothoracic sutures almost obsolete; metathorax with a few minute wrinkles, very shining; abdomen black. Sides of segment 1, and suturiform articulation pale; wings slightly infumated, as in no other allied species. Occiput not visibly margined. Sutureform articulation distinct, not crenate. Legs sometimes marked with fuscous. Otherwise like the ♀.

The Försterian genera being often so constructed as to admit but one species, it is difficult to refer to its place any form with which he was not acquainted. The present insect seems best to agree with *Phanomeris*, on account of the distinct sutureform articulation.

The ♀ was taken near London by Walker. A ♂ by Fitch in the New Forest, and two more by Bignell in Devonshire.

ii. XENARCHA, Först.

Först., Verh. pr. Rheinl., 1862, p. 235.

Sutureform articulation obsolete. Head protuberant at the base of the antennæ. Mesothoracic sutures distinct, punctulate. Radius originating beyond the middle of the stigma.

1. *Xenarcha lustrator*, Hal. (Pl. I., fig. 3).*Colastes lustrator*, Hal., Ent. Mag., iv., 58, ♂.

Black; the palpi and legs pale yellow; abdomen fuscous, testaceous in the middle; stigma large, elliptical, blackish, emitting the radius between the middle and the apex. ♂. Length, $1\frac{1}{4}$; wings, $2\frac{3}{4}$ lin.

Head black, very shining, the front slightly protuberant: antennæ rather longer than the body, 29-jointed, fuscous, paler at the base: mesothoracic lobes well marked, convex, the sutures punctulate; metathorax punctulato-rugulose, with an inchoate carina at the base: abdomen as long as the head and thorax, depressed, widest at the base of the 2d segment: 1st segment fuscous, a little longer than its width, longitudinally striolated, the margins flavescens at the apex (not in my specimen); 2d and 3d segments of equal length, the former striolated like the 1st, and fuscous above; the place of the suturiform articulation is denoted by a smooth transverse impression; apex of segment 2, and segments 3—4 entirely, testaceous, the remainder pitchy: tarsi fuscous at the apex: wings hyaline.

One ♂ taken in North Ireland by Haliday, another by me in the New Forest, and a third in Leicestershire. Considerably resembles a male *Bracon*, but must be carefully distinguished by structure. The occiput is almost invisibly margined, again showing the insufficiency of this character for systematic division.

iii. BATHYSTOMUS, Först.

Först., Verh. pr. Rhehl., 1862, p. 235.

Suturiform articulation obsolete. Recurrent nervure inserted in the 2d cubital areolet; radius springing from the middle of the stigma: pobraehial areolet of the hind wing half the length of the præbraehial. Mesothoracic sutures obsolete. Third joint of the palpi minute, as in *Rhyssalus*.

1. *Bathystomus funestus*, Hal. (Pl. I., fig. 4).*Colastes funestus*, Hal., Ent. Mag., iv., 93, ♂.

♂. Black; palpi and legs pitchy-testaceous. Wings subhyaline, stigma and nervures fuscous. First abdominal segment bearrinated. ♀. Disk of mesothorax, abdominal segments 1—2, and the others at the hind margins, rufo-testaceous; lateral margins of segment 2 blackish. Length, ♀ $1\frac{1}{2}$; wings, 3 lin.

Antennæ ♂ 32-jointed, in Haliday's specimen, as long as the

body; of the ♀ hardly shorter, 34-jointed; head and thorax very finely punctulate, pubescent; metathorax obsolete areated; abdomen obovate, segment 1 angulated at the base, from thence to the apex nearly linear, one-half longer than its width, with two carinæ slightly convergent posteriorly, the interstices punctulate, and the apical angles with a membranaceous margin: segment 2 ♂ punctulate at the base; the rest smooth, shorter: legs ochraceous or subfuscous: stigma large, ovate-lanceolate, emitting the radius from about the middle.

A single ♂ taken in England by Walker. The ♀, in Fitch's collection, exhibits differences of colour, but there is little doubt that it belongs to this species.

iv. RHYSIPOLIS, Först.

Först., Verh. pr. Rheinl., 1862, p. 235.

Suturiform articulation obsolete. Radius springing from the middle of the stigma: recurrent nervure inserted in the 1st cubital areolet: pobrachial areolet of the hind wing hardly longer than $\frac{1}{3}$ of the præbrachial. Terebra short, exerted.

1. *Rhysipolis mediator*, Hal. (Pl. I., fig. 5).

Colastes mediator, Hal., Ent. Mag., iv., 56, ♂.

Black; palpi and legs ferruginous; stigma fuscous; abdomen brown, the 1st segment black: præbrachial transverse nervure in the hind wings wanting. ♂ ♀. Length, $1\frac{3}{4}$; wings, $3\frac{1}{2}$ lin.

Head almost hemispheric, as broad as the thorax: antennæ ♂ 31-jointed, as long as the body: thorax elongate, attenuated in front and behind, shining, with scattered pubescence; metathorax thinly rugoso-reticulated, indistinctly areated, the intermediate areolet not penetrating between the two dorsal: abdomen linear, gradually attenuated towards the base: 1st segment one-half longer than its apical width, at the base only half as wide as at the apex, the tubercles placed a little before the middle; two acute longitudinal carinæ coalesce in the middle of the disk, and continue thence to the apex; the rest of the surface is shining, and minutely rugulose: the other segments are smooth, brown, with darker hind margins: legs elongate, pubescent, ferruginous: wings subhyaline, radix and squamulae ferruginous, nervures and stigma brown, the latter oblongo-lanceolate: pobrachial areolet of the hind wing hardly longer than $\frac{1}{3}$ of the præbrachial. Terebra shorter than $\frac{1}{2}$ abdomen.

The ♂ was taken once near London by Walker; a ♀ in bad condition is in my collection.

III. RHYSSALIDES.

Head transverse, occiput faintly margined. Abdomen short, subpetiolated, suboval or spathuliform; thyridia of segments 2, 3, inconspicuous; suturiform articulation superficial. Three cubital areolets, the 2d trapeziform, the 1st intercubital nervure being very oblique; recurrent nervure interstitial, or (in *Colastes*) slightly rejected; pabrachial transverse nervure everted; anal nervure not interstitial. *Terebra* elongate.

It will be seen that these characters are the same as those of the *Exothecides*, with the exception of the occipital margin, which, however, is very indistinct. The separation of the two groups is perhaps unnecessary; at all events the interpolation between them of such dissimilar forms as *Spathiides*, *Rhogalides*, &c., in Förster's table, does not tend to distinctness. The *Rhyssalides* make a somewhat near approach to *Clinocentrus*, from which they are best distinguished by the absence of rugosity on the abdomen.

The few British species are of weak structure and obscure colours. One of them is remarkable in its habits, being an *external* parasite of lepidopterous larvæ. The three genera here adopted were united by Wesmæl under *Exothecus*, and separated by Haliday into *Rhyssalus* and *Colastes*, of which latter *Oncophanes* is a further section established by Förster.

- (2) 1. Hind tarsi shorter than their tibiæ, the latter
incassated in the ♂. Metathorax com-
pletely areated i. RHYSSALUS.
- (1) 2. Hind tarsi not shorter than their tibiæ, the
latter simple in both sexes. Metathorax
not areated, or with only a medial bifid
carina.
- (4) 3. Recurrent nervure rejected ii. COLASTES.
- (3) 4. Recurrent nervure interstitial iii. ONCOPHANES.

i. RHYSSALUS, *Hal.*

Hal., Ent. Mag., i., 266; iv., 53.

Metathorax with a medial elongate area, and two on each side. Post-scutellum armed with a conical tubercle. Abdomen short, subpetiolated, deltoid or spathuliform; 1st segment margined, sculptured, the rest smooth. Femora subclavate; hind tibiæ in the ♂ incassated, except at the base; tarsi ♂ ♀ short, the 3d pair not longer than the 1st and 2d, distinctly shorter than their tibiæ,

the 1st joint in the ♀ subincrassated, as long as the three following joints. Radius originating somewhat beyond the middle of the stigma; recurrent nervure interstitial; præ- and pobrachial nervures more approximated than usual. Terebra subelevated.

- (2) 1. Second abscissa of the radius twice as long as the first; stigma incrassated; colour uniform, pitchy-black 2. *indagator*, Hal.
 (1) 2. Second abscissa of the radius about 4 times longer than the first; stigma attenuated; colour pitchy, partly testaceous 1. *clavator*, Hal.

1. *Rhyssalus clavator*, Hal.

Rhyssalus clavator, Hal., Ent. Mag., iv., 53, ♂ ♀.

Piceous; anterior half of the abdomen, antennæ at the base, and legs, testaceous; stigma fulvescent, attenuated; hind tibiæ of the ♂ clavate, fuscous; terebra as long as the body without the head. Length, 1—1 $\frac{3}{4}$; wings, 2—3 $\frac{1}{2}$ lin.

Antennæ ♀ 25—26-jointed, hardly longer than the body. Mesothoracic sutures punctulate, meeting in a rugulose fovea. Medial area of the metathorax extending to the base. Abdomen deltoid, compressed, truncate at the apex; segment 1 stouter than that of the ♂; 2, 3, and 4 at the base, fulvescent; the rest fuscous except the two last, which are ferruginous. Femora subclavate. Wings subhyaline, narrower than in the other species; stigma attenuated; 2d cubital areolet differently shaped, the side formed by the 2d abscissa of the radius being equal in length to the first intercubital nervure; pobrachial areolet of the hind wing scarcely longer than $\frac{1}{3}$ of the præbrachial.

Antennæ ♂ 25—33-jointed (in my specimen 27-jointed), half as long again as the body. Abdomen spathuliform, depressed; 1st segment three times longer than broad, the tubercles placed before the middle, shining, rugulose, the margins raised, and defined interiorly by an impressed line, testaceous; the rest piceous, becoming darker towards the apex. Clavate hind tibiæ fuscous except at the base.

I have taken both sexes at Barnstaple, but only the ♂ now remains.

2. *Rhyssalus indagator*, Hal. (Pl. I., fig. 6).

Rhyssalus indagator, Hal., Ent. Mag., iv., 54, ♂ ♀.

Exotheccus tuberculatus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 82, ♂ ♀.

Pitchy-black; legs testaceous, hind femora (and in the ♂ the clavate hind tibiæ) fuscous, except at the base; terebra as in the preceding. Length, 1 $\frac{1}{2}$ —2; wings, 3 $\frac{1}{4}$ —3 $\frac{3}{4}$ lin.

Larger and darker than *clavator*; the wings broader in proportion, fuscous; stigma broader, fuscous. The 2d cubital areolet has the side formed by the 2d abscissa of the radius much shorter than the 1st intercubital nervure. Pobrachial areolet of the hind wing equal to $\frac{1}{2}$ the præbrachial. Antennæ ♂ 28—30, ♀ 24—25-jointed; the numbers 39 and 33 in the Ent. Mag. are undoubtedly misprints. A ♀ taken by Bridgman July 27th at Earham, near Norwich, has the stigma unusually narrow, but not like that of *clavator*, and the hind femora testaceous. Sometimes the antennæ and 1st abdominal segment are also pale.

Not uncommon in old hedges: taken by Fitch at Maldon: by me at Bishop's Teignton, Devon, and St. Albans; also a fine series near Abergavenny.

ii. COLASTES, Hal.

Hal., Ent. Mag., i., 266; iv., 55; Först., Verh. pr. Rheinl., 1862, p. 241.

Post-scutellum unarmed. Metathorax not areated; with a medial bifid carina. Antennæ and legs long and slender; femora and tibiæ simple in both sexes; hind tarsi at least as long as their tibiæ. Abdomen subpetiolated, ovate, depressed; suturiform articulation obsolete. Terebra exerted. Radius originating before the middle of the stigma; recurrent nervure rejected or interstitial; podisoidal areolet shorter than the prædisoidal.

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| (2) 1. Margin of the occiput fringed with long whitish hairs | 2. <i>hariolator</i> , Hal. |
| (1) 2. Margin of the occiput not fringed. | |
| (4) 3. Stigma fuscous, 3 times longer than broad, emitting the radius just before the middle; 2d cubital areolet simple in both sexes .. | 1. <i>decorator</i> , Hal. |
| (3) 4. Stigma yellow, 4 times longer than broad, emitting the radius before $\frac{1}{3}$ of its length; lower side of the 2d cubital areolet incrassated in the ♂ | 3. <i>braconius</i> , Hal. |

1. *Colastes decorator*, Hal. (Pl. II., fig. 1).

Colastes decorator, Hal., Ent. Mag., iv., 92, ♀.

Exothecus ruficeps, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 78, ♂ ♀, pl., fig. 9 (wing).

Testaceous; antennæ at the base, palpi, and legs, ochreous; stemmaticum, thorax, and 1st abdominal segment black; the rest of the abdomen piceous; terebra $\frac{2}{3}$ the length of the abdomen. Length, 2; wings, $4\frac{1}{2}$ lin.

The distribution of the colours is variable. Antennæ ♀ as long as the body, 38—40-jointed, fuscous above, rufescent beneath, paler at the base. Head rufo-testaceous, tinged laterally behind the eyes with fuscous. Prothorax black above; mesothorax the same, or with a testaceous central patch. Hind margins of the abdominal segments fuscous; segment 2 sometimes partly, and the anal segment generally, testaceous. Hind tibiæ and tarsi fuscous at the apex. Stigma fuscous. Head wider than the thorax, occiput not ciliated, ocelli salient; mesothoracic sutures impunctate, converging into a smooth fovea; metathorax smooth, shining, with a medial bifurcate carina; segment 1 about twice as long as its breadth, gradually narrowed towards the base, punctatopunctate, the other segments smooth, the 4th and following margined behind; pabrachial areolet of the hind wing less than $\frac{1}{2}$ the length of the præbrachial. The ♂, not known to me, is described by Wesmael as similar, but the number of joints in the antennæ is not stated. Antennæ after death convoluted at the apex.

Taken by Haliday among felled oaks, at the Cartland Craigs, Scotland; and twice lately near Plymouth by Bignell. Wesmael had 5 females and 1 male from Brussels and Liège. According to Giraud a parasite of *Ortalis connexa*, Fab., bred from the fruit of *Cynanchum vincetoxicum*—an exotic Asclepiad—is doubtfully referable to *Exothecus ruficeps*, Wesm. (*cf.* Verh. z.-b. G. Wien, 1861, p. 490).

2. *Colastes hariolator*, Hal.

Colastes hariolator, Hal., Ent. Mag., iv., 92, ♀.

Exothecus barbatus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 79, ♂ ♀.

Very like the preceding, but smaller; the head is less transverse or more cubical, and the margin of the occiput ciliated with long whitish hairs. Testaceous. antennæ at the base, palpi, and legs, ochreous; head, mesothorax more or less, metathorax, and 1st abdominal segment, black; terebra $\frac{2}{3}$ the length of the abdomen. Length, $1\frac{1}{2}$; wings, $3\frac{1}{2}$ lin.

Antennæ ♀ 33—40-jointed; occiput distinctly margined and ciliated, especially in the middle between the eyes. The colours are inconstant. The ♂ is like the ♀.

Var. ♀. Head and thorax entirely black. Hind coxæ at the base, femora at the apex, and tibiæ except at the base, fuscous.

In a wood near St. Albans I took a ♀ with the pro- and mesothorax testaceous, and another at Bishop's

Teignton. Bignell has captured four specimens near Plymouth, one of which is the dark variety. The species was founded on a single example taken by Walker in England; Wesmael possessed three males and eight females from the environs of Brussels.

3. *Colastes braconius*, Hal.

Colastes braconius, Hal., Ent. Mag., iv., 57, ♂ ♀.

Exothecus debilis, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 75, ♂ ♀, pl., fig. 8 (wing ♂ ♀); Ratz., Ichn. d. Forst., ii., 45, pl. ii., fig. 12 (wing ♀); iii., 42, ♂ ♀.

Black; antennæ at the base, palpi, and legs, pale; abdomen in the middle indeterminately testaceous; stigma elongate, lanceolate, yellow, emitting the radius much before the middle; lower side of the 2d cubital areolet incrassated in the ♂; recurrent nervure almost interstitial; terebra $\frac{1}{4}$ — $\frac{1}{3}$ the length of the abdomen. Length, $\frac{3}{4}$ —2; wings, 1— $4\frac{1}{2}$ lin.

Variable in size and colour. Head subglobose, narrower than the thorax; antennæ slender, 27—31-jointed. Mesothoracic sutures converging into a wide rugulose depression; metathorax punctulate, pubescent, not areated, often with a smooth space in the middle and a faint longitudinal carina. Abdomen of the ♂ linear; of the ♀ elongate-ovate, segment 1 obconic, longer than its apical breadth, striolated, sometimes with a medial carina, and two contiguous foveæ placed transversely behind the middle; the rest of the abdomen smooth and shining. Legs slender. Wings hyaline; radius originating from the yellowish stigma before $\frac{1}{3}$ of its length; præ- and pobrachial nervures approximated; pobrachial areolet of the hind wing rather less than $\frac{1}{2}$ the præbrachial.

Var. α . Small. (Length, $\frac{3}{4}$ —1; wings, $1\frac{2}{3}$ — $2\frac{1}{3}$ lin.). Antennæ 22—24-jointed. Piceous, the middle of the abdomen paler, legs almost whitish; sculpture of the metathorax and 1st segment very minute.

Var. β . Larger. (Length, $1\frac{3}{4}$; wings, $3\frac{2}{3}$ lin.). Antennæ 30-jointed. Head, thorax, and 1st segment black, 2—4 testaceous, the rest fuscous.

Var. γ . Largest. (Length, 2; wings, $4\frac{1}{2}$ lin.). Abdomen, after the 2d segment, fulvescent. Taken by Bignell and myself.

A common solitary parasite of leaf-mining Lepidoptera and Diptera. Its fragile form, long, folded wings, pale legs, and slow movements, give it a very gnat-like appearance. Bred by Reissig in April, and by Ratzeburg in July, from beech-leaves (Buchenlaube), mined by

a *Tinea* which Ratzeburg calls *Lithocolletis cavella*, Zell., but as this feeds on birch the species intended may be *L. tristrigella*, Haw. Obtained by Nicelli from *L. quercifoliella*, Fisch. In England by Dorville, Barrett, and Elisha, from *L. lautella*, Zell.; by Elisha, March 14th, from *L. tenella*, Zell.; and by Fletcher, May 9th, from *Tischeria dodonæa*, Heyd. Prematurely forced at the end of February by Elisha from *Lithocolletis Bremiella*, Zell., *lautella*, Zell., *cavella*, Zell., and *Nepticula aucupariæ*, Frey; March 20th from *L. Cramerella*, Fab.; and April 27th from *L. lantanella*, Schr. At Cambridge bred by Warren from *Ornix betulæ*, Staint. It does not confine its attacks to Lepidoptera, having been reared by Reissig and Nördlinger from *Orchestes fagi*, L., and from dipterous leaf-miners, as *Phytomyza nigricornis*, Macq. Brischke reports it from a *Phytomyza*, and also from *Cryptocampus bellus*, Zadd. Incbald and Fitch have bred it from a fly mining the leaves of *Symphoricarpus*; and the latter on July 17th from *Phytomyza loniceræ*, Desv., in the leaves of honeysuckle. The diversity of food may account for the differences of size and colour in these parasites.

iii. ONCOPHANES, Först.

Först., Verh. pr. Rheinl., 1862, p. 241.

Third joint of the labial palpi united with the 4th. Metathorax areated. Abdomen subsessile, ovate; terebra exerted, decurved. Radius originating rather beyond the middle of the stigma, which is angulated, not rounded, at the point of origin; recurrent nerve interstitial; pobrachial areolet of the hind wing longer than the præbrachial.

1. *Oncophanes lanceolator*, Nees. (Pl. II., fig. 2).

Bracon lanceolator, Nees, Mon., i., 92, ♂ ♀ (nec Fab.).

Colastes lanceolator, Hal., Ent. Mag., iv., 58, ♂ ♀.

Exotheus minutus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 83, ♂ ♀.

? *Erotheus levigatus*, Ratz., Ichn. d. Forst., iii., 43, ♂.

Oncophanes, S. v. Voll., Schets., ii., tab. 5.

Black; antennæ at the base, palpi, and legs, testaceous; stigma yellowish; abdomen, after the 1st segment, piceous, often indeterminate testaceous in the middle, segment 1, and 2 at the base, rugulose; hind tibiæ stout, subsinuated, whitish towards the

base; terebra as long as $\frac{1}{2}$ the abdomen. Length, 1—1 $\frac{1}{2}$; wings 2 $\frac{1}{3}$ —3 $\frac{1}{2}$ lin.

Shorter and stouter in proportion than any of the preceding, and with fewer joints in the antennæ. Those of the ♀ are not longer than the body, 20—24-jointed; of the ♂, longer than the body, 24—30-jointed; fuscous, pale at the base. Mesothoracic sutures impunctate, converging to a punctate pubescent depression before the scutellum. First abdominal segment hardly narrower at the base, $\frac{1}{2}$ longer than its apical breadth, rugulose; segments 2 and 3 broadest, smooth and shining, the former more or less striolated at the base, the remaining segments short, and rapidly decreasing in width to the apex; segment 2 often more or less ferruginous. Legs either wholly testaceous, or the hind coxæ at the base, and the 2d and 3d pairs of femora and tibiæ more or less, fuscous. The sexes are similar.

Not uncommon in England; found at Hastings, St. Albans, Maldon. Taken by Haliday also in the Hebrides, and rarely in Ireland. Bred by Bignell from *Tortrix viridana*, L.; the two females thus obtained had the 2d segment marked with a testaceous spot. Ratzeburg records the species as a parasite of *Recurvaria (leucatella, Clerck?)* living *externally* upon the body of the larva, a fact not noticed in connection with *Tortrix viridana*. Brischke's observation is here translated from Ratz., *lib. cit.*, iii., 43:—

“On May 28th I found on a service-tree [*Pyrus domestica* or *aucuparia?*], between leaves fastened together by a web, some small caterpillars, probably of *leucatella* or some other *Tinea*. One of these was being sucked by three parasitic larvæ, placed externally, two on the 7th and one on the 9th segment. The parasites were $\frac{1}{3}$ line long, translucent, and orange coloured on the posterior half, most likely from the copiously absorbed juices of the caterpillar. The latter was 5—6 lines long; it remained motionless, although still quite vigorous. On May 30th the parasites were $\frac{1}{2}$ line long; they had changed their positions; and now a fourth was to be seen, which before had probably been sucking on the under side of the caterpillar. On the 31st their length had increased to 1 line, and the colour was now more reddish. The caterpillar had shrunk to 4 lines in length. Finally, on June 1st, when the parasites were 1 $\frac{1}{2}$ lines long, and exhibited lateral rows of tubercles, three of them quitted the body of the caterpillar, and

began to crawl about. Towards noon they commenced spinning white cocoons, and on the 10th appeared the first ichneumon, which was soon followed by the others. The cocoons are of a very thin texture and, lying close together, they are flattened at the sides by mutual pressure. The egg-state lasts about eight days; the larva is full-fed in four or five days; and the imago appears after eight or nine days more. So that the entire development of the insect is accomplished in less than a month." Reissig obtained the ♂ from a similar cocoon found between elm-leaves. The fact of external parasitism is confirmed more recently by Brischke, *Schrift. nat. Ges. Danzig*, n. s. V., iii., 136.

IV. SPATHIIDES.

Several singular exotic forms belong here, but the only British genus is

SPATHIUS, *Nees*.

Nees, *Act. Ac. L. C.*, 1818, p. 301; *Mon. i.*, 11.

Head cubical; occiput margined. Maxillary palpi 5-, labial 3-jointed. Antennæ long and slender. Abdomen depressed, ovate, with a long petiole; segment 1 nearly as long as the rest taken together; 2—3 connate, forming about one-sixth of the remainder of the abdomen; suturiform articulation obsolete, *Terebra* elongate. Cubital areolets 3, the 2d subpentagonal, its interior posterior angle much produced, receiving the recurrent nervure; anal nervure interstitial.

This well-known genus has a considerable literature, and may be found described at great length in Nees, *l. c.*, and Haliday, *Ent. Mag.*, iv., 41—3. The two British species are thus distinguished:—

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|---|----------------------------|
| Wings fuscous with 3 white bands; petiole as long as $\frac{2}{3}$ of the rest of the abdomen; <i>terebra</i> not longer than the abdomen | 1. <i>rubidus</i> , Rossi. |
| Wings subfuscous with 2 darker bands; petiole nearly as long as the rest of the abdomen; <i>terebra</i> much longer than the abdomen | 2. <i>exarator</i> , L. |

1. *Spathius rubidus*, Rossi. (Pl. II., fig. 3).*Ichneumon rubidus*, Rossi, Mant., App., ii., 110.*Spathius rubidus*, Nees, Mon., i., 14; Hal., Ent. Mag., iv., 42, ♂ ♀.

Rufo-testaceous; abdomen (except segment 1) black or blackish; tibiæ white at the base, hind tibiæ annulated with fuscous; coxæ and tarsi more or less pale. Wings fuscous, white at the base and apex, and with a white fascia beneath the bicolorous stigma. Terebra nearly as long as the abdomen. ♂ ♀. Length, 1—2; wings, $1\frac{1}{2}$ — $3\frac{1}{4}$ lin.

Antennæ longer than the body, of the ♀ 29-, of the ♂ 31-jointed (in one specimen); front impressed and transversely striolated. Thorax less shining than the head, coriaceous. Segment 1, and base of 2, finely striolated; the rest smooth. The colours vary; small specimens often have the thorax and petiole infuscated, and the markings of the wings and legs subobsolete.

Less common than the next species. I captured a ♀ on an elm tree near Esher, another among larches in Pré Wood, St. Albans, and ♂ ♀ out of an old hedge near Abergavenny. Bridgman has taken two fine typical females near Norwich. Their parasitism has not been well traced; Giraud supposes them to infest *Xiphydria dromedarius*, Fab., which seems unlikely. *Spathius anobii*, Gir., Ann. Soc. Fr., 1877, p. 415, bred by Perris from *Anobium longicorne*, Sturm, is very like this species, and conjectured by Perris to be identical. *S. erythrocephalus*, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 131, ♂ ♀, differs only in having segment 2 very smooth, and may also be the same; it has been bred by Wissman from *Ochina ptinoides*, Marsh. *S. pedestris*, Wesm., is an apterous form from Louvain, of which Wesmael had only one specimen.

2. *Spathius exarator*, L.*Ichneumon exarator*, Lin., F. S., 1614, ♀.*Cryptus clavatus*, Panz., F. G., cii., 16, ♂, badly figured.

Spathius clavatus, Nees, Mon., i., 12; Hal., Ent. Mag., iv., 43; Wesm., Nouv. Mém. Ac. Brux., 1838, p. 129, pl., fig. 16 (wing); Ratz., Ichn. d. Forst., i., 48, pl. vii., fig. 10; ii., 42; iii., 41, ♂ ♀; S. v. Voll. Schets., ii., tab. 5, ♀.

Testaceous, varied with fuscous; palpi, fore coxæ, all the trochanters, and tibiæ at the base, whitish, the last obscurely

annulated with fuscous. Wings subfuscous, indeterminately clouded with a darker tint before and underneath the bicolorous stigma. Terebra as long as the body. ♂ ♀. Length, $1\frac{1}{4}$ — $3\frac{1}{4}$; wings, $2\frac{3}{4}$ —6 lin.

Longer and usually larger than the preceding; the colours more dingy; antennæ ♂ ♀ 29—38-jointed; petiole and terebra much longer.

The Linnean name of this insect is here restored. There are two females in the Linnean cabinet labelled in that author's handwriting. The species is common throughout Europe, attacking *Anobium pertinax*, L., *striatum*, Ol., &c., which perforate old woodwork. I obtained a fine series from a hovel, well known to some entomologists, at Camachgouran, near Loch Rannoch. The female raises the abdomen so as to bring the terebra into a vertical position, and explores the burrows of the beetles with the inserted instrument. If disturbed in this operation she will not fly off, and may be captured with the fingers. A similar mode of action is employed by *Ephialtes*, and other Ichneumons with a prolonged ovipositor. Reared by Bouché, Boie, Reinhard, and Brischke from *Anobium striatum*, Ol. By Giraud from *Ptilinus pectinicornis*, L.; and I procured many in Devonshire from the same beetle. Van Vollenhoven reports it as a parasite of *Hylosinus fraxini*, Fab. According to Ratzeburg it also attacks *Orchestes quercus*, L., having been reared in June from oak-leaves collected the year before for the purpose of breeding the Curculio; these leaves had been carefully separated from the twigs, so that no xylophagous Coleoptera could be found among them. The *Spathius* thus obtained must have been very small, and the fact is so contrary to its habits and structure as to be liable to suspicion. Its accidental presence among the oak-leaves is much more probable. Further observations on the parasitism of this species are desirable, for it seems impossible that a full-sized *Spathius*, nearly 3 lines long exclusive of the terebra, could be nourished within the body even of the largest *Anobium*. A still stranger fact recorded by Ratzeburg is the rearing of *S. exarator* by Nördlinger from the lepidopterous *Sericoris? Nördlingeriana*, Ratz., and *Coccyx Mulsantiana*, Ratz., both pupating in cases made of the leaves of *Pinus pinaster*.

V. HECABOLIDES.

Established by Förster to include those forms of the Cyclostomi which have only two cubital areolets. Of the ten genera enumerated (Verh. pr. Rheinl., 1862, p. 236) only five refer to described types; the others must be consigned to the limbo of MS. names. After the subtraction of *Pambolus*, which appears too widely aberrant to find a place here, there remains, belonging to the British Fauna, the single genus—

HECABOLUS, Cur.

Cur., B. E., 507 (1834); Hal., Ent. Mag., iv., 48 (1836).

Head cubical; abdomen subsessile, the segments discrete, suturiform articulation faintly marked; terebra ♀ elongate; fore wings with two cubital areolets; hind wings of the ♂ with a stigma near the base; the recurrent nervure, but not the anal, interstitial.

1. *Hecabolus sulcatus*, Cur. (Pl. II., figs. 4, 4a).

Hecabolus sulcatus, Cur., B. E., pl. dvii; Hal., Ent. Mag., iv., 48; Ratz., Ichn. d. Forst., ii., 34, pl. ii., fig. 11 (wings ♂); iii., 32; S. v. Voll., Schets., ii., tab. 5 (where the striolæ on the base of the 3d segment are not represented).

Anisopelma Belgicum, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 134, pl., fig. 17 (wing), ♀.

Black, the abdomen pitchy; palpi pale; antennæ at the base, and legs, testaceous; femora, tibiæ in the middle, and hind coxæ, more or less fuscous; intermediate tarsi very short; abdominal segments 1—2 depressed, and, together with the basal half of the 3d, striolated longitudinally, the rest of the abdomen smooth; wings hyaline, stigmata fuscous; terebra ♀ longer than the body. Length, 1—2 $\frac{3}{4}$; wings, 1 $\frac{1}{2}$ —3 $\frac{1}{2}$ lin. ♂ ♀.

Antennæ ♀ shorter than the body, 19—26-jointed; of the ♂ hardly as long as the body, 21-, 22-, 25-jointed, in 3 examples.

The abdomen of the ♀ is clavate, of the ♂ linear-lanceolate. The stigma of the hind wings in the ♂ almost fills up the costal and præbrachial areolets, and is about half the size of the fore-stigma: no other British Braconid possessing this character is at present known. Like other parasites of xylophagous insects, it varies much in size; the ♂ is always smaller than the ♀.

Parasitic on *Ptilinus pectinicornis*, L., and may be taken on old posts and rails perforated by that insect. My specimens are from Cheltenham and Leicester. Others are from Fullham, Maldon, Norfolk, and Yorkshire. According to Ratzeburg also reared from *Ochina ptinoides*, Marsh., by Nördlinger; and by Hartig and Perris from *Ptilinus costatus*, Gyll., in old willow-trunks.

VI. PAMBOLIDES.

Head transverse, occiput margined; abdomen sessile (or petiolated), with only two apparent segments, the suturiform articulation being effaced, and the 4th and following segments retracted beneath the 3d; ♂ apterous or winged, in the latter case with two cubital areolets, the anal nervure interstitial (*cf.* Subfam. VIII.); ♀ apterous, the terebra exerted.

This curious group is distinguished from most others by the biarticulate structure of the abdomen. It is included among the *Hecabolides* by Förster (Verh. pr. Rheinl., 1862, p. 237), but as it has little in common with that section except the number of cubital areolets, I prefer for the present to consider it as a separate subfamily, including 3 genera, *Pambolus*, Hal., *Arrhaphis*, Ruthe, and *Dimeris*, Ruthe. The two first genera are not yet known as indigenous; *Dimeris* is represented by a few females. *Arrhaphis*, Ruthe (Stett. Zeit., 1854, p. 346) differs from the other two in having the abdomen petiolated, and the author remarks that it should stand next to *Calyptus*, Hal. (*Brachistes*, Wesm.) among the Cyclostomi, though in his collection it is associated with *Dimeris*. The identity of *Pambolus* ♂ with *Dimeris* ♀ is maintained by Förster (*lib. cit.*, p. 282); but this is not in accordance with the observations of Fitch, who in 1883 inspected Ruthe's collection, just before its removal to South Kensington, with a view to the settlement of this question, and found it to contain several allied and unpublished species, including males of *Dimeris* diverse from *Pambolus*. Without confidently asserting that the two genera in question are not identical, he concluded that at all events *Pambolus biglumis*, Hal., ♂ is not the same species as *Dimeris mira*, Ruthe, ♂ ♀; and this is sufficient so far as the British Fauna is concerned. It may be useful to reproduce Fitch's notes so far as to indicate the resources to be found in the Ruthian collection, whenever anyone may be disposed to attempt a revision of this subfamily.

“ I found a most interesting lot of these little apterous or subapterous Bracons :—

Dimeris aptera, Ruthe MS. Seven females taken 3rd March, 22nd—26th September, 28th December, 1854; antennæ 16-jointed.

D. mira, Ruthe. Twelve females and one male taken 30th October, 28th December, 1854, 2nd September, 1855; antennæ ♂ 20-jointed, ♀ 16-jointed.

An *Dimeris* sp. ? One male taken 6th June, 1858; base of abdomen yellow, antennæ 18-jointed.

Arrhaphis dubia, Ruthe MS. (an *Dimeris* ♂ ? ?). Three males taken 16th September, 1855, 4th June, 1856, 28th July, 1856; antennæ 18—24-jointed.

Dimeris incermis, Ruthe MS. Two males, three females taken 26th October, 1854, 3rd January, 16th September, 1855, 15th August, 1856.

Arrhaphis tricolor, Ruthe. Two males, black, with black 23-jointed antennæ, winged; three females, fulvous, with long tricoloured, 19—20-jointed, antennæ, black in the middle, pale at the apex, apterous; taken 23rd—26th October, 1852, 22nd October, 1856 (♀), 29th June, 1858 (♂). Bred from various species of *Cryptocephalus* (Stett. Zeit., xx., 103; 1859).

A. imminens, Ruthe MS. Two males, black with much shorter antennæ, taken 7th July, 1854, 24th July, 1856.

Terenusia silesiaca, Ratz. (*Bracon silesiacus*, Ratz., Ichn. d. Forst., ii., 30. *Ecephylus silesiacus*, Först., Verh. pr. Rheinl., 1862, p. 237; S. v. Voll., Schets., ii., tab. 6, fig. 11). Var. An n. sp. ? One male, antennæ 18-jointed, taken 16th June, 1858; one female.

Terenusia sp. ? One small male.”

i. DIMERIS, *Ruthe*.

Ruthe, Stett. Zeit., 1854, p. 344; 1855, p. 329.

? *Pambolus*, Hal., Ent. Mag., iv., 49 (1836); S. v. Voll., Schets., ii., tab. 6.

Head globose, antennæ submoniliform, 16—20-jointed, the scape elongate; space between the mandibles and clypeus ample, semicircular; maxillary palpi 5-jointed, 2d joint elongate, 3—5 not so stout, subequal; metathorax bidenticulate; abdomen subbiarticulate, sessile; segment 1 semicircular, divided from the 2d by a deep suture; suturiform articulation effaced; ♂ with 2 cubital areoletts;

podiscoidal areolet complete; anal nervure interstitial; ♀ apterous, terebra exerted.

According to Haliday (*lib. cit.*, p. 50) *Pambolus* ♂ has the antennæ 23-jointed, the joints of the flagellum cylindrical; the 3d joint of the maxillary palpi about equal to the two preceding; the scutellum bounded at the base by a double crenate fovea, &c.; and the whole description exhibits discrepancies which forbid the identification of the genus with *Dimeris*.

1. *Dimeris mira*, Ruthe. (Pl. II., fig. 5).

Dimeris mira, Ruthe, Stett. Zeit., 1854, p. 345; 1855, p. 329.

Pambolus melanocephalus, Marsh., E. M. M., vi., 228, ♀.

Paraptesis flavipes, Magretti, Bull. Soc. Ent. Ital., xvi., 1884, p. 101 ♀, tav. ii., f. 2.

Blackish brown, very thickly and finely tuberculated, beset with short adpressed hairs; metathorax bispinose; 1st abdominal segment aciculated; legs, and basal half of the antennæ rufescent; terebra slender, $\frac{1}{4}$ of the abdomen in length; the latter obtusely rounded at the apex; apterous. ♀. Length, 1—1 $\frac{1}{4}$ lines.

Var. Thorax and base of the abdomen rufescent.

I have never seen a ♂, and Ruthe's brief description supplies no more than is given above. The ♀ specimen I possess belongs to the var.; it was given to me some years ago at Cheltenham, but of the circumstances of its capture I have no knowledge. Billups captured four females at Headley Lane on January 28th. One ♀ taken near Florence by Piccioli.

VII. DORYCTIDES.

Head cubical; occiput margined; fore wings with three cubital areolets; abdomen subsessile.

The *Doryctides* are distinguished from the succeeding subfamilies by the cubical head; from the *Braconides* and *Exothecides*, by the margined occiput; from the *Spathiides*, by the subsessile abdomen; and from the *Hecabolides*, by the number of cubital cells. Of the three British genera which Förster's classification here brings together, *Histeromerus* is too abnormal to be mistaken for anything else; *Caloides* and *Doryctes* considerably resemble *Bracon*.

TABLE OF GENERA.

- (2) 1. Antennæ submoniliform, 18—20-jointed, shorter than the head and thorax iii. HISTEROMERUS.
 (1) 2. Antennæ filiform, more than 20-jointed, nearly as long as, or longer than, the body.
 (4) 3. Suturiform articulation distinct; præ- and post-brachial areolet of the fore wings of equal length i. CÆLOIDES.
 (3) 4. Suturiform articulation obsolete; præbrachial areolet of the fore wings shorter than the post-brachial ii. DORYCTES.

i. CÆLOIDES, Wesm.

Wesm., Nouv. Mém. Ac. Brux., 1838, p. 59.

Front excavated between the antennæ and ocelli; 3d joint of the antennæ not longer than the 2d; occiput margined. The other characters are those of *Bracon*. The 2d cubital areolet of the fore wing is remote from the exterior margin by much more than its length, measured along the cubitus,—a structure which belongs only to two British species of *Bracon*, *stabilis* and *brevicornis*, Wesm. The species of *Cæloides* are parasites of xylophagous Coleoptera; the two known to be British may be thus distinguished:—

- Legs black; abdomen testaceous; recurrent nervure rejected 1. *scolyticida*, Wesm.
 Legs testaceous; abdomen black above; recurrent nervure interstitial 3. *melanotus*, Wesm.

1. *Cæloides scolyticida*, Wesm. (Pl. II., fig. 6).

Bracon initiator, var. γ ., Nees, Mon., i., 102, ♀.

Cæloides initiator, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 60, ♂ ♀, pl., f. 4 (wing). (nec Fab.).

C. scolyticida, Wesm., *lib. cit.*, p. 61.

C. initiator, Ratz., Ichn. d. Forst., ii., 39; cf. iii., 41.

Cæloides, S. v. Voll., Schets., ii., tab. 5.

Black, smooth and shining; head and abdomen testaceous; palpi, mandibles at the base and apex, stemmaticum, frontal impression, and a large square spot on the face, blackish; prothorax pleuræ, and pectus, somewhat piceous; wings subfuscous with a hyaline stripe beneath the stigma, which is fusco-ferruginous; recurrent nervure rejected; 2d, 3d, and 4th joints of the antennæ short and equal; terebra ♀ about as long as the body. Length, $2\frac{1}{2}$; wings, 5 lines. ♂ ♀.

Antennæ ♀ slender, nearly as long as the body, 37—44-jointed; suture between the pro- and mesothorax sometimes more or less

testaceous; mesothoracic sutures obsolete in the middle of the disk, being merged in a punctulate, obscure space before the scutellum; metathorax and abdomen smooth, the latter sub-compressed, convex above, as long as the head and thorax; 2d segment short, $\frac{1}{2}$ as long as the 1st, with two lateral impressed lines, curved forwards and uniting to enclose a semicircular space; 3d longest, the rest decreasing in length to the apex; articulations of the legs subferruginous.

The ♂ is similar; antennæ 40—47-jointed, testaceous at the base beneath; the black facial spot often reduced to a narrow line; sometimes there is a black line on the occiput; prothorax more or less testaceous at the sides; fore coxæ and femora, and articulations of the tarsi, more or less testaceous; apical segments of the abdomen often infuscated; wings paler than those of the ♀.

Described from three mutilated specimens, a male and three females, given to me long ago, which agree well with Wesmæl's description taken from 16 females and 13 males, except that he considers black to be the predominant colour of the head, while in the British examples testaceous is more prevalent.

Probably this is the species which Curtis (Guide, 2d ed., column 115) referred to *Bracon initiator*, Fab., and of which a pair exists in the Stephensian collection in the British Museum. The true *initiator* is similar, but more than twice as large, with darker wings, and 49—54-jointed antennæ, a parasite of *Rhagium indagator*, Fab., and *Astynomus ædilis*, Lin. If British, it is most likely to be found in Scotland.

C. scolyticida is a parasite of *Scolytus destructor*, Ol., and has been reared abundantly by Radzay and Wissmann, according to Ratzeburg. See Wesm., Bull. Ac. Brux., 1838, p. 220, and Guérin-Ménéville, Bull. S. E. F., 1846, p. lxxviii., on the services rendered by this insect in keeping down the numbers of the *Scolytus*, and Giraud (Bull. S. E. F., 1872, p. x.) on the probable parasitism of this or an allied species on *Bostrychus typographus*, L. The "*B. initiator*," bred by Perris from *Pissodes notatus*, Fab., is doubtless referable to this species.

2. *Cœloides melanotus*, Wesm.

Cœloides melanotus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 61, ♂ ♀; Ratz., Ichm. d. Forst., iii., 40, ♂.

Testaceous, smooth and shining; antennæ black, except at the base; head, thorax, and abdomen black above; wings subfuscous,

paler towards the tips; recurrent nervure interstitial; 4th joint of the antennæ as long as the 2d and 3d together; terebra ♀ as long as the body. Length, $1\frac{1}{2}$ —2; wings, 3—4 lin. ♂ ♀.

Antennæ ♂ ♀ about 26—27-jointed (Ratzeburg says 29 in ♂), scarcely as long as the body. Mesothoracic sutures uniting in an impunctate space before the scutellum. The rest of the structure resembles that of the preceding species. In the ♂ the apex of the abdomen is wholly testaceous, and the black colour of the upper surface less intense than in the ♀; in one specimen the 2d segment is entirely piceous.

Described from five males and three females in good preservation. One pair was taken on an old railing in Shropshire, the others are from South Wales; I believe Chapman bred them from some xylophagous coleopteron, probably *Hylosinus* (see E. M. M., v., 120). Cartereau found them parasitic on *Hylosinus fraxini*, Fab., and Nördlinger bred a ♂ on July 3rd.

ii. DORYCTES, Hal.

Hal., Ent. Mag., iv., 43; Reinh., Berl. ent. Zeit., 1865, p. 246.

Suturiform articulation obsolete or subobsolete; terebra exerted; recurrent nervure interstitial or rejected; anal nervure not interstitial; præbrachial areolet shorter than the pabrachial; pabrachial areolet of the hind wings longer than $\frac{1}{2}$ the præbrachial; hind wings ♂ without a stigma; hind coxæ angularly produced in front.

The insects of this genus have an elongate appearance, which is due to the production of the head behind the eyes, and the attenuation of the thorax in front and behind. Mesothoracic sutures rugulose, ending posteriorly in a shallow fovea before the scutellum; middle lobe of the mesothorax more or less canaliculated; metathorax elongate, obscurely divided into five compartments, two larger in front, and three behind, whereof the medial one penetrates to some distance between the anterior. Abdomen of the ♀ obovate, convex; of the ♂ narrower, elongate, and depressed.

In the Ent. Mag., iv., 46, Haliday's Subgenus III. *Heterospilus* has been a source of error and perplexity. It was misplaced by the printer, and appears to belong to Spp. 4, 5, 6, whereas it refers only to the footnote on p. 47 (cf. p. 106, note), its type being the exotic Sp. 6b *H. quæstor*, the ♂ of which has a stigma in the hind

wings. The name *Heterospilus* must therefore be eliminated from every work on European insects where it occurs, and *Doryctes* substituted instead, according to the author's intention. At the same page 46, for Sp. 4. *H. D. striatellus*, and Sp. 5. *H. D. Imperator*, read *R. D. striatellus*, and *R. D. Imperator*. In Förster's Synopsis (Verh. pr. Rheinl., 1862, p. 239) all that relates to *Heterospilus*, "*♂ H. Flügel mit einem Randmal*," &c., must be struck out.

Reinhard has described 13 species of *Doryctes*, parasites of the *Cerambycidae*, *Buprestidae*, *Anobiidae*, and *Cureulionidae*. The four British species are very rare.

- | | | | | |
|--------|--|---------|----|------------------------------|
| (2) 1. | Second abdominal segment smooth | .. | 1. | <i>imperator</i> , Hal. |
| (1) 2. | Second abdominal segment striolated. | | | |
| (4) 3. | Abdomen (except the first segment) bright testaceous | .. .. . | 2. | <i>Heydenii</i> , Reinh. |
| (3) 4. | Abdomen fuscous or piceous. | | | |
| (6) 5. | Vertex and thorax granulated, obscure, with fulvous pubescence | .. .. | 3. | <i>spathiiformis</i> , Ratz. |
| (5) 6. | Vertex and thorax mostly shining, with very few hairs | .. .. . | 4. | <i>striatellus</i> , Nees. |

1. *Doryctes imperator*, Hal.

Doryctes imperator, Hal., Ent., Mag., iv., 46, ♀.

Ischiogonus zonatus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 127, ♀.

Bracon præcisus, Ratz., Ichn. d. Forst., iii., 36, ♀.

Doryctes imperator, Reinh., Berl. ent. Zeit., 1865, p. 247, ♂ ♀.

Pitchy-black; antennæ at the base, mouth, and legs, rufo-testaceous; tibiæ at the base, and palpi, pale; 2d abdominal segment of the ♀ piceo-rufous; wings subhyaline; vertex smooth and shining; sides of the mesothorax smooth, with an elongate crenate impression; 1st abdominal segment striolated, the rest smooth; terebra ♀ as long as, or longer than, the body. ♂ ♀. Length, 2½—3½ lines; wings, 4½—6⅔ lin.

Var. 1, ♀. Abdomen entirely rufous or rufo-testaceous.

Var. 2, ♀. Head and abdomen piceo-rufous.

Var. 3, ♀. Piceo-testaceous, the head piceo-rufous.

Head rugulose in front, vertex convex, smooth, and shining; antennæ as long as the body, in one ♀ 29-jointed; mesothorax finely granulated, with rugulose sutures, somewhat shining; metathorax elongate, with five areæ, the two anterior granulated, almost obscure, the medial area narrow, rectangularly produced in front,

the posterior area more rugulose; abdomen ♂ narrow, lanceolate; of the ♀, elongate; 1st segment ♂ half as long again as its apical width, of the ♀ somewhat longer, subattenuated towards the base, elevated in the middle, depressed at the sides, longitudinally striolated, or in the middle almost smooth, the following segments entirely so; wings nearly hyaline, radius originating somewhat behind the middle of the fuscous stigma. The colours of the ♀ are variable, but the varieties above indicated are much rarer than the typical form.

Very rare in England, but formerly taken by Curtis, and a ♀ by me in a hedge near Abergavenny. Wesmael had only a single example from Liège. Reinhard's description is from 7 males and 21 females collected in different parts of Germany. Parasitic on the Continent on *Buprestis Bérolinensis*, Fab., and *Astynomus ædilis*, L. Brischke saw six issue, on May 23rd, from a hole in timber made by *Astynomus*. This longicorn is not yet extinct in Scotland, and the *Doryctes* may be expected to occur in the Black Wood of Rannoch.

2. *Doryctes Heydenii*, Reinh. (Pl. II., fig. 7).

Doryctes Heydenii, Reinh., Berl. ent. Zeit., 1865, p. 253, ♀.

Elongate, black; mouth piceous; palpi and base of tibiæ pale; abdomen (except the 1st segment) bright rufo-testaceous: vertex, and sides of the mesothorax, smooth, shining, the latter with a rounded smooth foveola continued forwards by a narrow channel; abdominal segments 1, 2, and base of 3, rimulose; suturiform articulation subobsolete; wings hyaline: terebra ♀ as long as the abdomen. Length, 2½; wings, 4½ lines. ♀. Male not known.

Antennæ black, slender, 40-jointed, as long as the body with the terebra; mesothorax granulated in the middle of the disk, the three lobes more shining, punctulate; scutellum and metathorax granulated, obscure; the latter areated, the intermediate area projecting angularly between the two dorsal, which are partly smooth at the base; abdomen oblong-ovate, somewhat longer but not wider than the thorax, compressed, flattened above; segment 1 longer than its apical width, hardly attenuated at the base; the 4th and following segments have each a faint transverse impression in the middle; 2d joint of the trochanters testaceous: stigma and nervures brown, recurrent nervure interstitial. The abdomen of the living insect is of a bright orange colour, except the 1st segment. Valves of the terebra pilose, black.

I obtained this rare and conspicuous species by beating an old whitethorn hedge, in July, near the village of Anstey, Leicestershire. Reinhard's three specimens were from Prussia, Hungary, and Italy.

3. *Doryctes spathiiiformis*, Ratz.

Doryctes obliteratus, Hal., Ent. Mag., iv., 44, ♂ (nec Nees, Wesm., Ratz.).

Bracon spathiiiformis, Ratz., Ichn. d. Forst., ii., 37, ♂ ♀.

Doryctes spathiiiformis, Reinh., Berl. ent. Zeit., 1865, p. 257, ♂ ♀.

Rufo-piceous; spots on the mesothorax, metathorax, coxæ, and femora, fuscous; trochanters and tibiæ pallid, the latter broadly annulated with fuscous in the middle; wings subhyaline, the three cubital areolets clouded in the middle with fuscous; head and thorax clothed with short, fulvous, adpressed pubescence; head granulated, scarcely shining; sides of the mesothorax smooth, with a crenate impression; abdominal segments 1, 2, and base of 3, very finely and closely aciculated, suturiform articulation usually discernible, but very fine; terebra ♀ as long as the body. ♂ ♀. Length, $\frac{3}{4}$ — $2\frac{1}{4}$ lines; wings, $1\frac{1}{3}$ —4 lin.

Antennæ somewhat longer than the body, of the ♀ 32-, of the ♂ 36-jointed; mesothorax and scutellum dull, granulated; metathorax the same, but more shining at the base, areation distinct, the intermediate area small and narrow; 1st abdominal segment gradually attenuated to the base, where it is only half as wide as at the apex, in the ♂ about twice as long, in the ♀ $1\frac{1}{2}$ as long, as its apical width, finely aciculated throughout; suturiform aciculation marked by a fine line, visible at least in places; 2d segment and basal half of the 3d very finely aciculated longitudinally; the following segments smooth, each having in the middle a brown transverse band; recurrent nervure rejected; præ- and pobrachial areolets nearly of equal length.

I have translated Reinhard's description, having before me only a specimen of Walker's in bad condition. Rare in England, but taken also formerly by Curtis. In Sichel's collection are six specimens from Brétagne. Bred by Nördlinger at Pont Château near Grand Jouan (also in Brétagne) from hazel-sticks containing the larvæ of *Anobium striatum*, Ol. Some of the Braconids emerged in winter, and others in the following summer.

4. *Doryctes striatellus*, Nees.

Bracon striatellus, Nees, Mon., i., 107, ♀.

Doryctes striatellus, Hal., Ent. Mag., iv., 46, ♀.

D. tabidus, Hal., lib. cit., 47, ♂.

Ischiogonus obliteratus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 126, ♂ ♀, pl., fig. 15 (wing). (nec Nees, Hal., Ratz.).

Doryctes striatellus, Reinh., Berl. ent. Zeit., 1865, p. 256, ♂ ♀.

Shorter and stouter than the two preceding. Black; palpi pale, mandibles and legs ferruginous, tibiæ at the base obsolete whitish; head very slightly narrowed behind the eyes, vertex smooth; sides of the mesothorax smooth, with a round foveola, continued forwards by a linear impression; 1st abdominal segment, and most of the 2d, rimulose; prothorax beneath, and segments 1—3, more or less piceous or rufous; wings hyaline, stigma and nervures fuscous; terebra ♀ as long as the abdomen. Length, ♂ $1\frac{1}{4}$ — $1\frac{1}{2}$; ♀ $2\frac{1}{2}$; wings, $4\frac{1}{2}$ lines.

Var. 1, ♀. Thorax and abdomen entirely black,

Var. 2, ♀. Pro- and metathorax rufous; abdominal segments 1—2 rufo-testaceous.

Head smooth and shining; antennæ ♀ 33—40-jointed, as long as the body, black, the first two joints piceous; mesothoracic sutures rugulose, converging in a rugulose obscure space before the scutellum; metathorax rugulose, very distinctly areated in one specimen, the two dorsal areæ oblong, rounded at the apex, smooth at the base; abdomen oblong-lanceolate, flattened above; segment 1 hardly narrower at the base, a little longer than its apical width, with two inchoate basal carinæ; suturiform articulation invisible, or only slightly apparent at the sides; legs stout, fore tarsi nearly twice as long as their tibiæ; recurrent nervure rejected; 2d intercubital nervure decolorous.

Antennæ ♂ 33—42-jointed, longer than the body; abdomen wholly piceous-black; four posterior femora with a black line above; tibiæ at the base less distinctly pallid. In the Ent. Mag., iv., 47, the number of joints in the antennæ is printed 29, which is probably a misprint for 39. Bridgman's specimen has the antennæ 33-jointed, which agrees with Wesmael's description.

Parasitism not known. Haliday says he had seen one ♀; and his ♂ (*tabidus*) was taken near London by Walker. The ♂ has been found recently near Norwich by Bridgman; the ♀ in a house at Worcester by Fletcher, and another by me at Lasingham, Yorkshire. Bonelli

sent specimens of the ♀ to Nees from Italy. Wesmael was acquainted with 26 of both sexes, taken on windows and on the fence of a botanic garden. Reinhard examined only a single pair from Von Heyden's collection, and doubts their distinctness from *D. oblitteratus*, Nees, in which the legs are piceous, &c.

iii. HISTEROMERUS, *Wesm.*

Wesm., *Nouv. Mém. Ac. Brux.*, 1838, p. 63.

Head depressed, elongate behind the eyes, which are small; oral aperture large, transverse; maxillary palpi 6-, labial 4-jointed; antennæ ♂ ♀ submoniliform, shorter than the head and thorax; abdomen sessile; suturiform articulation obsolete; four anterior legs very short, with clavate tibiæ, shorter than the tarsi; hind tibiæ and tarsi of equal length, the metatarsus longer than the other joints together, curved, incrassated at the base and gradually diminishing to the apex, where it is again slightly enlarged; three cubital areolets in the fore wings; 2d intercubital nervure sub-obsolete; transverse nervure everted; præ- and pobrachial areolets of equal length; anal nervure not interstitial; pobrachial nervure sinuated not far from its origin; radial areolet narrow, elongate; nervures of the hind wings as well defined as those of the fore; radius, cubitus, and præbrachial transverse complete; pobrachial areolet not half the length of the præbrachial.

1. *Histeromerus mystacinus*, Wesm. (Pl. III., fig. 1).

Histeromerus mystacinus, Wesm., *Nouv. Mém. Ac. Brux.*, 1838, p. 65, ♀; pl., f. 5 (wing); ff. A—E (details); S. v. Voll., *Schets.*, ii., tab. 5 (wing).

Piceous, smooth; head and thorax black; antennæ fuscous, testaceous at the base; legs, stigma, nervures, and valves of the terebra, piceo-testaceous; terebra less than $\frac{1}{2}$ the abdomen. ♂ ♀. Length, ♂ 1; wings, $2\frac{1}{2}$; ♀ $1\frac{3}{4}$; wings, $3\frac{1}{2}$ lines.

Antennæ ♂ ♀ about $1\frac{1}{2}$ times as long as the head, 17—20-jointed, the joints discrete, equal, subquadrate, except the last, which is ovate, acuminate. The shape of the head suggests that of *Bethylus* or *Epyris*. Palpi and mandibles pale, the former beset with long hairs; prothorax piceous; 1st abdominal segment rectangular, somewhat longer than its width, with two curved lateral impressions enclosing a smooth space; terebra rufous, the valves piceous, darker at the apex. The ♂ corresponds in all respects, but is much smaller; the thorax is piceous instead of black.

The ♀ here described exhibits a singular irregularity in the neuration. The left fore wing is furnished with an extra recurrent nervure, connecting the middle of the 2d cubital areolet with the anal nervure, and forming a pentagonal areolet equal in size to the prædiscoidal.

This curious insect, of unknown habits, has not hitherto been noticed as British. The pair I possess was given to me by Ward, who had several which he wished to get named. They were taken, I believe, in or about London. Wesmael possessed two females taken probably near Brussels.

VIII. HORMIIDES.

Head transverse, occiput margined; antennæ submoniliform; abdomen consisting of more than two visible segments, sessile or subsessile; suturiform articulation superficial or effaced; terebra exerted; three cubital areolets; anal nervure interstitial.

Distinguished from the *Pambolides* by the number of cubital areolets, and of sutures in the abdomen. The anal nervure is in the same straight line as the præbrachial, a character rarely found among the Braconids, and belonging to no other group of Cyclostomi except this and the *Pambolides*. Förster has separated the two genera by the difference of the suturiform articulation, which is difficult to seize, and of only secondary value. On page 240 of his Synopsis (Verh. pr. Rheinl., 1862) an error must be corrected. For "Erstes und zweites Segment," read "Zweites und drittes"; and for "Erstes Segment von dem zweiten," read "Zweites Segment von dem dritten."

The genera may be thus distinguished:—

Præbrachial areolet shorter than the pobrachial;				
antennæ ♂ 11-, ♀ 12-jointed	..	..	..	i. CHREMYLUS.
Præ- and pobrachial areolets of equal length; an-				
tennæ ♂ ♀ more than 12-jointed	..	..	..	ii. HORMIUS.

i. CHREMYLUS, Hal.

Hal., Ent. Mag., i., 266; iv., 50; *Penecerus*, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 70.

Antennæ submoniliform, as long as the head and thorax, 11—12-jointed; abdomen wider than the thorax, depressed, ovate; segment I constituting one-fifth of the whole, semicircular, transverse, with two acute longitudinal carinæ; suturiform articulation effaced,

the compound segment thus formed equalling by itself $\frac{1}{2}$ of the abdomen; the remaining segments short, partially retracted beneath the 2d, but not invisible as in the *Pambolides*; radius originating in the middle of the stigma; 2d cubital areolet trapeziform, shorter and less produced inwardly than in *Hormius*; recurrent nervure interstitial; pobrachial areolet of the hind wings less than $\frac{1}{2}$ the length of the præbrachial.

1. *Chremylus rubiginosus*, Nees. (Pl. III., fig. 2).

Hormius rubiginosus, Nees, Mon., i., 156, ♀.

Chremylus rubiginosus, Hal., Ent. Mag., iv., 51, ♀;
Cur., Farm Ins., 365, ♂ ♀; S. v. Voll., Schets.,
ii., tab. 6, ♀.

Penecerus rubiginosus, Wesm., Nouv. Mém. Ac. Brux.,
1838, p. 70, ♀, pl., f. 7 (wing).

Castaneous; head, antennæ at the apex, thorax and base of abdomen more or less, and stigma, fuscous; palpi pale; terebra $\frac{1}{3}$ — $\frac{2}{3}$ of the abdomen. ♂. Length, $\frac{1}{2}$; wings, $\frac{3}{4}$ line: ♀, length 1; wings, 2 lines.

♀. Granulated, obscure; scutellum and apical half of the abdomen more shining; metathorax rugulose, truncate, and bidenticulated at the hind angles, but less acutely than in *Dimeris*, more or less distinctly divided into five areas, the two dorsal large, rounded behind, the medial projecting angularly between them; 1st abdominal segment and base of the 2d punctulate, the former semiorbicular, as in *Dimeris*, with two acute parallel carinæ.

The ♂ (which I have not seen) is similar, according to Curtis, but only $\frac{1}{4}$ as large, and is remarkable for having one joint less in the antennæ than the ♀, the ordinary sexual distinction being reversed: cf. Hal., Ent. Mag., i., 266, where he appears to have established the genus upon a ♂ specimen, although in iv., 50, only the ♀ is described. The same writer says that the metathorax is "haud areatus"; probably he had before him a ♀ in which this structure was not conspicuous, as in my specimens, and in the six described by Wesmael.

Widely distributed, and often found in windows of old houses: I have four females taken in such a situation in Northamptonshire. According to Curtis (*l. c.*) it is a frequent parasite of *Bruchus rufimanus*, Boh.; his specimens were bred on April 24th from beans grown in Essex; Rondani bred it from *Bruchus seminarius*, L.;

and Taschenberg says it is a parasite of *B. granarius*, Sch. Fitch reared a ♀ on Sept. 8th from wheat-refuse infested with weevils (*Calandra*); and Billups another on May 23rd. Brischke has bred it from the cases of *Tinea pellionella*, L.

ii. HORMIUS, Nees.

Nees, Act. Ac. L. C. 1818, p. 305; Mon., i., 152; Hal., Ent. Mag., iv., 52.

Antennæ much longer than the head and thorax, more than 12-jointed; abdomen more oblong than in *Chremylus*; segment 1 formed as in *Bracon*, with an oblong medial scutum and membranaceous margins; suturiform articulation superficial; segment 2 twice as long as 3, with two longitudinal impressions near the sides, arcuate, and approximating towards the base; hind margins of the segments somewhat elevated; segments 4—6 equal, 7—8 minute; radius originating beyond the middle of the stigma; 2d cubital areolet with its inner hinder angle much produced, this angle receives the everted recurrent nervure; pobrachial areolet of the hind wings as in *Chremylus*.

1. *Hormius moniliatus*, Nees. (Pl. III., fig. 3).

Hormius moniliatus, Nees, Mon., i., 153, ♀; Hal., Ent. Mag., iv., 52, ♂ ♀; Wesm., Nouv. Mém. Ac. Brux., 1838, p. 67, pl., f. 6 (wing), ♀; S. v. Voll., Schets., ii., tab. 5.

H. piciventris, Wesm., *lib. cit.*, p. 68, ♂ ♀.

Metathorax and scutum of the 1st abdominal segment black, the rest of the body variable in colour, black, red, or testaceous; antennæ ♂ longer, of the ♀ rather shorter, than the body; wings yellowish hyaline, often with an indeterminate dusky medial stripe from the base to the apex; stigma generally yellow; terebra ♀ exerted, short. Length, 1—1½; wings, 2—2¾ lines.

Variable in colour, in the length, and number of joints, of the antennæ, and in the rugosity of the 1st segment, which is graduated in different specimens until finally it appears almost smooth. I am unable to find any real difference between Wesmael's *piciventris* and the radical species, and they are here united, in accordance with the opinion of Haliday. The abdomen in British examples is testaceous, more or less pitchy, and with the lateral margins darker; the legs are testaceous, with more or less infuscated femora, the tips of the tarsi hardly darker.

Var. 1. Head, thorax, and antennæ, black ♀; antennæ ♂ testaceous at the base.

Var. 2. Head and thorax ferruginous varied with black; antennæ fuscous.

Var. 3. Head and thorax ferruginous; antennæ testaceous, darker at the base and apex.

Var. 4. Stigma fuscous.

Antennæ ♀ 17—22-jointed; thorax smooth, shining; mesothoracic sutures meeting in a rugulose depression; at the base of the scutellum is a bipartite rugulose foveola; metathorax reticulato-rugulose, with or without two carinæ indicating the medial area between the two dorsal; abdomen regularly ovate, depressed, pellucid (the ova, according to Nees, being visible in life, strung into a series posteriorly towards the oviduct); segment 1 transverse, the membranaceous edges depressed, scutum oblong, rectangular, more or less rugulose, or even smooth; terebra one-fourth or one-sixth the length of the abdomen. The ♂ is much smaller, with 24—25-jointed antennæ.

Abundant at the roots of rushes on the sand-hills at Freshwater Bay, Pembrokeshire; most of these belong to the dark varieties (*piciventris*, Wesm.). Found in moss at the roots of trees, or shaken out of furze and dead leaves in spring; St. Albans, Maldon, Worcester, Headley Lane, &c. Bred by Brischke from *Tortrix corylana*, Fab. Cocoons thin, white, cylindrical, attached together by threads of silk.

IX. RHOGADIDES.

Head transverse, occiput margined; mandibles bifid; maxillary palpi 6-, labial 4-jointed; abdomen sessile, segments 1—3 largest, sculptured, thyridia of the 2d and 3d visible; three cubital areolets, the 2d rectangular (in *Clinocentrus* and *Pelecystoma*, trapezoidal); recurrent nervure rejected; pabrachial areolet longer than the præbrachial; anal nervure not interstitial; terebra subexserted (in *Clinocentrus* and *Pelecystoma*, exserted).

The insects of this very natural division are of large or moderate size, and robust structure, with elongate antennæ and abdomen; their integuments are hard, and more or less covered with rugulosities or punctures; their colours are black, testaceous, and rufous, the last appearing chiefly in bands upon the abdomen, or alternating with black upon the head and thorax of the typical Rhogades. They are parasites of lepidopterous larvæ.

The genus *Rhogas*, Nees, was divided by him into three sections (Act. Ac. L. C., 1818, p. 306), comprising very dissimilar insects. The first and third sections have the clypeus contiguous to the mandibles, the former being co-extensive with the *Macrocentrides*, and the latter (*Ademon*, Hal.) agreeing better with the *Opiides*, according to the views of Wesmael and Reinhard; but it was placed by Haliday between *Rhogas* and *Clinocentrus*. The second section, "Species genuinæ" of Nees, has been subdivided into five genera, all of which are British, and may be synoptically represented as follows:—

- 4) 1. Suturiform articulation obsolete.
 (3) 2. Second cubital areolet rectangular; abdomen longer than the head and thorax, of the ♀ strongly compressed from the 2d segment; terebra subexserted ii. PETALODES.
 (2) 3. Second cubital areolet trapeziform; abdomen not longer than the head and thorax, of the ♀ only subcompressed at the apex; terebra considerably exserted i. CLINOCENTRUS.
 (1) 4. Suturiform articulation distinct, crenulate.
 (6) 5. Third joint of the maxillary palpi dilated internally, securiform; terebra exserted .. iii. PELECYSTOMA.
 (5) 6. Third joint of the maxillary palpi simple; terebra subexserted.
 (8) 7. First abscissa of the radius longer than the second; in the ♀, segments 4 and following retracted and concealed beneath the 3d .. iv. HETEROGAMUS.
 (7) 8. First abscissa of the radius shorter than the second; in the ♀, segments 4 and following not retracted and concealed beneath the 3d .. v. RHOGAS.

i. CLINOCENTRUS, Hal.

Hal., Ent. Mag., i., 266 (1833); iv., 94.

Abdomen ♀ oblong-ovate, not longer than the head and thorax, convex above and subcompressed at the apex, segments 1—3 subequal, occupying about $\frac{7}{8}$ of the total length, the rest being very short; spiracles of the 1st segment medial; suturiform articulation obsolete; sides of the mesothorax impressed with a deep furrow; 1st cubital areolet hexagonal, one of its shortest sides, the lower, always decolorous, the rejected transverse nervure falls exactly on the inner end of this side; 2d cubital areolet trapeziform; terebra $\frac{1}{3}$ — $\frac{3}{4}$ the length of the abdomen. Abdomen ♂ more linear, depressed, segments 1—3 occupying about $\frac{2}{3}$ of its length.

This genus is intermediate between the *Exothecides* and the true *Rhogadides*, showing affinity to the former

in the exertion of the terebra, the obsolete suturiform articulation, and the trapezoidal shape of the 2d cubital areolet. Wesmael described three species, forming the last section of his *Exothecus*, all of which appear to be British, and, with the exception of *exsertor*, Nees, identical with those established by Haliday.

- (2) 1. Hind femora tipped with black 3. *exsertor*, Nees.
 (1) 2. Hind femora entirely testaceous.
 (4) 3. Stigma testaceous, darker at the outer angle 4. *cunctator*, Hal.
 (3) 4. Stigma fuscous, the inner angle testaceous;
 in one case wholly fuscous.
 (6) 5. Segment 3 dull, minutely aciculated .. 1. *excubitor*, Hal.
 (5) 6. Segment 3 shining, smooth, or nearly so.
 (8) 7. Stigma ♂ fuscous, unicolorous; terebra ♀
 as long as $\frac{1}{2}$ abdomen 5. *vestigator*, Hal.
 (7) 8. Stigma ♂ bicolorous; terebra ♀ as long as
 $\frac{1}{3}$ abdomen 2. *umbratilis*, Hal.

1. *Clinocentrus excubitor*, Hal.

Clinocentrus excubitor, Hal., Ent. Mag., iv., 94, ♂ ♀ ;

(?) S. v. Voll., Schets., ii., tab. 5.

Exothecus marginellus, Wesm., Nouv. Mém. Ac. Brux.,
 1838, p. 86, ♀ .

Black; mouth, orbits, mesothorax beneath, legs, and a line before the wings, testaceous; abdominal segments 1—3 longitudinally rugulose; segment 1 obconic; stigma bicolorous; terebra ♀ $\frac{2}{3}$ as long as the abdomen. Length, 2—2 $\frac{2}{3}$; wings, 4 $\frac{1}{2}$ —5 $\frac{1}{2}$ lines.

Clypeus testaceous, palpi paler; antennæ as long as the body, 33—36-jointed (35- in my specimen), black, joint 1 beneath, and 2 at the apex, testaceous; metathorax not areated, rugose; abdomen hardly longer than the thorax, obovate, segments 1—2 longitudinally rugulose, with punctulate interstices, 3 more finely sculptured, nearly smooth at the apical angles, the hind margin narrowly testaceous; the other segments smooth, almost entirely retracted beneath the 3d, with similar pale margins; segment 1 almost twice as wide at the apex as at the base, shorter than twice its apical width, with a medial carina which is bifurcate at the base; wings hyaline, stigma fuscous, its inner half testaceous, ♀ . The ♂ has the suturiform articulation more completely effaced, the abdomen narrower, and sometimes a rufescent patch on the mesothorax.

Taken by Haliday in woods, England and Ireland; by me near Barnstaple. Wesmael found a ♀ at Charleroi.

According to Van Vollenhoven, four males and five females were bred from the pupæ of *Noctua ditrapezium*, Bork.

2. *Clinocentrus umbratilis*, Hal.

Clinocentrus umbratilis, Hal., Ent. Mag., iv., 95, ♀.

Black; face, orbits, sometimes the base of the antennæ, prothorax, pectus, disk of the mesothorax more or less, legs with their coxæ, and 3d abdominal segment more or less, testaceous; stigmaticum and claws black. Wings hyaline, stigma bicolorous. Segments 1—2 rimulose, faintly carinated in the middle, 1 almost linear, 3 and following smooth, 3 slightly punctulate in the ♀. Terebra as long as $\frac{1}{2}$ the abdomen. ♂ ♀. Length, $2\frac{3}{4}$; wings, 5 lines.

Like *excubitor* in sculpture, but the abdomen is longer and narrower: segment 1 hardly attenuated at the base, more than twice as long as its apical width; 1—2 striolated, 3 vaguely punctulate in the ♀, the punctures disposed in minute irregular striolæ, which towards the sides divaricate transversely; extreme lateral margins rufescent; in the ♂ the 3d segment is smooth, and nearly all testaceous, except the fore and hind margins. Abdomen somewhat nigro-fuscous; belly testaceous. Antennæ ♂ 30-jointed. Scutellum (in one specimen) testaceous.

The ♀, which I have not seen, was taken by Haliday with *excubitor* and *cunctator*. I found one ♂ at Govilon, near Abergavenny, and another in the New Forest, in May.

3. *Clinocentrus exsertor*, Nees. (Pl. III., fig. 4).

Rogas exsertor, Nees, Mon., i., 207, ♀.

Exotheucus exsertor, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 87, ♂ ♀, pl., fig. 10 (wing).

Bracon orbitator, Nees, Mon., i., 91, ♀.

Black; mouth, orbits, mesothorax before the scutellum, 3d abdominal segment, and legs, rufo-testaceous; hind femora (sometimes also the intermediate pair) black at the apex; segments 1—2 and part of 3, rugulose; stigma bicolorous; terebra nearly as long as the abdomen. ♂ ♀. Length, $1\frac{1}{2}$ —2; wings, $3\frac{3}{4}$ — $4\frac{1}{4}$ lines.

Variable in the extent of the testaceous markings; orbits and metathorax often wholly black; 3d abdominal segment rufo-testaceous only at the sides, or the abdomen is entirely black; the intermediate femora not always black at the apex.

Antennæ ♀ as long as the body, 31—36-jointed (34- in my specimen), joints 1—2 sometimes testaceous at the base; metathorax

rugulose, the medial area more or less distinct; 1st abdominal segment with a medial carina bifurcate at the base, longitudinally striolate, like the 2d; segment 3 more or less testaceous, more finely striolate, posteriorly smooth, the striolæ have a tendency to divaricate from the medial line and become transverse; the remaining segments smooth, extreme apex of the abdomen rufescent; the hind femora at least are always tipped with black, by which the species may be known. The ♂ has also 34-jointed antennæ in my specimens, longer than the body; the rugulosity of the 3d segment is more pronounced, and straight; in one example the hind coxæ are infuscated.

Neither *umbratilis* nor *vestigator*, Hal., can be this species, as their hind femora are concolorous, a reason which Haliday himself gives (*Ent. Mag.*, iv., 96) for not uniting *umbratilis* and *exsertor*.

Not uncommon near St. Albans; I have five males and one female from that neighbourhood, and a ♀ taken in Darenth Wood. Elisha bred a dark ♂ from *Hedya neglectana*, Dup., on July 31st.

4. *Clinocentrus cunctator*, Hal.

Clinocentrus cunctator, Hal., *Ent. Mag.*, iv., 95, ♂ ♀.
Erotheus analis, Wesm., *Nouv. Mém. Ac. Brux.*, 1838,
 p. 85, ♂ ♀.

Black; mouth, orbits, markings of the thorax in front, abdomen at the apex, and legs, testaceous; abdomen striolate at the base, segment 1 obconic; terebra $\frac{2}{3}$ the length of the abdomen. ♀. Length, $1\frac{1}{2}$ —2; wings, 3— $4\frac{1}{2}$ lines.

Like *excubitor*, Hal., differing principally in the sculpture of the abdomen; segments 1—2 somewhat shining, finely striolated, the interstices impunctate; the other segments dull testaceous, or infuscated, 3d minutely aciculated transversely, the following almost smooth; belly pale testaceous; head testaceous, face beneath the antennæ, middle of the vertex, and rim of the occiput, fuscous; thorax in front, at the sides, and beneath, testaceous, on the disk are three confluent fuscous patches; metathorax black, punctato-reticulate, without areæ; legs pale testaceous; wings hyaline, stigma pale testaceous, fuscous at the apex. The ♂ differs in having the posterior abdominal segments less abbreviated and more broadly smooth; the exterior nervures of the wings are sometimes incrassated; antennæ (in one specimen) 28-jointed.

Antennæ ♀ 30-jointed, as long as the body, blackish above, ferruginous beneath, joints 1—2 testaceous; prothorax testaceous

beneath; mesothorax with two longitudinal testaceous lines dilated behind and uniting near the middle of the disk, curved outwards in front and bordering the prothorax to the insertion of the wings; 3d abdominal segment testaceous, blackish at the sides and apex; the remaining segments, and belly, testaceous; terebra nearly as long as the abdomen. In the ♂ described by Wesmael the testaceous dorsal lines of the mesothorax were indistinct, and segments 4—5 blackish.

Not common; Haliday took his specimens in woods in the West of Ireland; I found a ♂ near Abergavenny in May; and Wesmael possessed a male and two females captured near Brussels.

5. *Clinocentrus vestigator*, Hal.

Clinocentrus vestigator, Hal., Ent. Mag., iv., 95, ♂ ♀.

Black; antennæ at the base, mouth, orbits, and legs, testaceous; abdomen rugulose at the base; stigma of the ♂ entirely fuscous; terebra ♀ $\frac{1}{3}$ the length of the abdomen. Length, $1\frac{1}{2}$ —2; wings, 3—4 lines.

Shorter than the preceding species, metathorax more coarsely rugose; antennæ 27-jointed; abdomen shorter, ovate, segments 1—2, and sometimes 3 at the base, rugulose, the rest smooth, nigro-piceous; terebra less than half as long as in the other species, stouter, subclavate; wings hyaline, stigma somewhat larger, fuscous, pale at the base, in the ♂ wholly nigro-fuscous, or with a small testaceous basal streak.

Var. 1. Third abdominal segment testaceous at the sides, fuscous in the middle.

Var. 2, ♂. Apex of the scutellum fuscous.

Var. 3, ♂. More finely sculptured; head black, face pale testaceous.

Inhabits England and Ireland. Not common. I have a ♂ of this species, taken at Nunton, near Salisbury.

ii. PETALODES, *Wesm.*

Wesm., Nouv. Mém. Ac. Brux., 1838, p. 123; Reinh., Berl. ent. Zeit., 1865, p. 245.

Suturiform articulation obsolete; 2d cubital areolet rectangular; abdomen sublinear, of the ♂ depressed, of the ♀ strongly compressed from segment 2 to the apex, longer than the head and thorax; terebra subinserted.

1. *Petalodes unicolor*, Wesm. (Pl. III., fig. 5).

Petalodes unicolor, Wesm., *l. c.*, ♀, pl., fig. 14 (wing);
Reinh., *l. c.*, ♂ ♀; S. v. Voll., *Pinac.*, pl. iv., f. 2
(with details of ♀ abdomen and antenna).

Rogas compressor, Schöff., F. G., 156.

Testaceous; stemmaticum, a patch on the metathorax, and the antennæ towards the apex, fuscous; valves of the terebra and tips of the tarsi black; wings subhyaline, stigma yellow, nervures pale fuscous. ♂ ♀. Length, $2\frac{1}{4}$ —3; wings ♀, $4\frac{1}{2}$ lines.

Antennæ ♀ 32-jointed, in two specimens (36-jointed in the one described by Wesmael), much shorter than the body; front with a geminated fovea above the antennæ; thorax compressed; mesothorax flat on the disk, truncated in front of the ante-scutellar crenate fovea, the sutures subobsolete; head and thorax granulated, not shining; a smooth space on each side of the scutellum; metathorax carinated, villose; abdomen $\frac{1}{2}$ longer than the head and thorax, segment 1 rectangular, $2\frac{1}{2}$ times as long as its width, striolated, with narrow, raised, smooth margins, finely carinated from the base to beyond the middle; segment 2 equal and similar, except that here begins the lateral compression of the abdomen; 3 shorter, narrower, more compressed, striolated at the base, smooth at the apex, as are the following segments, which present a subcultriform edge above, and successively diminish in length; suturiform articulation nearly effaced; belly similarly compressed; valves of the terebra flattened, punctulate, scarcely surpassing the anus. Antennæ ♂ as long as the body, 42-jointed; abdomen somewhat longer than the head and thorax, parallel at the sides to the end of segment 4, depressed, thence to the apex more convex, and narrower.

The ♀ is easily distinguished by the elongate compressed abdomen; the ♂ resembles some of the pale species of *Rhogas*, but may be known by the obsolete suturiform articulation, and the shape of the abdomen, the sides of which are parallel near the base.

This species has the same habits as *Rhogas*, attacking young larvæ, and undergoing its transformations inside their dried bodies. A dozen or more males and females were bred in this manner from larvæ of *Pygæra pigra*, Hufn., taken by Norgate in the New Forest. These larvæ perished after attaining the length of about 4 lines, and one *Petalodes* emerged from each through a hole in the posterior dorsal segments of the hardened

skin. At Vienna this parasite has been reared by Giraud from *Heterogenea limacodes*, Hufn.

iii. PELECYSTOMA, Wesm.

Wesm., Nouv. Mém. Ac. Brux., 1838 p. 91.

Third joint of the maxillary palpi dilated internally, securiform; suturiform articulation distinct, crenulate; 3 cubital areolets, the 2d trapeziform; recurrent nervure interstitial; pabrachial areolet longer than the præbrachial; anal nervure not interstitial; terebra ♀ exserted. This genus approaches *Rhogas* and *Heterogamus* more nearly than any of the preceding, but differs in the unique structure of the maxillary palpi, the exserted terebra, and the 2d cubital areolet, which is not exactly rectangular.

1. *Pelecystoma lutea*, Nees. (Pl. III., figs. 6, 6a).

Rogas luteus, Nees, Mon., i., 218 (excl. synon.); Schöff., F. G., 156, 9.

Pelecystoma luteum, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 92, pl., fig. 12 (wing); Reinh., Berl. ent. Zeit., 1865, p. 244, ♂ ♀; S. v. Voll., Pinac., pl. iv., f. 1 (with details of maxillary palpus and antenna).

Bracon luteus, Ratz., Lehn. d. Forst., ii., 36, ♂ ♀.

Testaceous; antennæ fuscous, except at the base, 2d joint much shorter than the 1st; stemmaticum, mandibles at the apex, and tips of the tarsi, black; abdominal segments 1—4 rugulose; terebra ♀ hardly equal to $\frac{1}{4}$ of the abdomen. ♂ ♀. Length, 3—4; wings, $6\frac{1}{2}$ lines.

Antennæ ♀ somewhat longer than the body, 53-jointed in one British specimen; mesothorax very convex, sutures distinct, sides smooth, with an impressed line; metathorax rugose; 1st abdominal segment with a bifurcate carina from the base to the middle; wings hyaline, stigma and nervures testaceous, 1st intercubital transverse nervure somewhat oblique. The ♂ is similar.

The right of this species to be considered British is established by two females, one mutilated, in Fitch's collection; this was bred by Sang from a doubtful Geometer feeding on fir, *Ellopiæ prosapiaria*, L., *Thera firmata*, Hüb., or *variata*, Schiff. The other from *Heterogenea limacodes*, Hufn., by Raynor on June 22nd. Reissig and Goureau have both reared it on the Continent from this host. Wesmael describes also *P. tricolor*, not yet known as British, having the first two joints of the antennæ equal, and the abdomen fuscous in the middle, which Giraud has likewise obtained out of *Heterogenea*.

iv. HETEROGAMUS, *Wesm.*

Wesm., *Nouv. Mém. Ac. Brux.*, 1838, p. 120.

This genus is not of equal value with the other genera of the present subfamily. It was made a subsection of *Rhogas* by both Haliday and Wesmael, differing only from that genus as follows :—

Second cubital areolet so narrow that the 1st abscissa of the radius is made longer than the 2d ; abdomen of the ♀ dilated from the base to the apex of the 3d segment, with rectilinear sides ; 4th and following segments retracted under the 3d, only the extreme apex protruding ; in the ♂, however, the 4th segment is half as long as the 3d, and the 5th and following retracted ; the antennæ of the ♀ are ringed with white (as in no other British Braconid, unless *Helcon annulicornis*, Nees, be indigenous) ; those of the ♂ are more slender in proportion (remarks Haliday) than the antennæ of any other Ichneumonideous insect.

1. *Heterogamus dispar*, Cur. (Pl. IV., figs. 1, 2).

Rogas dispar, Cur., B. E., dxii. ; Hal., *Ent. Mag.*, iv., 103, ♂ ♀ ; S. v. Voll., *Pinac.*, pl. iv., f. 3 (♀, with details of antenna).

Heterogamus crypticornis, Wesm., *Nouv. Mém. Ac. Brux.*, 1838, p. 120, ♂ ♀.

♀. Rufo-testaceous, granulated ; thorax more or less, and apex of the abdomen, fuscous ; antennæ stout, tricolorous ; fore wings cinereous, hind wings hyaline. ♂ testaceous ; thorax more or less, and abdomen at the apex, fuscous ; antennæ very slender ; wings hyaline. ♂ ♀. Stigma bicolorous. Length, $2\frac{1}{2}$; wings, $4\frac{1}{2}$ lines.

♀. Variable in colour ; testaceous, with the vertex and occiput fuscous, or with the head, thorax, and abdominal segments after the 2d, blackish ; antennæ 39—40-jointed, testaceous for $\frac{1}{4}$ of their length, then fuscous, then white, afterwards fuscous to the apex ; the white ring occupies 5—7 articulations ; palpi, trochanters, and anterior coxæ, whitish ; mesothoracic sutures effaced ; metathorax rugulose, elongate, cylindrical, truncate and bidentulate at the apex ; abdominal segments 1—2 punctato-rugulose, longitudinally carinated ; segment 3 thickly punctulate ; legs slender, femora often fuscous at the apex ; stigma fuscous, yellow at the base ; a white streak or spot in the 1st cubital areolet, and the portion of the cubital forming its lowest side effaced by another white streak.

♂. Antennæ 42—43-jointed, fuscous, the two first joints testaceous ; variable in colour, the vertex, occiput, sides of the meso-

and metathorax, segment 1 at the base, 3 at the apex, and all the following, are liable to be black or infuscated; the segments after the 4th are always so; metathorax not bidenticulate.

Found in fir-woods in autumn, but not common. Taken by Haliday in Ireland and Scotland; in England by Curtis and Dale. I have captured the ♀ at Birch Wood, and among larches at Lidford, near Dartmoor, and a ♂ at Niton, Isle of Wight. Bridgman has taken the ♀ at Norwich.

v. RHOGAS, Nees.

Nees, Act. Ac. L. C., 1818, p. 306.

Third joint of the maxillary palpi simple. Abdomen linear or somewhat obovate, sessile; suturiform articulation distinct, crenulate; segments 1—3 subequal, longitudinally carinated in the middle, rugulose or aciculated; the remainder very short, but not retracted or concealed beneath the 3d. First cubital areolet receiving the recurrent nervure much before its apex; 1st abscissa of the radius shorter than the 2nd; pobrachial areolet longer than the præbrachial, and therefore the podiscoidal shorter than the prædiscoidal. Anal nervure not interstitial. Terebra subexserted.

The insects of this genus manifest a peculiar economy. They are solitary parasites of young lepidopterous larvæ, the bodies of which they do not quit at the time of pupation, but make their cocoons inside, protected by the indurated skins of the victims. The perfect *Rhogas* ultimately escapes through a hole bored in the posterior dorsal segments of the caterpillar. These facts, now well established, render improbable the account given by S. v. Vollenhoven of the production of *R. circumscriptus*, Nees, from a *Lophyrus* cocoon. And Brischke's remark on the breeding of another species from a *Nematus* is perhaps also erroneous. Whatever progress in the knowledge of this genus has been made since the writings of Haliday and Wesmael, is due to Reinhard's paper in the 'Berliner ent. Zeitschrift,' which has been here followed as closely as possible. Of the seven British species described by Haliday, only three (*gasterator*, *geniculator*, *bicolor*) retain the names which he assigned to them; while out of eight which he indicated as continental (Ent. Mag., iv., 104) four are now known to be indigenous. *R. irregularis*, *tristis*, *armatus*, *vittiger*, *nigricornis*, and *dimidiatus* are here added to the British list. On the other hand, *testaceus* has been rejected, for

reasons which will be stated hereafter. The instability of the colours renders the determination of the species difficult, and their exhibition in a tabular form still more so.

TABLE OF SPECIES.

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|------|---|-----------------------------------|
| (16) | 1. Legs rufous; ground colour of the body black, with or without rufous markings. In other words, the pale portions of the body (if any) are rufous, not testaceous. | |
| (3) | 2. Podisoidal areolet only $\frac{1}{3}$ as long as the prædisoidal | 2. <i>reticulator</i> , Nees. |
| (2) | 3. Podisoidal areolet $\frac{2}{3}$ — $\frac{3}{4}$ as long as the prædisoidal. | |
| (11) | 4. Fourth abdominal segment shining, not margined beneath at the sides. | |
| (6) | 5. Antennæ 60-jointed | 1. <i>dissector</i> , Nees. |
| (5) | 6. Antennæ with fewer than 60 joints. | |
| (8) | 7. Palpi testaceous; hind tibiæ yellow with black tips | 3. <i>irregularis</i> , Wesm. |
| (7) | 8. Palpi fuscous; hind tibiæ rufous with black tips; (in <i>gasterator</i> ♂, yellowish at the base). | |
| (10) | 9. Mesopleuræ with a rugose dull fovea; antennæ ♀ not more than 40-jointed, shorter than the body | 4. <i>dimidiatus</i> , Spin. |
| (9) | 10. Mesopleuræ with a punctate shining fovea; antennæ ♀ 54-jointed, as long as the body | 5. <i>gasterator</i> , Jur. |
| (4) | 11. Fourth abdominal segment (like the 3 preceding) dull, margined beneath at the sides. | |
| (13) | 12. Segment 1 distinctly longer than 2, contracted at the base; body elongate, slender | 7. <i>tristis</i> , Wesm. |
| (12) | 13. Segment 1 scarcely longer than 2, hardly contracted at the base; body short, stout. | |
| (15) | 14. Antennæ 48—52-jointed | 6. <i>geniculator</i> , Nees. |
| (14) | 15. Antennæ 37—40-jointed | 8. <i>bicolor</i> , Spin. |
| (1) | 16. Legs testaceous; ground colour of the body testaceous, more or less varied with black. In other words, the pale portions of the body (if any) are testaceous, not rufous. | |
| (18) | 17. Antennæ 35—40-jointed | 10. <i>circumscriptus</i> , Nees. |
| (17) | 18. Antennæ with more than 40 joints. | |
| (20) | 19. Black species (not variable), with a testaceous spot on the abdomen; belly black | 9. <i>nigricornis</i> , Wesm. |
| (19) | 20. Testaceous species, with some parts black or fuscous; belly pale. | |

- (22) 21. Head and mesothorax testaceous, immaculate; stigma yellow, sometimes fuscous at the apex 12. *armatus*, Wesm.
 (21) 22. Head and mesothorax more or less black; stigma fuscous, with a pale spot at the base 11. *vittiger*, Wesm.

1. *Rhogas dissector*, Nees.

Rogas dissector, Nees, Mon., i., 208, ♂; Reinh., Berl. ent. Zeit., 1863, p. 252, ♂ ♀; S. v. Voll., Pinac., pl. iv., fig. 4.

R. rugulosus, Hal., Ent. Mag., iv., 97, ♂ ♀ (nec Nees).

Black, mouth and legs rufous, the latter stouter than in the other British species; hind tibiæ pale, broadly black at the apex; hind tarsi black. Mesopleuræ smooth and shining, rugose above, thinly punctulate on the hinder margin. Abdomen attenuated at the base, ruguloso-punctate. Second cubital areolet about twice as broad as its length; 1st intercubital nervure oblique. ♂ ♀. Length, $3\frac{1}{4}$ — $3\frac{3}{8}$; wings, $5\frac{1}{2}$ —7 lin.

Antennæ somewhat longer than the body, black, about 60—64-jointed, a number reached by no other British species. Face transversely rugose. Mandibles rufous; palpi fuscous or rufescent. Mesopleuræ often with a longitudinal rufous stripe. Metathorax flattened, ruguloso-punctulate, with a medial carina. Abdomen narrower than in the other species, gradually widening to the end of the 3d segment; segments 1—2, and 3 at the base, rugulose, the rest smooth and shining; segment 1 at the apex twice as broad as its base; segment 2 as long as its basal breadth. Abdomen of the ♀ somewhat compressed at the apex; terebra very short. Wings ample; 2d cubital areolet as long as the podiscoidal; stigma more attenuated than usual at the apex; radial areolet narrow. Coxæ rufous; hind femora subinfuscated at the apex.

Var. *α*. Abdomen wholly black.

Var. *β*. Segment 1 at the apex more or less, and 2 entirely, piceous.

Var. *γ*. Segments 1—2 bright rufous.

I have not seen this species, which, according to Haliday, is not rare in Ireland, frequenting umbelliferous flowers in autumn. In Reinhard's table it is ranked among species with the abdomen wholly black, which, considering the varieties mentioned by Nees and Haliday, may sometimes lead to difficulty. The true *rugulosus*, Nees, has not yet been identified in England; it has been bred by Brischke from *Acronycta caphorbie*, Fab., and *A. abscondita*, Tr.

2. *Rhogas reticulator*, Nees.

Bracon gasterator, varr. 1, 2, Spin., Ins. Lig., ii., 121
(nec Jurine).

Rogas reticulator, Nees, Mon., i., 211; Reinh., Berl.
ent. Zeit., 1863, p. 260, ♂ ♀; S. v. Voll., Pinac.,
pl. iv., fig. 5.

R. nobilis, Cur., B. E., 512; Hal., Ent. Mag., iv., 98.

Black, mandibles, and abdominal segments 1, 2, and 3 at the base, rufous; legs variable. Mesopleuræ smooth and shining, rugose above. Abdomen hardly narrowed at the base, rather short; segment 1 not longer than its apical breadth, 2 transverse, both striato-rugose; 3 striolated at the base, very smooth and shining at the apex, like the 4th and following, which in the ♂ are covered with adpressed yellowish hairs, the middle and the apical margin being glabrous. Podiscoidal areolet only $\frac{1}{2}$ as long as the prædiscoidal, by which the species may be distinguished from every other. Second cubital areolet subquadrate. ♂ ♀. Length, $2\frac{1}{2}$; wings, 5 lin.

Antennæ as long as the body, about 50-jointed; palpi black, seldom testaceous. Mesothorax sparingly punctate, more shining than in the other species. Mesopleuræ sometimes obsoletely impressed with a longitudinal rugose fovea. The hair of the ♂ is often worn away; the ♀ exhibits only a thin pubescence.

Var. *a*. Legs black, 1st pair of knees and tibiæ fuscous.

Var. *β*. Legs rufous, coxæ of the 1st, or 1st and 2d pairs, knees of the 2d and 3d, tibiæ of the 3d, and all the tarsi, black. This is described by Nees as the typical form.

Var. *γ*. Antennæ at the base beneath, and legs, rufous; femora and tibiæ of the 3d pair, and all the tarsi, black at the apex.
R. nobilis, Cur.

This and the preceding are the only species I have not seen; both occur in Holland; and Reinhard gives the distribution of *reticulator* from England to Syracuse. Taken by Haliday in Ireland, near Holywood, Belfast, ♂; and by Dale at Monk's Wood, near Cambridge.

3. *Rhogas irregularis*, Wesm. (Pl. IV., fig. 3).

Aleiodes irregularis, Wesm., Nouv. Mém. Ac. Brux.,
1838, p. 101, ♂.

Rogas irregularis, Reinh., Berl. ent. Zeit., 1863, p. 260,
♂ ♀; S. v. Voll., Pinac., pl. iv., f. 11 (head).

Black; palpi testaceous; mandibles, abdominal segments 1 at the apex, 2 entirely, and 3 at the base, rufous; 3d pair of tibiæ

pale yellow, their apex and tarsi, as well as the last joint of the other tarsi, black; 3d and following abdominal segments very shining; spurs of the 3d pair of tibiæ stout, blunt. ♂ ♀. Length, 3—3½; wings, 6—6½ lin.

Antennæ ♂ 55—57-, ♀ 52—54-jointed, as long as the body, or longer. Mesopleuræ shining, minutely punctulate, rugose under the wings, and with a rugose fovea below. Abdomen elongate, in the ♀ somewhat compressed at the apex, terebra subexserted; segments 1—2 rugulose, carinated, 3 rugulose at the base. Second cubital areolet transverse, a little shorter than the podiscoidal; stigma blackish.

Var. α. First abdominal segment wholly rufous, or with a single black spot.

This species may be recognised by the yellow hind tibiæ, tipped with black, and the very shining apex of the abdomen. The ♂ of *gasterator* has the base of the hind tibiæ narrowly and indistinctly yellowish, but the rest is rufous.

Appears to be not uncommon, yet has hitherto escaped notice. Bridgman has taken eight males and six females in Norfolk, in May and June; I have a pair in bad condition found near Leicester; taken by Fitch at Maldon and Harwood at Colchester; W. H. B. Fletcher bred a pair from *Hadena unanimitis*, Tr.

4. *Rhogas dimidiatus*, Spin.

Bracon dimidiatus, Spin., Ins. Lig., iii., 125, ♀.

Rogas dimidiatus, Nees, Mon., i., 214, ♀; Reinh., Berl. ent. Zeit., 1863, p. 257, ♂ ♀; S. v. Voll., Pinac., pl. iv., f. 6.

Aleiodes nigripalpis, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 97, ♂.

A. brevicornis, Wesm., lib. cit., p. 98, ♀.

Rogas ruficornis, Schäff., F. G., clvi., 10, ♀.

Male. Black; mandibles, abdominal segments 1—2, base of 3, and legs, rufous; coxæ (or only the 1st pair), 1st joint of the trochanters, 3d pair of femora and tibiæ at the apex, with their tarsi, black. Antennæ as long as the body, about 52-jointed, black, rarely rufous at the base. Wings subinfuscated, scarcely extending beyond the apex of the abdomen.

Female. Rufous; palpi, genæ, apex of the antennæ, pectus, metathorax, 3d and following abdominal segments, and apex of the 3d pair of femora, black, their tarsi fuscous. Antennæ rather stout, distinctly shorter than the body, 37—40-jointed (in my

specimen 45-jointed), rufous on the basal half of the flagellum. Terebra hardly visible. Wings short, as in the ♂, somewhat darker, with a hyaline stripe. Length, $2\frac{1}{3}$ —3; wings, $4\frac{2}{3}$ lin.

♂ ♀. Mandibles rufous, palpi black; eyes small and not very prominent, whereby the vertex behind them appears scarcely narrowed, and the inferior margin of the eyes is above the upper margin of the oral aperture. Mesopleuræ punctate, somewhat shining, rugose under the wings, with a dull rugose fovea below. Abdomen short and stout, segments 1—2 striato-rugose, 3d at the apex, and all the following, smooth and shining; segment 1 sometimes with a basal black spot, not longer than its apical breadth, very slightly narrowed at the base; 2d transverse; 3d and following with very fine scattered hairs. Second cubital areolet transverse, a little shorter than the podisoidal.

Var. *a*. A facial spot, base of the antennæ, mesothoracic sutures, scutellum, and two spots on the metathorax, rufous. ♂.

Var. *β*. Head and thorax more or less fuscous or black; mandibles rufous. ♀.

? Var. *γ*. Metathorax rufous.

I have a ♂ taken at Niton, Isle of Wight, another from the Pyrenees, and a ♀ from Darent Wood. The last has the metathorax rufous; the antennæ are not quite as long as the body, 45-jointed; the infuscated wings, and the tarsi, are shorter than in *gasterator*, to which I should otherwise have referred this specimen. *R. dimidiatus* is widely diffused in Europe, from the Baltic to the Mediterranean; its occurrence in England is therefore nothing remarkable. Giraud records it as a parasite of *Bombyx quercus*, L., and *Nemophila russula*, L. The Vienna Museum contains a specimen of var. *β*. (head and thorax black) bred from *Caradrina alsines*, Brahm (Berl. Ent. Zeit., 1865, p. 243).

5. *Rhogas gasterator*, Jurine.

Bracon gasterator, Jur., Hym., pl. viii., Gen. 3, ♀, ant., mand. (nec Spin.).

Rogas gasterator, Nees, Mon., i., 212, ♂ ♀; Hal., Ent. Mag., iv., 99 ♀ (not the ♂); Reinh., Berl. ent. Zeit., 1863, p. 259, ♂ ♀.

Colours as in the preceding, but the hind tibiæ of the ♂ are yellowish at the base. Eyes large; vertex a little narrowed posteriorly. Antennæ ♂ ♀ as long as the body, of the ♂ 53—58-jointed; in the ♀ the base of the flagellum is rufous. Mesopleuræ with a smooth subobsolete fovea. Length, 3— $3\frac{1}{2}$; wings, $5\frac{1}{2}$ — $5\frac{3}{4}$ lin.

The ♀ may be separated from that of *dimidiatus* by the much longer antennæ and wings. The ♂ is more difficult to distinguish. Reinhard, after remarking that the identity of the sexes brought together under this species is not free from doubt, discriminates the ♂ of *gasterator* as follows:—The eyes are larger than in *dimidiatus*, and their inferior margin is situated lower down than the upper margin of the oral cavity; they are also more prominent laterally, causing the vertex to appear somewhat narrowed behind. The mesopleuræ are more shining, much more sparingly punctate; the longitudinal furrow is very faintly impressed and entirely smooth, or it is indicated by a small hardly shining fold. The antennæ are usually black. Those of the ♀ are dull rufous from the base of the 3d joint to about the middle. The wings are distinctly longer than the abdomen, and subhyaline; the venuration agrees with that of *dimidiatus*. The palpi are fuscous, paler at the tips.

I possess two males with 54-jointed antennæ, taken near Abergavenny in June, and four from an osier-bed at Nunton, Wilts, whose antennæ are 53-, 55-, 56-, and 58-jointed; but the ♀ is unknown to me.

6. *Rhogas geniculator*, Nees.

Bracon rugulosus, var. β , Nees, Mag. Ges. Berl., 1811, p. 33, ♂.

Rogas geniculator, Nees, Mon., i., 211, ♂; Hal., Ent. Mag., iv., 99, ♂; Reinh., Berl. ent. Zeit., 1863, p. 262, ♂ ♀.

Alciodes geniculator, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 118, ♂ ♀, pl., fig. 13 (wing); Ratz., Ichn. d. Forst., iii., 34, ♂ ♀.

Rogas signatus, Nees, Mon., i., 210, ♂.

R. annulipes, Schöff., F. G., clvi., 8.

R. alternator, Nees, Mon., i., 213, ♂; Hal., Ent. Mag., iv., 100.

Alciodes alternator, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 119, ♂.

Rogas balteatus, Cur., B. E., pl. dxii., ♂.

Variable; black, orbits behind, abdominal segments 1—2, 3 at the base, and legs, rufous; femora and tibiæ (except the 1st pair) generally tipped with black. Mesopleuræ obscure, rugulose above, and more coarsely sculptured in the wide longitudinal fovea; a small space behind, next to the metathorax, smooth and shining.

Abdomen hardly narrowed at the base, segments 1—4 margined at the sides underneath; segment 1 rather longer than its apical breadth; 2 transverse; 4 and the following punctato-rugulose, not shining. Abdomen of the ♀ subcompressed at the apex; terebra subexserted. Wings nearly hyaline; 2d cubital areolet slightly transverse, a little shorter than the podisoidal; stigma fuscous, with a pale spot at the inner angle.

Antennæ about as long as the body, 48—52-jointed, often brownish beneath. Mandibles and palpi varying from fuscous to testaceous. Vertex moderately narrowed behind the eyes.

Var. *a.* Abdominal segments 1—3 black, with rufous margins. (*R. signatus* and *annulipes*).

Var. *β.* Abdomen black, disk of the 2d segment rufous; coxæ black.

Var. *γ.* Rufous; head, scutellum, metathorax, and abdomen at the apex, black. (*R. alternator* and *balteatus*).

Var. *δ.* Pro- and metathorax rufous, variegated with black above; mesothoracic sutures, abdominal segments 1—3, and base of 4, rufous.

Var. *ε.* Rufo-testaceous; vertex, pectus, and metathorax above, varied with black.

Described in the Ent. Mag., iv., 99, from specimens taken by Walker in Jersey and England. The var. *balteatus* was found by Haliday near the harbour of Donaghadee. Frausen at Rotterdam, according to S. v. Vollenhoven, and Bignell, near Plymouth, have bred males and females from young larvæ of *Odonestis potatoaria*, L., found in the spring; the transformations taking place within the dried skin of the victim. Infested larvæ of this moth may be found in April and May, resting on various grasses, and apparently prepared to moult for the fourth time. Instead of moulting, they gradually contract and perish, retaining the same position. The *Rhogas* escaped through a perforation, in one case, of the 9th and 10th segments. Bred by Brischke, June 30th, from *Hedya ocellana*, Hüb.; July 6th, from *Orgyia gonostigma*, Fab.; also from *O. antiqua*, L., *Dasychira selenitica*, Esp., and an undetermined *Tortrix*. According to Giraud, bred by Perris from *Triphæna fimbria*, L.; and, according to Reinhard, from *Arctia caia*, L., *Porthesia*, &c.

7. *Rhogas tristis*, Wesm.

Rogas bicolor, var. β , Nees, Mon., i., 214, ♂ ♀.

Aleiodes tristis, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 114, ♂ ♀; S. v. Voll., Pinac., pl. iv., f. 10 (with base of antenna).

Rogas tristis, Reinh., Berl. ent. Zeit., 1863, p. 263, ♂ ♀.

Black, palpi and mandibles pale; orbits and thorax more or less rufous; legs rufo-testaceous, femora of the 2d and 3d pairs often black at the apex. Vertex behind the eyes much narrowed, the sides subrectilinear. Mesopleuræ dull, rugulose, with a smooth shining space near the metathorax. Abdomen elongate, rugulose, very little narrowed at the base, segments 1—4 margined beneath at the sides, segment 2 subquadrate. Wings nearly hyaline, stigma narrow, acuminate, testaceous, bordered with fuscous. Terebra subinserted. Length, $2\frac{1}{2}$; wings, 5 lin.

Antennæ as long as the body, 45—48-jointed in the ♂, 41—44-jointed in the ♀ (in the British specimen, 45-jointed), sometimes testaceous at the base. Body covered with thin greyish pubescence. Abdominal segments 1—3 rugulose, apex of the 3d more finely, 4th and following punctulate and slightly shining. The legs are rufous inclining to testaceous, intermediate in colour between the two sections in the table of species. The femora are sometimes more than half black.

Var. α . Thorax entirely black.

Var. β . Prothorax above and at the sides, and mesothorax above, rufous.

Var. γ . Head entirely and coxæ partly, black.

Var. δ . Like the last, but the palpi and mandibles fuscous.

Var. ϵ . Head rufous, a black spot on the face, vertex, and occiput.

This must be carefully distinguished from *R. bicolor*. It is a trifle larger, and more slender in proportion; the antennæ have more joints; the head is longer (*i. e.*, not so transverse), more distinctly narrowed behind the eyes, and with the sides much less rounded; the eyes are larger and more prominent; the thorax somewhat flatter; and in respect of colours (although these are very variable), the legs of *tristis* are constantly and decidedly marked with black, while in *bicolor* only the 3d pair of femora are exceptionally tipped with that colour. The head of the ♀ *bicolor* is nearly always rufous; that of *tristis* black, with the orbits more or less pale.

R. modestus, Reinh., according to the description, is very similar, but has the mesopleuræ smooth and shining.

Discovered near Plymouth by Bignell, and taken also by Capron. Bignell's specimen is a ♀ with the head and body entirely black, and the four posterior femora very broadly tipped with that colour. Fitch has two specimens agreeing best with var. β. It is a widely distributed species in Europe. Brischke bred it from *Eupithecia pinpinellata*, Hüb., with *R. modestus*.

8. *Rhogas bicolor*, Spin.

Bracon bicolor, Spin., Ins. Lig., ii., 128.

Rogas bicolor, Nees, Mon., i., 213; Hal., Ent. Mag., iv., 100, ♂ ♀ (excl. syn. *R. prerogator*, Nees); Reinh., Berl. ent. Zeit., 1863, p. 263, ♂ ♀; S. v. Voll., Pinac., pl. iv., f. 7 (with profile of abdomen, posterior coxa, and palpus).

Alciodes bicolor, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 116, ♂ ♀.

Rogas zygænæ, Nees, Mon., i., 210.

R. ater, Cur., B. E., 512.

Black, usually with black palpi and pale mandibles; head, thorax, and scutellum of the ♀ rufous, of the ♂ varied with rufous; legs rufous; vertex behind the eyes rounded at the sides. Mesopleuræ as in the preceding. Abdomen shorter and broader. Wings similar, but the stigma is less attenuated, oval, fuscous, with a pale spot at the base, or wholly testaceous. Length, $2\frac{1}{2}$ — $3\frac{1}{4}$; wings, $4\frac{1}{2}$ — $5\frac{1}{2}$ lin.

Antennæ 37—40-jointed. First abdominal segment hardly longer than its apical breadth; 2d in the ♂ somewhat longer than broad, in the ♀ transverse.

Var. α. Body and coxæ black, legs rufous. (*R. zygænæ*).

Var. β. Mouth, orbits, and legs rufous; 3d pair of knees and tarsi fuscous. (*R. ater*).

Var. γ. Head black, orbits behind rufous; thorax black; 1st abdominal segment at the sides, 2d wholly, except a discal spot, 3d at the sides and basal angles, rufous.

It would be useless to give more colour-varieties. The most usual forms presented are (1) head and thorax rufous, and (2) entirely black, except the legs.

Has been found in England, Scotland, and Ireland; generally, according to Haliday, on sandy sea-coasts. Var. α was reared by Nees von Eisenbeck from the larvæ

of *Zygæna filipendulæ*, L., which, before attaining its full growth, attached itself by the fore legs to a blade of grass and perished, the skin after death preserving its natural form and colour. The parasite emerged from an irregular hole near the tail, on July 7th, 1810. So far Nees; and his observation is confirmed by the breeding of var. γ from the same *Zygæna* at Shedfield, Hants, by Mrs. Jenkyns (see pl. iv., fig. 3a). Reinhard says of three specimens bred from *Zygæna*, that two females were the typical *bicolor*, and the male was *zygænæ*, leaving no doubt as to the correctness of the synonymy. A black var. in my collection is accompanied by the larva-skin of *Lioptilus tephrodactylus*, Hüb., from which it was bred by R. C. R. Jordan (cf. E. M. M., vi., 138). Brischke obtained the species from *Ino pruni*, Schiff.; and Von Heyden, according to Reinhard, a ♀ var. from a hairy larva feeding upon *Ononis*, perhaps *Mimscoptilus phæodactylus*, Hüb.

9. *Rhogas nigricornis*, Wesm.

Aleiodes nigricornis, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 105; Ratz., Ichn. d. Forst., iii., 33, ♂ ♀.

Rogas nigricornis, Reinh., Berl. ent. Zeit., 1863, p. 267, ♀.

Black; palpi, mandibles, legs, and an oblong medial spot on the abdomen, testaceous; orbits above and behind, meso- and meta-thorax beneath and at the sides, and sometimes the scutellum, rufescent. Eyes large, vertex narrowed posteriorly. Antennæ 45—50-jointed, wholly black, or fuscous beneath. Mesopleuræ granulated, somewhat shining; fovea obsolete. Abdomen elongate, of the ♀ almost obovate; 1st segment $\frac{1}{2}$ longer than its apical breadth, three times broader at the apex than at the base; 3d segment broader than the 2d; segments 1—2, and 3 at the base, finely rugulose, more distinctly so at the sides; the rest punctulate, slightly shining. Terebra subexserted. Wings hyaline, stigma testaceous, bordered with fuscous along the radial areolet; 2d cubital areolet about twice as broad as its length, not shorter than the podiscoidal. Length, 3; wings, 6 lin.

This must be carefully distinguished from the dark varieties of *circumscriptus*. It is larger, the antennæ are black, and have more joints; the legs are uniform testaceous, with a rufous tinge; the vertex is rectilinearly narrowed behind the eyes; the abdomen is more

strongly contracted at the base, and less convex, black, with a pale spot on the 2d segment; the mesopleuræ are more finely granulated and more shining; the wings are proportionally larger; the colours are not subject to variation. The sexes are similar.

This species has not hitherto been noticed in England. It is not uncommon near Abergavenny in July, where it seems to take the place of *circumscriptus*; also taken at Braemar, Bugbrook and Maldon. According to Ratzburg, it occurs in corn-fields and grassy places. He bred several specimens from naked 16-footed (*Tortrix*?) larvæ, the name of which is not given.

Reinhard says that Brischke bred a female from *Calocampa solidaginis*, Hüb.; Brischke gives it himself in his Wirths-Tabelle from *Xylophasia rurea*, Fab.

10. *Rhogas circumscriptus*, Nees.

Rogas circumscriptus, Nees, Mon., i., 216; Schöff., F. G., clvi; Reinh., Berl. ent. Zeit., 1863, p. 269, ♂ ♀; S. v. Voll., Pinac., pl. iv., ff. 8, 9 (with wing).

Aleiodes circumscriptus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 106, ♂ ♀.

Rogas pictus, Schöff., F. G., clvi.

R. testaceus, Hal., Ent. Mag., iv., 101 (nec Nees).

Bracon circumscriptus, Ratz., Ichn. d. Forst., ii., 35; iii., 33 (partly).

Aleiodes nigriceps, Wesm., *lib. cit.*, p. 109, ♀.

Variable, testaceous, more or less marked with black; abdomen often black above, with an elongate medial testaceous patch, as in the preceding species. Antennæ 35—41-jointed, testaceous, fuscous at the apex. Mesopleuræ dull, granulated, rugose under the wings, and with an obsolete rugose fovea. Abdomen of the ♂ elongate, segment 1 half as long again as its apical breadth, segment 2 a little longer than broad; of the ♀ somewhat obovate, segment 1 scarcely longer than its apical breadth, 2 somewhat transverse. The 3d segment in both sexes is broadest, its apex, and the following segments, punctulate, rather shining. Wings hyaline, stigma testaceous, often with a fuscous apical spot; 2d cubital areolet twice as broad as its length, somewhat narrowed exteriorly, longer than the podiscoidal; radius of the hind wings obsolete. Terebra concealed. Length, $2\frac{1}{2}$ — $2\frac{1}{2}$; wings, 4— $4\frac{3}{4}$ lin.

Antennæ as long as the body, with fewer joints than in any other

British species. Metathorax granulated, with a faint medial carina. Abdominal segments 1—3 finely rugulose, more distinctly at the sides, in the middle often only granulated; the carina of the 2d segment seldom visible. This may be regarded as the typical form of the 2d section of *Rhogas*, comprising Spp. 9—12. They make an approach to *Clinocentrus*, and differ from the rest of the genus in the substitution of a paler tint instead of red; their wings are longer in proportion, the stigma larger, the præ- and pobrachial areolets of the hind wings wider, and the radius of the same wings indistinct: the joints of the antennæ are fewer in number.

The numerous colour-varieties are arranged by Reinhard as follows:—

A. Head, prothorax, mesothorax, and legs, testaceous.

Var. *a*. Testaceous, uniform: apex of the abdomen in the ♂ sometimes black. Or the metathorax and 1st segment are black above. (*Aleiodes nigriceps*, Wesm.).

Var. *β*. The same, but the abdomen is black, with a pale oblong spot, as in *nigricornis*. Sometimes there is a black stripe under the wings.

Var. *γ*. Abdomen wholly, and pectus partly, black.

B. Head black, with testaceous mouth and orbits; metathorax, 1st abdominal segment, anus, and 3d pair of femora broadly at the apex, blackish or fuscous.

Var. *δ*. Prothorax, mesothorax, and abdominal segments 2—3, testaceous.

Var. *ε*. The same, but with a trilobed black spot on the mesothorax.

Var. *ζ*. Like the last, but the abdomen is black, with a medial testaceous spot.

Var. *η*. Like the last, but the pro- and mesothorax are black, the scutellum rufescent, and there is a black stripe under the wings. Or the scutellum and a pectoral spot are black.

The dark varieties must not be confounded with *nigricornis*, Wesm.

By far the commonest species. Bred by Bignell from half-grown larvæ of *Ebulca croccalis*, Hüb., June 20th, *Teniocampa stabilis*, View., July 5th, and *Melanippe galiata*, Hüb., Sept. 21st. Four males by W. H. B. Fletcher from *Cucullia verbasci*, L. The larvæ after death continue to cling to their food-plant, the parasites

complete their transformations inside, and finally emerge through a hole in the 10th—12th segments. The species has been reared on the Continent from *Agrotis agathina*, Dup.; by Brischke from *Caradrina alsines*, Brahm, *Noctua baia*, Fab., *Eupithecia castigata*, Hüb., *Anticlea rubidata*, Fab., *Tortrix rosana*, L., and *Dictyopteryx Holmiana*, L. Ritsema found it with *Rhogas testaceus*, Spin., in birds' nests at Haarlem in January, showing that it hibernates as an imago.

The synonym *R. pallidus*, Bouché, ought to be erased, as referring to *R. testaceus*, Spin. The occurrence of the latter species in this country is merely hypothetical. The name was introduced by Haliday, who, relying upon the descriptions of Spinola and Nees, confused it with *circumscriptus*, and treated that name as a synonym. It is necessary therefore to discard *testaceus* until some one can produce an authentic British specimen. From a remark of Haliday it seems certain that no specimens of that species were mixed up with those which he examined. Had this been the case he would not have said (Ent. Mag., iv., 102) that the antennæ of *testaceus* possess more joints than those of *circumscriptus*. *Rhogas testaceus* (Spin., Ins. Lig., ii., 131; Reinh., Berl. ent. Zeit., 1863, p. 270) has the antennæ 33—35-jointed; the 1st abdominal segment in the ♂ is at most as long as its apical breadth; in the ♀, distinctly shorter; the 2d segment in the ♂ is slightly transverse, in the ♀ conspicuously so. The colour is uniform testaceous, or the metathorax and 1st abdominal segment are marked with fuscous. It is a parasite of *Dicranura vinula*, L., *bifida*, Hüb., *Tortrix rosana*, L., *Depressaria applanata*, Fab., *Cilir glaucata*, Scop., *Porthesia aviflua*, L., *Plusia gamma*, L., and *Eupithecia sobrinata*, Hüb. Compare Ratz., Ichn. d. Forst., ii., 35, pl. ii., fig. 4 (wing).

11. *Rhogas vittiger*, Wesm.

Aleiodes vittiger, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 112, ♀.

Rogas vittiger, Reinh., Berl. ent. Zeit., 1863, p. 267, ♂ ♀.

R. seriatus, Schöff., F. G., elvi., 12.

Pale testaceous; occiput, or whole head (except the orbits), disk of the thorax (except the scutellum), a patch beneath the wings. 1st abdominal segment almost to its apex, and 3d pair of femora broadly at the apex, black; tips of the antennæ, and two oblong

spots on the 2d segment, sometimes on the 3d also, fuscous. Eyes large, vertex narrowed behind. Antennæ 42—52-jointed, slender, longer than the body. Mesopleuræ very finely granulated, somewhat shining. Abdomen elongate, obovate, broadest at the end of the 3d segment, then abruptly rounded; 1st segment half as long again as its apical breadth, which is double the basal breadth; segments 1—3 minutely rugulose, the rest more shining, punctulate. Wings hyaline, stigma fuscous, with a pale basal spot; 2d cubital areolet twice as broad as its length, twice as wide as, and a little longer than, the podisoidal. Terebra subexserted. Length, $2\frac{1}{2}$; wings, $4\frac{1}{4}$ lin.

Var. *a*. Pro- and mesothorax pale, the latter with three dusky stripes; metathorax pale at the sides.

In Reinhard's table of species this is separated from *circumscriptus* only by the form of the vertex, which is straight behind the eyes, instead of rounded. The ground colour is a remarkably pale testaceous, almost transparent, the coxæ and trochanters nearly colourless. According to Wesmael (*lib. cit.*, p. 95, note) the 1st intercubital nervure is slightly oblique. I possess an old female specimen taken at Barnstaple, which almost certainly belongs to this species, although not in a condition to exhibit some of the characters very distinctly. The 52-jointed antennæ, the form of the abdomen, &c., show that it cannot be *circumscriptus*.

12. *Rhogas armatus*, Wesm.

Aleiodes armatus, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 112, ♂.

Rogas armatus, Reinh., Berl. ent. Zeit., 1863, p. 268, ♂ ♀.

Testaceous, immaculate, or with the metathorax, and abdomen at the base and apex, fuscous. Eyes large; vertex behind them with straight sides; genæ of the ♂ ending in a vertical tooth, those of the ♀ unarmed. Antennæ 40—44-jointed, as long as the body. Mesopleuræ very finely granulated, somewhat shining, the fovea obsolete. First abdominal segment of the ♂ $\frac{1}{2}$ longer, of the ♀ only a little longer, than its apical breadth, the apex twice as broad as the base; segment 2 quadrate; 3 not broader than 2, its apical margin and the remaining segments punctulate, somewhat shining. Wings hyaline, stigma testaceous, sometimes fuscous at the apex; neurulation as in the preceding; radius of the hind wings obsolete. Length, $2\frac{1}{2}$; wings, $4\frac{3}{4}$ lin.

Differs from *circumscriptus* in the proportions of the 1st abdominal segment, and the number of joints in the antennæ. The abdominal segments 1—3 are very minutely striolated, not shining.

A male and two females of this new British species, in fine condition, are in Fitch's collection. Hitherto taken in Belgium, Austria, and Switzerland.

II. CRYPTOGASTRES.

X. SIGALPHIDES.

Clypeus entire; mouth closed; maxillary palpi 6-, labial 4-jointed; occiput margined. Abdomen broadly sessile; segments 1—3 connate above, forming a carapace, usually with two superficial, crenulate sutures; the remaining segments concealed, or (i *Allodorus*) very briefly exerted. Two cubital areolets; recurrent nervure rejected; radial areolet ovate, acuminate, not reaching the apex of the wing; præ- and pobrachial areolets subequal. *Terebra* elongate.

The original genus *Sigalphus*, Latr. (1802) included the subfamilies *Sigalphides*, *Chelonides*, and *Calyptides*. The *Chelonides* were separated in 1807 by Jurine. Nees von Esenbeck, in 1834, divided *Sigalphus* into two sections, the 1st comprising the *Sigalphides* proper (with a mixture of *Calyptus*); the 2d containing two species now referred to the *Alysiides*. Haliday, in 1835, gave the name *Triaspis* to Von Esenbeck's first section, distinguishing *Calyptus*; and in the same year Wesmael independently established the same divisions, but under the names *Sigalphus* and *Brachistes*. Finally, the appropriate creation of the genus *Allodorus* by Förster, in 1862, reduces *Sigalphus* to its lowest terms. The *Sigalphides* and *Chelonides* are nearly connected by their abdominal structure, although differing in the wings and terebra. They formed together the group *Cryptogastres* of Wesmael, which, as represented in Europe, is entirely isolated, though some of the exotic genera (*Spinaria*, *Fornicia*) exhibit a certain affinity to the *Bracon* type.

The two British genera may be thus distinguished:—

- | | |
|--|-------------------|
| Segments 4—5 not entirely concealed under the carapace; the 2d longer than the 3d; axillary areolet bisected before the apex by a transverse nervure | i. ALLODORUS. |
| Segments 4—5 entirely concealed; the 2d shorter than the 3d; axillary areolet undivided | .. ii. SIGALPHUS. |

i. ALLODORUS, Först.

Först., Verh. pr. Rheinl., 1862, p. 242.

Head broadly transverse, vertex short; mandibles bifid. Prothorax distinct; metathorax with a tooth on each side. Abdomen longer and less convex than in *Sigalphus*, rimulose, not shining; carapace triarticulate, segment 1 longer than broad, somewhat narrowed anteriorly, bicarinated; segment 2 broadest, longer than 3; segments 4—5 very briefly exerted. Radial areolet longer than in *Sigalphus*, almost reaching the apex of the wing; cubitus and anal nervure distinct; axillary areolet with an additional inchoate transverse nervure near the middle. Terebra elongate.

This genus has never been described before, and I possess only one ♂ specimen from which to derive characters. *Allodorus semirugosus*, Nees, is given in the Catalogue, p. 101, but appears to me now too dubious to be retained as a British insect. *Sigalphus glypturus*, Thoms., Opusc. Ent., vi., 1874, p. 559, apparently belongs to this genus.

1. *Allodorus lepidus*, Hal. (Pl. IV., fig. 4).

Triaspis lepidus, Hal., Ent. Mag., iii., 125, ♂ ♀.

Allodorus pallidus, Reinh., MS. in litt., ♂.

Black, antennæ at the base beneath, mouth, palpi, and legs, testaceous; hind tibiæ and tarsi fuscous; abdomen obovate, rimulose. The ♂ has the vertex, stigmaticum, and occiput, black; the rest of the head, the prothorax, and the mesopleuræ anteriorly, testaceous. Terebra ♀ as long as the abdomen. Length, $1\frac{1}{2}$ — $2\frac{1}{2}$; wings, $3\frac{3}{4}$ —5 lin. °

Head wider than the thorax, flattened in front and behind, vertex transversely convex, mandibles concealed under the clypeus. Antennæ ♀ shorter than the body, 29-jointed, pubescent, convoluted at the apex, the exterior joints very short, pateriform; those of the ♂ longer than the body, slender, 30—31-jointed (30-jointed in my specimen); thorax ♂ more attenuated at both ends than that of the ♀, metathorax rugulose, with a smooth basal space; abdomen longer, obovate, thickly and irregularly striolated, not shining, subpiceous in the middle; beneath carinated, hardly concave, testaceous; 1st segment twice as broad at the apex as at the base, with two carinæ converging towards, but not reaching, the apex; 2d segment broadest, as long as the 1st; 3d shorter, less rugulose; protruding apex of the 4th smooth and shining; 5th invisible. Coxæ and trochanters pallid; hind coxæ long and stout.

Wings hyaline, stigma and nervures fuscous; cubitus and anal nervure not decolorous as in *Sigalphus*.

The description of the ♀ is from Haliday. The ♂ I captured in a wood near King's Teignton, S. Devon. Reinhard, after kindly examining this specimen, returned it with the MS. name *pallidus*, adding that the same species occurred near Dresden. After careful examination I cannot find any difference between this and *lepidus*, Hal., and I conclude them to be identical. The types of *lepidus* were discovered by Curtis.

ii. SIGALPHUS, Latr.

Latr., H. N., iii., 327; Wesm., Nouv. Mém. Ac. Brux., 1835, p. 207.

Head less transverse, suborbicular. Prothorax inconspicuous; metathorax hardly bituberculate. Abdomen short, ovate, convex, rimulose (except at the apex); segment 1 transverse, imperfectly bicarinated; segment 2 shorter than 3; the remaining segments concealed under the carapace. Radial areolet not much larger than the stigma, ovate, acuminate, remote from the apex of the wing; cubitus and anal nervure decolorous; axillary areolet without an additional transverse nervure. Terebra elongate.

The small black species of this genus are parasites of *Curculionidæ* and Lepidoptera, and may be taken plentifully on umbellate flowers. Some of the males are not easily distinguished from each other, as is notably the case with *floricola* and *caudatus*. A difficulty also occurs in determining whether any particular insect belongs to this genus or *Calyptus*. In Förster's synopsis the two are widely separated under different rubrics, thus:—

- | | |
|---|---------------------------------|
| 9. Segments 1—3 exarticulate, connate .. | SIGALPHUS. |
| 11. Segments 1—3 articulated in the usual way | CALYPTUS (<i>Brachistes</i>). |

But as this character is recondite, and, however true, contrary to appearances, it may be useful to add the distinction pointed out by Reinhard. On inspecting the under side of *Sigalphus*, the belly is found to be concave from the base to the apex, its margins forming a sharply defined edge, and not reflexed; in *Calyptus* only the 1st segment (and, in the ♂, the base of the 2d) is acutely margined; the edges of the rest are reflexed, so as

partially to cover the ventral surface. Both Nees and Ratzburg have confused these genera; the former by regarding *Calyptus fasciatus* as a *Sigalphus*, the latter by describing *S. pallidipes* under the name of *Brachistes* (*Calyptus*) *fagi*.

TABLE OF SPECIES.

(2)	1. Thorax rufous	8. <i>thoracicus</i> , Cur.
(1)	2. Thorax black.	
(4)	3. Both sutures of the carapace obsolete ..	7. <i>ambiguus</i> , Nees.
(3)	4. One or two sutures distinct.	
(6)	5. Palpi testaceous	5. <i>pallidipes</i> , Nees.
(5)	6. Palpi black, or blackish.	
(10)	7. Larger species, more than 1 lin., sometimes $1\frac{1}{2}$ lin. long.	
(9)	8. Abdomen ovate, subdepressed, not wider behind; terebra ♀ as long as the body	3. <i>striatulus</i> , Nees.
(8)	9. Abdomen subglobose, convex, widest behind; terebra ♀ shorter than the body	6. <i>luteipes</i> , Thoms.
(7)	10. Smaller species, 1 lin. long, or less.	
(12)	11. Abdomen widest behind, obtuse	4. <i>obscurellus</i> , Nees.
(11)	12. Abdomen widest in the middle, attenuated behind.	
(14)	13. Terebra ♀ longer than the body ..	1. <i>caudatus</i> , Nees.
(13)	14. Terebra ♀ much shorter than the body	2. <i>floricola</i> , Wesm.

1. *Sigalphus caudatus*, Nees.

Sigalphus caudatus, Nees, Mon., i., 268; Wesm., Nouv. Mém. Ac. Brux., 1835, p. 210; Ratz., Ichn. d. Forst., ii., 25; iii., 26; Cur., Farm. Ins., pp. 239, 244, pl. H., frontisp., f. 20, and pl. xxxv., f. 15, ♂ ♀; Thoms., Opusc. Ent., vi., 1874, p. 561.

Triaspis caudatus, Hal., Ent. Mag., iii., 126, ♂ ♀ (excl. var.).

Black, shining, legs piceous, tibiæ rufescent; antennæ ♀ shorter than the body, 19—23-jointed, those of the ♂ somewhat longer than the body, 20—24-jointed; abdominal carapace tripartite, segments 1—2, and often 3 at the base and sides, rimulose; segment 3 of the ♂ more shining. Terebra ♀ longer than the body. Stigma black. Length, $\frac{2}{3}$ —1; wings, $1\frac{1}{2}$ — $2\frac{1}{4}$ lin.

Mandibles rufescent; palpi piceous. Mesothoracic sutures finely punctulate; metathorax uneven, sometimes irregularly carinated, punctulate. Abdomen ovate; 3d segment of the ♀ subrimulose, of the ♂ smooth and shining. Legs piceous, coxæ black; fore femora at the apex, and tibiæ, rufescent; middle and hind tibiæ at the apex, and tarsi, fuscous. The femora of the ♀ are a little

stouter than those of the ♂. Wings hyaline, stigma black; according to Ratzeburg, the stigma of the ♀ is testaceous, but this must have been some accidental peculiarity, perhaps in an immature specimen. There are other trifling discrepancies in the descriptions of authors, but the species is distinct from all others by the length of the terebra in the ♀. The ♂ appears not to differ from that of the following species, and Wesmael remarks that had it not been for the difference of the terebra, he should have united his *floricola* with *caudatus*.

Reared from *Orchestes quercus*, L., which mines in oak-leaves, by Nördlinger at Grand Jouan, in Brittany. On June 6th, at Neustadt Eberswalde, Ratzeburg found the cocoons in the blisters formed upon oak-leaves by that Curculio. These cocoons are brown, 1 line long, and semitransparent, resembling in miniature those of the *Tachinide*, minus the spiracles. A similar cocoon was found by Reissig in oak-leaves rolled up by the larva of *Halias quercana*, Hüb. Curtis bred several females from the stems of barley containing the pupæ of *Oscinis rastator*, Cur. S. v. Vollenhoven assigns a different origin to this insect, regarding it as a parasite of *Tortrix hypericana*, Snell., perhaps erroneously.

2. *Sigalphus floricola*, Wesm.

Triaspis obscurellus, Hal., Ent. Mag., iii., 126, ♂ ♀;
Thoms., Opusc. Ent., vi., 1874, p. 562 (nec Nees).
Sigalphus floricola, Wesm., Nouv. Mém. Ac. Brux.,
1835, p. 208, ♂ ♀.

Very like the preceding. Legs black, fore femora at the apex, fore tibiæ, middle and hind tibiæ at the base, rufescent. Antennæ ♀ 19—21., ♂ 20—22-jointed. Terebra ♀ not longer than the abdomen. Length, $\frac{2}{3}$; wings, $1\frac{1}{2}$ lin.

The length of the terebra is the only tangible difference between this and *caudatus*; the males seem absolutely identical. The average size of *floricola* is somewhat less, and the antennæ appear a trifle shorter. In adjusting the synonymy I have been guided by the following considerations:—1. Haliday and Wesmael certainly had in view the same species, being the one that so closely resembles *caudatus*. 2. Both writers are of well-known accuracy, yet here we find them at variance, Haliday considering the species to be *obscurellus*, Nees, and Wesmael regarding it as undescribed. The

question is, which of the two is mistaken. 3. *S. obscurellus*, as described by Nees, is distinct enough from *caudatus*, and from the present insect (*cf.* Wesm., *lib. cit.*, p. 210). 4. A common species is found in England which corresponds with *obscurus*, Nees, and not of Haliday. I have 11 specimens, and, if Haliday's pre-occupation of the name *obscurus* were correct, these would have to be renamed as new. Hence it follows that the mistake is on the side of Haliday, not Wesm. This conclusion clears up the difficulty; and it is further strengthened by the fact that Curtis (*Guide*, 2d ed., p. 120) gives *obscurus*, Nees (by which *he* meant *obscurus*, Hal.) as a synonym of *floricola*.

Common, like the preceding. Abundant in Ireland on sandy shores, according to Haliday. I have taken it in Birch Wood, Kent; and also in Leicestershire. Brischke states it to have been bred from beetle-larvæ, and in his Wirths-Tabelle gives it as a parasite of *Scandria adumbrata*, Kl.

3. *Sigalphus striatulus*, Nees.

Sigalphus striatulus, Nees, *Mag. Ges. Berl.*, 1816, p. 249; *Mon.*, i., 268, ♂ ♀; *Ratz.*, *Ichn. d. Forst.*, ii., 26, ♀; not of Thoms., *Opusc. Ent.*, vi., 1874, p. 560 (terebra much shorter than the body).

Black; legs piceo-rufous, coxæ, trochanters, femora above, tibiæ except at the base, and tarsi, fuscous; antennæ 27—29-jointed; carapace tripartite, segments 1—3 rimulose, the 3d more faintly; terebra ♀ as long as the body. Length, $1\frac{1}{2}$; wings, $3\frac{1}{3}$ lin.

Abdomen ♀ somewhat shorter than the thorax, rimulose, the lines of sculpture fainter on the 3d segment, in the shining medial line of which they are reduced to punctures. Metathorax rugulose, without carinæ. The legs, as in the other species, vary in being lighter or darker. In the ♂ the abdomen is as long as the thorax, and the 3d segment more shining. Resembling *caudatus* in habit, but larger, with shorter terebra, the 3d segment more rimulose, and the antennæ attaining the maximum of joints for the genus.

Not before noticed as British. Supposed by Ratzeburg to be a parasite of *Pissodes notatus*, Fab. I have one specimen, a ♂ with 27-jointed antennæ, taken on the banks of the Usk, near Abergavenny. Another ♂ which I captured at Barnstaple has the sutures sub-obsolete.

4. *Sigalphus obscurellus*, Nees. (Pl. IV., fig. 5).

Sigalphus obscurellus, Nees, Mag. Ges. Berl., 1816, p. 252; Mon., i., 270, ♂ ♀ (nec Hal., Thoms.).

Less intensely black than *caudatus*; legs piceous, fore tibiæ entirely, and the others at the base more or less, rufescent or testaceous; antennæ ♀ shorter than the body, 22—23-jointed, those of the ♂ somewhat longer than the body, 23—25-jointed; mouth entirely black; carapace tripartite, segments 1—3 rimulose; segment 3 of the ♂ sometimes more faintly, but hardly shining. Stigma black. Terebra ♀ somewhat decurved at the apex, as long as the abdomen, or sometimes a little shorter. Length, 1—1½; wings, 2½—3 lin.

This species has a different habit from *caudatus* and *floricola*, more easily seen than described. It is of a duller black, broader in proportion, if not longer; the abdomen is more convex, the rimulosity of the 3d segment coarser and more constant; even in the ♂ that segment cannot be called shining, more commonly it is as much sculptured as the two preceding; the mandibles, palpi, and stigma are black, or nearly so. Nees says that the 3d segment of the ♂ is more rimulose than that of the ♀, and he gives as a var. a ♂ with that segment nearly smooth; examples of both are among those before me.

Six males and five females were bred, on Sept. 9th, from *Gymnetron noctis*, Hbst., on toadflax, by Bignell; and several of both sexes by Billups on March 16th—19th from the cabbage-galls formed by *Ceuthorrhynchus sulcicollis*, Gyl. Cornelius bred *S. flavipalpis*, Wesm., from *Gymnetron antirrhini*, Germ. (Stett. Zeit., 1863, p. 117).

5. *Sigalphus pallidipes*, Nees.

Sigalphus pallipes, Nees, Mag. Ges. Berl., 1816, p. 251, pl. vii., f. 2; Mon., i., 270; Cur., Farm. Ins., 364; ♂ ♀.

Triaspis fulvipes (Cur.) Hal., Ent. Mag., iii., 127, ♂ ♀;
Sigalphus fulvipes, Ratz., Ichn. d. Forst., ii., 26, ♀.

Brachistes fagi, Ratz., lib. cit., iii., 28, ♂ ♀.

Black, pubescent, legs rufous; antennæ of the ♀ 23-jointed, as long as the body, stout; of the ♂ 22-jointed, longer; abdomen short, ovate, dilated behind, anus obtuse; carapace subbipartite,

the 2d suture more or less obsolete; segments 1—3 (or 1—2, and 3 at the sides more or less) finely rimulose; terebra as long as the body. Length, $\frac{3}{4}$ —1; wings, 2—2 $\frac{1}{2}$ lin.

The 2d suture is often indistinguishable, which, with the rufous legs, may assist in separating this from the four preceding species. Palpi testaceous. Legs sometimes with a narrow fuscous streak on the femora, or the hind tibiæ tipped with fuscous; coxæ black. It resembles sp. 6 in habit, but *luteipes* is larger, with three segments distinct, and a shorter terebra.

An abundant insect in England, according to Curtis. A ♀ was taken from a cell of *Bruchus granarius*, L., in Russian beans. Subsequently he detected numbers in the long-pod beans from his own garden. It is also a parasite of *Orchestes semirufus*, Gyll., which mines in birch-leaves; reared by Nördlinger at Grand Jouan. Brischke obtained both sexes at the beginning of June from *Orchestes fagi*, L., feeding on the beech.

6. *Sigalphus luteipes*, Thoms.

? *Sigalphus aciculatus*, Ratz., Ichn. d. Forst., ii., 26; iii., 26, ♂ ♀, pl. ii., f. 2 (wing and abdomen).

S. luteipes, Thoms., Opusc. Ent., vi., 1874, p. 561.

The largest British species. Black, with rufous palpi and legs; antennæ ♂ 25—26-, ♀ 23—26-jointed; abdomen ovate, very convex, not dilated behind; carapace tripartite, segments 1—2 rimulose, 3 punctulate, hardly shining, sometimes rimulose at the sides; radius subsinuated; terebra somewhat longer than the abdomen. Length, 1 $\frac{1}{2}$; wings, 3 $\frac{1}{4}$ lin.

This is most likely to be Thomson's species, though his description is too short. That of Ratzeburg applies very well, but, as the length of the terebra does not correspond, I have left a query before the name. The following is a summary of his description:—"Terebra $\frac{1}{2}$ the length of the abdomen. Segments 1—2 entirely rimulose, as well as the base and sides of the 3d, which is nevertheless shining. Antennæ ♂ 25-jointed. Recurrent nervure ending 2 $\frac{1}{2}$ times its own breadth before the end of the 1st cubital areolet. Stigma and squamulæ fuscous. Antennæ black. Tarsi obscure; in the ♀ brownish. Legs reddish; coxæ, trochanters, femora at the base and on the upper edge, and hind tibiæ at the apex, black. Metathorax with a carina bifurcated before the middle smooth before the bifurcation, afterwards rugulose." In another place (iii., 26) he notices a ♂

with 26-jointed antennæ. In three females I find the antennæ 23-, in another 26-jointed; but the antennæ of *Sigalphus* are variable in the same species. *S. flavipalpis*, Wesm., is out of the question, because that writer says that it so much resembles his *floricola* as perhaps to be only a variety.

I have before me five females and one male. Two females were taken by Walker, and two by myself at Sandwich; the remaining male and female were sent by Fitch. Ratzeburg's *S. aciculatus* was bred in both sexes from *Ochina hedere*, Müll., by Nördlinger at Grand Jouan, in Brittany; and again by Jacobi at Nordhausen, from *Anobium rufipes*, F., nesting in the decayed branch of a plum-tree.

7. *Sigalphus ambiguus*, Nees.

Sigalphus ambiguus, Nees, Ges. Berl., 1816, p. 253; Mon., i., 272, ♂ ♀; Hal., Ent. Mag., iii., 128, ♂; Wesm., Nouv. Mém. Ac. Brux., 1835, p. 212, ♂ ♀; Thoms., Opusc. Ent., vi., 1874, p. 562.

Black, pubescent, legs rufous; antennæ ♂ 22—24-, of the ♀ 22-jointed; abdomen convex, rimulose, the carapace undivided; anus in the ♀ emarginate, terebra shorter than the abdomen. Length, $1\frac{1}{4}$ — $1\frac{1}{2}$ lin.

Male. Black, hardly shining, pubescent, thinly punctulate; antennæ attenuated at the apex; thorax short, anteriorly gibbous; mesothoracic sutures broadly and thickly punctate, the intermediate lobe longitudinally depressed; metathorax very short, apical angles acutely elevated; abdomen very short, obovate convex, entirely and thickly rimulose, dull, posteriorly with an obsolete smooth longitudinal line, obtusely bicarinated at the base; sutures almost wholly obliterated, as in *Chelonus*; legs short, coxæ fuscous; hind legs stouter, tibiæ at the apex, and tarsi, darker; wings hyaline, stigma large, ovate, fuscous, the nervures paler; radial areolet larger than in *S. caudatus* and the kindred species. According to Nees, the legs are sometimes fuscous, the fore femora at the apex, their tibiæ entirely, and the posterior tibiæ at the base, rufous.

Var. Smaller; antennæ 20-jointed; colour of the legs fuscous, &c.; nervures pale.—Nees.

I have not seen this species; the description is taken from Haliday, who found two males in Ireland. Wesmael's male, taken near Brussels, had black trochanters and 21-jointed antennæ.

8. *Sigalphus thoracicus*, Cur.

Sigalphus thoracicus, Cur., Farm. Ins., 365.

“Similar in size and form to *S. pallipes*, but the thorax is of a red colour: all the legs are bright ochreous, the feet tipped with fuscous: the head was broken off and lost.”

A ♀ was obtained by Curtis from Sicilian beans. In Ruthe's collection is a specimen of a *Sigalphus* with the thorax red, ticketed “*S. thoracicus*.” Nothing more appears to be known of this species.

X. CHELONIDES.

Clypeus entire, mouth closed. Maxillary palpi 6-, labial 4-jointed. Occiput margined. Abdomen sessile; segments 1—3 united by coalition, without visible sutures, rarely with two superficial sutures; two other segments concealed, or the 4th rarely subexserted. Three cubital areolets; recurrent nervure interstitial or rejected; radial areolet small, remote from the apex of the wing, triangular, rarely ovate or lanceolate; pabrachial areolet longer, rarely shorter, than the præbrachial. Terebra concealed or exserted.

The typical *Chelonus* and its subdivision *Ascogaster* form a small natural group, sharply distinguished from every other by their uniformly rugose surface, and the undivided carapace of the abdomen. They have been found, with few modifications of structure, in every quarter of the globe. *Phanerotoma* and *Sphæropyx* are aberrant genera, with few species, having the carapace superficially tripartite. The former genus stands nearer to *Sigalphus*; the latter to *Agathis* and *Microgaster*. The *Chelonides* are parasites of Lepidoptera, chiefly, as it appears, of the *Tortricidæ*; less frequently of Coleoptera.

TABLE OF GENERA.

- | | |
|--|------------------|
| (4) 1. Abdomen above showing three segments; lateral margins not reflexed beneath. | |
| (3) 2. Abdomen beneath simple, edentate; intermediate tibiæ externally gibbous | i. PHANEROTOMA. |
| (2) 3. Abdomen beneath with two teeth, pointing backwards; intermediate tibiæ simple | iv. SPHÆROPYX. |
| (1) 4. Abdomen above not divided into segments; lateral margins reflexed beneath. | |
| (6) 5. Eyes hairy; first cubital areolet not separated from the prædiscoidal | ii. CHELONUS. |
| (5) 6. Eyes naked; first cubital areolet separated from the prædiscoidal | iii. ASCOGASTER. |

i. PHANEROTOMA, *Wesm.*

Wesm., *Nouv. Mém. Ac. Brux.*, 1838, p. 165.

Eyes naked. Abdomen superficially divided into 3 segments; lateral margins not reflexed beneath. Intermediate tibiæ externally gibbous. First cubital areolet distinct from the prædiscoidal; pabrachial shorter than the præbrachial; recurrent nerve sub-obsolete. Terebra (in the European* species) subexserted.

1. *Phanerotoma dentata*, Panz. (Pl. IV., fig. 6).

Chelonus dentatus, Panz., F. G., lxxxviii., 14; *Krit. Revis.*, ii., 100.

Sigalphus dentator, Nees, *Mag. Ges. Berl.*, 1816, p. 257, p. viii., f. 2, a, b.

Chelonus dentator, Nees, *Mon.*, i., 279, ♂ ♀.

Ascogaster dentatus, Wesm., *Nouv. Mém. Ac. Brux.*, 1835, p. 244; *cf. lib. cit.*, 1838, p. 165, ♂ ♀.

Sigalphus rufescens, Latr., *Gen. Crust. et Ins.*, iv., 13.

Phanerotoma dentatus, Thoms., *Opusc. Ent.*, vi., 1874, p. 582.

Finely rugulose, abdomen striolated. Head rufo-testaceous, eyes and stemmaticum dusky; thorax and abdomen variable, usually testaceous with the metathorax and 3d abdominal segment fuscous; legs testaceous, often with the hind femora at the apex,

* The following exotic species has never been described. It is remarkable for having the terebra more exserted than usual in this subfamily:—

Phanerotoma noctivaga, n. s.

Testacea, coriacea, oculis (in viva) viridibus; antennarum apice, metathoracis litura, abdomine postice, plerumque segmentorum primi et secundi limbo, tibiisque posticis apice, fusciscentibus; feminae segmento anali emarginato; alis hyalinis, stigmatibus pallido vel fusco-maculato, terebra abdomine brevior, tenuissima, falcata. ♂ ♀. Long. 1—1 $\frac{3}{4}$; alar. exp. 2—3 $\frac{1}{2}$ linearum.

Antennæ in both sexes 22-jointed, of the ♀, as long as the body, of the ♂, longer. Head wider than the thorax, transverse; vertex flat; clypeus entire, obtusely rounded, discrete, with two impressions at the base. Body very finely rugulose, almost coriaceous; abdomen very finely rimulose, constructed like that of *P. dentata*; the gibbosity before the apex, marking the limit of the 3d segment, more conspicuous in the ♂. Terebra as long as $\frac{2}{3}$ of the abdomen, curved upwards, very slender and whitish, the valves at the apex fuscous. Legs nearly white, only the tips of the hind tibiæ fuscous; hind femora and tibiæ incrassated; intermediate tibiæ gibbous on their outer edge before the base.

Frequent in the Island of Antigua, flying by night. I took three males and three females at different times, attracted into the house by lamps, and saw many more.

together with a ring before the base, and all the tarsi, fuscous.
♂ ♀. Length, $2\frac{1}{4}$; wings, $4\frac{1}{2}$ lin.

Eyes during life of a fine green colour. Antennæ as long as the body, fuscous towards the apex, 23-jointed. Head subcubical, pubescent; face carinated. Metathorax with an abbreviated medial transverse carina. Abdomen subdepressed, segments 1—2 transverse, rimulose, the 1st with two basal carinæ, converging and vanishing before the middle; the 3d longer than broad, more finely rimulose, truncate at the apex, and with a gibbosity just before the truncature, indicating the posterior limit of the segment; both the sutures crenulate. Wings slightly fuscous, nervures and stigma brownish, the latter pale at the base; before and behind it is a decolorous streak; 2d cubital areolet much attenuated outwardly; radial areolet approaching the apex of the wing. In the hind wing the radial areolet is constricted in the middle, where an imperfect transverse nervelet almost joins the costa.

Var. *α*. Fusco-ferruginous, uniform, orbits and legs paler; hind tibiæ more broadly fuscous; wings without hyaline streaks.

Var. *β*. Ferruginous, disk of the mesothorax fuscous with a pale patch anteriorly bifid; abdomen fuscous, segment 1, and 2 at the base, more or less pale.

Var. *γ*. The same, but the vertex and pectus are also fuscous.

Var. *δ*. Thorax and abdomen entirely fuscous.

In the darker varieties the hyaline streaks on the wings are more distinct, the orbits are rufous, and the hind tibiæ more highly coloured.

Not uncommon in Southern and Central Europe. I have a specimen which I took in Corsica. Rare in England, but one was captured by Dale in Stilton Fen, Huntingdonshire, August 14th, as recorded by Curtis, B. E., 672. Another was in Walker's collection. Several were taken at Dover by Sydney Webb, in a warehouse, in August, and conjectured by him, with great probability, to be parasites of *Myelois ceratonia*, Zell., occurring in the same warehouse. A specimen has also been captured by Billups. Obtained by Reissig from a *Tortrix* larva living on the oak; by Brischke out of *Rhodophaea advenella*, Zinck., from Silesia.

ii. CHELONUS, Jur.

Jur., Hym., 289 (1807); Nees, Mon., i., 288, Sect. IV.; Wesm., Nouv. Mém. Ac. Brux., 1835, p. 214.

Eyes naked. Abdomen above with no visible sutures; lateral margins reflexed beneath. Intermediate tibiæ simple. First

cubital areolet not separated from the prædiscoïdal; pobrachial shorter than the præbrachial; recurrent nervure interstitial. Terebra concealed or subexserted.

The species are of stout subcylindrical form, with hard integuments, covered with rugosity irregularly disposed in striæ or reticulated, and mixed with coarse punctures. They are black, frequently with a pair of testaceous spots, round or triangular, occupying the region of the spiracles of the 1st abdominal segment, and sometimes confluent. In *C. Wesmaëlii*, Cur., the abdomen is broadly rufous above. The legs are rufotestaceous, usually diversified with black. *C. pullatus*, Dahlb. (Sv. Ak. Handl., 1838, p. 163) is described as wanting the 2d cubital areolet, and seems therefore to belong to some other genus.

The abdomen, viewed from above, generally shows no vestige of sutures; but one or two are sometimes indicated by slight transverse depressions. On the under side it has the appearance of being eviscerated; the reflexed edges surround an oblong cavity, against the walls of which the belly is flattened after death by shrinking. The sutures of the ventral surface are always more or less visible; in the male at least five segments may be counted, showing that the shield is compounded of more than the first three segments. The sexual distinctions are best seen on the under side; the terebra originates just behind the middle of the abdomen, and is either falcate or straight; in the former case it curves upwards in a reverse direction to the contour of the abdomen. The valvula ventralis is distinct, contained within the shell in repose, but capable of being moved downwards and backwards so as to allow the terebra to pass the reflexed apical edge, in which a shallow groove is often cut for its reception. Many of the males exhibit a variously-shaped fissure at the apex of the abdomen, in the centre of which may be discerned the sheath of the generative organ, sometimes mistaken for the terebra, and the cause of confusion of sexes in the descriptions. In most cases the antennæ are also a guide to the determination of the sexes; those of the male are longer, setaceous, or tapering gradually to the extremity, while in the female they are shorter, compresso-dilated beyond the middle, and thence somewhat abruptly diminishing to the apex. The absence of a valvula ventralis will also serve to distinguish the males.

Uniformity of structure and colour makes the species difficult to separate by the eye, and still more so to describe. Their nomenclature is in the greatest disorder, so that without types it is often impossible to say what species are intended by authors. The earliest attempt at a monograph of the genus is that by Nees von Esenbeck (Mag. Ges. Berl., 1816, pp. 265—274), containing 13 species. Dahlbom followed (Sv. Ak. Handl., 1833, pp. 159—163) with 5, of which only one bears the same name as a species of Nees. In the next year Nees (Mon., i., pp. 288—298) republished his 13 species without taking notice of Dahlbom's work. Wesmael (Nouv. Mém. Ac. Brux., 1835, pp. 214—225, and 1837, Suppl. pp. 156—163), also unacquainted with Dahlbom's paper, published 12, of which only 6 bear the same names as those of Nees, some of them doubtfully. His descriptions, and those of Nees, are the chief sources of information, although the same species is sometimes given more than once, and in several cases the male is mistaken for the female. In 1867 Reinhard (Berl. ent. Zeit., pp. 358—360) adjusted the synonymy of *C. sulcatus*, Nees, and *curytheca*, Wesm., with the addition of two new species. And in 1874 Thomson (Opusc. Ent., vi., pp. 563—581) published 27 species, 18 with new names. My coadjutor Fitch and myself have been disappointed in our efforts to gain information from this paper. To the above-mentioned works are to be added a few descriptions by Herrich-Schäffer (F. G., cliii, cliv), and Curtis (B. E., delxxii).

TABLE OF SPECIES.

MALES.

- (16) 1. Abdomen without an apical fissure.
 (3) 2. Abdomen broadly rufous above, the apex and a medial line black 3. *Wesmaelii*, Cur.
 (2) 3. Abdomen entirely black, or with 2 yellowish basal spots, sometimes confluent.
 (13) 4. Third abscissa of the radius of the fore wing curved, concave exteriorly; radius of the hind wing (in addition to its basal flexure) curved in the middle.
 (10) 5. Squamulae black, or blackish.
 (7) 6. Hind tibiae rufous, generally tipped with black, but not black or annulated with darker colour at the base; 1st joint of the hind tarsi broadly rufous at the base. Length, $2\frac{1}{2}$ lines; largest sp. 1. *innuitus*, L.

- (6) 7. Hind tibiæ black or blackish at both ends (the base often only annulated with fuscous), rufous in the middle; 1st joint of the hind tarsi wholly fuscous. Length, $1\frac{1}{2}$, seldom 2 lines; middle-sized spp.
- (9) 8. Antennæ more than 30-jointed; frontal fovea smooth, shining, deep, geminated by a carina 4. *carbonator*, n. s.
- (8) 9. Antennæ 27-jointed; frontal fovea rugulose, dull, nearly obsolete, not geminated or carinated 6. *corvulus*, n. s.
- (5) 10. Squamulæ testaceous.
- (12) 11. Face not remarkably pubescent 8. *dispar*, n. s.
- (11) 12. Face almost concealed by dense whitish pubescence 9. *canescens*, Wesm.
- (4) 13. Third abscissa of the radius of the fore wing straight; radius of the hind wing (after its basal flexure) straight or nearly so.
- (15) 14. Antennæ 32-jointed, much longer than the body; length, $1\frac{1}{2}$ lin. 10. *catulus*, n. s.
- (14) 15. Antennæ 23-jointed, not longer than the body; length, $1\frac{1}{2}$ lin. 11. *pusio*, n. s.
- (1) 16. Abdomen furnished with an apical fissure.
- (18) 17. Apical fissure 10 times broader than long, its shining edges produced along each side of the abdomen 12. *risorius*, Reinh.
- (17) 18. Apical fissure not so much broader than long, not produced along the sides of the abdomen, ovate, reniform, or suborbicular; small spp.
- (20) 19. Prothorax much produced, forming a distinct neck 13. *secutor*, n. s.
- (19) 20. Prothorax as usual.
- (22) 21. Antennæ 27—30-jointed 14. *paricornis*, Schöff.
- (21) 22. Antennæ 20—24-jointed.
- (24) 23. Apical fissure about 3 times broader than long, reniform 15. *sulcatus*, Nees.
- (23) 24. Apical fissure subcircular.
- (26) 25. Head transverse; cheeks not dilated 16. *latrunculus*, n. s.
- (25) 26. Head subcubical; cheeks dilated 17. *exilis*, n. s.

FEMALES.

- (14) 1. Antennæ with more than 16 joints.
- (7) 2. Hind tibiæ rufous, generally tipped with black, but not black or annulated with darker colour at the base; 1st joint of the hind tarsi broadly rufous at the base. Length, $2\frac{1}{2}$ lines; largest spp.
- (6) 3. Costa and parastigma fuscous; antennæ shorter than the body; frontal fovea not shining, rugose like the rest of the head.

- (5) 4. Antennæ compresso-dilated beyond the middle, suddenly attenuated near the apex 1. *inanitus*, L.
- (4) 5. Antennæ setaceous, gradually diminishing to the apex 2. *submuticus*, Wesm.
- (3) 6. Costa and parastigma testaceous; antennæ as long as the body (setaceous); frontal fovea shining, smooth .. 5. *speculator*, n. s.
- (2) 7. Hind tibiæ black or blackish at both ends (the base often only annulated with fuscous), rufous in the middle; 1st joint of the hind tarsi wholly fuscous. Length, $1\frac{1}{2}$, seldom 2 lines; middle-sized spp.
- (9) 8. Antennæ 18-jointed 9. *canescens*, Wesm.
- (8) 9. Antennæ with more than 18 joints.
- (11) 10. Frontal fovea subobsolete, dull and rugulose like the rest of the head .. 6. *corvulus*, n. s.
- (10) 11. Frontal fovea conspicuous, smooth and shining.
- (13) 12. Hind tibiæ broadly rufous in the middle, blackish at both ends; tarsi rufous at the base 7. *decorus*, n. s.
- (12) 13. Hind tibiæ black, with a narrow rufescent ring; tarsi wholly blackish .. 4. *carbonator*, n. s.
- (1) 14. Antennæ 16-jointed.
- (16) 15. Squamulæ testaceous 8. *dispar*, n. s.
- (15) 16. Squamulæ black. Small species.
- (18) 17. Base of the abdomen determinately yellowish 18. *basalis*, Cur.
- (17) 18. Abdomen entirely black.
- (20) 19. All the femora rufo-testaceous .. 16. *latrunculus*, n. s.
- (19) 20. Femora black, except at the apex.
- (24) 21. Head transverse, contracted behind the eyes; cheeks not dilated.
- (23) 22. Apex of the abdomen beneath with a shallow groove to receive the point of the terebra 14. *paricornis*, Schöff.
- (22) 23. Apex of the abdomen not so grooved .. 15. *sulcatus*, Nees.
- (21) 24. Head subcubical, not contracted behind the eyes; cheeks dilated 17. *exilis*, n. s.

1. *Chelonus inanitus*,* L.

Cynips inanita, Lin., S. N., ii., 917, ♀.

Chelonus inanitus, Nees, Mon., i., 289; Wesm., Nouv. Mém. Ac. Brux., 1835, p. 217, ♂ ♀; *C. inanitor*, Thoms., Opusc. Ent., vi., 1874, p. 566, ♂ ♀.

C. oculator, Dahlb., Sv. Ak. Handl., 1832, p. 159, pl. iv., f. 14 (♀ with details); Wesm., *lib. cit.*, p. 216, pl. ii. (wing); Thoms., Opusc. Ent., vi., 1874, p. 564, ♂ ♀; (*C. oculatus*, Nees, Mon., i., 290, and all other synonyms and varieties, are doubtful).

Black; palpi black; mandibles rufescent at the tips; abdomen with or without 2 basal yellowish rounded spots; legs rufo-testaceous, coxæ, trochanters, femora at the base more or less, and 4 posterior tibiæ at the apex sometimes, black; tarsi fuscous, black at the tips, the 1st joint flavo-testaceous with the apex fuscous; spurs pale. Wings fumato-hyaline, nearly limpid at the base; a curved whitish streak under the stigma, which together with the outer nervures is dark fuscous; costa and parastigma fusco-testaceous; præbrachial and other basal nervures of all the wings testaceous; squamulæ black; 3d abseissa of the radius of the fore wings curved, concave outwardly; radius of the hind wings sinuated. Body coarsely rugose, somewhat shining, beset with short, scattered, pale hairs. Head reticulato-rugose, striato-rugose

* *Chelonus Antillarum*, n. s.

C. inanita similimus, niger, pubescens, opacus, scaber; antennis maris 30-, feminae 26-articulatis; scutello medio læviusculo; metathorace bicarinato, subquadridentato; abdomine integro, ovali, antice flavo-bimaculato; pedibus sordide testaceis, sericeis, coxis trochanteribusque nigris, femoribus anticis basi, posterioribus fere totis, tibiis etiam posterioribus apice et ante basin, piceis; terebra recondita. ♂ ♀. Long. 2½; alar. exp. 4½ linearum.

Palpi pitchy, mandibles black, clypeus bearded with pale pubescence, which is also thinly scattered over the whole body. Metathorax acutely bidenticulate, and with several longitudinal carinæ, two of which are elevated at the apex; hence subquadridentate. Abdomen bicarinated and reticulato-rugose at the base, rugoso-punctate towards the apex, and glistening with hoary pubescence. The yellowish abdominal spots are triangular, and smaller than in the similar European species; in one female, obsolete. Wings hyaline towards the base, with decolorous nervures; dusky towards the apex, with fuscous stigma and neuration; cubitus and anal nervure attenuated outwardly and subobsolete; 3d abseissa of the radius not sinuated; radial areolet shorter and more obtuse than in *C. inanitus*.

Common in the West Indies; I found several of both sexes in Barbados, Martinique, and Antigua.

round the orbits and cheeks; vertex transverse, not widened behind the eyes, cheeks not dilated; clypeus bisinuated, elevated, shining, punctulate; frontal fovea rugose, hardly more shining than the rest of the head, geminated by a carina. Antennæ ♂* as long as the body, setaceous, 27—30- (usually 28-) jointed; of the ♀ shorter than the body, compresso-dilated beyond the middle, the last 5—6 joints rapidly decreasing in size, 23—24- (rarely 25-) jointed. Mesothorax reticulato-rugose, the reticulations coarser behind, and falling into irregular striæ before the scutellum. Scutellum smooth in the middle, except two or three faint striæ, reticulated and margined all round; the basal fovea cancellated. Metathorax short, transverse, truncated, reticulato-rugose, 4-denticulate. Abdomen ♂ depresso-cylindrical; viewed laterally, clavate; obtuse behind, rather longer than the head and thorax, the sides sub-parallel, very slightly sinuated near the basal tubercles; of the ♀ shorter, the sides somewhat curved, and the apex rounded; the base covered with coarse reticulations arranged in striæ, two of which are often more elevated, forming carinæ; the reticulations become shorter and finer posteriorly, so that the apex is more shining, and almost punctate. Terebra ♀ testaceous with black valves, falcate, concealed in repose, but capable of being protruded a little beyond the anus. ♂ ♀. Length, 2½; wings, 4½ lin.

Described from 38 males and 29 females, mostly taken by myself at the same time and place in the Isle of Wight, and which are uniform in their characters, agreeing with Wesmael's *oculator* and *inanitus*. The yellowish abdominal spots are inconstant, appearing but seldom in the males, and only in a minority of the females; a specimen from Maldon has a spot on one side of the abdomen only.

Common throughout the country, and especially near the coast of the Isle of Wight at Niton, in July, where I took 46 in a few hours; 21 more specimens were sent me by Fitch, obtained by himself and Bridgman. Bignell has also captured many in Devonshire. A solitary parasite of Lepidoptera; two females were bred by Elisha, August 12th, from *Catoptria æmulana*, Schl.; in one of these the femora are more broadly black than usual, and the hind tibiæ are blackish at the base; the other exhibits no peculiarity. Specimens in Brischko's collection (named by Ruthe) were reared from *Miana literosa*, Haw., and *Tapinostola elymi*, Tr.

* A ♂ taken by Bignell has the left antenna 28-, the right 27-jointed, both unusually short.

The synonymy of this species is embarrassing, and perhaps can never be quite cleared up. More species than one seem to be contained under the name *oculator* of authors, and it is useless now to enquire whether Fabricius, Olivier, Panzer, and Latreille had all the same insect in view. It appears, however, that Nees was right in regarding his own *C. oculatus* as distinct from *Cynips inanita*, L. *C. oculator*, Wesm., is identical with *Cynips inanita*, L., and different from *C. oculatus*, Nees. This conclusion, attained after much puzzling, obliges me to unite *Cynips inanita*, L., with *C. oculator*, Wesm., and to restore the Linnean name. The insect representing *Cynips inanita* in the Linnean cabinet has been carefully examined by Fitch, and there is every reason to believe it to be the common *C. oculator*, Wesm. It is a female with the terebra slightly exerted, which is nothing remarkable. The legs are rufous, only the hind tibiæ black at the apex. The Linnean diagnosis has the words "pedibus ferrugineis"; the further description adds "pedes ferruginei exceptis tibiis nigris," where "tibiis" is due to some inadvertence, or perhaps the word "apice" is omitted. Wesmael, delighting over much in subtleties, having erroneously assumed his own *oculator* to be the *oculatus*, Nees, was bound to follow that writer in regarding *inanitus*, Nees, as distinct. He endeavours to establish the distinctness of *inanitus* on two grounds only: (1) the terebra projects beyond the anus; (2) the abdomen seems a little broader, and somewhat more rounded at the sides and posteriorly. The first difference is merely due to the temporary position of the organ, and may happen in the case of any female *Chelonus*. The second is vague and inappreciable, when we consider that the individuals of a species are not cast in a mould. These differences moreover belong only to the females, no attempt being made to discriminate the males. There are several English specimens which will pass for *C. inanitus*, Wesm., ♀. I believe them to be nothing but fine examples of *oculator*, Wesm., having the abdominal spots, and killed at a time when the genital apparatus was in a state of tension. One such female was taken by Billups at Walmer; others by Sharp and Fitch; and by me at Niton, Isle of Wight.

For *C. oculatus*, Nees, Mon., i., 290, see *C. carbonator*, sp. 4, infra.

C. oculator, Thoms., Opusc. Ent., vi., 1874, p. 564, ♂ ♀, is placed in a section characterised by the deeply reflexed edges of the emarginations of the mesosternum which receive the fore coxæ. I have failed to discover this character in British specimens of any species. Moreover, the metathorax is described as “concinne minus fortiter punctatus,” which is inapplicable to our species.

C. cylindrus, Nees, Mon., i., 291, ♂. Antennæ 29- (i. e.,* 28-) jointed. Perhaps the same as *C. oculator*, Wesm. Nees has taken great pains to show that it is not his *C. oculatus*.

C. scaber, Nees., Mon., i., 297, ♂ ♀, was regarded by the author as doubtfully distinct from his *oculatus*. Length, 2—2½ lin. Body stouter and more compact; abdomen shorter, more oval, without basal carinæ—which Nees declares to be never wanting in his *oculatus*, another proof of the diversity of that species from *oculator*, Wesm.—seldom with yellowish spots; femora black, only the fore pair rufous at the apex; tibiæ pale testaceous, not rufous, the middle pair always darker at the apex, generally fuscous with the base pale; wings darker than in *oculatus*; scutellum not smooth in the middle. Antennæ not described. (Compare *C. carbonator*, sp. 4, infra). This is said by Haliday and Curtis to be the same as *C. annulipes*, Wesm., which Wesmael himself expressly denies; by Thomson it is joined doubtfully to his *C. buccatus*, which is insufficiently described. *Ichneumon scabrator*, Fab., E. S., ii., 174, quoted by Nees as a synonym, is not now in the Banksian collection.

Ruthe in his collection distributed the specimens which stand under the name *C. oculatus*, Nees, into three varieties; (a) *rufipes* (b) *variipes*, and (c) *nigripes* = *scabrator*, Fab. But his views on the affinities of the *Cheloni* were unfortunately never published.

2. *Chelonus submuticus*, Wesm.

Chelonus submuticus, Wesm., Nouv. Mém. Ac. Brux., 1835, p. 218, ♂ ♀.

Similar to the preceding, but with different antennæ. Those of the ♀ are as long as $\frac{3}{4}$ of the body, 26-jointed (27- according to

* As Nees reckons the radicle, it is necessary always to subtract 1 from his enumerations.

Wesmael), setaceous, not dilated and compressed beyond the middle, nor suddenly attenuated at the apex. The other differences are less obvious; abdomen broader, more obtuse behind, the apex subtruncate, channelled beneath to receive the point of the terebra; base with 2 small triangular yellowish spots not touching the reflexed edges, which are also yellowish for a short distance; 2 faint basal carinæ not reaching the pale spots. Metathorax strongly bidenticulate, and with 2 blunter lateral angulations. Terebra concealed. Wings as in the preceding species; costa, basal nervures, and parastigma testaceous, the latter with a fuscous spot. I have not seen the ♂, which, according to Wesmael, is like the ♀, and with similar antennæ, but 29—30-jointed. ♂ ♀. Length, $2\frac{1}{2}$; wings, $4\frac{1}{2}$ lin.

More robust than *C. inanitus*, L., and evidently distinct. The antennæ alone lead me to conclude that it is the real *submuticus*, Wesm., for the other characters given by him are not likely to be constant. The metathorax is more strongly bidenticulate than in Wesmael's description, and the basal carinæ of the abdomen more feeble; all the characters, however, are present. As the cheeks are not dilated, it cannot be *C. buccatus*, Thoms., which that writer compares, as to its antennæ and metathorax, with *submuticus*, Wesm.

One female is in Fitch's collection.

Bridgman captured, at Brundall, Norfolk, a ♂ closely resembling the above ♀, except that the antennæ are 25-jointed. It is no doubt a different species, which I am unable to name, or to describe intelligibly without more specimens, including the other sex.

3. *Chelonus Wesmaelii*, Cur.

Chelonus Wesmaelii, Cur., B. E., pl. dclxxii., ♂.

Black; palpi testaceous; abdomen bright rufo-testaceous above for $\frac{2}{3}$ of its length, with a black medial stripe, sometimes interrupted; legs rufo-testaceous, coxæ and trochanters black, hind femora and tibiæ narrowly at the apex, and all the tarsi except their basal joint, fuscous. Wings fuscous, longer and narrower than in the two preceding species, with a whitish streak beneath the attenuated stigma; radial areolet elongate, acuminate, the 3d abscissa almost straight; radius of the hind wings curved. Rugose, pubescent; antennæ ♂ as long as the body. 32—34-jointed. ♂. Length, 3; wings, $4\frac{3}{4}$ lin.

Size of *C. inanitus*, L., but more slender, with longer legs and less coarse rugosity. I have not seen the ♀, and the very old specimen of the ♂ which I possess does not admit of minute description; but the species cannot be mistaken. Antennæ 32-jointed, setaceous; according to Curtis 34-jointed. Metathorax bluntly bidenticulate. Abdomen somewhat wider behind, with a transverse depression indicating the 1st suture, at which place the black longitudinal stripe is interrupted in Curtis's specimen; in mine it is continuous, emitting a short branch on either side; the apex is impressed with a shallow triangular fovea.

This fine species is not noticed by the continental writers, and seems to have occurred only in England, where it must be very rare or local. The locality given by Curtis is Tollesbury, near Maldon, in Essex. My specimen is the gift of Walker, who possessed several, which are now in the Oxford Museum, numbered 334, as I am informed by the Professor of Zoology.

4. *Chelonus carbonator*, n. s.

Niger, abdomine immaculato; palpis nigricantibus; femoribus anticis præter apicem, mediorum apice ipso, tibiis anticis totis, posterioribus medio, ferrugineis, vel tibiis posticis nigris rufo-annulatis. Alæ anticæ infumatæ, in femina saturatius, posticæ magis hyalinæ; squamulæ nigre; stigma cum costa nervisque exterioribus fuscum; parastigma et nervus præbrachialis testacea; areola radialis brevis, stigmatè latior, abscissa 3tia curvata; alarum inferiorum radius sinuatus. Clypeus discretus, punctis ad basin duobus exiguis impressus; vertex transversus, pone oculos contractus, genis nequaquam dilatis; fovea frontalis nitida, profunda, geminata. Maris antennæ 33—34-, feminae 28—33-articulate, crassiusculæ, apicem versus sensim decrescentes. Mesothorax antice fortiter punctatus, posterius striato-reticulatus. Metathorax brevis, valde transversus, 4-denticulatus, medio subcarinatus, reticulatus. Abdomen sculptura solita exasperatum, carinis basilibus nullis, maris apice integrum, obtusum, feminae magis ovatum, terebra occulta.

Black, abdomen immaculate; palpi blackish; tips of mandibles, fore femora except the base, fore tibiæ entirely, intermediate femora at the extreme apex, ferruginous; 4 posterior tibiæ dull ferruginous, broadly blackish at the apex and annulated with fuscous near the base, or the hind tibiæ black with a subferruginous ring; tarsi blackish, the 4 anterior rufous at the base. Fore wings infumated,

darker in the ♀, with a curved whitish streak behind the stigma; hind wings nearly hyaline; squamulæ black; stigma, costa, and nervures fuscous, only the parastigma and præbrachial nervure testaceous; radial areolet short, broader than the stigma; 3d abscissa of the radius curved; radius of the hind wings sinuated. Head and thorax rather shining, the former finely and irregularly rugulose, reticulated, partly striato-rugulose, beset with pale hairs, especially on the face, which is also transversely striated; clypeus shining, densely punctulate, discrete, the punctiform basal foveæ very minute; vertex transverse, narrowed behind the eyes, cheeks not dilated; frontal fovea shining, deep, geminated. Antennæ ♂ as long as the body, 33—34-jointed; of the ♀ shorter, 28—33-jointed, incrassated for about $\frac{2}{3}$ of their length, afterwards slightly and gradually decreasing. Mesothorax shining, uneven, with coarse irregular scattered punctures in front, striated and sub-reticulated towards the scutellum, which is shining and sparingly punctulate. Post-scutellum not dentiform. Metathorax short, very transverse, quadridenticulate, shining, coarsely reticulated, with traces of a medial carina. Abdomen dull, pubescent at the apex, as long as the head and thorax, without basal carinæ, depresso-cylindrical, reticulated and striato-rugose at the base, the striæ becoming shorter and finer posteriorly, leaving the apex punctulate and somewhat shining. Abdomen ♂ obtuse and imperforate at the apex; of the ♀ ovate, less bluntly rounded behind; terebra concealed. ♂ ♀. Length, $1\frac{3}{4}$ —2; wings, 3— $3\frac{1}{2}$ lin.

Described from two males and two females. One pair was taken by Billups, the ♀ is ticketed "Margate." Bignell captured a ♂ in Devonshire, and the remaining ♀ is in Fitch's collection. A ♂ with 34-jointed antennæ is among some Andalusian insects brought by Sharp from the Sierra Nevada.

Having failed to clear up the obscurity surrounding *C. annulatus*, Nees, and *annulipes*, Wesm., I am forced to impose a new name, and probably to make a synonym, for which some excuse may perhaps be found in the following considerations:—

C. annulatus, Nees, ♂ (wrongly called ♀, and according to Reinhard = *fenestratus*, Nees, ♂) has 33- (*i. e.*, 32-) jointed antennæ, and is the only Neesian species to which this could be referred. The femora are rufous, the hind tibiæ black with a white ring, and the abdomen is bimaclated with yellow. It is also out of the question through being coupled by Reinhard with a ♀ whose antennæ are 16-jointed, viz., *fenestratus*, Nees. Of

Thomson's *annulatus* I can make nothing, except that, having the squamulæ "plerumque albidæ," it cannot be the present insect. Wesmael's *C. annulipes* ♂ (excluding the ♀, the variety, and the synonyms) has the mandibles black, the abdomen bimaculated, the middle tibiæ not annulated at the base, and the wings almost hyaline; the probability of its being the present species is further diminished by Reinhard's remark that *annulipes*, Wesm., ♂ = *sulcatus*, Nees, ♂, with 25- (*i. e.*, 24-) jointed antennæ. *C. scaber*, Nees, said by Haliday and Curtis to be *annulipes*, Wesm., has been already mentioned under sp. 1. It resembles the present insect in the colour of the hind tibiæ. Thomson's *annulipes* is described as having the cheeks dilated, the post-scutellum dentiform, the ♀ with 24-jointed antennæ, and is referred to *annulipes*, Wesm., doubtfully, without further explanation.

C. oculatus, Nees, Mon., i., 290, ♂ ♀ (excluding varieties) differs in the colour of the hind tibiæ, but is otherwise nearer to this species than to *C. inanitus*, L. Length, 2— $3\frac{1}{4}$ lin. Antennæ ♂ 33- (*i. e.*, 32-) jointed, those of the ♀ not described. Scutellum smooth at the base, punctate broadly at the apex. Abdomen immaculate, or (in dubious varieties) spotted; always with 2 distinct basal carinæ. Hind tibiæ rufous tipped with black; tarsi fuscous, not testaceous at the base, but only on the under side of the 1st joint; femora black at the base, or entirely black. It will be seen that the size, the number of joints in the antennæ, and the colour of the tarsi, do not quadrate with our sp. 1., the numerous examples of which are constant in their characters.

Two doubtful specimens may here be noticed, which at present it would be useless to describe. A ♂ taken by Fitch, agreeing with *carbonator*, except in size (length, $2\frac{1}{2}$ lines), and in the antennæ, which are 29-jointed. And a ♀ equally large, in too bad condition to describe, having the antennæ 25-jointed, and the hind tibiæ wholly black. The latter I captured in the New Forest.

5. *Chelonus speculator*, n. s.

Niger, abdominis basi bimaculata; palpis nigricantibus; pedibus testaceis; coxis, femorum anticorum basi, posterioribus præter apicem totis, tibiæ posticarum apice, nigris, harum basi fuscescente; tarsis fuscis, basi testaceis. Alæ infunata, tinctu ferrugineo, stigmate nervisque fuscis, parastigmate et nervis basalibus testaceis, squamulis piceis; abscissa 3tia curvata; alarum inferarum radio sinuato. Caput reticulatum, orbitis striolatis, fovea frontali rugulosa, nitida, genis paulo dilatatis. Feminae antennæ 27-articulatae, ultra medium incrassatae, vix ad apicem sensim decrescentes, *C. inaniti* antennis multo longiores. Corporis rugæ subtiliores. Scutellum medio læve. Abdomen more solito scabratum, ellipticum, carinis basalibus nullis. Metathorax longior, subquadridentatus, fortius reticulatus. Mesosternum antice haud reflexum. Terebra occulta.

Black, with 2 large triangular yellowish spots at the base of the abdomen; palpi dusky; mandibles at the tip, and legs, testaceous; coxæ, fore femora at the base, 4 posterior wholly except the tips, and tips of the hind tibiæ, black; these last slightly fuscescent at the base, their tarsi blackish with the 1st joint testaceous; calcaria pale. Wings infunated, with a ferruginous tinge, and a darker stain underneath the fuscous stigma; parastigma and basal nervures testaceous, the rest fuscous; squamulae pitchy; 3d abscissa of the radius curved; radius of the hind wings sinuated. Head reticulato-rugulose, orbits and cheeks striolated; frontal fovea deep, rugulose, shining; cheeks somewhat dilated. Antennæ ♀ 27-jointed, incrassated beyond the middle and only slightly attenuated towards the apex, hardly shorter than the body and much longer than those of *C. inanitus* ♀. Rugosity of the body finer and more variolose than in that species. Scutellum shining in the middle. Abdomen longer, not so obtuse behind, but regularly elliptical, without basal carinae. Metathorax longer, subquadridentate, more coarsely reticulated. Anterior edge of the mesosternum not reflexed. Terebra concealed. ♀. Length, 2¼; wings, 4 lin.

When compared with the ♀ of *C. inanitus* this is very distinct; more elongate, the abdomen regularly elliptical, rounded behind instead of obtuse; the antennæ are $\frac{1}{3}$ longer, stouter and less attenuated at the apex; the frontal fovea is smooth and shining; the wings are darker and more ferruginous; the radial areolet larger, the 2d cubital more produced inwardly, the parastigma and basal nervures paler, and the posterior femora

differently coloured. It agrees with Thomson's description of *C. Gravenhorsti* (Opusc. Ent., vi., p. 573), but not with *C. Gravenhorstii*, *pellucens*, Nees, or *eurytheca*, Wesm., all which are cited by Thomson as synonyms. *C. eurytheca*, Wesm., is very different, and, according to Reinhard, is the ♂ of *parvicornis*, Schöff. (see sp. 14, infra). In any case a new name is here required.

I captured this ♀ on a strawberry-bed in my garden at Nunton, Wilts.

6. *Chelonus corvulus*, n. s.

Chelonus annulipes, var. 1, Wesm., Nouv. Mém. Ac. Brux., 1838, p. 162 (antennæ 26—29-jointed).

Black, abdomen immaculate; palpi and tips of the mandibles, fore femora at the apex broadly, the middle pair more narrowly, and all the tibiæ testaceous; hind tibiæ tipped with black and annulated with dusky near the base; tarsi fuscous, the 1st joint of the 4 posterior pale at the base; calcaria whitish. Wings infumated, stigma and nervures fuscous, parastigma and basal nervures subtestaceous; squamulæ piceous; 3d abscissa of the radius very slightly curved; radius of the hind wings sinuated. Reticulato-rugose, dull; head more finely sculptured, orbits and cheeks striolated; vertex transverse, contracted behind the eyes, cheeks not dilated; frontal fovea large, shallow, smoother than the rest of the head, geminated by a carina. Antennæ ♂ 27-jointed, longer than the body; of the ♀ 24—26-jointed, stouter, shorter, incrassated beyond the middle, and near the apex suddenly attenuated. Mesothorax coarsely reticulated, especially near the scutellum, slightly shining, with an obsolete medial raised line, the sides and scutellum more finely rugulose. Metathorax short, transverse, truncate, coarsely reticulated, bidentate, with 2 longitudinal carinæ diverging posteriorly and sometimes obsolete. Abdomen depresso-cylindrical, somewhat shorter than the head and thorax, covered with oblong subparallel reticulations, finer posteriorly, the apical third smoother and rather shining; at the base are 2 short carinæ, subobsolete and confused with the other striæ. Abdomen ♂ imperforate. Terebra ♀ concealed. ♂ ♀. Length, $1\frac{1}{2}$ —2; wings, $2\frac{3}{4}$ — $3\frac{1}{2}$ lin.

Described from six males and four females. Common; taken on Umbelliferæ in Leicestershire, and again near Barnstaple.

C. annulipes, Thoms., Opusc. Ent., vi., 1874, p. 572, ♀ agrees with this, so far as the description extends;

but the writer doubts whether his species be the same as Wesmael's. Wesmael quotes *annulatus*, Nees, as a synonym, but doubtfully, because the latter has testaceous femora; in his Supplement he changes his mind, and thinks they may be the same, since H.-Schäffer (F. G., cliv., 23) describes the femora as sometimes black. Reinhard's opinion has been already mentioned (see sp. 4). Wesmael also states that the males of his *C. fenestratus* belong to *annulipes*, var. 1 (without pale spots on the abdomen). But *fenestratus*, Nees, Wesm., is made up of the sexes of two different species, and the name ought to be abandoned. Reinhard pronounces *sulcatus*, Nees, ♂ to be certainly the same as *annulipes*, Wesm. (but not necessarily its varieties); and *fenestratus*, Nees, ♂ probably the same as *annulatus*, Nees. This is fortunately almost the last sample of the nomenclature of *Chelonus* we shall have occasion to give. The present insect is clearly not *annulatus*, Nees, nor *annulipes*, Wesm., but var. 1 of the latter, which seems a good species, and requires a name.

7. *Chelonus decorus*, n. s.

Niger, abdomine triangulariter bimaculato; palpis testaceis, basi fuscis; pedibus rufo-testaceis, femoribus anterioribus basi, posticis præter apicem, nigris; tibiis posticis apice basique, tarsis omnibus apice, fuscis. Alæ subfusco-hyalinæ, stigmatе nervisque fuscis, costa et parastigmate cum nervo præbrachiali testaceis, squamulis nigris; areola radialis brevis, lata; abscissa 3tia extus vix concava; alarum inferarum radius sinuatus. Vertex transversus, pone oculos contractus; genæ haud dilatatae. Antennæ ♀ 27-articulatae, ultra medium dilatatae, apice teretiuseculæ, corpore breviores. Fovea frontalis parva, nitida, parum rugulosa. Mesothorax antice variolosus, postice reticulatus. Scutellum confertim variolosum, punctis majoribus undique cinctum. Metathorax a basi declivis, apice truncato, angulis posticis vix dentiformibus. Abdomen postice latius, thorace longius, apice rotundato, more solito scabratum, carinis basalibus nullis. Terebra recondita.

Black; abdomen with 2 triangular basal yellowish spots; palpi and tips of mandibles rufo-testaceous, the former dusky at the base; legs rufo-testaceous, fore and middle femora at the base, hind femora except the apex, black; hind tibiæ fuscous at both ends; all the tarsi testaceous with fuscous tips. Wings subfusco-hyaline, stigma and nervures fuscous, costa, parastigma, and præbrachial nervure testaceous, squamulæ black; radial areolet broader but

not longer than the stigma; 3d abscissa of the radius slightly concave outwardly; radius of the hind wings sinuated. Body scarcely shining. Head with a transverse vertex, slightly contracted behind the eyes, cheeks not dilated; reticulato-rugose, orbits and cheeks striolated, the face transversely; clypeus punctulate, shining; frontal fovea small, shining, somewhat rugulose. Antennæ ♀ 27-jointed, dilated and compressed beyond the middle, not much attenuated at the tips, shorter than the body. Mesothorax in front variolose, rather shining, reticulated before the scutellum, which is thickly variolose, margined with coarser punctures. Metathorax coarsely reticulated, the disk inclined from the base, truncate behind, the angles hardly denticulated. Abdomen longer than the thorax, a little wider behind, rounded, not obtuse, at the apex, depresso-cylindrical, covered with the usual oblong reticulations becoming finer posteriorly, the apex rather shining; basal carinæ none. Terebra concealed. ♀. Length, 2; wings, $3\frac{3}{4}$ lin.

At first sight like *C. dispar*, sp. 8, ♀, but the abdomen is considerably longer in proportion, the antennæ are much more than 16-jointed, and the sculpture is finer. The yellowish abdominal spots are triangular, and widely separated in the middle.

One specimen is in Fitch's collection, the origin of which is not stated.

8. *Chelonus dispar*, n. s.

Niger; abdomen bimaculatum, maculis triquetris, subconfluentibus. *Maris* pedes flavo-testacei, coxis, femorum intermediorum plaga, femoribus posticis præter basin totis, tibiæ posticarum apice basique (hac anguste) nigris, tarsis fuscis basi testaceis: *feminae* trochanteres partim fusci, femora intermedia fere ad apicem nigra. Alæ infumatæ, costa, nervis, stigmatæ, fuscis; parastigmatæ, nervo præbrachiali, squamulis, fusco-testaceis; areola radialis stigmatæ longior vix latior; abscissa tertia extus leviter concava; alarum inferarum radius sinuatus. Vertex transversus, pone oculos contractus; genæ hand dilatatæ. Antennæ ♂ 28-, ♀ 16-articulatæ, ultra medium dilatatæ, apice ipso teretiussculo, corpore multo breviores. Fovea frontalis carinata, geminata, hand nitida. Mesothorax antice punctulato-rugulosus, postice fortiter reticulatus, sulcatus. Scutellum rugulosum. Metathorax brevis, truncatus, bis in longitudinem carinatus, angulis posticis denticulatis. Abdomen quam præcedenti brevius, sculptura solita fortiori; maris apice integrum. Terebra recondita.

Black; abdomen at the base with 2 large triangular yellowish subconfluent spots; legs ♂ flavo-testaceous; coxæ, a streak on the intermediate femora, hind femora except at the base, hind tibiæ at the apex and narrowly at the base, black; tarsi fuscous, 1st joint more or less testaceous; in the ♀ the trochanters are partly fuscous, and the intermediate femora black nearly to the apex. Wings infumated, especially towards the apex; costa, nervures, and stigma fuscous; parastigma, præbrachial nervure, and squamula dull testaceous; radial areolet longer but not broader than the stigma; 3d abscissa of the radius slightly curved; radius of hind wings sinuated. Body scarcely shining. Head with a transverse vertex, contracted behind the eyes, cheeks not dilated; punctulate in front, orbits and cheeks striolated; frontal fovea shallow, geminated by a carina. Antennæ ♂ 28-jointed, filiform to about the 18th joint, thence gradually attenuated, as long as the body; of the ♀ 16-jointed, dilated from the middle to near the apex, the last 3 joints smaller. Mesothorax rather shining in front, punctulato-rugulose, coarsely reticulated or sulcate behind. Scutellum rugulose. Metathorax reticulated, short, truncate, the basal portion more horizontal than in the last species, with 2 medial carinæ, and the hind angles dentiform. Abdomen at the base sulcate, afterwards reticulato-rugose, striated, behind more finely, the apex somewhat shining. Anus ♂ imperforate; terebra ♀ concealed. ♂ ♀. Length, $1\frac{1}{2}$; wings, 3 lin.

Described from two males and one female. The agreement between the sexes is so complete that I cannot do otherwise than join them, though the ♀ was taken separately. It would be mere guess-work to attempt to name them from the books; *C. cylindrus*, Nees, Mon., i., 291, ♂ may perhaps be compared, having 29- (*i. e.*, 28-) jointed antennæ; but it is a larger insect ($2\frac{1}{2}$ lin. long), and otherwise different. *C. fenestratus*, var. β , Nees, might be the ♀, but it has no separate description, and the typical form in either sex is quite beside the mark. Thomson's *C. fenestratus* ♂ has 23-jointed antennæ, and the description is too short; but in any case that name cannot stand. My specimens are old, and some few details cannot well be taken from them.

The two males are from Darenth Wood; the female from Milford Haven.

Reinhard (Berl. ent. Zeit., 1867, p. 360) has proposed to make another genus of those *Cheloni* whose females have 16-jointed antennæ, and the males a perforated abdomen. But the existence of such a species as the

present, together with others indicated by Thomson, shows that there is no necessary correspondence between the sexes in these respects.

9. *Chelonus canescens*, Wesm. (Pl. V., fig. 1).

Chelonus canescens, Wesm., Nouv. Mém. Ac. Brux., 1835, p. 224, ♀; Thoms., Opusc. Ent., vi., 1874, p. 574, ♂ ♀.

Black; abdomen immaculate; palpi pale; mandibles testaceous in the middle; coxæ and upper trochanters black; legs rufotestaceous, fore femora at the base, 4 posterior entirely except the apex, and apical half of hind tibiæ, black, these last with an obsolete dusky ring near the base; tarsi fuscous, the hind pair blackish. Wings subfumato-hyaline, darker towards the apex, stigma and nervures fuscous, costa, parastigma, præbrachial nervure, and squamulæ testaceous; radial areolet broader than the stigma, 3d abscissa of the radius straight, radius of the hind wings straight, except its basal curvature. Body not shining, thinly beset with whitish hairs, which become thicker on the face, so as almost to conceal the surface, and form 2 tufts at the angles of the metathorax. Head minutely subrugulose, almost coriaceous; vertex transverse, contracted behind the eyes; cheeks not dilated; frontal fovea ample, shallow, not shining, nor geminated. Antennæ ♂ 23-jointed (about 20-jointed according to Thomson), somewhat longer than the body; of the ♀ 18-jointed, as long as the body, slightly compresso-dilated beyond the middle, joints 15—17 tapering, 18 abruptly smaller, linear. Mesothorax somewhat shining and punctulate in front, subreticulated with longer punctures before the scutellum, which is minutely punctulate and almost smooth; post-scutellum not dentiform. Metathorax inclined from the base, hardly truncate posteriorly, reticulato-rugose, bluntly 4-dentate, with 2 short medial ridges not reaching the base or the apex. Abdomen hardly as long as the head and thorax, ovate, rounded behind, reticulato-rugulose at the base, and with 2 short carinæ placed obliquely, the reticulations shorter and finer posteriorly, interspersed with indistinct punctiform impressions; abdomen ♀ broader and more rounded than that of the ♂, which is imperforate at the anus. Terebra concealed. ♂ ♀. Length, $1\frac{3}{4}$ — $1\frac{3}{4}$; wings, $2\frac{3}{4}$ —3.

Very like *C. corvulus*, sp. 6, but differing in the antennæ, the pubescence of the face, the testaceous squamulæ, the radial areolet, and the radius of the hind wings. *C. retusus*, Nees, ♀ may be suspected of being

this species; it has 18- (*i. e.*, 17-) jointed antennæ, and the abdomen grooved beneath at the apex to receive the point of the terebra. The latter character means very little, and may be seen in many females accidentally. Wesmael, however, states that its absence is the only reason why he did not join the two species. A greater difficulty seems to arise from the silence of Nees respecting the dense pubescence of the face, which distinguishes *canescens* from all other species. Thomson doubtfully assigns *retusus*, Nees, to his own *caudatus*.

Described from one male and three females. A pair is in Cameron's collection, from Clober, Scotland; Fitch possesses a ♀, and another was taken by me in Bradgate Park, Leicestershire.

10. *Chelonus catulus*, n. s.

Niger, abdomine immaculato; palpis nigricantibus, mandibularum apice rufo. Pedes antici rufo-testacei, femorum basi latius nigra; posteriores nigri, tibiæ intermediarum basi et apice, posticarum basi tantum, trochanteribus inferis omnibus, rufo-testaceis; tarsi fusci, apice potius nigro. Alæ subfuscæ stigmatate, costa, parastigmatate, nervis nigricantibus, præbrachiali modo subrufescente, squamulis nigris; areola radialis stigmatate brevior, latior; abscissa 3tia recta; alarum inferiorum radius subrectus. Corpus opacum, subtiliter confertim punctulatum fere coriaceum. Genæ dilatæ, unde caput subcubicum, pone oculos non contractum; facies albedo-pubescentis; fovea frontalis ampla, geminata; orbitæ cum genis striolatæ. Maris antennæ 32-articulatæ, corpore longiores. Mesothorax punctulatus, prope scutellum subreticulatus; hoc immarginatum. Metathorax brevis, crasse reticulatus, acute bidenticulatus. Abdomen thorace longius, cano-pubescentis, more solito subtilius scabratum, carinis basalibus nullis, ano imperforato.

Black; abdomen immaculate; palpi blackish; tips of mandibles rufous; fore legs rufo-testaceous, $\frac{2}{3}$ of their femora black; 4 posterior legs black, intermediate tibiæ at both ends, hind tibiæ at the base only, and all the lower trochanters, rufo-testaceous; tarsi fuscous, darker at the tips. Wings subfuscous, stigma, parastigma, costa, and nervures blackish, only the præbrachial nervure subrufescent; squamulæ black; radial areolet shorter and broader than the stigma; 3d abscissa straight; radius of hind wings nearly so. Body dull, minutely and thickly punctulate, almost granulated; head transverso-cubical, not contracted behind the eyes, checks dilated; face beset with whitish pubescence; frontal fovea

ample, geminated; cheeks and orbits striolated. Antennæ ♂ 32-jointed, $\frac{1}{4}$ longer than the body, setaceous. Prothorax not produced. Mesothorax somewhat shining, thickly punctulate, subreticulated with confluent punctures before the scutellum, which is also thickly punctulate, and not margined. Metathorax short, transverse, coarsely reticulated, acutely bidenticulate. Abdomen longer than the thorax, sparingly covered with grey pubescence, ovato-cylindrical, depressed at the base and striated with oblong reticulations becoming finer posteriorly to the rounded apex; basal carinæ none; anus not perforated. ♂. Length, $1\frac{1}{2}$; wings $2\frac{3}{4}$ lin.

Most like *C. secutor*, sp. 13, but differing in the imperforate anus, short prothorax, darker wings, and longer antennæ.

Taken at Nunton, near Salisbury, in an osier-ground.

11. *Chelonus pusio*, n. s.

Niger, abdomine immaculato; palpis nigricantibus, mandibularum apice piceo. Femorum anticorum apices cum tibiis ferruginei; tibiæ posteriores ferrugineæ apice basique nigræ; tarsi nigricantes. Alæ fusco-hyalinæ stigmatе nervisque fuscis, parastigmatе nervoque præbrachiali testaceis, squamulis nigris; areola radialis lata, stigmatе brevior; abscissa 3tia modo non recta; alarum inferiorum radius etiam basi vix curvatus. Corpus opacum, confertim subtilius ruguloso-punctulatum. Genæ dilatæ, unde caput subcubicum, pone oculos haud contractum; fovea frontalis minime profunda, subobsoleta. Maris antennæ crassæ 23-articulatæ, setacæ. Mesothorax et scutellum fere coriacea, hoc immarginatum; post-scutellum elevatum, tuberculiforme. Metathorax reticulatus, basi deplanatus, postice truncatus, vix bidenticulatus, medio carinatus. Abdomen, ut assolet, scabratum, baseos carinis duabus inchoatis, ano imperforato.

Black; abdomen immaculate; palpi dusky; mandibles pitchy at the apex; tips of the fore femora, and all the tibiæ, ferruginous, the 4 posterior black at both ends; tarsi blackish. Wings fusco-hyaline, nervures and stigma fuscous, parastigma and præbrachial nervure testaceous, squamulæ black; radial areolet broad, shorter than the stigma; 3d abscissa almost straight; radius of hind wing hardly curved at the base. Body dull, thickly and minutely ruguloso-punctulate. Head transverso-cubical, not contracted behind the eyes; cheeks dilated; frontal fovea very shallow, subobsolete. Antennæ 23-jointed, stout, setaceous, very slightly tapering towards the apex (hence probably a ♂). Mesothorax and scutellum thickly

and minutely punctulate, almost coriaceous; the latter not margined; post-scutellum elevated into a tubercle. Metathorax horizontal, truncated behind, reticulato-rugulose, carinated in the middle, hardly bidentulate. Abdomen deplanato-cylindrical, broader posteriorly, obtuse (hence probably a ♂), sculptured as usual, and with two inchoate basal carinæ; anus not perforated. ♂. Length, $1\frac{1}{3}$; wings, $2\frac{1}{3}$ lin.

Very like *sulcatus*, Nees, ♂, but distinguished by wanting the anal fissure. The sex can only be inferred from the antennæ (which are not quite conclusive) and from the obtuse abdomen, which is not likely to be that of a ♀.

The single specimen was bred by W. H. B. Fletcher from *Elachista atricomella*, Staint., or *E. luticomella*, Zell.

12. *Chelonus risorius*,* Reinh.

Chelonus risorius, Reinh., Berl. ent. Zeit., 1867, p. 360, ♂.

Black; abdomen immaculate; palpi black; fore tibiæ and tips of the fore femora testaceous; or all the tibiæ like the tarsi,

* The following is another large species, the ♂ of which exhibits the anal fissure. As the ♀ has not been before noticed, it may be useful to describe it here:—

C. nitens, Reinh., Berl. ent. Zeit., 1867, p. 360.

Black, fore femora at the apex, fore tibiæ, intermediate tibiæ on one side, or entirely, and the hind pair in the middle, testaceous. Wings subhyaline, stigma and nervures fuscous, parastigma and præbrachial testaceous, squamulæ black; radial areolet twice as large as the stigma, 3d abscissa slightly curved, radius of hind wings straight except at the base. Head minutely rugulose, vertex transverse, cheeks dilated. Antennæ ♂ broken (25-jointed according to Reinhard); of the ♀ 27-jointed in one specimen, broken in the other. Mesothorax punctate, shining in front, reticulato-rugulose behind; scutellum shining, punctulate. Metathorax dull, rugose, reticulated, bidentate. Abdomen with the usual sculpture, that of the ♂ longer than the head and thorax, subcylindrical, apical fissure three times broader than its length, margined, ciliated; of the ♀ shorter, rounded at the sides, and wider behind. Terebra and valvula ventralis visible, prolapsed. ♂ ♀. Length, $2\frac{1}{2}$; wings, 5 lin.

Equal in size to *C. inanitus*. The sexes correspond in all respects, and the antennæ of the ♀ show that *C. crosus*, Schiëff., F. G., cliii., 9, which has 16-jointed antennæ, does not belong to this species.

A male and two females were taken by Sharp in the Sierra Nevada.

piceous. Wings infumated, stigma and nervures fuscous, only the præbrachial testaceous; squamule black; 3d abscissa straight; radius of hind wings straight except a slight basal curve. Body slightly shining, punctulato-rugulose. Head finely aciculated, striolated on the cheeks and orbits, transverso-cubical, not contracted behind the eyes, cheeks subdilated; frontal fovea not shining. Antennæ shorter than the body, 20- (according to Reinhard 18-) jointed. Mesothorax punctulato-rugulose, coarsely reticulated just before the scutellum, which is rugose. Metathorax reticulated, acutely bidenticulate at the hind angles, and obtusely on each side of the base. Abdomen longer than the head and thorax, somewhat wider behind, striato-rugose, the rugosity becoming gradually finer to the rounded aciculated apex; anus ♂ perforated, the fissure ten times broader than long, extending to some distance along the sides of the abdomen, its margins very smooth and shining. ♂. Length, $1\frac{1}{2}$ — $2\frac{1}{2}$; wings, 3—5 lin.

I have not seen the ♀, which Reinhard conjectures may possibly be *C. submarginatus*, Schæff., F. G., cliii.

Reared by Billups from the galls of *Andricus terminalis*, Fab., in which numerous insects, including some lepidopterous larvæ, find food and shelter.

13. *Chelonus secutor*, n. s.

Niger, abdomine immaculato; palpis nigricantibus, mandibularum apicibus piceis. Pedes ferruginei, trochanteribus superis, femorum anteriorum basi, posticis præter lateris superioris lituram totis, tibiæ posticarum apice, tarsis omnibus, nigris. Alæ infumatæ, stigmatæ nervisque nigricantibus, squamulis nigris; areola radialis brevis, lata, stigmati æqualis; abscissa 3tia subbisinuata; alarum inferiorum radius basi tantum leviter inflexa. Corpus elongatum, parum nitidum, subtilius rugulosum. Caput scabriculum orbitis striolatis, propter genarum tumorem postice latius; facies cano pubescens; fovea frontalis ampla, geminata, nitida, postice striolata, parum profunda. Antennæ 25-articulatæ, corpore non breviores. Prothorax eximius, productus, striolatus. Mesothorax confertim punctulatus, juxta scutellum variolosus; hoc immarginatum. Metathorax subtiliter reticulatus, truncatus, angulis posticis obtusis. Abdomen capite et thorace haud brevius, a basi inde ad apicem obtusum sensim dilatatum, sculptura solita, carinis duabus baseos inchoatis, rima anali transversa, oblonga.

Black; abdomen immaculate; palpi dusky; mandibles pitchy at the apex; legs ferruginous, upper trochanters, 4 anterior femora at the base, hind pair entirely except a spot on the upper edge, 4 posterior tibiæ at the apex, and all the tarsi, blackish. Wings

infumated, nervures stout, and, together with the stigma and parastigma, blackish; squamulæ black; radial areolet short, broad, as large as the stigma; 3d abscissa slightly bisinuated, convex outwardly near the apex; radius of hind wings somewhat curved near the base, radial areolet narrowly lanceolate. Body dull, elongate, minutely rugulose. Head finely shagreened, striolated round the orbits; cheeks much dilated, so that the head seen from above is widest behind the eyes; face thinly beset with whitish hairs; frontal fovea large, shallow, smooth in front, striolated behind, geminated. Antennæ 25-jointed, as long as the body, and much longer than those of *C. sulcatus*, Nees, sp. 15, ♂. Prothorax unusually produced, forming a distinct neck, somewhat shining, striolated. Mesothorax thickly punctulate, variolose with larger punctures before the scutellum, which is also punctulate and not margined. Metathorax finely reticulated, transverse, truncate, not denticulated. Abdomen as long as the head and thorax, sculptured as usual, with 2 inchoate carinæ among the basal striæ, narrowest at the base, and increasing in width to the obtuse apex, beneath which is an oblong transverse fissure with a small angular projection on its upper edge, and ciliated with whitish hairs. ♂. Length, $1\frac{1}{2}$; wings, $2\frac{3}{4}$ lin.

The elongate form, produced prothorax, shape of the head, and length of the antennæ, distinguish this from *sulcatus*, Nees, *latrunculus*, n. s., and *parvicornis*, Schöff. It belongs to Thomson's last section, with cubical head, immarginate scutellum, &c., but apparently not to any of his species.

I found one male in an osier-ground at Nunton, near Salisbury.

14. *Chelonus parvicornis*, Schöff.

Chelonus parvicornis, Schöff., F. G., cliv., 30; Wesm., Nouv. Mém. Ac. Brux., 1838, p. 162, ♀; Reinh., Berl. ent. Zeit., 1867, p. 359, ♂ ♀.

C. eurytheca, Wesm., *lib. cit.*, 1838, p. 158, ♂ (wrongly called ♀).

Black; abdomen immaculate; palpi, mandibles at the apex, and legs, testaceous; coxæ black, the fore pair somewhat pitchy; fore femora fuscous on both edges, posterior blackish, the extreme tips testaceous; hind tibiæ broadly black at the apex, narrowly fuscous at the base; tarsi fuscous. Wings infumated; a whitish streak under the stigma, which, with the nervures, is fuscous; parastigma and præbrachial hardly paler; radial areolet larger than the stigma, 3d abscissa straight, radius of hind wings very slightly

curved at the base; squamulæ testaceous. Head and mesothorax somewhat shining, minutely ruguloso-punctulate; the former almost coriaceous, not contracted behind the eyes, cheeks sub-dilated, frontal fovea smooth, shining, carinated in the middle. Antennæ ♂ as long as the body, 27—30-jointed (27- in English specimens); of the ♀ 16-jointed. Mesothorax more rugulose than the head, especially near the scutellum, which is shining in the middle. Metathorax reticulated, rugose, bidentulate. Abdomen rather shorter than the head and thorax, sculptured as usual; at the apex is a large transversely ovate fissure, not quite twice as broad as long, ciliated. The ♀, which I have not seen, is said to have the coxæ testaceous at the apex, and the anus emarginate beneath to receive the point of the subexserted terebra. ♂ ♀. Length, $1\frac{1}{2}$; wings, $2\frac{3}{4}$ lin.

Described from three males taken in Epping Forest, Yorkshire, and near St. Albans; and a fourth bred by W. H. B. Fletcher, July 1st, from *Scoparia phæoleuca*, Zell. Reinhard examined five males and nine females from Germany and Switzerland; two were reared by Von Heyden from the cases of a *Tineid* feeding on juniper.

15. *Chelonus sulcatus*, Nees. (Pl. V., fig. 1 a).

Chelonus sulcatus, Nees, Mon., i., 293, ♂ (wrongly called ♀; antennæ 23-jointed); Reinh., Berl. ent. Zeit., 1867, p. 359, ♂ ♀; not of Wesm.

C. fenestratus, Nees, Mon., i., 292, ♀ only; not the vars.; antennæ 17- (*i. e.*, 16-) jointed; Wesm., Nouv. Mém. Ac. Brux., 1835, p. 223, ♀ only.

C. contractus, Nees, Mon., i., 298, ♀; not of Ratz., Ichn. d. Forst., ii., 24, which is there wrongly placed under *Ascogaster*.

Black; abdomen immaculate; palpi, tips of mandibles, 4 anterior femora at the apex, their tibiæ, and a broad ring on the hind tibiæ, testaceous; middle tibiæ often annulated with fuscous near the base. Wings infumated; a whitish streak under the stigma, which, with the nervures and costa, is fuscous; parastigma and præbrachial nervure testaceous; radial areolet short, of the same size as the stigma, 3d abscissa straight, radius of hind wings very slightly curved at the base; squamulæ fuscous. Sculpture as in the last species; head transverse, contracted behind the eyes, cheeks not dilated; frontal fovea dull, rugulose, carinated in the middle. Antennæ ♂ as long as the body, 23—24-jointed; of the ♀ much shorter, 16-jointed, filiform. Scutellum

rugulose. Metathorax bidenticulate. Abdomen ♂ with an oblong, reniform anal fissure, thrice as broad as long, margined and ciliated all round. ♂ ♀. Length, $1\frac{1}{2}$; wings, $2\frac{3}{4}$ lin.

Described from one male and ten females, all taken at the same time and place. A second male in Fitch's collection is rather doubtful, having the radial areolet longer and more acute; the antennæ are 24-jointed, and the other characters are those of the description, except that the hind tibiæ are testaceous only at the base. Unless the sexes of these small species are taken or bred together, and in some numbers, they can scarcely be determined. Formerly found by me rather commonly on umbellate flowers in Leicestershire. Reinhard examined 32 males and 37 females from central Europe; some of them were bred from *Retinia buoliana*, Schiff. Brischke reared one from a *Tortrix*, and another from a *Gelechia*, perhaps *G. mulinella*, Zell.; he describes the cocoon as 6 mm. long, elliptical, white, shining, and transparent.

The synonymy given above is that determined by Reinhard, with the exception of *C. lugubris*, Wesm., *Nouv. Mém. Ac. Brux.*, 1835, p. 219, ♂ (wrongly called ♀); and *C. sulcatus*, Jurine, *Hym.*, 291, pl. xii., f. 41, ♀, which are both questionable. Jurine, it is true, is the author of the name *sulcatus*, but his figure, unaccompanied by a description, is a mere hieroglyphic (as Wesmael remarks); the only thing certain is that he has represented some species of which the ♀ has 16-jointed antennæ. Thomson describes no *sulcatus*, but observes that his *C. depressus* (*Opusc. Ent.*, vi., 1874, p. 576, antennæ ♂ 21-jointed) is much like *C. sulcatus*, Wesm. He has also restored the confusion which Reinhard laboured to clear up, by making *C. lugubris*, Wesm., a synonym of *C. parvicornis*, Thoms. (not of Schæff. and Reinh.), and by redescribing *C. fenestratus*, Nees, in terms altogether vague, as a distinct species. *C. parvicornis*, Thoms., seems to be the following species.

16. *Chelonus latrunculus*, n. s.

Niger, abdomine immaculato, palpis concoloribus, mandibulis apice rufescentibus. *Femina* pedes cum trochanteribus rufotestacei, coxis nigris, tarsis et tibiæ posticarum apicibus infuscatis. *Maris* femora anteriora medio late, postica tota, tibiæ posticæ apice, nigra. A *C. sulcato* haud facili negotio dignoscendus.

Caput, ut videtur, magis cubicum, genis deorsum productis, dilatatis, oculis minoribus, antennis multo tenuioribus, *maris* 22-, *femine* 16-articulatis, ultra medium incrassatis, flagelli basi rufa. Abdomen minus ovatum juxta basin angustatum, lateribus magis parallelis; *maris* rima anali potius cordiformi vel subcirculari, subtus emarginata, ibidemque ciliata, limbo undique depresso splendente; pedibus denique *femine* fere totis testaceis.

Black; abdomen immaculate; palpi black; mandibles rufescent at the tips; legs ♀ rufo-testaceous, including the trochanters, coxæ black, tarsi and tips of hind tibiæ fusciscent; of the ♂ the four anterior femora are black, testaceous at both ends, hind femora entirely, and their tibiæ at the apex, black. Very like *C. sulcatus*, Nees, but distinguished as follows:—Head less transverse, more orbicular, cheeks produced downwards, and somewhat dilated; eyes smaller; antennæ more slender, of the ♂ 22-, of the ♀ 16-jointed, compresso-dilated beyond the middle, the last 3—4 joints abruptly diminishing; 1st joint of the flagellum testaceous. Abdomen less oval, more contracted at the base, the sides more parallel; anal aperture of the ♂ narrower and longer, *i. e.*, more cordiform, emarginate on the lower side and there ciliated, with a depressed shining margin. ♂ ♀. Length, 1½; wings, 2¾ lin.

The colour of the legs in the female renders it probable that this may be *C. parvicornis*, Thoms., Opusc. Ent., vi., 1874, p. 579, ♂ ♀, but not of Schäffer and Wesmael. The sexes differ only in the colour of the femora, and as they were taken together I presume that they are correctly paired.

Described from two pairs captured in Northants, and another from Cadder Wilderness, near Glasgow, in Cameron's collection; also a male taken by Fitch at Maldon.

17. *Chelonus exilis*, n. s.

Niger, abdomine immaculato, palpis nigricantibus, mandibulis apice rufis. Pedes antiei testacei, femorum basi nigra; posteriores nigri tibiis obscure ferrugineis, posticis apice basique fuscis; tarsi fuscii. Alæ fumato-hyalinæ, stigmatate nervisque pallide, parastigmatate et costa obscurius fuscis; squamulæ nigricantes; areola radialis stigmatate major; abscissa 3tia recta; alarum inferiorum radius sinuatus. Corpus parum nitidum, subtiliter scabriculum, parcius cano pubescens. Caput subcubicum, pone oculos haud contractum, genis dilatatis, subcoriaceum, clypeo levioere; fovea frontalis minima, obsoleta. Antennæ *maris* 23-, *femine* 16-articulatæ. Mesothorax subtiliter punctulatus, subcoriaceus. Scutellum

immarginatum; post-scutellum haud elevatum. Metathorax reticulatus, in longitudinem bis terve carinulatus, obtuse bidenticulatus. Maris rima analis fere orbicularis; feminae terebra conspicienda quidem, sed anum haud attingens, recta, valvulis compressis, testaceis, pilosis.

Black; abdomen immaculate; palpi blackish; mandibles tipped with rufous; fore legs testaceous, their femora black at the base; posterior legs black, their tibiae obscurely rufous, the hind pair fuscous at the base and apex; tarsi fuscous. Wings fumato-hyaline, nervures and stigma pale fuscous, parastigma and costa darker; squamulae fuscous; radial areolet larger than the stigma; 3d abscissa straight; radius of the hind wings sinuated. Body dull, minutely scabrous, and sparingly beset with grey pubescence. Head subcoriaceous, subcubical, not contracted behind the eyes, cheeks dilated; clypeus almost smooth; frontal fovea minute, obsolete. Antennae ♂ 23-, ♀ 16-jointed. Mesothorax punctulate, subcoriaceous. Scutellum not margined; post-scutellum not elevated. Metathorax reticulated, with 2 or 3 longitudinal raised lines, bluntly bidenticulate. Abdomen as long as the head and thorax, of the ♂ slightly widened and obtuse behind, of the ♀ elliptical; finely reticulated at the base, afterwards punctulate; basal carinae none. Anal aperture of the ♂ nearly circular; terebra of the ♀ visible, but not reaching the anus; valves testaceous, compressed, hairy. ♂ ♀. Length, $1\frac{1}{3}$; wings, $2\frac{1}{2}$ lin.

This species differs from *C. parvicornis*, Schaff., in the number of joints of the antennae; from *sulcatus*, Nees, in its more slender form, dilated cheeks, and longer antennae; from *latrunculus*, n. s., similarly, and also in the colour of the legs.

Described from two males and a female, which were bred, June 5th, by Warren from *Cosmopteryx Lienigiella*, Zell.

18. *Chelonus basalis*, Cur.

Chelonus basalis, Cur., B. E., 672, No. 8, ♀.

Black; basal third of the abdomen determinately testaceous; legs black; fore femora at the apex, their tibiae, and the base of the hind tibiae, testaceous. Wings fuscous, nervures and stigma fuscous; radial areolet, &c., as in the other small species. Antennae ♀ 16-jointed, stout, shorter than the body, incrassated before the apex. Body dull, minutely punctulate, pubescent. Metathorax bidenticulate, and with two medial longitudinal carinae. Terebra concealed. ♀. Length, $\frac{3}{4}$; wings, $1\frac{1}{2}$ lin.

The smallest known British species, and easily distinguished by the colour of the abdomen. I have not seen the male, but most likely it is one of those furnished with an anal perforation. The two specimens at hand are very old, and in no condition to be described.

Discovered by Walker, and briefly noticed by Curtis, *l. c.* One of the original specimens is in my collection, and more, as I learn from Prof. Westwood, in the Oxford Museum.

iii. ASCOGASTER, *Wesm.*

Wesm., *Nouv. Mém. Ac. Brux.*, 1835, p. 226.

Eyes glabrous. First cubital areolet distinct from the præ-discoidal. Otherwise identical with the preceding genus.

A convenient artificial section of *Chelonus*, improperly called a genus, co-extensive with Section III. of Nees. Wesmael originally included in it *Chelonus dentatus*, Panz., but for this he afterwards formed, with better reason, the genus *Phanerotoma*. The species have been revised by Reinhard in the *Berl. ent. Zeit.*, 1867, where he describes seventeen, of which nine have been detected in Britain. These appear to have been all known to Haliday and Curtis; the latter is the only English writer who has described any, but the descriptions are mostly insufficient for their determination. We have added a single new species.

TABLE OF SPECIES.

- | | | |
|------|---|-------------------------------|
| (14) | 1. Trochanters rufous (the anterior sometimes fuscous at the base). | |
| (3) | 2. Clypeus truncate, reflexed, with a medial acute denticle | 1. <i>instabilis</i> , Wesm. |
| (2) | 3. Clypeus obtusangular or rounded. | |
| (5) | 4. Hind tibiæ fuscous, with a white ring.. | 2. <i>annularis</i> , Nees. |
| (4) | 5. Hind tibiæ rufous, tipped with fuscous. | |
| (9) | 6. Coxæ rufous, sometimes black at the base. | |
| (8) | 7. Mesothorax with distinct* punctures.. | 3. <i>rufipes</i> , Latr., ♂. |
| (7) | 8. Mesothorax reticulato-rugose | 4. <i>elegans</i> , Nees. |
| (6) | 9. Coxæ black. | |
| (11) | 10. Hind tarsi whitish at the base.. . . | 3. <i>rufipes</i> , Latr., ♀. |
| (10) | 11. Hind tarsi entirely fuscous, or sometimes reddish at the base. | |

* Except a space before the scutellum, and the mesothoracic sutures, which in all the species are reticulato-rugose.

- (13) 12. Mesothorax punctured; clypeus tridentate 5. *rufidens*, Wesm.
 (12) 13. Mesothorax reticulato-rugose; clypeus obtusangular 6. *Ratzeburgii*, n. s.
 (1) 14. Trochanters black.
 (18) 15. Mesothorax punctured.
 (17) 16. Clypeus rounded.. .. . 7. *variipes*, Wesm.
 (16) 17. Clypeus bidentate 8. *bicarinatus*, Schöff.
 (15) 18. Mesothorax reticulato-rugose.
 (20) 19. Front impressed with a distinct margined fovea 9. *armatus*, Wesm.
 (19) 20. Front with an obsolete fovea, which is not margined 10. *4-dentatus*, Wesm.

1. *Ascogaster instabilis*, Wesm. (Pl. V., fig. 2).

Ascogaster instabilis, Wesm., Nouv. Mém. Ac. Brux., 1835, p. 227; Reinh., Berl. ent. Zeit., 1867, p. 364; Thoms., Opusc. Ent., vi., 1874, p. 582, ♂ ♀.

A. Esenbeckii, Cur., B. E., 672, No. 8, ♂.

A. pallida, Ruthe, Stett. Zeit., 1855, p. 293.

Chelonus femoralis and *rufiventris*, Schöff., F. G., cliv.

Black; antennæ at the base, thorax, abdomen, and legs, more or less rufo-testaceous; trochanters rufo-testaceous. Head very finely punctulato-rugulose; clypeus discrete, depressed, unidentate, the apical margin truncate. Mesothorax and pleuræ punctulate, the latter impressed with a rugose fovea. Metathorax reticulato-rugose, truncate, hardly bidentate. ♂ ♀. Length, $1\frac{1}{2}$ — $2\frac{1}{4}$, wings, 3— $4\frac{1}{2}$ lin.

Palpi black. In the ♂ the base of the abdomen is more or less rufo-testaceous; the fore femora at the apex, and all the tibiæ, usually of the same colour; the middle or hind tibiæ, or both, blackish at the apex. Antennæ longer than the body, 32—39-jointed. Abdomen with two short basal parallel carinæ, sometimes obsolete. Wings slightly infuscated, with a whitish streak under the stigma, which in large specimens has a pale dot at the base; cubital and anal nervures distinct; recurrent nervure interstitial. Antennæ ♀ 35-jointed (in one specimen), as long as the body, the basal half usually testaceous, as are also the thorax more or less, the abdomen at the base or entirely, and the legs; the posterior femora, and hind tibiæ at the apex, commonly fuscous. The largest British species, distinguished by its truncate clypeus, long antennæ, and conspicuously testaceous abdomen; that of the ♂, however, is often wholly black.

Described from two females and four males. Not uncommon; Leicestershire, Devonshire, Yorkshire, Essex, &c. Glanville's Wootton, taken by Dale (Curtis).

2. *Ascogaster annularis*, Nees.

Chelonus annularis, Nees, Mon., i., 286, ♂.

Ascogaster annularis, Reinh., Berl. ent. Zeit., 1867,
p. 369, ♂ ♀.

Black; mandibles, palpi, antennæ at the base beneath, and legs, rufo-testaceous; posterior, or only hind, coxæ, sometimes hind femora above, and hind tibiæ, fuscous, these last with a white ring in the middle; hind tarsi fuscous; trochanters rufo-testaceous. Abdomen with or without two lateral basal testaceous spots, which are sometimes confluent on the disk. Head and thorax thickly and finely punctulato-rugulose; scutellum smooth; metathorax and abdomen reticulato-rugulose, the former with two or three irregular carinæ. Clypeus hardly discrete, rounded at the apex. Mesothoracic sutures obsolete. Mesopleuræ punctulate. Metathorax edentate. ♂ ♀. Length, $1\frac{1}{3}$ — $1\frac{1}{2}$; wings, $2\frac{1}{2}$ —3 lin.

Antennæ ♂ filiform, 23—25-jointed; ♀ distinctly shorter than the body, incrassated before the apex, 21-jointed. The species may be known by its small size, fine sculpture, and the colour of the hind tibiæ.

Described from three males and one female. A male was bred by Bignell from old furze-sticks containing larvæ of *Æcophora lambdella*, Donovan. The others I captured somewhere in the London district. Hellins took a male at Weston-super-Mare. Bred by Von Heyden from one of the *Coleophoridae*, according to Reinhard; by De Graaf from *Xysmatodoma melanella*, Haw., according to Vollenhoven, and by Warren from the same on June 18th.

3. *Ascogaster rufipes*, Latr.

Sigalphus rufipes, Latr., Gen. Crust. et Ins., iv., 14 ♂.

Chelonus rufipes, Nees, Mon., i., 283; Ratz., Ichn. d.

Forst., ii., 24, ♂ ♀.

Ascogaster rufipes, Reinh., Berl. ent. Zeit., 1867,
p. 365; Thoms., Opusc. Ent., vi., 1874, p. 583,

♂ ♀.

A. bidentulus, Wesm., Nouv. Mém. Ac. Brux., 1835,
p. 230, ♀.

Chelonus multiarticulatus, Ratz., Ichn. d. Forst., iii., 25.

C. pallipes, Schöff., F. G., eliv.

Black; ♂ with the antennæ beneath, mouth, and legs, rufo-testaceous; hind coxæ at the base, hind tibiæ at the apex, and their tarsi, fuscous, these last whitish at the base; trochanters

rufo-testaceous. ♀ with the basal half of the antennæ, mouth, anterior femora and tibiæ for the most part, and hind tibiæ at the base, rufo-testaceous; hind tarsi whitish at the base. Head thickly punctulate; clypeus indiscrete, angulated and bidenticulated at the apex. Mesothorax rather shining, punctulate; pleuræ punctato-rugulose; metathorax truncate, quadridentate. ♂ ♀. Length, $1\frac{3}{4}$ —2; wings, $3\frac{1}{2}$ —4 lin.

Var. ♀. Abdomen testaceous at the base; legs as in the ♂.

Antennæ ♂ ♀ 30—35-jointed. Head covered with whitish pubescence. Palpi whitish. Mesothoracic sutures irregularly crenulate. Wings hyaline, with a distinct fuscous cloud under the stigma, before which is a whitish streak.

Common. Bred by Elisha from *Stigmonota Leplastrierana*, Cur., and *Colcophora gryphipennella*, Bouché, both on July 31st. By Bignell from a *Tortrix*. By W. H. B. Fletcher, seven males, from *Coccyx ustomaculana*, Cur., July 5th. By Brischke from *Earius chlorana*, L., and *Tortrix podana*, Scop., on willows; also from *Teras Holmianum*, L., and *Hyponomeuta padellus*, L.; in his 'Wirths-tabelle' it is mentioned as a parasite of *Selandria tenella*, Kl. By Bouché, according to Ratzeburg, from "*Tortrix funerana*," not in the lists (? *Anesychia funerella*, Fab.). Ratzeburg also mentions the remarkable occurrence of two of these Ascogasters in one cocoon found in a larva of *Emydia cribrum*, L., while a second cocoon from the same victim produced a *Microgaster* (iii., 24, 47). The cocoon is white and pellucid, like gold-beater's skin.

4. *Ascogaster elegans*, Nees.

Chelonus elegans, Nees, Mon., i., 287, ♂.

Ascogaster elegans, Reinh., Berl. ent. Zeit., 1867, p. 366, ♂ ♀.

Black, antennæ sometimes at the base beneath, palpi, basal third of the abdomen, and legs, rufo-testaceous, including the coxæ and trochanters; hind coxæ at the base above, 4 posterior tibiæ at the apex, with their tarsi, black. Head rugulose, clypeus not discrete, angulated at the apex. Mesothorax and pleuræ thickly reticulato-rugulose; metathorax obliquely descending at half its length, rugose, bidentate. ♂ ♀. Length, 2; wings, $3\frac{1}{2}$ lin.

I have not seen the ♂. According to Nees and Reinhard the antennæ of the ♂ are wholly black, of the ♀ testaceous at the base beneath. Those of the British ♀

specimen are, however, entirely black, 36-jointed, slightly incrassated before the apex. Nees states the metathorax to be 4-dentate; according to Reinhard, and in the British example, it is 2-dentate. Nees says that all the coxæ are rufo-testaceous; Reinhard that the hind coxæ are black at the base above; in the British specimen all the coxæ are so coloured. These discrepancies, and the want of more specimens, render the identification uncertain. The insect agrees, however, very well with Reinhard's description.

One ♀ taken by Bridgman; Brundall, Norfolk, July 3rd.

5. *Ascogaster rufidens*, Wesm.

Ascogaster rufidens, Wesm., Nouv. Mém. Ac. Brux., 1835, p. 231, ♂; Reinh., Berl. ent. Zeit., 1867, p. 365; Thoms., Opusc. Ent., vi., 1874, p. 584, ♂ ♀.

Chelon rufipes, Schöff., F. G., cliv. (not Latr.).

C. levigator, Ratz., Ichn. d. Forst., iii., 25.

Black, antennæ ♀ on their basal half (of the ♂ only beneath), mandibles, palpi, and legs, rufo-testaceous; coxæ black, trochanters rufo-testaceous; tarsi, hind femora, and tibiæ, fuscous in the middle. Head finely and thickly punctulate, clypeus hardly discrete, angulated in front and subtridentate. Mesothorax and pleuræ rather shining, strongly punctured. Metathorax bidentate, Mesothoracic sutures distinct, crenulate. ♂ ♀. Length, $1\frac{3}{4}$ —2; wings, $3\frac{1}{2}$ —4 lin.

Var. The fuscous colour on the legs more or less obsolete.

Described from 27 specimens. Antennæ ♂ ♀ 32—34-jointed. Face covered with white pubescence, faintly carinated above. Mandibles testaceous. Mesothorax punctate, in the middle rugose with confluent punctures. Scutellum shining, punctulate. Metathorax reticulato-rugose. Abdomen bicarinated at the base. Wings slightly tinted, but not with a distinct fuscous cloud, as in *rufipes*.

Common. Bred by Fitch from *Arctia caia*, L., June 30th; by Elisha from *Teleia vulgella*, Hüb., July 31st; by Bignell from *Gracilaria syringella*, Fab., July 26th. Taken in Scotland by Cameron and bred by him on July 1st from *Andricus terminalis* gall. Ratzeburg's *levigator* is said by Brischke to be a parasite of *Saperda populnea*, L., and obtained from excrescences on *Populus*

tremula inhabited by that longicorn; also bred by Brischke from *Laverna Hellerella*, Dup. Cocoon white, pellucid, like that of *A. rufipes*.

6. *Ascogaster Ratzburgii*, n. s.

Niger, palpis fuscis; trochanteribus, femoribus tibiisque anterioribus, rufo-testaceis, illis basi, his apice, latius fuscis; tarsis etiam fuscis. Caput rugulosum, clypeo non discreto, antice angulato. Thorax totus cum pleuris confertim reticulato rugosus; metathorax edentatus. Alæ leviter infuscatae; areola radialis brevis, stigmati æqualis; radii abscissa tertia regulariter curvata; nervus recurrens in areolam cubitalem primam rejectus.

Black, palpi fuscous; trochanters, anterior femora and tibiæ, rufo-testaceous, the base of the former and the apex of the latter, broadly fuscous; tarsi fuscous. Head rugulose, clypeus indiscrete, angulated in front. Thorax and pleuræ thickly reticulato-rugose; metathorax unarmed. Wings slightly infuscated; radial areolet short, of the same size as the stigma; 3d abscissa of the radius regularly curved; recurrent nervure rejected. ♂. Length, 2; wings, 3½ lin.

Antennæ somewhat longer than the body, 34-jointed, entirely black. Mandibles rufous. Face covered with white pubescence; front carinated, and with the usual shallow fovea above the antennæ immarginate. Hind legs wholly black, except the trochanters. Radial areolet not elongate and acuminate as in other species, but the 3d abscissa of the radius regularly curved throughout its length, as in *Microctonus*.

One ♂ taken by Bridgman, July 3rd, at Brundall, Norfolk, at the same place and time as *A. elegans*, Nees; but the two insects are abundantly distinct.

7. *Ascogaster variipes*, Wesm.

Ascogaster variipes,* Wesm., Nouv. Mém. Ac. Brux., 1835, p. 234, pl. ii. (wing); Reinh., Berl. ent. Zeit., 1867, p. 366; Thoms., Opusc. Ent., vi., 1874, p. 587, ♂ ♀.

Black, fore femora at the apex, fore tibiæ entirely, middle and hind tibiæ at the base, rufo-testaceous; trochanters black. Mesothoracic sutures obsolete. Head thickly punctate, clypeus discrete,

* The Latin *varus*, "crooked," is confounded with *varius*, "diversified," in too many entomological names, and is likely to mislead those who expect to find a meaning in descriptive epithets.

rounded in front, not tridentate. Mesopleuræ and metathorax reticulato-rugose, the latter truncate, bidentate. Abdomen ♀ sometimes testaceous at the base. ♂ ♀. Length, $1\frac{3}{4}$ —2; wings, $3\frac{1}{2}$ —4 lin.

Antennæ 33—35-jointed. Face feebly carinated. Thorax and scutellum granulated; mesothoracic sutures obliterated. Wings slightly tinted. The black trochanters distinguish this from all the preceding species.

One ♂ taken in Epping Forest, and another by Bridgman in Workhouse Lane, Norwich, July 6th.

8. *Ascogaster bicarinatus*, Schöff.

Chelonus bicarinatus, Schöff., F. G., cliv., 10. c. ♀.

Ascogaster bicarinatus, Reinh., Berl. ent. Zeit., 1867, p. 368, ♀.

Black, palpi dusky; anterior femora at the apex, fore tibiæ entirely, and hind tibiæ at the base, rufo-testaceous; trochanters black. Head buccate, punctato-rugulose; clypeus scarcely discrete, rounded, bidentate. Mesothorax and pleuræ thickly punctulate, somewhat shining. Metathorax reticulato-rugulose, with 2 carinæ diverging in the middle; obtusely bidentate. ♂ ♀. Length, $1\frac{3}{4}$; wings, $3\frac{1}{2}$ lin.

Antennæ ♂ much longer than the body, 36-jointed. Those of the original ♀ example of Herrich-Schäffer, examined by Reinhard, were broken, but 24 joints remained. I have not seen the ♀. Face carinated; viewed from above the carina appears like a small spine. Wings infuscated; recurrent nervure interstitial. In one ♂ the base of the abdomen is obscurely rufescent; in another the 2d suture is indicated by a transverse depression. Closely allied to *variipes*, but the clypeus is toothed in front, and the antennæ of the ♂ longer. From *armatus*, Wesm., it differs in the finer sculpture, the toothed clypeus, and the shallower, immarginate, less shining frontal excavation.

Two males taken in Leicestershire, and one in Herts.

9. *Ascogaster armatus*, Wesm.

Ascogaster armatus, Wesm., Nouv. Mém. Ac. Brux., 1835, p. 233; Reinh., Berl. ent. Zeit., 1867, p. 363, ♂ ♀.

Chelonus luteicornis, Schöff., F. G., cliii., 8, ♂ ♀.

Black, palpi black, base or basal half of the antennæ, 4 anterior femora at the apex, fore tibiæ entirely, 4 posterior tibiæ at the base, rufo-testaceous or rufo-piceous; trochanters black; abdomen

♂ sometimes obscurely rufescent at the base, of the ♀ rufo-ferruginous with the apex black. Head broad, rugulose, buccate, front with a deep, shining, fovea margined on each side; clypeus discrete, rounded, edentate. Mesothorax, pleuræ, and metathorax reticulato-rugose, the last bidenticulate. ♂ ♀. Length, $2\frac{1}{2}$; wings, $3\frac{1}{2}$ lin.

Among the four species with black trochanters this may be known at once by the mesothorax not being punctate, but rugose, and by the smooth, deep, margined, frontal fovea. Antennæ ♂ rather longer than the body, 36-jointed (in one specimen); those of the ♀ shorter, thickened beyond the middle, 37—38-jointed. In the only British example, which is a ♂, joints 1—3 are testaceous, with a fuscous line above; and the palpi are not black, but dingy testaceous. The abdomen is entirely black, as in the ♂ described by Wesmael.

The specimen is in Bridgman's collection, and was taken at Buckenham, Norfolk, August 17th. It is accompanied by a broken example, which was named by Reinhard, in Fitch's collection.

10. *Ascogaster quadridentatus*, Wesm.

Ascogaster quadridentatus, Wesm., Nouv. Mém. Ac. Brux., 1835, p. 237; Reinh., Berl. ent. Zeit., 1867, p. 367; Thoms., Opusc. Ent., vi., 1874, p. 588, ♂ ♀.

Chelonus similis, Ratz., Ichn. d. Forst., i., 42, pl. vii., f. 16 (not of Nees).

C. impressus, Schöff., F. G., cliii., 9.

C. quadridens, Schöff., F. G., cliv., 10.

Black, antennæ at the base, fore tibiæ, fore femora at the apex, posterior tibiæ often at the base narrowly, rufo-testaceous. Head finely rugulose, clypeus hardly discrete, angulated at the apex, not tridentate. Mesothoracic sutures obsolete. Mesothorax, mesopleuræ, and metathorax reticulato-rugose, the last 2—4-dentate, ♂ ♀. Length, $1\frac{3}{4}$ —2; wings, $3\frac{1}{2}$ —4 lin.

Var. ♂ ♀. Antennæ entirely black; of the ♀ 33-jointed.

Antennæ ♂ 29—30-jointed, 1st joint black tipped with testaceous, the following joints also testaceous, especially on the under side, becoming darker to the middle, the rest black. Face covered with short ashy pubescence, having a fine medial carina reaching from near the clypeus to the ocelli. Clypeus minutely angulated in the middle, the angle somewhat raised. Mandibles black, sometimes

testaceous at the points; palpi testaceous or dusky. Metathorax armed with 4 strong teeth, 2 lateral, and 2 shorter, intermediate. Wings very slightly tinted, with traces of a decolorous line below the blackish stigma; 2d cubital areolet broader and shorter than in *varipes*, receiving the recurrent nervure near its base. Antennæ ♀ 34-jointed, wings more distinctly tinted near the stigma. One ♀ described by Wesmæl had the recurrent nervure interstitial in one wing, and everted in the other.

Of 11 British specimens, 10 belong to the variety with black antennæ, and nine are females. One ♀ was bred June 25th from pupa of *Endopisa nigricana*, Ste., at Worcester by J. E. Fletcher; another from galls of *Cynips Kollari*, Hart., and a third from *Eupithecia absinthiata*, L. These are in Fitch's collection. Reared by Ratzeburg from *Hedya ocellana*, Fab., when in 1839 that *Tortrix* was the pest of German apple trees. Bred by Von Heyden, according to Reinhard, from *Carpocapsa splendidana*, Hüb. By Goossens, according to Giraud, from *Pardia tripunctana*, Fab. Brischke reared it from *Tortrix rosana*, L., *heparana*, Schiff., *Dictyopteryx Bergmanniana*, L., *Pædisca Solandriana*, L., *Opadia funebrana*, Tr., *Endopisa nigricana*, Ste., and other *Tortricidæ*; also from *Hyponomeuta padellus*, L., *malinellus*, Zell., *Laverna Hellerella*, Dup.; from a sawfly, *Nematus leucostictus*, Hart., and a dipteran (?) *Anthomyia albimana* (perhaps *Heteroneura albimana*, Meig., which, however, is far removed from *Anthomyia*). Captured by Curtis at Shotover, near Oxford; by me in Northants, one male, three females; by Fitch at Hastings and Maldon; near Guildford, by Capron; and at Headley Lane, by Billups. *Chelonus impressus*, Schæff., was so named from an accidental impression marking one of the abdominal sutures.

iv. SPHÆROPYX, Hal.

Hal., Ent. Mag., i., 266 (1833); *Rhitigaster*, Wesm., Nouv. Mém. Ac. Brux., 1835, p. 247.

Abdomen with two visible sutures; lateral margins not reflexed; beneath with two teeth, pointing backwards. Mesothoracic sutures distinct. Intermediate tibiæ simple. First cubital areolet distinct from the prædiscoidal. Recurrent nervure rejected. Præ- and pabrachial areolets subequal. Terebra subexserted, obtuse, ensiform.

This genus is placed last in the subfamily, as serving to connect the *Chelonides* with the *Microgasterides* and

Agathidides. The abdomen, though tending to lose the form of a carapace, still shows a similarity to that of *Chelonus*; the 1st segment, thorax, and head, are like those of *Agathis*; the terebra and its valves are formed as in *Microgaster*. There seems to be no reason why the name *Sphaeropyx* of Haliday should be neglected in favour of Wesmael's wrongly spelt *Rhiti-gaster*, which is of later date. The subgenus *Acampsis*, Wesm., formed for the reception of *Chelonus alternipes*, Nees, differs from *Sphaeropyx* in that a portion of the 4th abdominal segment is visible; but the character is not of generic value, and the species is not British.

1. *Sphaeropyx irrorator*, Fab. (Pl. V., fig. 3).

Ichneumon irrorator, Fab., E. S., ii., 177; cf. DeGeer, Mém. I., iv., 29, pl. xxxvi., ff. 12, 13.

Chelonus irrorator, Nees, Mon., i., 276, ♀; Ratz., Ichn. d. Forst., iii., 25.

Rhiti-gaster irrorator, Wesm., Nouv. Mém. Ac. Brux., 1835, p. 248, ♂ ♀; Thoms., Opusc. Ent., vi., 1874, p. 555; St. Farg., Hym., pl. xliv., f. 4; S. v. Voll., Schets., ii., tab. 5 (♀ and ♂ abdomen).

Black, with whitish pubescence; segment 3 aureo-sericeous; legs hirsute, fore femora at the apex, and their tibiæ on one side, testaceous; middle tibiæ dull testaceous at the base; hind tibiæ testaceous with black tips. Wings subhyaline towards the base, the apical half fuscous; stigma ferruginous; beneath it is a whitish spot. Metathorax rugose, canaliculated. Abdomen showing 3 segments, rugose, clavate. Terebra very short. ♂ ♀. Length, 4—5; wings, 8—10 lines.

Antennæ about as long as the body, 50-jointed. Head narrower than the thorax; clypeus deeply impressed on each side at the base; face carinated. Mesothoracic sutures distinct, the 2 lateral much deeper than the middle one. Before the smooth scutellum are two deep impressions. Metathorax shining, rugose, canaliculated in the middle. Abdomen longer than the head and thorax, gradually widened to the apex; segments 1—2 rugose, dull; segment 1 bidentulate at the base, bicarinated, the carinæ continued upon segment 2, but more faintly; segment 3 very convex, less rugulose, and covered above with adpressed hairs, forming a golden sericeous spot. Belly concave, carinated in the middle, armed just behind the terebra with 2 acute teeth pointing backwards.

Var. Segment 2 blood-red with abbreviated black band; Wesm., l. c., 1838, p. 166.

A solitary parasite of *Noctuæ*, mostly found in southern and central Europe, but also known in Sweden and Holland; taken by Dahl at Vienna, and by Wesmael at Brussels, Liège, &c. First bred by DeGeer from *Acronycta psi*, L. Subsequently, according to Ratzeburg, by Bouché from *Hadena pisi*, L.; by Drewsen and Boie from *Acronycta psi* on June 10th; by Brischke, July 8th, from *Acronycta tridens*, Schiff.; S. v. Vollenhoven records it as several times reared in Holland from *A. tridens*; and Giraud bred it in France from the same host. Introduced into the British list, perhaps wrongly, by Curtis (Guide, 2d ed., column 120); but it was not in his collection. Five specimens in Walker's collection at Oxford, ticketed *P. irrorator*, are nothing but *Asco-gasters*; judging at least from the one kindly lent us by the Professor of Zoology, which was determined by Fitch and verified by me. Stephens, in his 'Catalogue,' records the species as British, and taken by himself in the London district, but no recent captures have occurred. Our figure is drawn from a foreign example in the British Museum. Cocoon 5 lines long, hard, white, and elliptical.

III. AREOLARII.

XI. MICROGASTERIDES.

Clypeus entire; mouth closed. Maxillary palpi 4—5-, labial 3-jointed. Vertex short, occiput seldom margined. Mesothoracic sutures obsolete. Abdomen sessile or subsessile, sutures distinct. Cubital areolets 2 or 3; in the latter case the 2d is minute, subtriangular or stirrup-shaped, often imperfect; radial areolet ample, nearly reaching the apex of the wing; exterior nervures, and especially the radial, more or less attenuated and obsolete; recurrent nervure rejected (except in *Acoelius*); pabrachial areolet longer than the præbrachial (except in *Acoelius*). Terebra subexserted or elongate.

The number of joints in the antennæ is invariable in each genus, and the same in both sexes. The abdomen above exhibits usually 8 segments (in *Mirax* 7, in *Acoelius* 5). The 1st consists, as in *Bracon*, of a hard, variously shaped scutum, with soft membranaceous edges, generally pale-coloured, and not always visible, being shrunk up in dead specimens. The last segment is very minute. In the ♀ the subapical ventral segment is more or less carinated and acutely produced, forming a fulcrum to support the terebra, and called the *valvula ventralis*. The anterior ventral segments, like those of *Bracon*, are

membranaceous, often pale and pellucid. The hind coxæ are incrassated, elongate, approximate, and obliquely inserted.

The *Aréolaires* of Wesmael consisted of this subfamily together with the *Agathidides*, both distinguished by the minute 2d cubital areolet, resembling that of the true Ichneumons. The *Agathidides* are known at once by their narrow triangular radial areolet. Latreille's genus *Microgaster*, co-extensive with this group, was first subdivided by Nees von Esenbeck into two sections, founded upon the completeness or imperfection of the areolet. The last species, however, of his 2d section, *M. rugosus*, belongs to the *Agathidides*, genus *Orgilus*. Haliday and Wesmael worked upon the same lines as Nees. Ratzeburg attempted some further divisions, also based upon the characters of the areolet, but too minute and uncertain to be generally acceptable. The arrangement here adopted is that of Förster, confirmed and illustrated by Reinhard. *Mirax* and *Acelius* are aberrant genera discovered by Haliday.

TABLE OF GENERA.

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| (2) 1. Antennæ 20-jointed; præ- and pobrachial areolets of equal length | ii. ACELIUS. |
| (1) 2. Antennæ with less than 20 joints; pobrachial areolet longer than the præbrachial. | |
| (4) 3. Antennæ 14-jointed | i. MIRAX. |
| (3) 4. Antennæ 18-jointed. | |
| (6) 5. Wings with 2 cubital areolets (the 2d being confused with the 3d) | iii. APANTELES. |
| (5) 6. Wings with 3 cubital areolets (the 2d being more or less complete). | |
| (8) 7. Spurs of the hind tibiæ shorter than $\frac{1}{2}$ the metatarsus; segments 2, 3 not or hardly impressed with a transverse furrow | iv. MICROPLITIS. |
| (7) 8. Spurs of the hind tibiæ longer than $\frac{1}{2}$ the metatarsus; segments 2, 3 impressed with a transverse furrow | v. MICROGASTER. |

i. MIRAX, Hal.

Hal., Ent. Mag., i., 263; ii., 230 and 467.

Maxillary palpi 4-, labial 3-jointed. Antennæ 14-jointed. Eyes somewhat villose. Abdomen showing 7 segments above, 6 beneath, smooth and shining. Radius of the fore wings hardly inchoate, springing from the same point in the stigma as the 1st intercubital; two cubital areolets, the 2d imperfectly separated from the radial. Terebra subexserted.

1. *Mirax spartii*, Hal. (Pl. V., fig. 4).

Mirax rufilabris, Hal., Ent. Mag., ii., 230, ♀; S. v. Voll., Schets., II. Braconiden, tab. vi., wings, drawn by Haliday.

M. spartii, Hal., *lib. cit.*, 467; Ruthe, Berl. ent. Zeit., 1858, p. 7, ♀.

Black; head rufo-castaneous with a black spot on the vertex; abdominal segments 1—2 pale yellowish; legs ferruginous; wings hyaline, yellowish at the base, stigma fuscous with the extreme apex pale. ♀. Length, 1; wings, $2\frac{1}{2}$ lin.

Head transverse, as broad as the thorax, covered with whitish pubescence; eyes green, small, minutely and thinly villose. Antennæ scarcely shorter than the body, slender, blackish, with the pedicel rufescent; scape ovato-cylindrical; 3d joint of the flagellum longer than the scape, the others decreasing in length to the apex. Mandibles triangular, bifid. Thorax ovate, depressed; mesothorax smooth, sericeous, with fine whitish pubescence; metathorax and abdomen smooth and shining, the latter as long and as broad as the thorax, ovato-orbicular, subdepressed, anterior segments equal, posterior short, transverse; scutum of the 1st segment very narrow (more so than in *Apanteles lateralis*, Hal.), elevated, attenuated at the apex, membranaceous margins broadly visible; valvula ventralis carinated, produced. Terebra subexserted. Wings hyaline, nervures pale fuscous, squamulæ fusco-ferruginous.

First taken, in some numbers, by Haliday, on *Spartium scoparium*, the common broom; but its association with this plant seems to have been accidental. Now known to be a parasite of *Nepticula septembrella*, Stainton, which mines the leaves of *Hypericum perforatum*, St. John's wort. Fitch bred a specimen from this source on June 7th, and W. H. B. Fletcher, of Worthing, about a dozen in May and June, all females.

ii. ACÆLIUS, Hal.

Adelius, Hal., Ent. Mag., i., 262 (1833); *Acælius*, Hal., *lib. cit.*, ii., 231.

Maxillary palpi 5-, labial 3-jointed. Antennæ 20-jointed, the scape elongate. Eyes villose. Occiput contracted, finely margined. Vertex prolonged behind the ocelli. Abdomen broad, sessile, shorter than the thorax, showing 5 segments above, 6 beneath, smooth and shining; segment 1 as long as 2—5 taken together,

not scutated. Radius of the fore wings subobsolete, isolated, springing from a point remote from the 1st intercubital; two cubital areolets, the 2d imperfectly defined, all the exterior nervures being obsolete. Terebra subexserted.

The prolongation of the vertex makes the head appear, from above, subhemispherical. The præ- and pobrachial areolets are of equal length; recurrent nervure sub-interstitial; stigma large and rounded, instead of triangular. Metathorax bidenticulate. Tibiæ subclavate, rounded at the apex; in the other genera they are truncate. In addition to Haliday's species seven are described by Förster, Verh. pr. Rheinl., 1851, pp. 30—38, and one by Ruthe, Berl. ent. Zeit., 1858, p. 4. Unlike other *Microgasters*, they run with great rapidity. In size and colours they are variable; in structure uniform.

1. *Acælius subfasciatus*, Hal. (Pl. V., fig. 5).

Acælius subfasciatus, Hal., Ent. Mag., ii., 232, ♂ ♀ ;

S. v. Voll., Schets., II. Braconiden, tab. iv.

Adelius subfasciatus, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 68, pl. (wing), ♂ ♀ .

Pleiomerus subfasciatus, Ratz., Ichn. d. Forst., iii., 65, fig.

Var. *Acælius germanus*, Hal., Ent. Mag., ii., 232, ♂ ♀ .

(Fore legs, and sometimes the face, coxæ, and trochanters, testaceous. Length, $\frac{3}{4}$ lin.).

Black; mandibles, palpi, fore tibiæ at the base and apex, 4 anterior tarsi, and apex of the trochanters, fusco-testaceous or piceous. Wings whitish, with two more or less distinct dark bands, separated by a whitish interval below the fuscous stigma; most of the nervures decolorous. Head and thorax minutely punctulate, dull; abdomen shining. Terebra subexserted. ♂ ♀ . Length, $\frac{1}{2}$ — $\frac{3}{4}$; wings, $1\frac{1}{8}$ — $1\frac{3}{4}$ lin.

Antennæ ♂ ♀ longer than the body, those of the ♀ incrassated in the middle, of the ♂ longer, attenuated towards the apex. Thorax minutely punctulate; metathorax elongate, subrugulose, bidenticulated, not much lower than the scutellum. Legs stout, 4 posterior femora and hind tibiæ incrassated, the latter clavate. Calcaria shorter than $\frac{1}{2}$ the metatarsus. The dark fasciæ on the wings are variable, and often obsolete.

In a MS. note by Haliday, accompanying his types preserved in the British Museum, *A. germanus* and *subfasciatus* are united into one species. This is no doubt

correct, and also in accordance with the views of Ratzeburg. Haliday was acquainted with very few specimens, which he found on willows, and regarded as rare. They have since proved to be everywhere common parasites of *Tineidæ*, and especially, as it would seem, of *Nepticula*. Nearly 50 have been bred by W. H. B. Fletcher, of Worthing, mostly in May, from *Nepticula poterii*, Staint., *anomalella*, Göze, *Weaveri*, Dougl., *trimaculella*, Haw., *marginicolella*, Staint., *salicis*, Staint., *basiguttella*, Hein., *filipendule*, Wocke, *plagicolella*, Staint., and others; also from *Coccyx ustomaculana*, Cur. (?), *Coleophora ahenella*, Wocke, and *Lithocolletis alnifoliella*, Hüb. Elisha has obtained them from *Ornix scoticella*, Staint., or *Nepticula aucupariæ*, Frey., and *Lithocolletis Schreberella*, Fab.; the last was prematurely forced on March 14th. A very different origin is assigned to them by Ratzeburg, according to whom Brischke reared them from the galls of *Cecidomyia rosaria*, Loew, on *Salix alba* and *fragilis*.

iii. APANTELES, Först.

Först., Verh. pr. Rheinl., 1862, p. 245; Reinh., Berl. ent. Zeit., 1880, p. 361.

Maxillary palpi 5-, labial 3-jointed. Antennæ 18-jointed. Eyes villose. Mesopleuræ impressed with a smooth fovea. Abdomen sessile; suturiform articulation distinct. Radius of the fore wings subobsolete; 2 cubital areolets, the 2d being open on the outer side, and thus confused with the 3d. Spurs of the hind tibiæ never much shorter than $\frac{1}{2}$ the metatarsus.

The total absence of the outer side of the areolet distinguishes this genus from *Microplitis* and *Microgaster*; it differs also from *Microplitis* in the more developed spurs of the hind tibiæ; and from *Microgaster*, in that the 2d abdominal suture is not marked by any transverse depression. To the genus *Apanteles* belong most of the *Microgasterides*, the natural enemies of Lepidoptera, no single species of which, in temperate climates, seems to be free from their attacks. In the tropics, however, their place is taken by the multitudinous forms of *Agathis* and its allied genera. A few species have been recorded as parasites of other orders than Lepidoptera. Among the Coleoptera, *Rhynchites betuleti*, Fab., and *Linu tremulæ*, Fab., have been found to be infested by *Apanteles hoplites*, Ratz.; *Orchestes quercus*, L., by *A. brevicentris*, Ratz.; *Anthonomus pomorum*, L., by *A. impurus*, Nees, and *A.*

lacteus, Nees; and *Hypera variabilis*, Hbst., by *A. sericeus*, Nees. *A. breviventris*, Ratz., has been reared from the hymenopterous *Andricus terminalis*, Fab.; and in the Mayr collection at Vienna, according to Reinhard, is a series of *A. albipennis*, Nees, bred from *Andricus multiplicatus*, Gir. *A. lineola*, Hal., has without doubt been reared from the larva of a dipterous insect, *Syrphus pyrastris*, L.; and *A. scabriculus*, Reinh., probably from the galls of *Cecidomyia rosaria*, Loew. *A. ultor*, Reinh., by Brischke from the larva of a *Chrysopa*. Reinhard, who has collected most of the above notices, is of opinion that as the greater part of these parasites have also been bred from Lepidoptera, the observations connecting them with other orders require further confirmation. For example, *Andricus multiplicatus*, Gir., makes galls which are abundantly infested by a moth, and it is much more likely that *A. albipennis*, Nees, is parasitic upon this than upon the *Cynips*. Similarly *A. cusiformis*, Ratz., issuing from the galls of *Rhodites rosæ*, L., is not thereby proved to be a parasite of that *Cynips*. The references to economy in Dours' Catalogue have not been copied, as the determinations of the species by Perris or Goureau are unreliable. The maggots of *Apanteles* are themselves subject to the attacks of hyperparasites, belonging to the Ichneumonideous genera *Hemiteles*, *Pezomachus*, and *Mesochorus*, as well as to the family *Chalcididae*; some instances of this we shall have occasion to notice hereafter. The fine silk cocoons spun by the larvæ of *Apanteles* are well-known objects, and of great use in the difficult task of determining species. They are either white, yellow, or buff-coloured, and often protected by an external web enveloping the whole brood, except in the case of the solitary species; in a few instances they are arranged in an alveariform mass, which always denotes that their victim was a geometrical larva. Roughly speaking, we may lay it down as a rule that all the species with a long terebra (Sect. II.) make white cocoons; as also those of Sect. IV. Yellow cocoons belong to comparatively few species, of Sect. I. and III. Buff-coloured cocoons are perhaps limited to two or three species, as *A. juniperatæ*, Bouché, and *difficilis*, Nees.

Haliday, in the Ent. Mag., 1834 (ii., pp. 242—254), described 33 species of this genus, while the number contained in the present work is 69. This increase is

due to the large supply of materials, mostly bred specimens, kindly contributed by many lepidopterists, to whom we cannot sufficiently express our obligations. Among these gentlemen we must specially mention Bignell, whose whole collection, considerable in numbers and admirable for its careful preparation, has long been in our hands for examination. Reinhard's valuable papers in the Berl. ent. Zeit. (1880—81) have done much to facilitate the study of this genus. They contain a systematic revision of 59 species brought together from the works of Haliday, Nees, Bouché, Wesmæl, and Ratzeburg. Of these 49 are here introduced as British. To these are to be added 8 indigenous species described by Haliday, but not known to Reinhard; all these have been identified, with the exception of *lincola*. *A. perspicuus*, *analís*, *scriccus*, Nees, and *caia*, Bouché, have likewise been verified, and several new species discovered.

A synopsis of the species will be more intelligible if we first divide them into sections, and then give a separate table for each.

- Sect. I.—First abdominal segment subquadrate, seldom a little longer than broad, truncate behind. Segment 2 as long as 3, or nearly so. Terebra very short. Spp. 1—25.
- Sect. II.—First abdominal segment as in Sect. I. (except *A. viminetorum*, Wesm., and *exilis*, Hal., where its length is about double its breadth), seldom a little narrowed behind. Segment 2 much shorter than 3. Terebra elongate, at least $\frac{1}{4}$ as long as the abdomen. Spp. 26—53.
- Sect. III.—First abdominal segment about $\frac{1}{2}$ longer than broad, rarely more subquadrate, truncated behind. Segment 2 never much shorter than 3, impressed with two oblique lines remote from the margins, converging to the base, and enclosing a subtriangular space. Terebra very short. Spp. 54—58.
- Sect. IV.—First abdominal segment attenuated behind, rounded or lanceolate at the apex, at least twice as long as broad. Segment 2 not much shorter than 3, with two oblique impressed lines converging to the base, and enclosing a subtriangular space. Terebra variable. Spp. 59—69.

In Sect. II. the males of the species with a shorter terebra, and whose 2d segment is not so distinctly shorter than the 3d, are liable to be incorrectly referred to Sect. I.

In Sect. III. the impressed lines upon the 2d segment are not marginal or lateral, but discal. When the segment is only margined by impressed lines afterwards converging to the base, as in *glomeratus*, the species is referred to Sect. I.

In Sect. IV., when the 1st segment happens to be somewhat more broadly rounded than usual, care must be taken not to regard it as truncated.

With these unavoidable exceptions, the sections are sharply defined, and almost any species may be referred to its place with certainty.

TABLE OF SPECIES.

SECTION I. Segment 1 broad, truncated behind. Segment 2 as long as 3, or nearly so. *Terebra* very short.

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| (6) | 1. Segment 3 rugulose, at least at the base. | |
| (3) | 2. Hind femora more or less testaceous, often edged with black or fuscous | 1. <i>solitarius</i> ,* Ratz. |
| (2) | 3. Hind femora wholly black or fuscous. | |
| (5) | 4. Segments 1—2 carinated; length, 1½ lin. | 3. <i>salebrosus</i> , n. s. |
| (4) | 5. Segments 1—2 not carinated; length, 1 lin. | 4. <i>tetricus</i> , Reinh. |
| (1) | 6. Segment 3 smooth, or only sparingly and minutely punctulate. | |
| (12) | 7. Hind coxæ granulated, scarcely shining. | |
| (9) | 8. Fore coxæ testaceous | 5. <i>ruficrus</i> , Hal. |
| (8) | 9. All the coxæ black. | |
| (11) | 10. Belly broadly testaceous at the base .. | 6. <i>ordinarius</i> , Ratz. |
| (10) | 11. Belly black at the base, or with only a pellucid spot | 7. <i>congestus</i> , Nees. |
| (7) | 12. Hind coxæ smooth, shining, punctulate. | |
| (18) | 13. Legs, with the coxæ, entirely testaceous, or only the hind coxæ fuscous at the base. | |
| (15) | 14. Mesothorax rufous | 8. <i>ferrugineus</i> , Reinh. |
| (14) | 15. Mesothorax black. | |
| (17) | 16. Valvula ventralis surpassing the anus; antennæ not longer than the head and thorax; abdomen rufous, the segments margined with fuscous | 9. <i>Bignellii</i> , n. s. ♀. |
| (16) | 17. Valvula ventralis not surpassing the anus; antennæ as long as the body; abdomen black above, testaceous beneath and at the apex | 10. <i>analis</i> , Nees, ♀. |
| (13) | 18. Legs not wholly testaceous, at least the hind coxæ black. | |
| (28) | 19. Hind femora testaceous, often tipped with black. | |

* Sp. 2, *lincola*, Hal., requires to be rediscovered, and is here omitted.

- (21) 20. Segment 2 not carinated; hind femora not tipped with black 10. *analis*, Nees, ♂.
- (20) 21. Segment 2, and often 3, with a shining medial carina; hind femora usually tipped with black.
- (23) 22. Segments 1—2 distinctly edged at the sides with testaceous 11. *limbatus*, n. s.
- (22) 23. Segments 1—2 not, or very narrowly, edged at the sides with testaceous.
- (25) 24. Squamulæ dull testaceous 12. *rubripes*, Hal.
- (24) 25. Squamulæ black.
- (27) 26. Wings dusky hyaline; length, $1\frac{1}{2}$ lin. (cocoon creamy white) 13. *rubecula*, n. s.
- (26) 27. Wings limpid; length, $1\frac{1}{2}$ lin. (cocoon sulphur-yellow) 14. *glomeratus*, L.
- (19) 28. Hind femora black or fuscous, seldom testaceous on the sides.
- (30) 29. Mesothorax and scutellum very shining, smooth, impunctate 15. *sericeus*, Nees.
- (29) 30. Mesothorax and scutellum more or less shining, but always with some visible punctuation.
- (32) 31. Segments 1—2 almost smooth; (length, $\frac{3}{4}$ lin.) 9. *Bignellii*, n. s. ♂.
- (31) 32. Segments 1—2 rugulose.
- (38) 33. Spurs of hind tibiæ slender, not longer than $\frac{1}{2}$ the metatarsus.
- (35) 34. Segment 2 not, or hardly, shorter than 3 16. *spurius*, Wesm.
- (34) 35. Segment 2 more distinctly shorter than 3.
- (37) 36. Stigma and nervures pale fuscous; length, 1 lin. 17. *Geryonis*, n. s.
- (36) 37. Stigma black, nervures fuscous; length, $1\frac{1}{2}$ lin. 18. *zygænarum*, n. s.
- (33) 38. Spurs of hind tibiæ stout, longer than $\frac{1}{2}$ the metatarsus.
- (40) 39. Stigma pale at the base 19. *jucundus*, n. s.
- (39) 40. Stigma unicolorous.
- (44) 41. Wings dusky hyaline.
- (43) 42. Ventral valve ♀ surpassing the anus; length, $1\frac{1}{4}$ lin. 20. *caia*, Bouché.
- (42) 43. Ventral valve ♀ not surpassing the anus; length, $1\frac{1}{2}$ lin. 21. *juniperatæ*, Bouché.
- (41) 44. Wings limpid hyaline.
- (50) 45. Segment 2 as long as 3.
- (47) 46. Metathorax carinated; stigma rufotestaceous 22. *gracilis*, Cur.
- (46) 47. Metathorax not carinated; stigma fuscous or fuscouscent.
- (49) 48. Length, $1\frac{1}{4}$ lin. 23. *placidus*, Hal.
- (48) 49. Length, $\frac{2}{3}$ lin. 24. *nothus*, Reinh.
- (45) 50. Segment 2 somewhat shorter than 3 25. *difficilis*, Nees.

SECTION II. Segment 1 broad, truncated behind. Segment 2 much shorter than 3. Terebra elongate.

- (18) 1. All the femora testaceous, hind pair sometimes edged with fuscous.
- (9) 2. Fore coxæ, at least, testaceous.
- (6) 3. Terebra as long as $\frac{1}{2}$ of the abdomen.
- (5) 4. Stigma and nervures fuscous, the former with a pale spot at the inner angle 26. *punctiger*, Wesm.
- (4) 5. Stigma and nervures testaceous-yellow, the former unicolorous 27. *lætus*, n. s.
- (3) 6. Terebra as long as the abdomen.
- (8) 7. Antennæ entirely black 28. *adjunctus*, Nees.
- (7) 8. Antennæ reddish beneath 29. *lictorius*, Reinh.
- (2) 9. All the coxæ black.
- (11) 10. Squamulæ testaceous 30. *fulcatus*, Nees.
- (10) 11. Squamulæ black.
- (13) 12. Abdomen ♀ after segment 1 strongly compressed, cultrate; valvula ventralis considerably surpassing the anus 31. *cultrator*, n. s. ♀.
- (12) 13. Abdomen ♀ not much compressed except at the apex; valvula ventralis not surpassing the anus.
- (17) 14. Stigma unicolorous.
- (16) 15. Mesothorax thickly punctulate, dull .. 32. *ultor*, Reinh.
- (15) 16. Mesothorax hardly punctulate, sericeous, shining 33. *decorus*, Hal.
- (14) 17. Stigma bicolorous 34. *dilectus*, Hal.
- (1) 18. Hind femora black, sometimes pitchy at the sides or apex.
- (22) 19. Stigma testaceous, pellucid.
- (21) 20. Second abdominal segment smooth .. 35. *xanthostigmus*, Hal.
- (20) 21. Second abdominal segment (like the 1st) rugulose 36. *contaminatus*, Hal.
- (19) 22. Stigma more or less intensely fuscous.
- (42) 23. First abdominal segment rugulose, dull.
- (31) 24. Segment 2 distinctly rugulose.
- (28) 25. Stigma bicolorous.
- (27) 26. First abscissa of the radius curved, making no angle with the first inter-cubital nervure; length, 2 lines. .. 37. *prætor*, n. s.
- (26) 27. First abscissa of the radius making an angle, as usual, with the first inter-cubital nervure; length, $1\frac{1}{4}$ ln. .. 38. *emarginatus*, Nees.
- (25) 28. Stigma unicolorous.
- (30) 29. Mesothorax, and pleuræ in front, thickly and rather strongly punctured; terebra about $\frac{2}{3}$ of the abdomen 39. *obscurus*, Nees.

- (29) 30. Mesothorax and pleuræ very finely punctulate, shining; terebra barely $\frac{1}{4}$ of the abdomen 40. *viminetorum*, Wesm.
- (24) 31. Segment 2 smooth.
- (37) 32. Wings milky-white or limpid hyaline.
- (34) 33. Stigma testaceous, with a fuscous border 41. *sodalis*, Hal.
- (33) 34. Stigma fuscous.
- (36) 35. Stigma with a pale dot at the inner angle; segment 1 scarcely longer than broad; length, $1\frac{1}{2}$ lin. .. . 42. *albipennis*, Nees.
- (35) 36. Stigma unicolorous; segment 1 longer by $\frac{1}{2}$ than its breadth; length, $1\frac{1}{4}$ lin. 43. *impurus*, Nees.
- (32) 37. Wings fusco-hyaline, or subhyaline.
- (39) 38. Clypeus and face produced, rostriform (as in *Agathis*) 44. *naso*, n. s.
- (38) 39. Clypeus and face of the usual form.
- (41) 40. Segment 1 subquadrate; wings fusco-hyaline 45. *infirmus*, Hal.
- (40) 41. Segment 1 more than twice as long as broad; wings subhyaline 46. *exilis*, Hal.
- (23) 42. First abdominal segment smooth, or hardly subrugulose at the apex.
- (44) 43. Wings dark fuscous; hind legs entirely black 47. *gagates*, Nees.
- (43) 44. Wings whitish, or subhyaline; hind legs partly testaceous.
- (48) 45. Stigma testaceous, edged with fuscous, or testaceous at the inner angle.
- (47) 46. Terebra as long as the abdomen .. 48. *Halidaii*, Marsh.
- (46) 47. Terebra much shorter than the abdomen 49. *conifera*, Hal.
- (45) 48. Stigma fuscous.
- (50) 49. Hind femora black, with a longitudinal testaceous stripe 50. *lineipes*, Wesm.
- (49) 50. Hind femora wholly black.
- (52) 51. Terebra as long as the abdomen .. 51. *longicaudis*, Wesm.
- (51) 52. Terebra shorter than the abdomen.
- (54) 53. Terebra as long as $\frac{1}{2}$ abdomen 52. *fuliginosus*, Wesm.
- (53) 54. Terebra as long as $\frac{1}{2}$ or $\frac{2}{3}$ abdomen .. 53. *sicarius*, n. s.

SECTION III. Segment 1 about $\frac{1}{2}$ longer than broad, or subquadrate, truncated behind. Segment 2 not shorter, or not much shorter, than 3, impressed with two oblique lines, remote from the margins, converging towards the base, and enclosing a subtriangular space. Terebra very short.

- (2) 1. Metathorax rugulose 54. *octonarius*, Ratz.
- (1) 2. Metathorax smooth, or nearly so.
- (4) 3. Segment 2 shorter than 3 55. *abjectus*, n. s.
- (3) 4. Segment 2 not shorter than 3.

- (6) 5. Triangular enclosed space on segment 2
 aciculated 56. *immunis*, Hal.
- (5) 6. Triangular enclosed space on segment 2
 smooth.
- (8) 7. Segment 1 one-half longer than broad ;
 four posterior femora testaceous, often
 with fuscous lines 57. *caberae*, n. s.
- (7) 8. Segment 1 hardly longer than broad,
 subquadrate ; four posterior femora
 black 58. *popularis*, Hal.

SECTION IV. Segment 1 narrow, attenuated behind and rounded or lanceolate at the apex ; at least twice as long as broad. Segment 2 not much shorter than 3, usually impressed with two oblique discal lines converging towards the base, and enclosing a sub-triangular space. *Terebra* variable.

- (14) 1. Segment 1 less than three times as long
 as its medial breadth.
- (5) 2. Hind femora and tibiæ entirely or mostly
 black.
- (4) 3. Segment 1 attenuated posteriorly from
 the middle ; length, 1 lin. 59. *fraternus*, Reinh.
- (3) 4. Segment 1 attenuated posteriorly from
 near the apex ; length, $1\frac{1}{4}$ lin. .. 60. *triangulator*, Wesm.
- (2) 5. Hind femora and tibiæ testaceous, or
 with only slight infuscations.
- (7) 6. Metathorax carinated, rugulose .. 61. *pallidipes*, Reinh.
- (6) 7. Metathorax not carinated, smooth, or
 finely punctulate.
- (9) 8. Mesothorax punctulate 62. *bicolor*, Nees.
- (8) 9. Mesothorax smooth.
- (11) 10. Oblique impressions on segment 2 in-
 complete, not reaching the hind mar-
 gin ; length nearly 2 lines 63. *formosus*, Wesm.
- (10) 11. Oblique impressions on segment 2 com-
 plete ; length, 1 line or less.
- (13) 12. Abdomen* testaceous with the apex
 black ; terebra $\frac{1}{3}$ of the abdomen ;
 length, 1 lin. 64. *lautellus*, n. s.
- (12) 13. Abdomen black, testaceous at the sides ;
 terebra $\frac{1}{2}$ of the abdomen ; length,
 $\frac{3}{4}$ lin. 65. *umbellatarum*, Hal.
- (1) 14. Segment 1 three times as long as its
 medial breadth, or longer.
- (16) 15. Hind coxæ thickly punctured, dull . 66. *callidus*, Hal.
- (15) 16. Hind coxæ finely punctulate, shining.

* Except varieties, in which the black colour more or less pre-
 dominates.

- (20) 17. Hind femora and tibiæ tipped with fuscous; stigma fuscous; spurs of the middle tibiæ curved, not shorter than $\frac{1}{2}$ the metatarsus.
- (19) 18. Metathorax indistinctly punctulate at the sides; terebra $\frac{1}{2}$ as long as the abdomen 67. *lateralis*, Hal.
- (18) 19. Metathorax smooth; terebra very short 68. *vitripennis*, Hal.
- (17) 20. Hind femora and tibiæ unicolorous, testaceous; stigma rufescent; spurs of the middle tibiæ straight, shorter than $\frac{1}{2}$ the metatarsus 69. *fulvipes*, Hal.

SECTION I.

1. *Apanteles solitarius*, Ratz.

Microgaster solitarius, Ratz., Ichn. d. Forst., i., 73, ♂ ♀.

Apanteles solitarius, Reinh., Berl. ent. Zeit., 1880, p. 367, ♀.

Black, with black coxæ; palpi and legs testaceous, 4 posterior femora, and hind tibiæ at the tips, more or less black; belly at the base testaceous. Wings whitish hyaline, stigma fuscous. Mesothorax and pleuræ very finely punctulate, somewhat shining. Metathorax punctato-reticulate, subcarinated. First abdominal segment subquadrate, slightly narrowed towards the base; 2d transverse, a little shorter than the 3d; segments 1—2 rugulose, 3 subrugulose, but sometimes nearly smooth; 1—3 more or less obtusely carinated in the middle; the rest smooth and shining. Terebra very short. ♂ ♀. Length, $1\frac{1}{2}$; wings, $3\frac{1}{2}$ lin.

Abdomen flat above, beneath towards the apex subcompressed. The legs of the ♂ are more marked with black than those of the ♀; the hind femora may be all black, or only edged with that colour; the middle femora are usually black at the base; or the legs are entirely testaceous. Antennæ ♀ as long as the body; those of the ♂ longer.

Common. Bred by Bignell from *Orygia antiqua*, L., *Tæniocampa miniosa*, Fab., *T. stabilis*, View., *Zonosoma punctaria*, L., and *Hybernia defoliaria*, L. A solitary parasite, attacking young larvæ, which perish at the beginning of summer, before they are half grown. One of Bignell's has preserved beside it a young larva of *T. stabilis*. Reared in Germany by Ratzeburg from *Psilura monacha*, L., and *Oeneria dispar*, L.; by Brischke and Giraud from the same, as well as from *Leucoma salicis*, L., and *Zonosoma linearia*, Hüb. Cocoon pale sulphur-yellow, fixed to a leaf, the sides of which are drawn together by a few threads, for its protection.

2. *Apanteles lineola*, Cur. (Hal.).

Microgaster lineola, Cur., B. E., 321, No. 11; Hal., Ent. Mag., ii., 252, ♂.

“Male. Thorax very minutely punctulate; femora and tibiæ flavo-testaceous; 4 posterior femora on both sides, and their tibiæ at the apex, fuscous; wings whitish; segments 1—3 aciculated.”

“Size of *M. glomeratus*; palpi yellow; legs coloured nearly like those of *M. immunis*; stigma and nervures in the middle of the wing pale ferruginous, the rest decolorous; squamulæ black; metathorax punctato-reticulate; abdomen unusually short and broad, segments 1—3 punctato-reticulate; the 1st short, broad, its apical angles hardly margined with yellow.”

I have not seen this insect, and the above is a translation of Haliday's description. It must be nearly allied to the preceding species, if not the same. Reinhard hesitated in joining them on account of their different habits, *lineola* having been bred from a dipterous insect, *Syrphus pyrastris*, L. As this fact appeared doubtful to Reinhard, I shall quote the words of Curtis in 'Farm Insects,' p. 81:—"The maggots" [of *S. pyrastris*] "are green, and I found them in July, 1829, in some abundance on the sea-cabbages, *Brassica oleracea*, which grow under the cliffs near Dover. Many of them had been stung by a little parasitic fly, called *Microgaster lineola*, the maggots of which came out of the *Scæva* larvæ, and formed little elliptical silken cocoons almost white." In 1884 I searched for the *Syrphus*-larvæ in the Isle of Wight, but could only obtain one, which produced a dipterous imago. These larvæ are grass-green, with a black dorsal stripe, common among Aphides on the south coast, and easily reared. It is to be hoped that some entomologist before long will obtain from them *A. lineola*. In Walker's collection, at Oxford, are two females and one male, numbered 104, ticketed *lineola*; but I have not been able to examine them.

3. *Apanteles salebrosus*, n. s.

Niger; palpis, femoribus anticis præter basin, mediis apice late, tibiisque omnibus, rufo-testaceis; tibiis posticis apice, tarsis iisdem basi, nigris. Ventris basis concolor. Alæ hyalinæ, squamulis, costa, stigmatate, nervis, nigris. Caput et mesothorax crebre punctulata, nitidiuscula; scutellum lævius. Pleuræ parcius punctulatæ, nitidæ. Metathorax crasse reticulato-rugosus, nitidus, subcarinatus.

Abdominis segmentum 1um vix longius quam latius, basin versus paulo angustatum, marginatum, late truncatum; 2dum 3o æquale; segmenta 1—3 rugulosa, medio carinata, sed 3um apice læviusculum, carina minus elevata; cætera lævia, nitida. Terebra brevissima. Valvula ventralis anum non superans. Coxæ posticæ læves, nitidæ; calcaria metatarsis dimidio breviora, pallida.

Black; palpi, fore femora except at the base, middle femora at the apex broadly, and all the tibiæ, rufo-testaceous; hind tibiæ at the apex, their tarsi at the base, black. Belly at the base concolorous. Wings hyaline; squamulæ, costa, stigma, and nervures, black. Head and mesothorax thickly punctulate, somewhat shining; scutellum smoother. Metathorax coarsely reticulato-rugose, subcarinated, shining. Segment 1 hardly longer than broad, slightly narrowed towards the base, margined, broadly truncated; segment 2 as long as 3; segments 1—3 rugulose, carinated in the middle; 3 at the apex smoother, less strongly carinated; the rest smooth and shining. Terebra very short. Valvula ventralis not surpassing the anus. Hind coxæ smooth and shining; spurs of hind tibiæ shorter than $\frac{1}{2}$ the metatarsus, pallid. ♀. Length, $1\frac{1}{2}$; wings, $3\frac{3}{4}$ lin.

Not *carbonarius*, Wesm., which has the metathorax almost smooth, shining, strongly carinated; and the base of the belly pale. It is moreover $\frac{1}{3}$ less in size. The *carbonarius* of Reinh. differs from that of Wesm. in having the metathorax reticulato-rugose, and so far resembles the present species; but the squamulæ are testaceous, the size smaller, and the 2d segment shorter than the 3d.

Two females were bred singly on June 30th by Bignell from larvæ of *Oporobia dilutata*, Bork., taken in Scotland. Cocoons lemon-yellow. With them may be compared *A. immunis*, Hal., reared from the same victims, and making similar cocoons, but in structure very different.

4. *Apanteles tetricus*, Reinh.

Apanteles tetricus, Reinh., Berl. ent. Zeit., 1880, p. 367, ♂ ♀.

Black; palpi pale; 4 anterior femora tipped with testaceous, tibiæ testaceous, the hind pair at the base only; belly at the base piceous. Wings iridescent, subinfuscated, stigma fuscous. Antennæ rather longer than the body. Mesothorax and pleuræ thickly punctulate, dull. Metathorax coarsely rugose. Segment 1 subquadrate, slightly narrowed at the base; segment 2 hardly shorter

than 3, both rugose; 3d rugulose, more strongly at the base; the rest smooth. Terebra very short. ♂ ♀. Length, 1; wings, $2\frac{1}{2}$ lin.

Minutely pubescent with pale hairs. Metathorax more coarsely rugose than usual. The rugosity of segment 3 varies in extent, and is sometimes confined to the base, never entirely absent.

Hitherto only noticed in Devonshire. Gregarious. Bignell reared two broods, of 6 and 7 respectively, from *Epinephela Ianira*, L.; and I found a batch of 30 cocoons attached to grass near Teignmouth. Very likely these were from *Zygæna filipendulæ*, L., the larvæ of which were feeding round about. Cocoons white, of coarse texture, irregularly piled, connected by a slight web. Brischke says, "from *Eupithecia exiguata*, Hüb.; cocoon single, yellow, rough," having apparently mistaken the species.

5. *Apanteles ruficrus*,* Hal.

Microgaster ruficrus, Hal., Ent. Mag., ii., 253, ♂ ♀.

Apanteles ruficrus, Reinh., Berl. ent. Zeit., 1880, p. 368, ♂ ♀.

Black; palpi testaceous; squamulæ, belly at the base, and legs, rufo-testaceous; hind coxæ more or less, and tips of the hind femora, black; hind tarsi, and often the tips of the hind tibiæ, fuscous. Wings subhyaline, iridescent, stigma pale fuscous. Mesothorax and scutellum thickly punctate, dull; pleuræ the same, with a smooth space beneath the wings. Metathorax rugulose.

* This is most probably the species of which Goureaux gives us the life-history under the name *Microgaster globatus*, L.? (Ann. Soc. Fr., 1845, ser. 2, iii., pp. 355—361, pl. vii., ff. 1—5). It was parasitic on a full-fed *Noctua*-larva, thought to be *Hadena oleracea*, L., found feeding on the leaves of *Iris pseudacorus* on June 1st. The maggot is described as 4 mm. long and $\frac{3}{8}$ m. in diameter, green, cylindrical, soft, footless, glabrous, attenuated anteriorly; head brown; mouth transverse, cartilaginous, at the extremity of a muzzle; upper lip trilobed, lower entire; two black ocular points upon the second segment; body consisting of 12 segments, those after the head furnished with lateral tubercles by the help of which the maggot escapes from the body of the victim. Sixty of these maggots emerged on June 5th, and spun white cocoons gregariously under a common web. The perfect insects appeared on June 14th, and were all dead by the 17th. In the larval state they live by suction upon the juices of the adipose tissue; the soft structure of the mouth being not adapted for tearing or masticating solid substances. Their fluid aliment is constantly secreted by the digestive powers of the caterpillar, which probably suffers little inconvenience, showing no other signs of disease than a voracious appetite and a somewhat retarded growth. Goureaux's views upon this subject are

Segment 1 twice as long as broad, with parallel sides, truncate rugulose; 2 broader than 1, as long as 3, narrowed anteriorly, also rugulose; the rest smooth and shining. Terebra exerted, very short. Ventral valve somewhat surpassing the anus. Hind coxæ above rugulose, bristly. ♂ ♀. Length, $1\frac{1}{4}$; wings, $2\frac{1}{2}$ lin.

Sometimes the apical half of the hind femora is infuscated. The abdomen of the ♀ is acuminate, with the terebra visibly protruding. The 3d segment is occasionally margined with rufous at the apex, or there are two rufous spots at the hind angles; examples of both have been taken by Bignell.

Common; gregarious. Bred by Bignell in May from *Leucania littoralis*, Cur.; and Sept. 7th, from *Spilosoma menthastri*, Esp., 24 specimens, which remained in pupa 10—14 days. By Raynor from *Leucania pallens*, L., 28 on a card, of which only 3 are males. In Fitch's collection is a card of 9 from *Collix sparsata*, Hüb., others from *Agrotis præcox*, L., by Porritt, and bred by himself from *Diloba cæruleocephala*, L. Cocoons white, irregularly piled, connected by a web of filaments more closely woven than that of *tetricus*.

entirely in accord with those of Ratzeburg, to which we shall refer under *Apanteles fulvipes*, Nees (see note, *infra*). The caterpillar observed by Goureaux, after nourishing 60 parasites, and having been pierced with 60 holes, retained a languishing vitality for 8—10 days more, almost without power of motion. A post-mortem inspection shows in such cases that the holes made by the emerging maggots are marked each by a black speck. The specks are arranged on either side along the side of the spiracles, only 5—6 out of 60 occurring elsewhere, as in the back or the belly. This fact indicates that the maggots live in the vicinity of the tracheæ, probably because the air there obtainable is necessary for their imperfect respiration. The lateral tubercles above mentioned are organs whose function is temporary, being limited to the few moments during which the maggot is wriggling through the skin of the victim. Having forced a hole, and exerted the fore part of its body, it bends either to the right or left, exposing by that action a set of tubercles (2—5 in number) on the convex side, while the same number disappear on the concave side. The exerted tubercles rest upon the edge of the hole, and serve as a *point d'appui* for the elevation of the body on the opposite side. The same action is then reversed, and so on alternately, until the whole body is disengaged. After the appearance of the perfect parasites, Goureaux, having observed the union of the sexes, introduced among them a lepidopterous larva, with portions of a cabbage upon which it was feeding. They refused, however, to deposit their eggs in this caterpillar, which perhaps was not of a species which they would naturally attack. They showed a fondness for the cabbage, which they bit and sucked with avidity, proving that it is not contrary to their habits to take food in the imago-state.

6. *Apanteles ordinarius*, Ratz.

Microgaster ordinarius, Ratz., Ichn. d. Forst., i., 71.

M. reconditus, Hart., Jahresb., 252 (not of Nees, Wesm.)

Apanteles ordinarius, Reinh., Berl. ent. Zeit., 1880,
p. 368, ♂ ♀.

Black; palpi, apex of mandibles, margins of segments 1—2 narrowly, belly at the base broadly, squamulae, femora, and tibiae, testaceous; middle femora above, hind femora above and at the apex, or entirely, with the apex of their tibiae, black. Wings hyaline, stigma fuscous. Mesothorax thickly punctulate, rather shining; scutellum smooth; pleurae punctulate, shining; metathorax rugose, carinated. Segment 1 somewhat longer than broad, and, with the 2d, rugulose, both with a smooth medial carina; 2 not shorter than 3. Terebra very short. Hind coxae punctulate, shining. Inner spur of the hind tibiae longer than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{4}$ — $1\frac{3}{4}$; wings, $3\frac{1}{8}$ — $4\frac{3}{8}$ lin.

Second abscissa of the radius inchoate, punctiform. Abdomen above broad and flat, lanceolate and compressed beneath at the apex. First joint of the trochanters black, the 2d testaceous. Much like *rubripes*, Hal., but distinguished by greater size, colour of the legs, &c. Antennae ♀ shorter than the body. According to Reinhard the hind coxae are granulated, dull; Ratzeburg says nothing about this character, which can hardly be attributed to the present insect; the hind coxae are punctulate indeed, but not less shining than usual.

Seems to be uncommon in England; but a female is in Parfitt's collection, and two males and one female in that of Fitch, all having the hind femora black. Described by Ratzeburg as an abundant and constant parasite of *Lasiocampa pini*, L., in Germany. It takes its name from the regular rows in which the cocoons are usually placed on the leaves and twigs of the pine. According to Brischke, the white gregarious cocoons envelop the larva as with a furred coat; see Ratz., Die Waldv., pl. iii., f. S. Also bred from *Bombyx rubi*, L.; for a detailed account of its hatching from this species, see Ratz., Ichn. d. Forst., i., 65. *Hemiteles fulripes*, Gr., and *areator*, Gr., are hyperparasites.

N.B.—The specimens referred to by Brischke, which were determined by Reinhard, and bred from *Myelophila cribrum*, Schiff., are larger, with segment 3 rufous, and the wings more infumated; probably a different species.

7. *Apanteles congestus*, Nees.

Microgaster congestus, Nees, Mon., ii., 405.

Apanteles congestus, Reinh., Berl. ent. Zeit., 1880,
p. 369, ♂ ♀.

Microgaster globatus, Bouché, Naturg. (1834), 155.

M. intricatus, Hal., Ent. Mag., ii., 252, ♀; cf. 468, note.

M. perspicuus, Wesm., Nouv. Mém. Ac. Brux., 1837,
p. 45, ♂ ♀; Ratz., Ichn. d. Forst., iii., 55 (not of
Nees).

Black; antennæ ♂ often beneath and at the tips, with the palpi, testaceous; fore legs rufo-testaceous, their femora black at the base; middle and hind legs black, 2d joint of the trochanters and base of the tibiæ, rufo-testaceous; or femora and tibiæ rufo-testaceous; hind femora at the apex and on the upper edge, black or fuscous. Wings fusco-hyaline, stigma fuscous. Mesothorax thickly punctulate, dull; scutellum shining, punctulate; metathorax and segments 1—2 coarsely rugose; segment 1 longer than broad, narrowed at the base, truncate; 2 as long as 3. Terebra very short. Hind coxæ rugulose above. Spurs of the hind tibiæ slender, shorter than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length 1—1 $\frac{1}{4}$; wings 2—2 $\frac{1}{2}$ lin.

The hind coxæ above are distinctly rugulose, almost as rough as the base of the abdomen, by which character the species may be separated from *spurius*, *difficilis*, *gracilis*, and others, which it closely resembles. Haliday does not mention the hind coxæ, but his description of the nest of *intricatus* shows that he had this insect in view. The same remark applies to Bouché's *globatus*. Wesmael's description is abundantly conclusive. Haliday (MS. in Brit. Mus.) makes *sericcus*, Nees, a synonym of this species; but it agrees much better with the solitary parasite to which we have united it.

Very common. The gregarious larvæ form white cocoons, irregularly piled together, and enveloped in a woolly ball of oval shape and dull yellow colour, as large as a hazel- or even walnut. These balls are usually attached to blades of grass, and resemble the nests of certain spiders, for which they have often been taken, e. g., by Ratzeburg, Ichn. d. Forst., iii., 55, and this is the species referred to by Cameron, E. M. M., x., 211. It has been asserted that the victim-larva before its death spins this covering for the protection of the undeserving brood of parasites. See, however, Réaumur, i., pt. ii., p. 222; and Haliday (Ent. Mag., ii., 235) remarks that it would

be a singular fact if a caterpillar whose inside has been devoured should be found provided with an extra supply of silk for this unnecessary purpose. Reinhard states that when this *Microgaster* inhabits certain larvæ, *e. g.*, those of *Melitæa*, the cocoons are without an external covering. But in this case there has probably been some mistake as to the species. Described above from specimens reared by Bignell from *Hadena pisi*, L., accompanied by their nest. Bred copiously by other lepidopterists from *Spilosoma lubricipeda*, Esp., *Acronyeta rumicis*, L., *Triphæna pronuba*, L., *Calocampa exoleta*, L., and *Cucullia artemisiæ*, Fab., &c. By Brischke from *Vanessa urticæ*, L., *Zygæna filipendulæ*, L., *Tæniocampa incerta*, Hufn., *Cucullia argentea*, Hufn., *C. asteris*, Schiff., *Plusia gamma*, L., &c. By Giraud from *Pygæra anastomosis*, L. (*cf.* Verh. z-b. Ges. Wien, 1866, p. 952), *Plusia chrysitis*, L., and *Eupithecia abbreviata*, Ste.

8. *Apanteles ferrugineus*, Reinh. MS. (Pl. V., fig. 6).

Rufo-testaceus capite et metathorace nigris. Antennæ apicem versus, segmenti 2di area media, pectus pro parte, et abdomen postice plus minus, fusca vel nigricantia. Venter, alarum squamulæ, stigma, nervique omnes, flavida. Coxæ posticæ interdum supra fusco-maculatæ. Corpus totum depressum. Mesothorax confertim punctatus, nitidulus; scutellum læve, nitidum. Pleuræ granulatæ, spatio sub alis nitido, lævi. Metathorax productus, depressus, utrinque marginatus, medio carinulatus, et cum segmentis 1—2 subtilissime rugulosus, obscurus; segmentum 1um longius quam latius, apice truncatum, basi vix angustatum; 2dum 1mo latius, 3tio non brevius, utrinque arcuato-impressum; cætera lævia, nitida. Terebra brevissima. Valvula ventralis inconspicua. Coxæ posticæ subnitidæ. Tibiarum posticarum calcaria gracilia, metatarsi dimidio multo breviora.

Rufo-testaceous; head and metathorax black. Antennæ towards the apex, a space on the disk of segment 2, the pectus partially, and the abdomen posteriorly more or less, fuscous or blackish. Belly, squamulæ, stigma, and nervures, yellowish. Hind coxæ sometimes infuscated above. The whole body is very depressed. Mesothorax thickly punctate, rather shining; scutellum smooth, shining. Pleuræ granulated, with a smooth space underneath the wings. Metathorax produced, depressed, margined at the sides, with a faint medial carina, and together with segments 1—2, minutely rugulose, dull; segment 1 longer than broad, truncated at the apex, scarcely narrowed at the base; 2 wider than 1, not

shorter than 3, with two impressed curved lateral lines; the rest smooth and shining. Terebra very short. Valvula ventralis not carinated, closely applied to the belly. Hind coxæ somewhat shining. Spurs of the hind tibiæ slender, much shorter than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{2}$; wings, $2\frac{2}{3}$ lin.

A species remarkable for its colour, and differing considerably in structure from any other, though the form of the 1st segment refers it to this section. The mesothorax and scutellum are depressed so as to be in the same plane as the elongate metathorax, a conformation resembling that of *Belyta*, and often belonging to insects of subcortical habits.

Discovered by Porritt, who reared many from the larvæ of *Chilo phragmitellus*, Hüb., inhabiting the interior of reeds. 29 are preserved on one card. Cocoons silvery white, subtransparent, attached singly or in small groups by a few threads to the inside of the reed-stem.

9. *Apanteles Bignellii*, n. s.

♀. Niger, flagelli basi pallida; palpis, abdomine, pedibusque cum coxis, flavo-testaceis; segmentorum basi fusca. Alæ albido hyalinæ costa stigmatè nervis fusco-testaceis. Antennæ perbreves, capite cum thorace non longiores, submoniliformes. Mesothorax et scutellum confertim punctulata, subnitida; metathorax leviter rugulosus, subnitidus. Abdominis segmentum 1mum latitudine sesquilongius, lateribus pone medium paulo angustatum, marginatum, truncatum, angulis posticis obtusis, subrugulosum, nitidiusculum; 2dum transversum, 3tio æquale, 1mo latius, subrugulosum vel fere læve, subnitidum; cætera lævia. Abdomen apice infra compressum. Terebra subexserta. Valvula ventralis anum paulo superans. ♂. Antennæ totæ nigre, corpore longiores, filiformes. Abdomen nigrum; venter basi pallidus. Femora cum coxis picea vel fusca, tibiis tarsisque testaceis.

♀. Black, base of the flagellum pale; palpi, abdomen, and legs, with the coxæ, flavo-testaceous; abdominal segments fuscous at the base. Wings whitish hyaline; costa, stigma, and nervures, fusco-testaceous. Antennæ not longer than the head and thorax, submoniliform. Mesothorax and scutellum thickly punctulate, somewhat shining; metathorax slightly rugulose, somewhat shining. Segment 1 half as long again as its width, slightly narrowed behind the middle, margined, truncated, the hind angles obtuse, subrugulose, somewhat shining; 2 transverse, as long as 3, broader than 1, subrugulose or almost smooth, somewhat shining; the remaining

segments smooth. Abdomen compressed beneath at the apex. Terebra subexserted. Valvula ventralis somewhat surpassing the anus. ♂. Antennæ entirely black, longer than the body, filiform. Abdomen black; belly pale at the base. Femora and coxæ pitchy or fuscous; tibiæ and tarsi testaceous. ♂ ♀. Length, $\frac{3}{4}$; wings, $2\frac{1}{2}$ lin.

Described from 4 males, 5 females. The sexes are so unlike that no one, without breeding them, would suspect their identity. They are also anomalous in some other respects. Segment 1 is narrowed a little towards the apex, as in Sect. IV., but still distinctly truncated, as in Sect. I. Segment 2 is less rugulose than 1, in some specimens almost as smooth as the following segments; it is canaliculated in the middle, and furnished with two arcuate impressions converging forwards, as in Sect. III.; the space enclosed between the lines is raised and shining; but this structure is irregular and indistinct. In the ♀ the abdomen is testaceous; segment 1 at the base, and 2—5 more narrowly, fuscous. The cariniform edge of the belly and the subulated valves of the terebra are black.

Gregarious; bred in some numbers by Bignell from the larvæ of *Melitæa aurinia*, Rott., taken in North Devon. The white cocoons are enclosed in a common web of cottony texture.

10. *Apanteles analis*, Nees.

Microgaster analis, Nees, Mon., i., 180; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 59, ♀.

M. prætextatus, Hal., Ent. Mag., ii., 254, ♀.

Apanteles acuminatus, Reinh., Berl. ent. Zeit., 1880, p. 370, ♂ ♀.

Black; mandibles rufous; abdomen ♀ at the apex, with the sides and belly entirely, palpi, squamulæ, and legs, flavo-testaceous; hind coxæ more or less fuscous; tarsi fuscous. Abdomen ♂ black, belly at the base broadly testaceous. Wings hyaline, stigma testaceous. Mesothorax, scutellum, and pleuræ, thickly punctulate, dull; metathorax rugose. Abdomen towards the apex subcompressed, acuminated; segments 1—2 rugose, the rest smooth and shining; segment 1 subquadrate, margined, broadly truncate; 2 wider than 1, shorter than 3. Terebra very short. Hind coxæ punctulate, shining. Valvula ventralis somewhat surpassing the anus. ♂ ♀. Length, $1\frac{1}{2}$; wings, $2\frac{1}{2}$ lin.

Var. ♀. Hind femora tipped with fuscous; segments 1—2, and base of 3, testaceous; 7 fuscous; or 2—4 testaceous.

Much resembles *ruficrus*, Hal., in form and sculpture, but the hind coxæ are smoother, and the colours different.

Six specimens were in Fitch's collection, of which three are destroyed, leaving three females. On another card are five males and one female; their origin is not stated. Bred on the Continent, according to Reinhard, from *Melitæa** *Materna*, L., and *Phœbe*, Fab. Cocoons white.

11. *Apanteles limbatus*, n. s.

Niger. segmentorum 1—2 limbo laterali. ventris basi. palpis, squamulis. pedibusque testaceis; coxis nigris; femorum posticorum apice supra, tibiis iisdem apice, tarsis fere totis, fuscis. Alæ sub-fusco-hyalinæ stigmatæ fusco. Mesothorax confertim punctulatus, subnitidus; pleuræ fere læves; scutellum nitidum punctulatum. Metathorax rugulosus. Segmentum 1mum longius quam latius, basi parum angustatum, cum 2do rugulosum: hoc 3tio vix brevius, medio subcarinatum, 1mo latius; cætera lævia. Terebra sub-exserta. Coxæ posticæ nitidæ. punctulatæ. Tibiarum posticarum calcar internum metatarsi dimidio longius, intermediarum metatarsi dimidio æquale.

Black; lateral margins of segments 1—2. belly at the base, palpi, squamulæ. and legs, testaceous; coxæ black; hind femora at the apex above, their tibiæ at the apex, and tarsi almost entirely, fuscous. Wings dusky hyaline, stigma fuscous. Mesothorax thickly punctulate, somewhat shining; pleuræ almost smooth; scutellum shining, punctulate. Metathorax rugulose. Segment 1 longer than broad, hardly narrowed at the base, and like the 2d, rugulose; 2 broader than 1. scarcely shorter than 3, subcarinated in the middle; the rest smooth. Terebra subexserted. Hind coxæ shining. punctulate. Inner spur of the hind tibiæ longer than $\frac{1}{2}$ the metatarsus; that of the middle pair as long as $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{2}$; wings, $2\frac{2}{3}$ lin.

Very near *affinis*, Nees, Mon., i., 176; Reinh., Berl. ent. Zeit., 1880, p. 370, which at first I supposed it to be. It does not, however, agree with Reinhard's description; the mesothorax is thickly punctulate, and hardly shining; the hind femora and tibiæ are tipped with fuscous; the wings are not hyaline, but tinted, and the stigma is not flavo-testaceous. With the description

* Probably these are the butterflies meant: but authors' names being omitted in the Berl. ent. Zeit., there is room for doubt. The name *Materna* has been given to four, and *Phœbe* to three, different species of *Melitæa*.

of Nees it does not agree, because it is larger than *glomeratus*, L., the 1st segment is not canaliculated in the middle, and the wings are not pure hyaline.

Described from 14 specimens bred by Bignell: six females from *Abraxas grossulariata*, L., and the rest from unrecorded larvæ, seven being males. Gregarious. Cocoons pale lemon-colour, almost white, irregularly clustered, naked, connected merely by a few threads.

12. *Apanteles rubripes*, Hal.

Microgaster rubripes, Hal., Ent. Mag., ii., 253, ♀.

Apanteles rubripes, Reinh., Berl. ent. Zeit., 1880, p. 370, ♂ ♀.

? *Microgaster gastropachæ*, Bouché, Naturg. (1834), 157; Ratz., Ichn. d. Forst., i., 72.

Black, with pale palpi; belly at the base, and legs, rufo-testaceous; squamulæ rufo-fuscous; coxæ black; hind femora often with a fuscous apical spot, and hind tibiæ tipped with fuscous. Segments 1—2 narrowly edged with testaceous at the sides. Wings hyaline, stigma fuscous. Mesothorax and pleuræ thickly punctulate, shining, pubescent; scutellum smoother; metathorax rugulose. Segment 1 subquadrate, truncate, rugulose; 2 rugulose, shorter than 3, carinated at the base; the rest smooth and shining; segment 3 with some scattered punctures. Hind coxæ above shining, punctulate. Inner spur of the hind tibiæ longer than $\frac{1}{2}$ the metatarsus. Terebra very short. ♂ ♀. Length, $1\frac{1}{2}$; wings, $3\frac{3}{4}$ lin.

Antennæ beneath more or less piceous. The synonym *gastropachæ*, Bouché, adduced by Reinhard, is not free from difficulties. Bouché speaks of a subtriangular enclosed space upon segment 2, and Ratzeburg insists specially upon the colour of the coxæ, which he says are not black, but brown. The foreign specimens moreover were bred from Bombyces, which is not the case in England. The size mentioned by Reinhard, 2.8 mill. (= $1\frac{2}{3}$ lin.), is rather less than that of British examples. Reared on the Continent from *Bembecia hylæiformis*, Lasp., *Bombyx neustria*, L., *Geometra papilionaria*, L., *Abraxas grossulariata*, L., *Cymatophora or*, Fab., &c. Some confusion of species may here be suspected.

Closely resembling *limbatus*, No. 11, but apparently distinct. It is somewhat larger; the wings are more hyaline, segment 1 is more quadrate, and its margins less broadly testaceous; the cocoons are more obviously different.

Bred in England commonly from *Geometra papilionaria*, L.; by Curtis, four broods by Bignell, in July, and another by Raynor were named by Reinhard, including, however, one from *Cabera pusaria*, L., now destroyed, the cocoon of which shows it to have been another species. Also reared by Harding from *Vanessa urticae*, L., 8 on a card; and 5 by Cameron in Scotland, from *Pieris brassicae*, L. Gregarious. Cocoons sulphur-yellow, irregularly clustered, naked, and connected by a few filaments. They are larger and paler than those of *glomeratus*; and much more yellow than those of *limbatus*.

13. *Apanteles rubecula*, n. s.

Niger, palpis, ventrisque basi anguste, pallidis. Pedes rufotestacei, femoribus posticis apice nigris, tibiis iisdem apice tarsisque fusciscentibus. Alæ leviter infuscatæ, stigmatè nervisque fuscis, squamulis nigris. Mesothorax confertissime punctulatus, subnitidus; scutellum lævius; metathorax rugulosus, carinulatus. Segmentum 1mum non longius quam latius, basi paulo angustatum, apice late truncatum, cum 2do rugulosum; hoc 3tio brevius, medio carinulatum; cætera lævia, nitida; segmentum 3tium vage punctulatum. Coxæ posticæ nitidæ, punctulatæ. Tibiarum posticarum calcar internum metatarsi dimidio æquale. Terebra brevissima.

Black; palpi, and belly at the base narrowly, pale. Legs rufotestaceous, hind femora black at the apex, their tibiæ at the apex, and tarsi, fusciscent. Wings somewhat dusky hyaline, stigma and nervures fuscous, squamulæ black. Mesothorax very thickly punctulate, somewhat shining; scutellum smoother; metathorax rugulose, carinulated. Segment 1 not longer than broad, slightly narrowed at the base, the apex broadly truncated, rugulose like the 2d, which is shorter than the 3d, carinulated in the middle; 3d (with some scattered punctures) and following, smooth, shining. Hind coxæ shining, punctulate. Inner spur of the hind tibiæ equal to $\frac{1}{2}$ the metatarsus. Terebra very short. ♀. Length, $1\frac{1}{2}$; wings, $3\frac{3}{4}$ lin.

Separated from *rubripes*, Hal., on the following grounds:—The squamulæ are black; the wings have a dusky tinge; the metathorax is finely carinated; the cocoon and habits of the larva are different.

Two specimens were bred by Bignell, singly, on June 17th, from half-grown larvæ of *Pieris rape*, L. The cocoon differs in texture and colour from that of *rubripes*, Hal.; it is not woolly, but naked, wrinkled, and cream-coloured, nearly white; it is also somewhat larger, as is the perfect insect.

14. *Apanteles glomeratus*, L.

Ichneumon glomeratus, Lin., F. S., 410.

Microgaster glomeratus, Hal., Ent. Mag., ii., 250, ♂ ♀; Reinh., Berl. ent. Zeit., 1881, p. 33, ♂ ♀; Bouché, Naturg. (1834), 150; Taschen., Naturg. wirb. Thiere, 93, pl. iii., ff. 3, 4. Cf. Réau., Mém., ii., 419, pl. xxxiii., ff. 2—13; DeGeer, Mém., i., pl. xvi., f. 6; Bree, in Loud. Mag., 1832, pp. 105—107; Westw., in Loud. Mag., 1832, p. 301, and pp. 107—109 (economy); Westw., Int., ii., 144 (econ.), and pl. lxxvi., f. 16 (larva); Cur., Farm. Ins., 97.

M. reconditus, Nees, Mon., i., 174; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 47, pl., fig. F. ♂ ♀.

M. crategi, Ratz., Ichn. d. Forst., i., 72.

Black, with pale palpi; segment 1 at the sides narrowly, belly at the base, and legs, rufo-testaceous; hind femora black above towards the apex, hind tibiæ tipped with fuscous, coxæ black. Wings hyaline, squamulæ black, stigma fuscous. Mesothorax thickly and finely punctulate, somewhat shining; scutellum and pleuræ smooth. Metathorax rugulose. Segment 1 longer than its breadth by one half, the sides parallel, truncate at the apex, concave at the base, rugulose; 2 broader than 1, shorter than 3, with two lateral oblique impressions, rugulose, with a smooth medial obtuse carina; the rest smooth and shining. Hind coxæ punctulate, shining. Inner spur of the hind tibiæ shorter than $\frac{1}{2}$ the metatarsus. Terebra very short. ♂ ♀. Length $1\frac{1}{2}$; wings, $2\frac{1}{2}$ lin.

Segments 1—2 are shining, and slightly or moderately rugulose. The oblique impressed lines on segment 2, common to many species are here more developed, curved, and approximated at the fore margin, approaching the structure of Sect. III. They terminate in two distinct foveæ, which are one of the surest marks by which to recognise the species. The hind femora of the ♂ are usually more broadly black towards the apex than those of the ♀. Antennæ ♂ as long as the body.

Var. Antennæ ♂ longer than the body; segment 2 smooth; 4 posterior femora with a black line above; stigma pale fuscous. ♀. The same, but the 2d segment is rugulose, and the antennæ shorter. Length, 1 line. Bred by me formerly from *P. brassica*, L. Specimens are also in Fitch's collection. A further observation of them, together with their cocoons, is desirable. They were returned by Reinhard with the name *glomeratus*.

A brood similarly named, and bred by Bignell from *Phygalia pedaria*, Fab., is not the present species, but

difficilis, Nees. Two or three of the cocoons are accidentally more yellow than usual.

A. glomeratus is the well-known parasite of all the species of *Pieris*. Bignell has also obtained it from *Abraxas grossulariata*, L.; the specimens from the moth are absolutely the same. The sulphur-yellow cocoons of the gregarious maggots may be found plentifully near cabbage-gardens. They are irregularly heaped together, without a common covering, but merely connected by a slight web. As in the case of *congestus*, Nees, No. 7, it has been asserted that this web is constructed by the dying caterpillar of the butterfly. That this is not the fact I can testify, from having watched the operations of these parasites. The *Pieris*-larva was perfectly inert and moribund. Curtis counted as many as 67 *Microgaster*s which issued from the body of a single caterpillar of *P. brassicæ*, L.; Bignell counted 142 cocoons from a similar larva (*Entom.*, xvi., 263). They usually come out in September and spin their cocoons, in which they pass the winter. In the following May they hatch, and are ready to attack the spring-broods of butterflies. Giraud and Brischke have obtained this species also from *Aporia crataegi*, L.; and the latter (as he states) from *Smerinthus populi*, L., *Zygena ephialtes*, L., and *Bembecia hylæiformis*, Lasp. Miss Pasley, of Windermere (*E. M. M.*, i., 281), records the singular fact that an imago of *Pieris rapæ*, L., emerged from the pupa with two of the yellow cocoons of this parasite, containing pupæ, rolled up in the wings. Bouché (*Naturg.*, 168, No. 61) has described one of the *Chalcididæ*, which he calls *Diplolepis microgastri*, living parasitically in the cocoons of *glomeratus*, 3 or 4 together: the cocoons so infested are paler than healthy ones. *Hemiteles fulvipes*, Gr., is also a hyper-parasite, frequently taking the place of the entire brood.

15. *Apanteles sericeus*, Nees.

Microgaster sericeus, Nees, *Mon.*, i., 184, ♂ ♀.

M. præpotens, Hal., *Ent. Mag.*, ii., 252, ♀.

M. brevicornis, Wesm., *Nouv. Mém. Ac. Brux.*, 1837, p. 50, ♀; *Apanteles brevicornis*, Reinh., *Berl. ent. Zeit.*, 1881, p. 34, ♂ ♀.

M. fuliginosus, Ratz., *Ichn. d. Forst.*, iii., 56, partly (not of Wesm.).

Deep black; mandibles tipped with rufous, palpi pale; fore femora, apex of the intermediate femora narrowly, and all the

tibiæ, rufo-testaceous; middle and hind tibiæ more or less tipped with fuscous. Wings whitish hyaline, squamulæ black, stigma fuscous. Antennæ ♂ as long as the body; of the ♀ only $\frac{2}{3}$ as long, submoniliform at the apex. Mesothorax very shining, subpunctulate; metathorax rugulose. Segment 1 longer than broad, with parallel sides, rugulose and somewhat shining, like the 2d, which is a little shorter than the 3d; the rest smooth and shining. Hind coxæ smooth, shining. Terebra shortly exerted. Ventral valve surpassing the anus. Spurs of the hind tibiæ shorter than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{2}$ — $1\frac{3}{4}$; wings, 3— $3\frac{1}{2}$ lin.

A large species, characterised by intense blackness, very shining thorax, whitish wings, and in the ♀ unusually short antennæ, exerted terebra and ventral valve, whereby the abdomen appears acuminate. *M. sericeus*, Nees, has not hitherto been identified, but the agreement of our larger specimens with his description is very complete. The structure of the 2d segment, with two obsolete, lateral, impressed, converging lines, enclosing a rugulose space, is sufficiently indicated by Nees. It seems equally certain that *præpotens*, Hal., is to be referred to this species, although Reinhard places a (?) after the name. *M. placidus*, Hal., which Reinhard treats as a synonym, is a distinct species, and not hard to recognise among English specimens. Besides, Haliday was too careful a writer to describe the same insect under two different names, with only *lineola* between them. Nees compares his *sericeus* with *juniperatæ*, Bouché, but the latter agrees only in size, differing in the subfuscous wings, less shining surface, length of the ♀ antennæ, shorter ventral valve, and colour of the cocoons.

Common. A solitary parasite. Bred by Bignell from *Tethea retusa*, L., *Dianthæcia cucubali*, Fuess., and *capsineola*, Hüb., *Emmelesia alchemillata*, L., and *Eupithecia pulchellata*, Ste. By Fitch from *Mimesoptilus plagiodyctylus*, Staint., and by Raynor from *Eupithecia valerianata*, Hüb. By Cameron, at Milngavie, Scotland, from *Thera juniperata*, L. Bignell obtained his specimens from *E. pulchellata* on March 24th, out of cocoons taken in foxglove-flowers the preceding July; hence it appears that some of them hibernate as pupæ, although the majority come out in July and August. Nees also obtained his *sericeus* April 25th out of a larva which feeds on *Digitalis ambigua* flowers. Bred on the Continent by Kriechbaumer, of Munich, from *Hyssipetes impluviatus*,

Hüb.; according to Ratzeburg by Kirchner from *Hyponomeuta padellus*, L. Cocoons pale lemon-colour, or whitish yellow, attached singly to various plants. Cameron bred two hyper-parasitic species of *Hemiteles* from these cocoons (Zool., 1880, p. 269).

The origin of 4 specimens in Fitch's collection requires explanation. They are ticketed as having been hatched from cocoons of *Hypera variabilis*, Hbst., and some of the beetles are preserved with them. The difficulty is that *Microgaster*s spin cocoons for themselves, and are not known as using those of other insects.

Under *brevicornis*, Wesm., = *fuliginosus*, Ratz., Brischke states that he has bred this from *Erynnis alceæ*, Esp., also from a *Geometer* and a *Tortrix*. He describes the cocoons as white and gregarious, which renders the whole observation doubtful.

16. *Apanteles spurius*, Wesm.

Microgaster spurius, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 49; *Apanteles spurius*, Reinh., Berl. ent. Zeit., 1881, p. 34, ♂ ♀.

Black; palpi pale; legs rufo-testaceous, fore femora at the base only, the others entirely, black; hind tibiæ rarely fuscous at the apex. Wings hyaline, squamulæ black, stigma fuscous. Mesothorax thickly and very finely punctate, dull, more shining at the hind angles; scutellum sparingly punctulate, shining. Mesopleuræ shining and smooth. Metathorax and segments 1—2 rugulose, dull; segment 1 subquadrate, a little narrowed at the base; 2 hardly shorter than 3, which, with the rest, is smooth and shining. Terebra subexserted. Hind coxæ smooth. Spurs of the hind tibiæ slender, distinctly shorter than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, 1—1½; wings, 2—3 lin.

Var. All the femora piceo-testaceous.

Care must be taken to distinguish this from *difficilis*, Nees, and *caicæ*, Bouché. In the former the terebra is very short; in both, the spurs of the hind tibiæ are stouter and longer than those of *spurius*, which has also the legs longer and more slender, especially the joints of the hind tarsi, the hind tibiæ almost always concolorous at the apex, and makes different cocoons. "Probably, but not certainly," says Reinhard, "*M. picridis*, Bouché, Naturg., p. 152, is to be regarded as identical with this species." The cocoons, however, are described by Bouché as not white, but "dunkelgelb."

Common. Gregarious. Bred by Bignell from *Vanessa urticae*, L., *Melitea aurinia*, Rott., *Leucania littoralis*, Cur., and *Agrotis præcox*, L. By W. H. B. Fletcher from *Zonosoma orbicularia*, Hüb.; by Raynor from *Hypsipetes trifasciata*, Bork.; by Porritt from *Agrotis præcox*, L. Reared plentifully on the Continent by Nördlinger at Grand Jouan, in Brittany, from *Dicranura vinula*, L., the larvæ of which perished just before their last moult in autumn, and the parasites appeared early in the following May. By Brischke from *Melitea Maturna*, L., *Argynnis Latona*, L., *Polymmatas Dorylas*, Hufn., *Zygæna ephialtes*, L., *Bombyx castrensis*, L., *Dicranura bifida*, Hüb., *Lophopteryx camelina*, L., *Eupithecia sobrinata*, Hüb., *Thera juniperata*, L., and *Pionea forficalis*, L. By Giraud from *Vanessa urticae*, L., and *Zygæna filipendulæ*, L.; and by Franz Löw, in September, from *Hadena oleracea*, L.

Cocoons white, with hardly a sulphur-tinge, enveloped in a cottony ball, like those of *congestus*, but white, and less regularly formed.

17. *Apanteles Geryonis*, n. s.

Niger, palpis pallidis. Segmentum 1mum lateribus anguste, venter basi, pedesque, rufo-testacea; femora posteriora supra nigro lineata vel tota fusca, tarsis apice fuscis; coxæ nigræ. Alæ hyalinae, squamulis fuscis, stigmatate subferrugineo vel pallide fusco. Mesothorax confertim subtiliter punctulatus, opacus; pleuræ similes, spatio sub alis nitido. Metathorax punctatus, opacus. Segmentum 1mum longius quam latius, basi subangustatum, apice truncatum, cum 2do rugulosum, opacum; hoc 1mo latius, 3tio brevius, medio carinatum, linea impressa obsoleta utrinque marginatum; cætera nitida, lævia. Terebra brevissima. Tibiarum posticarum calcar internum metatarsi dimidio paulo brevius. Coxæ posticæ nitidæ.

Black, with pale palpi; segment 1 at the sides narrowly, belly at the base, and legs, rufo-testaceous; posterior femora with a black line above, or wholly fuscous, their tarsi fuscous at the tips; coxæ black. Wings hyaline, squamulæ fuscous, stigma subferrugineo-fuscous. Mesothorax thickly and finely punctulate, dull; pleuræ the same, with a shining space beneath the wings. Metathorax punctate, dull. Segment 1 longer than broad, slightly narrowed at the base, truncate at the apex, and like the 2d, rugulose, dull; segment 2 wider than 1, shorter than 3, carinated in the middle, margined on each by an obsolete impressed line;

the rest smooth and shining. Terebra very short. Inner spur of the hind tibiæ a little shorter than $\frac{1}{2}$ the metatarsus. Hind coxæ shining. ♀. Length, 1; wings, $2\frac{1}{2}$ lin.

Described from 3 females. Smaller than *glomeratus*, less shining, and with a differently formed 2d segment. The legs are more marked with black, and the pleuræ obscure with punctulation. Nothing but the colour of the legs, and the different source from which the insects were bred, prevents them from being considered *A. vanesse*, Reinh. This, however, has the legs wholly pale, and is parasitic on *Vanessa*, *Argynnis*, and *Limenitis*.

Bred by Bignell from *Procris Geryon*, Hüb. Cocoons pure white, attached together by some loose threads.

18. *Apanteles zygænarum*, n. s.

Niger, palpis pallidis; ventris macula basali, femoribus anticis præter basin, mediis apice, tibiisque omnibus, rufo-testaceis; harum posticis apice fuscis; trochanteribus inferis testaceis. Alæ fusco-hyalinæ, squamulis nigris; stigmatè nigro-fusco. Mesothorax subscabriculus, opacus. Scutellum confertim punctulatum, nitidulum. Mesopleuræ nitidæ, læves, antice punctulatæ. Metathorax carinulatus, et cum segmentis 1—2 rugulosus, subnitidus; horum 1mum longius quam latius, basin versus sensim angustatum, apice truncatum; 2dum medio elevatum, utrinque arcuato-impressum, 3tio paulo brevius; hoc interdum basi vage subrugulosum; cætera lævia, nitida. Terebra brevissima. Valvula ventralis magna, subtruncata, anum non superans. Coxæ posticæ nitidæ, punctulatæ. Tibiarum posticarum calcar internum gracile, metatarsi dimidio vix paulo longius.

Black, with pale palpi; a basal spot on the belly, fore femora except the base, middle femora at the apex, and all the tarsi, rufo-testaceous; hind tibiæ tipped with fuscous; lower trochanters testaceous. Wings fusco-hyaline, squamulæ black, stigma dark fuscous. Mesothorax dull, subscabriculous. Scutellum thickly punctulate, rather shining. Mesopleuræ shining, smooth, punctulate in front. Metathorax carinulated and, like segments 1—2, rugulose, rather shining; segment 1 longer than broad, gradually narrowed towards the base, truncate at the apex; 2 elevated in the middle, margined on each side with a curved impressed line, somewhat shorter than 3, which is sometimes vaguely subrugulose at the base; the rest smooth and shining. Terebra very short. Valvula ventralis ample, subtruncate, but not surpassing the anus. Hind coxæ shining, punctulate. Inner spur of the hind tibiæ slender, hardly longer than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{2}$; wings, 3 lin.

Closely allied to *difficilis*, Nees, and *juniperatæ*, Bouché; it equals the latter in size, but differs from both in having the mesothorax more thickly punctate and wholly obscure; the wings are rather lighter than those of *juniperatæ*; the metathorax is carinated, the abdomen at the base more finely rugulose and less shining, and the ventral valve not acuminate.

Two females and 4 males, bred by Bignell from *Zygæna filipendulæ*, L., remain, others having been destroyed. Bignell has also captured a ♀. Cocoons sulphur-yellow, like those of *glomeratus* and *rubripes*. Four cocoons produced the hyperparasite *Hemiteles fulripes*, Gr.

19. *Apanteles jucundus*, n. s.

Niger; palpis, ventris basi anguste, tibiis, femoribus anticis præter basin, intermediis apice, trochanteribusque inferis, flavo-testaceis; tibiis posticis, tarsisque omnibus apice, obscuris. Alæ albido-hyalinæ, squamulis, nigris, stigmatæ fusco basi subdilutiore, nervis pallide fuscis, costa prope basin testacea. Mesothorax confertim subtiliter punctulatus, opacus; scutellum vage punctulatum apice lævi. Metathorax punctato rugulosus, medio carinulatus. Segmentum 1mum latitudine media fere sesquialongius, lateribus perpaulo rotundatis, basin versus leviter angustatum, apice truncatum, marginatum, cum 2do rugulosum substriato-punctatum; 2dum carina media lævi, 1mo paulo latius, 3tio non multum brevius, hoc basi utrinque transversim impressum, carinula media inchoata, cum cæteris læve. Terebra brevissima. Valvula ventralis anum non superans. Coxæ posticæ læves. Calcaria postica metatarsi dimidio breviora.

Black; palpi, base of the belly narrowly, tibiæ, fore femora except at the base, middle femora at the apex, and lower trochanters, flavo-testaceous; hind tibiæ, and tips of all the tarsi, obscure. Wings whitish hyaline, squamulæ black, stigma fuscous, with a spot at the inner angle paler, nervures pale fuscous, base of the costa testaceous. Mesothorax thickly and finely punctulate, dull; scutellum sparingly punctulate, the apex smooth. Metathorax punctato-rugulose, with a fine medial carina. Segment 1 about half as long again as its medial width, the sides very slightly curved, somewhat narrowed towards the base, truncate at the apex, margined, rugulose and substriato-punctate like the 2d; 2d with a smooth medial carina, a little wider than the 1st, not much shorter than the 3d; 3d transversely impressed on each side of the base, with an inchoate medial carina, smooth and shining like the remaining segments. Terebra very short. Valvula

ventralis not surpassing the anus. Hind coxæ smooth. Spurs of the hind tibiæ shorter than $\frac{1}{2}$ the metatarsus. ♀. Length, $1\frac{1}{2}$; wings, $3\frac{1}{2}$ lin.

Var. Femora testaceous, hind pair with an apical black dot. Stigma almost unicolorous.

Certainly distinct from *glomeratus*, which it much resembles. It is larger; the legs are differently coloured (except in the variety); the stigma has an obsolete pale spot at the inner angle; the 2d segment is differently sculptured, wanting the impressed curved lines ending in two foveæ in front, as seen in *glomeratus*.

One ♀ taken by sweeping, in Northamptonshire; another (the var.) is in Fitch's collection, ticketed *glomeratus*.

20. *Apanteles caicæ*, Bouché.

Microgaster caicæ, Bouché, Naturg. (1834), 403.

M. perspicuus, Nees, Mon., i., 177, ♂ ♀ (not of Wesm. or Ratz.)

M. difficilis var. β ., Nees, Mon., ii., 403, ♀.

M. glomeratus, Newman, Loud. Mag., 1833, p. 109.

Black; palpi pale; lateral margins of segments 1—2 narrowly, belly at the base, and legs, rufo-testaceous: fore femora at the base, posterior femora more or less, tips of all the tarsi, and sometimes of the hind tibiæ, fuscous. Wings fusco-hyaline, squamulæ black, stigma fuscous. Mesothorax thickly punctulate, dull; scutellum more sparingly, shining. Mesopleuræ punctulate in front, smooth and shining behind. Metathorax and segments 1—2 rugulose, dull; segment 1 subquadrate, truncate, hardly narrower than 2, which is shorter than 3; 3rd and following smooth, shining; lateral impressed lines of segment 2 wide apart, subobsolete. Terebra stout, subexserted. Ventral valve large, surpassing the anus, whereby the abdomen appears acuminate, and apically compressed. Hind coxæ punctulate, shining. Spurs of hind tibiæ somewhat longer than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{2}$; wings, $2\frac{3}{4}$ lin.

The belly, which is broadly testaceous at the base, the terebra and ventral valve of the ♀, sufficiently distinguish this from *difficilis*, Nees, and *spurius*, Wesm. It also makes different cocoons. Trochanters black; hind tibiæ generally without fuscous tips; posterior femora seldom wholly piceous or fuscous, usually more or less testaceous at the base or in the middle, the edges remaining dark.

Gregarious. Bred by Bouché, Newman, and five times by Bignell, from *Arctia caia*, L., the broods consisting of 4—6 specimens. More of these, named by Reinhard *perspicuus*, Nees, are in Fitch's collection, together with a brood of 9 males, reared by Eedle from *Arctia villica*, L. Cocoons dirty white, irregularly heaped together, and without an external web. Very likely Brischke's specimens, named by him *perspicuus*, Nees, and bred from *Cucullia argentea*, Hufn., belong to this species. Possibly also his *difficilis*, Nees, bred from *Arctia caia*, L., *A. Hebe*, L., and *Spilosoma fuliginosa*, L.; although this is rather less likely.

21. *Apanteles juniperatæ*, Bouché.

Microgaster juniperatæ, Bouché, Naturg. (1834), 154;
Ratz., Ichn. d. Forst., i., 74.

Apanteles juniperatæ, Reinh., Berl. ent. Zeit., 1881,
p. 34, ♂ ♀.

Black; palpi pale; legs rufo-testaceous; fore and middle femora except at the apex, hind femora entirely, black; middle and hind tibiæ black or fuscous at the apex. Wings infumated, squamulæ black, stigma fuscous. Mesothorax punctulate, pubescent, and with the scutellum, somewhat shining. Mesopleuræ smooth and shining. Metathorax and segments 1—2 rugulose; segment 1 rather longer than wide, with parallel sides; 2 subcarinated, as long as 3; 3 more or less punctulate at the base, and, with the rest, smooth and shining. Terebra very short. Hind coxæ punctulate, shining. Spurs of hind tibiæ stout, somewhat longer than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{2}$; wings, $3\frac{1}{4}$ lin.

Very like *A. zygænarum*, No. 18; for differences see that species. Distinguished from *congestus*, *spurius*, and *difficilis* by greater size and tinted wings; from *congestus*, moreover, by the smooth hind coxæ; from *spurius* by the stout elongate hind spurs; and from *difficilis* by the 2d segment, which is not shorter than the 3d. The cocoons are coloured like those of *difficilis*, and unlike those of the others. Identified erroneously by Nees with his *sericeus*; see No. 15. The insects sent to me as types, named by Reinhard, were in great confusion, consisting of 3 species: *juniperatæ*, Bouché, *popularis*, Hal., and *difficilis*, Nees.

Said to have been reared once from a Bombycid, *Larva I-nigrum*, L., by Brischke; otherwise only from Geometræ, and originally by Bouché from *Thera juniperata*, L., in

which, according to that author, it lives singly. Other larvæ, however, according to their size, have been found to produce from two to eleven. The parasites when hatched are not gregarious, but form their cocoons separately. On issuing from the victim they spin each a rough case, and afterwards a finer cocoon inside it. The cocoons may be found scattered about on the needles of the juniper, &c., as in the case of *sericeus*. They are of a pale reddish buff, or flesh-colour, like those of *difficilis*, but larger. In the Berl. ent. Zeit. they are not very accurately described as "pale yellowish;" and by Brischke as "paler or darker brownish yellow to sulphur-yellow." In addition to *Thera juniperata*, L., Reinhard mentions *Emmelesia alchemillata*, L., and *Eupithecia sobrinata*, Hüb. The twenty-nine specimens examined by me were bred by Bignell from *Odontoptera bidentata*, Clerck, *Selenia bilunaria*, Esp., *Crocallis elinguaris*, L., *Himera pennaria*, L., and *Cidaria fulvata*, Forst. In the case of *Selenia*, eleven parasites came from the same larva during five or six days, and remained as pupæ about a fortnight. It is not easy to understand how a caterpillar of the size of *S. bilunaria* can accommodate eleven of these rather large *Microgasters*. To the above-mentioned Geometræ may be added, from Brischke, *Eupithecia exiguata*, Hüb., *nanata*, Hüb., *pimpinellata*, Hüb., *lariciata*, Freyer, &c.

22. *Apanteles gracilis*, Cur.

Microgaster gracilis, Cur., B. E., 321, No. 12; Hal., Ent. Mag., ii., 253, ♂ ♀.

Black; legs flavo-ferruginous, 4 posterior femora with a fuscous streak above and below, or nearly all fuscous, their tibiæ also infuscated in the ♂; coxæ and trochanters black. Wings hyaline, squamulæ fuscous, stigma pale ferruginous. Mesothorax and scutellum thickly punctulate, dull; metathorax smoother and more shining, usually with a medial carina. First segment $1\frac{1}{2}$ times longer than broad, somewhat rounded at the sides, truncate, and with the 2d, and base of the 3d, rugulose, dull; segment 2 as long as 3; the rest smooth and shining. Terebra very short. Valvula ventralis not surpassing the anus. Hind coxæ punctulate, shining. Spurs of hind tibiæ shorter than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $\frac{3}{8}$; wings, $2\frac{1}{2}$ lin.

Like *difficilis*, Nees, but much smaller; the rugulose part of the abdomen is less shining, and segment 2 more distinctly broader

than 1; spurs of hind tibiæ proportionally shorter. Antennæ ♀ as long as the body, of the ♂ longer. Stigma rufescent.

Specimens from Leicestershire, under this name, have long been in my collection. On re-examination I find them to agree entirely with Haliday's description, so far as that extends.

23. *Apanteles placidus*, Hal.

Microgaster placidus, Hal., Ent. Mag., ii., 251, ♂.

Black; palpi pale; belly at the base, sides of 1st segment narrowly, femora and tibiæ, rufo-testaceous; fore femora black at the base, posterior pitchy, black above and at the apex, or entirely black; hind tibiæ at the apex, and all the tarsi, fuscous. Antennæ ♂ much longer than the body, beneath and on their apical half sometimes flavo-testaceous. Wings whitish hyaline, stigma fusco-ferruginous. Mesothorax thickly and very finely punctulate, dull in the middle of the disk, posteriorly, together with the scutellum, more shining. Metathorax rugulose, sometimes carinulated. Segment 1 half as long again as its breadth, slightly narrowed at the base, truncated at the apex, rugulose; segment 2 rugulose, as long as 3; the rest smooth and shining. Hind coxæ punctulate, shining. Inner spur of the hind tibia not longer than $\frac{1}{2}$ the metatarsus. Shape slender, elongate. ♂ ♀. Length, $1\frac{1}{4}$; wings, $2\frac{1}{2}$ lin.

Described from a pair in Bridgman's collection, and a ♀ taken by myself. The ♂ is remarkable for its very long antennæ, of which the apical half is flavo-testaceous, perhaps accidentally. Reinhard refers the species doubtfully to *brericornis*, Wesm., i. e., *sericeus*, Nees, but the possession of both sexes of *placidus* shows them to be distinct, as correctly supposed by Haliday.

24. *Apanteles nothus*, Reinh. MS.

Niger, pedibus flavo-ferrugineis, femoribus posterioribus, tibiis iisdem apice late, tarsisque fuscis; coxis et trochanteribus nigris. Alæ subfumato-hyalinæ, squamulis, stigmatibus, nervis, pallide piceis. Mesothorax et scutellum confertim punctulata, parum nitida; metathorax leviter rugulosus. Segmentum 1mum subquadratum, marginatum, truncatum, cum 2do rugulosum, subnitidum; hoc 1mo non multo latius, paulo brevius quam 3tium; cætera lævia. Terebra brevissima. Valvula ventralis anum non superans. Calcaria postica metatarsi dimidio paulo longiora.

Black; legs flavo-ferruginous, 4 posterior femora, their tibiæ at

the apex broadly, and the tarsi, fuscous; coxæ and trochanters black. Wings somewhat dusky hyaline, squamulæ, stigma, and nervures pale pitchy. Mesothorax and scutellum thickly punctulate, hardly shining; metathorax slightly rugulose. Segment 1 subquadrate, margined, truncate, rugulose like 2, and somewhat shining; 2 not much wider than 1, rather shorter than 3; the rest smooth. Terebra very short. Valvula ventralis not surpassing the anus. Hind spurs a little longer than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $\frac{2}{3}$; wings, $1\frac{1}{2}$ lin.

This species is the smallest of the section, and very like *gracilis*, Cur. The antennæ are shorter, the legs differently coloured, and the proportions of the abdomen different.

Discovered and bred in some numbers by Bignell from *Anticlea badiata*, Hüb., *Epinephele Iaira*, L., *Melanippe galiata*, Hüb., *Tethea retusa*, L., and *Spilosoma menthastris*, Esp. Those from *Spilosoma* are a trifle larger, but appear to differ in no other respect. The cocoons are white, irregularly clustered, and connected by a few threads.

25. *Apanteles difficilis*, Nees.

Microgaster difficilis, Nees, Mon., i., 182, ♀; *Apanteles difficilis*, Reinh., Berl. ent. Zeit., 1881, p. 35, ♂ ♀.

M. vestalis, Hal., Ent. Mag., ii., 253, ♂ ♀.

M. insidens, Ratz., Ichn. d. Forst., i., 72.

M. melanoscelus, Ratz., lib. cit., 74, ♂.

Black; palpi pale; antennæ often dull reddish underneath; sides of segment 1 narrowly, apex of 4 anterior femora, sometimes 4 posterior at the sides, 2d joint of trochanters, and the tibiæ, rufotestaceous; 4 posterior, or only hind tibiæ, usually tipped with fuscous. Wings hyaline, squamulæ black, stigma fuscous or dull testaceous. Mesothorax thickly punctulate, dull; scutellum more shining. Mesopleuræ punctulate in front, smooth behind. Metathorax and segments 1—2 minutely rugulose, rather shining; segment 1 longer than broad, a little narrowed near the apex, and truncate; 2 rather shorter than 3, with two obsolete lateral impressions curving inwards anteriorly; 3 and the rest smooth and shining. Terebra very short. Ventral valve not surpassing the anus. Hind coxæ smooth, shining. Spurs of the hind tibiæ stout, longer than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{4}$; wings, $2\frac{1}{2}$ lin.

Differs from *juniperatæ* by its smaller size, hyaline wings, and impunctulate 3d segment, which is longer than the 2d; from *congestus* by the smooth hind coxæ,

and the cocoons; from *spurius* by the stout elongate spurs of the hind tibiæ, and the cocoons; from *gracilis* by larger size, and the absence of a carina on the meta-thorax.

Common. The cocoons are flesh-coloured or buff, like those of *juniperatæ*; a few, by some accident, are more yellow. The maggots, on leaving the body of their victim, make separate naked cases, without clustering together. From 1 to 20 issue from a single caterpillar, according to its size: Bignell has obtained from a specimen of *Selenia bilunaria*, Esp., a single *A. difficilis* accompanied by one of *A. caberæ*. *A. difficilis* has been reared frequently from Bombyces, more sparingly from *Zygænæ*, *Noctuæ*, and *Geometræ*. In Fitch's collection are 17 specimens on one card, bred from *Bombyx rubi*, L., by Meldola. Bignell's numerous broods are from *Zygæna filipendulæ*, L., *Euchelia jacobææ*, L., *B. rubi*, L., *Agrotis præcox*, L., *Hadena pisi*, L., *Amphidasys betularius*, L., *A. strataria*, Hufn., and *Phigalia pedaria*, Fab.; the last were mixed with *A. glomeratus*, L., probably because some of the cocoons were unusually tinged with yellow. Fitch has reared a brood from a young *Arctia caia*, L.; and a second lot in his collection were obtained by Sotheby (16 specimens) from *Melanippe galiata*, Hüb.; a third by E. A. Butler from *Selenia bilunaria*, Esp. According to Ratzeburg the species has been reared from *Arctia Hebe*, L., *Spilosoma fuliginosa*, L., *Pæcilocampa populi*, L., and *Diloba cæruleocephala*, L. Those recorded by Nees as coming from *Arctia caia*, L., are doubtful, and may belong to his var. β . = *perspicuus*, Nees = *caia*, Bouché, which is a distinct species. Brischke gives the following list of victims out of which he has bred this parasite; those above mentioned are not repeated. *Smerinthus populi*, L., *Zygæna trifolii* and *meliloti*, Esp., *ephiates*, L., *Leucoma salicis*, L., *Lasiocampa ilicifolia*, L., *Lophopteryx camelina*, L., *Notodonta dictæa*, L., *Acronycta euphorbiæ*, Fab., *Miselia oxyacanthæ*, L., *Aplecta tinctoria*, Brahm, *Odontoptera bidentata*, Clerck, *Eupithecia centaureata*, Fab., *pimpinellata*, Hüb., and *sobrinata*, Hüb., *Melanippe galiata*, Hüb., and *Eucosmia certata*, Hüb.

SECTION II.

26. *Apanteles punctiger*, Wesm.

Microgaster punctiger, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 61, ♀.

? *Apanteles punctiger*, Reinh., Berl. ent. Zeit., 1881, p. 36, ♂ ♀.

Black; antennæ pitchy beneath at the base; palpi, squamulæ, belly at the base, and legs, testaceous; middle coxæ sometimes at the base, hind coxæ entirely, black; hind tibiæ at the apex, and their tarsi except the base, also black. Wings fusco-hyaline, stigma fuscous or fusco-testaceous, with a pale spot at the inner angle. Meso- and metathorax, with the scutellum, thickly punctulate, shining. Segment 1 half as long again as its breadth, truncate, the sides parallel, covered with shallow confluent punctures; 2 more than half as long as 3, broader than 1, hardly rugulose; the rest smooth and shining. Terebra $\frac{1}{4}$ of the abdomen. Valvula ventralis not surpassing the anus. ♂ ♀. Length, $1\frac{1}{3}$; wings, 4 lin.

The single British specimen agrees very well with Wesmael's description, less exactly with that of Reinhard, who states the thorax to be dull instead of shining, and the stigma testaceous, making no mention of a pale spot at the inner angle. In the British example the intermediate coxæ are black at the base: the wings are ample, and tinged with dusky.* The terebra projects beyond the anus about $\frac{1}{4}$ of the length of the abdomen; if measured from the base it is longer. Wesmael's specimen was not in a condition to show the length of this organ, see *lib. cit.*, p. 62, note.

One ♀ was captured by Bignell near Plymouth.

27. *Apanteles lætus*, n. s.

Niger, palpis, pedibusque cum coxis, rufo-testaceis; tibiis posticis apice, tarsorumque articulis singulis præter basin, nigris. Abdomen vel rufo-testaceum, segmentis singulis disco plus minus nigricantibus; vel nigrum, ventris basi late testacea. Alæ hyalinæ, squamulis, costa, nervis, flavidis; stigma pallidum, flavo-cinctum. Mesothorax lævis, pubescens, iridescens; scutellum et metathorax lævia, nitida. Segmentum I num latitudine media sesquilinguis,

* The dusky tinge is not noticed by Wesmael, who would have only pinned specimens for examination. The colour of wings can hardly be accurately seen, unless a piece of paper is held behind them, to form a white background.

apicem versus subangustatum, truncatum, cum 2do leviter rugulosum; hoc 3tio brevius, 1mo latius; cætera lævia, nitida. Terebra abdominis quadrantæ æqualis, subdecurva, valvulis crassioribus. Valvula ventralis anum non superans, acuminata.

Black; legs, with the coxæ, rufo-testaceous; hind tibiæ at the apex, and each joint of the tarsi, except at the base, black. Abdomen either rufo-testaceous, with the disk of each segment more or less black; or black, with the base of the belly broadly testaceous. Wings hyaline, squamulæ, costa, and nervures yellowish; stigma almost hyaline, with a yellow border. Mesothorax smooth, pubescent, iridescent; scutellum and metathorax smooth, shining. Segment 1 half as long again as its medial breadth, slightly narrowed towards the apex, truncated, slightly rugulose like 2, which is shorter than 3, broader than 1; the rest smooth and shining. Terebra $\frac{1}{4}$ of the abdomen, somewhat decurved, the valves incrassated. Valvula ventralis not surpassing the anus, acuminated. ♀. Length, $\frac{1}{3}$ —1; wings, $1\frac{1}{2}$ — $2\frac{1}{2}$ lin.

Described from six females. Antennæ almost as long as the body. Mandibles partly rufous. The variable abdomen is entirely black above in one specimen; in the others the 1st segment is narrowly bordered with testaceous, the following segments are testaceous with a black discal patch. Two of these specimens were returned by Reinhard as *punctiger*, Wesm. They are, however, much smaller, the 1st segment is not punctate, and differs in shape, the wings are more hyaline, the stigma yellow, and the hind coxæ testaceous. They are more like *punctiger*, Reinh., only too small. The difference between *punctiger*, Wesm., and *punctiger*, Reinh., is such that they are probably not identical.

Four specimens were bred by Fitch, July 24th, and seven by Elisha, July 17th, from *Gracilaria semifascia*, Haw.; two also by Elisha, July 31st, from *Eupæcilia ciliella*, Hüb.

28. *Apanteles adjunctus*, Nees.

Microgaster adjunctus, Nees, Mon., i., 176, ♀.

Apanteles adjunctus, Reinh., Berl. ent. Zeit., 1881, p. 36, ♀.

Black; mandibles, sides of segment 1, belly at the base, and legs, testaceous; hind coxæ black above; hind tibiæ tipped with fuscous. Wings dull hyaline, stigma and nervures fuscous. Mesothorax and scutellum somewhat shining, finely punctulate; metathorax also

shining, slightly rugulose. Segment 1 rugulose, twice as long as its breadth, rounded behind, the sides parallel; 2 transverse, rugulose, smooth in the middle, scarcely half as long as 3; the rest smooth and shining. Terebra about $\frac{3}{4}$ of the abdomen, decurved, the valves compressed, subclavate. ♀. Length, $1\frac{3}{4}$; wings, $3\frac{3}{8}$ lin.

One of the largest of this section, and resembling *falcatus*, Nees, from which it may be separated by the broader 1st segment, and the hind coxæ, which are testaceous beneath. The terebra also is less curved, and the valvula ventralis more acute.

A single specimen was bred by Elisha from *Lioptilus microdactylus*, Hüb.

29. *Apanteles lictorius*, Reinh.

Microgaster ruficornis, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 61, pl., f. n., ♂ ♀ (not of Nees).

Apanteles lictorius, Reinh., Berl. ent Zeit., 1881, p. 37, ♂ ♀.

Black; antennæ reddish underneath; mouth, squamulæ, sides of segment 1, belly at the base, and legs, rufo-testaceous; hind coxæ wholly, or at the base, black; hind tibiæ tipped with fuscous. Wings hyaline, stigma and nervures fuscous. Mesothorax and scutellum shining, very finely punctulate; metathorax also shining, slightly rugulose. Segment 1 rugulose, twice as long as its medial breadth, its hinder half narrowed, the apex truncate; 2 rugulose, half as long as 3; the rest smooth and shining. Terebra hardly shorter than the abdomen, nearly straight, the valves subclavate. ♂ ♀. Length, $1\frac{1}{4}$; wings, $3\frac{1}{2}$ lin.

According to Wesmael the antennæ of the ♂ are testaceous or ferruginous, more or less black above and at the apex. The ♀ sometimes has the antennæ and hind coxæ entirely pale; and the terebra is described as slender. As the two descriptions above referred to do not quite agree, there is some doubt as to the correctness of the synonymy; the British specimen, however, agrees with the characters given by Reinhard, in all important respects. It is an old discoloured ♀ communicated by Parfitt, and probably from Dorville's collection. Wesmael took ten males and five females near Brussels in June and July.

30. *Apanteles falcatus*, Nees.

Microgaster falcatus, Nees, Mon., i., 175, ♂ ♀ (not of Ratz.); *Apanteles falcatus*, Reinh., Berl. ent. Zeit., 1881, p. 37, ♂ ♀.

M. equestris, Hal., Ent. Mag., ii., 242, ♂ ♀.

Black; palpi pale; squamulæ, sides of segments 1—2 more or less, belly at the base, and legs, rufo-testaceous; coxæ black; middle coxæ ♀ tipped with testaceous; hind femora ♂ with a black line above; hind tibiæ tipped with fuscous. Wings hyaline, with a testaceous tinge; stigma and outer nervures fuscous, the inner yellowish. Mesothorax and scutellum shining, punctulate; metathorax more obscure. Segment 1 nearly three times longer than broad, finely punctured, shining; 2 half as long as 3, nearly smooth, with two channels converging towards the base; 3 often margined with testaceous posteriorly, and, with the rest, smooth and shining. Terebra shorter than the abdomen, decurved, the valves compressed and dilated, not clavate. ♂ ♀. Length, 2; wings, 4 lin.

One of the largest species. The valvula ventralis ♀ is obliquely truncate, not acuminate, nor reaching the anus. The antennæ of the ♂ are rather longer, of the ♀ shorter, than the body.

Common, gregarious; according to Haliday, frequenting the blossoms of the *jacobæa*. Bred by Bignell from *Xylophasia monoglypha*, Hufn., on July 24th. Cocoons white, regularly disposed side by side without an external covering. Reared by me numerously from a batch of these cocoons found in Leicestershire.

31. *Apanteles cultrator*, n. s.

Niger, palpis, ventris basi, pedibusque, testaceis; coxis nigris; femoribus intermediis supra, posticis supra et apice, infuscatis. Alæ hyalinæ squamulis stigmatate nervis fuscis. Mesothorax confertissime punctulatus, parum nitidus; scutellum medio læve; metathorax rugulosus, nitidulus. Segmentum 1mum duplo longius quam latius, lateribus parallelis, truncatum, cum 2do rugulosum, nitidulum, hoc 3tio duplo brevius, sutura postica profundiore, 1mo latius; cætera lævissima, a 3tio inde fortiter compressa, cultrata. Terebra subsexserta. Valvula ventralis maxima, cultrata, anum longe superans.

Black; palpi, belly at the base, and legs, testaceous; coxæ black; intermediate femora above, hind femora above and at the apex, infuscated. Wings hyaline, squamulæ, stigma, and nervures fuscous. Mesothorax very thickly punctulate, scarcely shining;

scutellum smooth in the middle; metathorax rugulose, rather shining. Segment 1 twice as long as broad, the sides parallel, truncate, rugulose, and somewhat shining, like 2, which is half as long as 3 and broader than 1; the rest smooth and shining; suturiform articulation strongly marked; all the segments after the 2d strongly compressed, cultriform. Terebra subexserted. Valvula ventralis very large, cultrate, much surpassing the anus. ♀. Length, $1\frac{1}{4}$; wings, $2\frac{3}{4}$ lin.

The form of the abdomen renders this species very distinct. The shining black ventral valve is almost as large as the rest of the abdomen, and with the short terebra projects considerably beyond the anus. Viewed from above, the abdomen is more compressed and acuminate than in any other species here described.

Two specimens, reared by Raynor from a hairy larva preserved on the same card, are in Fitch's collection. The white cocoons are four in number.

32. *Apanteles ultor*, Reinh.

Microgaster lactipennis, Ratz., Ichn. d. Forst., iii., 54,

♂ ♀ (not *lactipennis*, Hal.).

Apanteles ultor, Reinh., Berl. ent. Zeit., 1881, p. 38,

♂ ♀.

Black, with fuscous palpi; legs testaceous, coxæ and upper trochanters black. Wings whitish, costa and stigma pale fusco-testaceous, the latter edged with fuscous; most of the nervures decolorous. Mesothorax and scutellum thickly punctulate, dull; metathorax rugulose with a smooth, margined, medial, area. Segment 1 a little longer than broad, margined, subcarinated in the middle, truncated at the apex, rugulose; segment 2 half as long as 3, and, with the rest, smooth and shining. Terebra $\frac{1}{3}$ of the abdomen. ♂ ♀. Length, $1\frac{1}{4}$; wings, $3\frac{1}{4}$ lin.

This must not be mistaken for *xanthostigmus*, Hal., which has black femora.

A ♂ taken by Fitch at Maldon, August 25th, 1884, is the only specimen I have seen. It has been bred, according to Reinhard, from *Porthesia chrysoorrhœa*, L., *P. similis*, Fues., and *Bombyx neustria*, L. Brischke says that he has reared it from *Acronycta psi*, L., and from the larva of a *Chrysopa*; adding that the cocoons are single or gregarious, cream-white or brownish yellow, surrounded by shining silk. More than one species seem to be here included.

33. *Apanteles decorus*, Hal.

Microgaster decorus, Hal., Ent. Mag., ii., 245, ♂ ♀ ;
Apanteles decorus, Reinh., Berl. ent. Zeit., 1881,
 p. 38, ♀ .

Black; palpi testaceous, fuscous at the base; belly and legs rufo-testaceous; hind coxæ and trochanters black; femora black at the base beneath, the hind pair also with a dark line above; hind tibiæ fuscous at the apex, the extreme base pallid, their tarsi mostly fuscous, the spurs pale. Wings hyaline, stigma fusco-ferruginous, squamulæ black. Mesothorax and scutellum very finely coriaceous, almost smooth, shining. Metathorax and segments 1—2 the same. Segment 1 a little longer than broad, its sides parallel, truncate at the apex; 2 half as long as 3, suturiform articulation curved; the other segments smooth, iridescent. Terebra as long as the abdomen, with the valves slightly dilated and compressed, straight nearly to the apex, afterwards a little decurved. Valvula ventralis acuminated, not surpassing the anus. ♂ ♀. Length, $1\frac{1}{2}$; wings, $3\frac{3}{4}$ lin.

The legs are variable, sometimes fuscous, the fore femora and tibiæ beneath, the 4 posterior femora with a lateral line, and the base of their tibiæ, testaceous; the legs of the ♂ are usually darker than those of the ♀, and the antennæ much longer. The ♀ differs from that of *emarginatus*, Nees, in having the hind femora and trochanters testaceous, the antennæ and terebra longer, and the stigma unicolorous. Nevertheless, according to Haliday (MS. note in Brit. Mus.), his *decorus* and *annularis* are the same species; the latter is indistinguishable from *emarginatus*, Nees, whence it would follow that the three ought to be united. According to Reinhard, *decorus*, Hal., is distinct; *annularis*, Hal., and *emarginatus*, Nees, probably the same, and this opinion, which is supported by the appearance of the specimens, is here adopted.

Taken occasionally by Haliday on the oak and larch; a ♀ by me near Abergavenny. Bred by Elisha, two females and one male, from *Conchylis dilucidana*, Ste.; these males have the legs mostly testaceous. In Germany Möschler reared a ♀ from *Argyresthia Gødartella*, L., feeding in catkins of the birch.

34. *Apanteles dilectus*, Hal.

Microgaster dilectus, Hal., Ent. Mag., ii., 246; *Apanteles dilectus*, Reinh., Berl. ent. Zeit., 1881, p. 38, ♀.

Black; palpi testaceous, fuscous at the base; mandibles rufous; antennæ at the base beneath, belly, and legs, rufo-testaceous; coxæ and tips of the hind tibiæ black; or the 4 posterior femora lineated with black above and beneath. Wings hyaline, stigma fuscous, pale testaceous at the inner angle; nervures also pale; squamulæ black. Antennæ ♀ stout to the apex, only the last joint acuminated. Mesothorax thickly and minutely punctulate, almost granulated, hardly shining; scutellum the same, smooth in the middle; mesopleuræ smooth and shining. Metathorax dull, granulated. Segment 1 half as long again as its breadth, with parallel sides, truncate at the apex, rugulose; 2 half as long as 3, granulated or coriaceous, with two lateral channels curving inwards near the base; suturiform articulation curved; the other segments subcoriaceous, hardly shining. Terebra $\frac{1}{2}$ the abdomen, or a little longer, the valves somewhat decurved. Valvula ventralis acuminated, not surpassing the annus. ♀. Length, $1\frac{1}{4}$; wings, $3\frac{1}{4}$ lin.

The 4 posterior femora are subject to be more or less black; and the middle tibiæ may be tipped with fuscous. Smaller than *decorus*, Hal., and distinguished by its bicolorous stigma and shorter terebra.

Bignell has bred three females singly from *Gracilaria syringella*, Fab. According to Reinhard, it has also been obtained on the Continent from a *Tortrix* feeding on *Syringa vulgaris*. Kriechbaumer reared it from a *Coleophora*, and Brischke considers himself to have bred it from a very different victim, *Leucoma salicis*, L.

35. *Apanteles xanthostigma*, Hal.

Microgaster xanthostigma, Hal., Ent. Mag., ii., 244, ♂;
Apanteles xanthostigma, Reinh., Berl. ent. Zeit.,
1881, p. 40, ♂ ♀.

M. ochrostigma, Wesm., Nouv. Mém. Ac. Brux., 1837.
p. 55, ♂ ♀; Ratz., Ichn. d. Forst., iii., 53.

Black; palpi pale, fuscous at the base; tibiæ at the base, fore tibiæ entirely, testaceous. Wings whitish, stigma yellowish or whitish with a fuscous border, costa and base of the radius testaceous, the other nervures decolorous. Mesothorax and scutellum minutely punctulate, almost smooth, shining; metathorax subgranulate, with a medial, depressed, margined area, which is often

shining. Segment 1 half as long again as broad, with parallel sides, truncate at the apex, rimulose, with a smooth medial channel; 2 scarcely half as long as 3, and, with the rest, smooth and shining. Terebra a little shorter than the abdomen, somewhat decurved, the valves subelavate. Valvula ventralis acuminated, testaceous, surpassing the anus. ♂ ♀. Length, 1—1½; wings, 3—4½ lin.

Var. ♂. Femora testaceous, edged above and below with black; perhaps immature. Bred by Elisha from *Eupithecia exiguata*, Hüb.

Common; taken repeatedly by Bignell in Devonshire, by Fitch in Essex, and by me in Northamptonshire, Leicestershire, and Wiltshire. Bignell bred the male from *Diurnea fagella*, Fab.; Parfitt, two males from *Swammerdamia cæsiella*, Hüb.; Fitch, three males from *Gracilaria semifascia*, Haw., and two females from an unknown larva; Raynor, one male from *Hypsipetes trifasciatus*, Bork., and another from *Eupithecia exiguata*, Hüb. According to Ratzeburg, many were reared by Bouché from *Tortrix rosana*, L., and Reissig obtained a female from some species of *Psyche*. Brischke bred it from *Swammerdamia lutarea*, Haw. A solitary parasite. Cocoons white.

36. *Apanteles contaminatus*, Hal.

Microgaster contaminatus, Hal., Ent. Mag., ii., 245, ♀.

Black; palpi and legs testaceous; coxæ and trochanters black; fore femora at the base, middle except the apex, and hind pair entirely, black; hind tibiæ at the apex, and their tarsi except the base of the 1st joint, fuscous. Wings hyaline, squamulæ, stigma, and nervures, flavo-testaceous; costa, from the inner angle of the stigma to the tip of the wing, as also the base of the radius, fuscous. Head and mesothorax minutely punctulate, shining; scutellum smooth, the frenum on either side very shining; mesopleuræ thickly punctulate; metathorax rugulose. Abdomen obtuse, shorter than the thorax; segment 1 broad, subquadrate, with parallel sides, truncate, emarginate in the middle of the hinder edge, rugulose; 2 rugulose, very transverse, shorter than 3, suturiform articulation sinuated; the other segments smooth and shining. Terebra curved, extending about ½ the length of the abdomen; valves subelavate. Valvula ventralis acute, not reaching the anus. Spurs of hind tibiæ longer than ½ the metatarsus. ♀. Length, 1¼; wings, 3 lin.

The rugosity of the metathorax and segments 1—2 of the broadly sessile, obtuse abdomen, gives this species the aspect of a *Microgaster*. Haliday's description

corresponds accurately, except that the terebra is insufficiently estimated as shorter than the body. *A. merula*, Reinh., Berl. ent. Zeit., 1881, p. 46, ♀, which he hesitated to join to this species, is widely different, having segments 1—2 smooth, the stigma fuscous, and the metathorax carinated.

One ♀ was found by Haliday in the Mourne Mountains, North Ireland. The 2 specimens here described were bred by W. H. B. Fletcher from an undetermined *Tineid*, mining the leaves of *Arctostaphylos ura-ursi*, the bearberry.

37. *Apanteles prætor*, n. s.

Ater, femoribus anticis apice, tibiis iisdem totis, posterioribus basi, ferrugineis. Alæ fusco-hyalinæ plaga sub stigmatate limpida hoc nigro-fuscum macula interiore testacea. Radii abscissa Ina curvata, cum nervo intercubitali Imo angulum nullum fingens. Mesothorax et scutellum nitida, subtilissime parcius punctulata; metathorax subtiliter exaratus, fere opacus. Segmentum Ium latitudine fere duplo longius, nitidum, marginatum, subrugosum, apice truncatum; 2dum 3tio vix duplo brevius, cum reliquis medio subcarinatum, læve. Terebra abdominæ paulo brevior, recta, valvis subelavatis.

Deep black; fore femora at the apex, their tibiæ entirely, and the other tibiæ at the base, ferruginous. Wings fusco-hyaline, with a limpid space under the stigma, which is dark fuscous, having a testaceous spot at the inner angle. First abscissa of the radius rounded, forming no angle with the 1st intercubital nervure. Mesothorax and scutellum shining, sparingly and very minutely punctulate; metathorax finely exarated, almost dull. Segment 1 about twice as long as its breadth, shining, margined, subrugose, truncate at the apex; 2 a little more than half as long as 3, smooth and subcarinated, as are also the remaining segments. Terebra a little shorter than the abdomen, straight, the valves subelavate. ♂ ♀. Length, 2; wings, $4\frac{1}{4}$ lin.

One of the largest species, and resembling *obscurus*, Nees; but the mesothorax is smooth, without the medial depressions, the stigma bicolorous, &c. From all the allied species it differs in the wings, as above described, the upper angle of the 2d cubital areolet not being indicated.

Described from two males taken by Bignell in S. Devon; and one female bred by Elisha, Sept. 4th, from *Catoptria æmulana*, Schl.

38. *Apanteles emarginatus*, Nees.

Microgaster emarginatus, Nees, Mon., i., 182, ♀; Wesm.,
Nouv. Mém. Ac. Brux., 1837, p. 56, ♀; Ratz.,
Ichn. d. Forst., iii., 53, ♀.

Apanteles emarginatus, Reinh., Berl. ent. Zeit., 1881,
p. 41, ♂ ♀.

Microgaster annularis, Hal., Ent. Mag., ii., 244, ♂ ♀.

Apanteles annularis, Reinh., lib. cit., p. 40, ♂ ♀.

Microgaster hilaris, Hal., Ent. Mag., ii., 245, ♀.

Black, sericeous, iridescent; palpi, sides of the belly, and 4 anterior legs, flavo-testaceous; coxæ black; intermediate femora more or less infuscated at the base; base of the hind tibiæ and tarsi flavo-testaceous. Wings whitish hyaline; stigma fuscous, with a pale spot at the inner angle; outer nervures decolorous, the rest pale testaceous; squamulæ variable. Mesothorax very minutely punctulate, somewhat shining; scutellum smooth; metathorax rugulose, with a medial channel. Segment 1 twice as long as broad, margined, aciculated, broadly rounded at the apex; 2 transverse, about one-third as long as 3, aciculated; the rest smooth and shining. Terebra shorter than the abdomen, slightly decurved. Valvula ventralis not surpassing the anus. ♂ ♀. Length, 1¼; wings, 3¼ lin.

The black markings of the legs vary in extent, as usual; the pale spot in the stigma is liable to be obliterated. The squamulæ vary from black to testaceous. The mesothorax, as to punctuation and gloss, offers no tangible differences. The antennæ of the ♀ are about as long as the body, of the ♂ longer, as remarked by Haliday under *annularis*; but Reinhard makes them the same length as those of the other sex.

Taken commonly by me near Teignmouth and Abergavenny; also in Epping Forest. Bred by Bignell, Aug. 2nd, from *Depressaria nervosa*, Haw.; a ♀ by W. H. B. Fletcher from *D. carduella*, Hüb., July 18th; a ♀ by Raynor, June 27th, from an undetermined *Tortrix*-larva on chamomile, and, June 3rd, from *Conchylis dilucidana*, Ste. From the *Tortrix*-larva issued a second and very different parasite, *Microgaster tiro*, Reinh. *A. annularis* was bred in Germany, according to Reinhard, from *Gracilaria rufipennella*, Hüb., and *Fribergensis*, Fritzsche. *A. emarginatus*, according to Ratzeburg, from *Psyche*-cases; according to Reinhard, from *Depressaria cherophylli*, Zell. Cocoons white, papyraceous, without gloss.

39. *Apanteles obscurus*, Nees.

Microgaster obscurus, Nees, Mon. i., 182, ♂ ♀; Wesm.,
Nouv. Mém. Ac. Brux., 1837, p. 58, ♂ ♀; *Apanteles*
obscurus, Reinh., Berl. ent. Zeit., 1881, p. 41, ♂ ♀.
M. arenarius, Hal., Ent. Mag., ii., 246, ♂ ♀.

Black; apex of palpi, and tibiæ ♀, ferruginous, the hind pair fuscous at the apex; those of the ♂ are generally ferruginous only at the base. Wings dusky hyaline, stigma fuscous, all the nervures visible. Mesothorax and scutellum thickly punctulate, shining, the former subtrilobate, the sutures ending before the scutellum in two rugulose depressions; ante-scutellar fovea large, crenated. Metathorax rugose. Segment 1 a little longer than broad, acutely margined, truncate, rugose like 2, which is not half as long as 3; the rest smooth and shining. Terebra less than $\frac{1}{2}$ the length of the abdomen; valves subclavate, hardly decurved. ♂ ♀. Length, $1\frac{1}{2}$ —2; wings, $3\frac{1}{2}$ — $4\frac{1}{2}$ lin.

A robust species, often as large as *falcatus*, Nees, and much resembling a *Microgaster*, except in the wings. According to Haliday the valvula ventralis ♀ is pale, and considerably surpasses the anus, but these characters do not appear in the ♀ above described, nor are they noticed by Nees and Reinhard. The antennæ of the ♂ are longer than the body, the fore tibiæ sometimes fuscous in the middle, and the hind tibiæ more broadly fuscous than in the ♀.

Taken by Haliday in numbers on *Salix argentea* near the sea-shore; I captured a ♂ at Niton, Isle of Wight. Bignell bred the ♂ July 12th, and the ♀ July 30th, from *Ebulea crocealis*, Hüb. A solitary parasite. Cocoons silvery white. Giraud, doubtless erroneously, gives it as a parasite of *Trypeta arnicæ*, Meig.

40. *Apanteles viminetorum*, Wesm.

Microgaster viminetorum, Wesm., Nouv. Mém. Ac.
Brux., 1837, p. 50, ♀.
Apanteles viminetorum, Reinh., Berl. ent. Zeit., 1881,
p. 42, ♀.

Black; fore tibiæ entirely, and the others at the base, testaceous. Wings subhyaline, stigma blackish, nervures fuscous, the outer decolorous. Thorax shining, punctulate. Segment 1 almost twice as long as broad, somewhat narrowed posteriorly, truncate, finely aciculated, the base smooth and shining; segment 2 half as long as

3, broader than 1, with two basal impressions, and, like the rest, smooth and shining. Terebra as long as $\frac{1}{4}$ of the abdomen, the valves compressed and, viewed laterally, very stout. ♂ ♀. Length, 1; wings, $2\frac{3}{4}$ lin.

Three males were bred by Bignell, singly, from *Ela-chista magnificella*, Tengström, June 30th. Two males and two females by W. H. B. Fletcher from *Lita instabil-ella*, Dougl. According to Reinhard, also bred from *Elachista adscitella*, Staint., and from mines of *E. airæ*, Staint., on *Aira cæspitosa*. Cocoons glossy white.

41. *Apanteles sodalis*, Hal.

Microgaster sodalis, Hal., Ent. Mag., ii., 246, ♀;
Apanteles sodalis, Reinh., Berl. ent. Zeit., 1881,
p. 42, ♂ ♀.

Black; base of the belly pitchy, subpellucid; tibiæ, apex of fore femora, and base of 4 posterior tibiæ, rufo-testaceous, in the ♂ more narrowly. Wings whitish hyaline, stigma dull stramineous, or testaceous, with a fuscous border. Mesothorax and scutellum punctulate, shining; metathorax rugulose. Segment 1 twice longer than broad, with parallel sides, truncate, rugulose; 2 broader than 1, half as long as 3, and, with the remaining segments, smooth and shining. Terebra as long as $\frac{1}{2}$ the abdomen; valves subclavate. Valvula ventralis not surpassing the anus. ♂ ♀. Length $1\frac{1}{2}$; wings $3\frac{1}{4}$.

Haliday had only one ♀, which he compares with *obscurus*, Nees, probably a small specimen. The pale stigma of *sodalis* somewhat resembles that of *xantho-stigmus*, Hal., but the latter insect has the mesothorax more shining, and the 1st segment broader.

Four males and seven females were bred, April 21st, by C. J. Boden, from *Solenobia inconspicua*, Staint. I captured a male and two females in Birch Wood, and a ♀ near Teignmouth. Parfitt has also taken the species at Exeter. According to Reinhard it has been reared by R. v. Stein, in Bohemia, from a *Tortrix* feeding on the alder. Brischke also bred it from a *Tortrix*. Cocoons white, silky, gregarious, and sur-rounded with wool.

42. *Apanteles albipennis*, Nees.

Microgaster albipennis, Nees, Mon., i., 186, ♂ ♀;
Ratz., Ichn. d. Forst., ii., 52, ♀ (not of Hal.).

M. lacteipennis, Hal., Ent. Mag., ii., 244, ♂ (not *lacteipennis*, Ratz.).

Apanteles albipennis, Reinh., Berl. ent. Zeit., 1881,
p. 43, ♂ ♀.

Deep black; legs coloured as in the last species. Wings milky-white, costa and stigma black, the latter usually with a pale dot at the inner angle. Mesothorax shining, minutely punctulate; scutellum smooth in the middle, punctulate at the sides; metathorax shining, slightly punctulate. Segment 1 hardly longer than broad, shining at the base, subrugulose and with a few punctures towards the broadly truncate apex; 2 not a quarter as long as 3, and, like the rest, smooth and shining. Terebra a little shorter than the abdomen; valves subclavate. Valvula ventralis not reaching the anus. ♂ ♀. Length $1\frac{1}{2}$; wings 4 lin.

Distinguishable from the other white-winged species by greater size and longer terebra, as also by the testaceous dot usually seen at the base of the stigma. In the hind wings the apex of the subcostal nervure is distinctly fuscous.

Rather common. Bred by Bignell, June 22nd, from *Lioptilus microdactylus*, Hüb., emerging after the victim-larva has taken up its winter-quarters in the stem of *Eupatorium cannabinum*. Kaltenbach reared from the same plume-moth an *Apanteles* identified by him with *Microgaster levigator*, Ratz. = *hoplites*, Ratz. Although *hoplites*, Ratz., is sufficiently distinct from *albipennis*, Nees, there is nothing to show this in Ratzburg's description; and hence it may be surmised with great probability that Kaltenbach's insect belongs to the present species. Obtained by Elisha, July 31st, from *Lita tricolorella*, Haw., one male, five females; a female from *Conchylis Francillana*, Fab.; five males, seven females from *Eupacilia ciliella*, Hüb.; one male, two females from *Douglasia ocnestomella*, Staint., July 6th; and three males from *Catoptria æmulana*, Schl., August 16th. Brischke bred it probably from *Ergatis Brizella*, Tr. Three males were taken by me at Barnstaple, and another at Niton, Isle of Wight. Reinhard mentions the existence, in Mayr's collection at Vienna, of a series of this species bred from galls of

Andricus multiplicatus, Gir. But according to Giraud (Verh. z.-b. Ges. Wien., 1859, p. 360), *Ephippiophora costipunctana*, Haw., occurs frequently in the same galls. It is therefore more probable that the *Apanteles* is a parasite of the moth, than of the *Cynips*. A solitary parasite. Cocoons glossy white.

43. *Apanteles impurus*, Nees.

Microgaster albipennis, var. β ., Nees, Mon., i., 187, σ φ (according to Haliday, MS. in Brit. Mus.).

M. candidatus, Hal., Ent. Mag., ii., 243, σ φ .

M. impurus, Nees, Mon., i., 187, σ φ ; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 53, pl., fig. G, σ φ ; Ratz., Ichn. d. Forst., ii., 51, φ .

Apanteles impurus, Reinh., Berl. ent. Zeit., 1881, p. 43.

Black; palpi fuscous; fore tibiæ, fore femora at the apex, middle and hind tibiæ at the base, flavo-ferruginous. Wings white, stigma nigro-piceous, nervures in the middle testaceous, elsewhere decolorous; costa pale at the base. Thorax punctulate, shining. Segment 1 half as long again as broad, truncate, margined, with parallel sides, slightly aciculated; segment 2 short, broader than 1, and, with the following segments, smooth and shining. Terebra $\frac{1}{2}$ as long as the abdomen, valves slender, scarcely curved. σ φ . Length $1\frac{1}{4}$; wings 3 lin.

Similar to the last species, but smaller: the 1st abdominal segment is narrower, the terebra shorter, and not clavate.

Common in the Isle of Wight in August; Devonshire; Northants; Kent, &c. Bred by Bignell from *Tortrix Forsterana*, Fab., three males, two females. According to Ratzeburg, obtained from apple-blossoms inhabited by a *Curculio*, *Anthonomus pomorum*, L. According to Reinhard, from *Gracilaria syringella*, Fab., and from the heads of thistles. Brischke reports that he bred this species from *Lycæna Corydon*, Fab., and *Eupithecia sobrinata*, Hüb.; the cocoons are described as single, and woolly, that from the *Lycæna* white, from the *Eupithecia*, yellow; a difference which seems to indicate some confusion of species, for no *Apanteles* of this section makes yellow cocoons. Cocoons white, with a satiny gloss, like those of *albipennis*, Nees; several joined together by a few threads.

44. *Apanteles naso*, n. s.

Niger, obscurus, ventris basi concolore, palpis fuscis, geniculis anticis, tibiis posterioribus basi, testaceis. Alæ subinfuscate, squamulis, stigmatè, nervis, nigro-fuscis. Clypeus elongatus, unde facies antice triangularis, in rostri speciem producta. Caput cum mesothorace ob puncturam subtilissimam coriaceum, haud nitidum; scutellum paulo lævius; metathorax rugulosus. Segmentum 1mum latitudine media duplo longius, apicem versus per paulo angustatum, truncatum, aciculatum; 2dum dimidio brevius quam 3tium, levisime aciculatum, utrinque arcuato-impressum, medio carinatum; cætera læviuscula, parum nitida. Abdomen breve, lanceolato-compressum, forcipe anali exserto. Coxæ posticæ læviusculæ. Calcaria postica metatarsi dimidio breviora.

Black, not shining; base of the belly concolorous; knees of the fore legs, and base of the 4 posterior tibiæ, testaceous. Wings somewhat dusky; squamulæ, stigma, and nervures, blackish. Clypeus and face elongate, triangular, produced into an obtuse rostrum. Head and mesothorax very minutely punctulate, or coriaceous, not shining; scutellum somewhat smoother; metathorax rugulose. Segment 1 twice as long as its medial width, very slightly narrowed towards the apex, truncated, aciculated; 3 twice as long as 2, the latter faintly aciculated, having on each side a curved impression, and in the middle an indistinct carina; the other segments smoother, but not shining. Abdomen short, lanceolate, compressed; the anal forceps exserted. Hind coxæ rather smooth. Spurs of hind tibiæ shorter than $\frac{1}{2}$ the metatarsus. ♂. Length 1; wings $2\frac{1}{2}$ lin.

Reinhard has described two species, *vipio* and *longipalpis*, having the oral parts produced into a rostrum, as in the genera *Vipio* and *Agathis*; but the present insect is distinct from both. The prolongation of the face, measured from the eyes, is about equal to the greatest length of one eye. The maxillary palpi are not longer than usual. The whole body is without gloss, except three smoother lines on the mesothorax, and the scutellum. The abdomen is short, narrow, and compressed. The wings are infuscated as in *infirmus*, Hal.; not so deeply as in *gagates*, Nees.

I found this ♂ on the sand-hills at the mouth of the Exe, opposite Star-Cross, Devon.

45. *Apanteles infimus*, Hal.

Microgaster infimus, Hal., Ent. Mag., ii., 243, ♂ ♀.

Apanteles infimus, Reinh., Berl. ent. Zeit., 1881, p. 44,
♂ ♀.

Black; tibiæ at the base rufo-testaceous. Wings fusco-hyaline, stigma blackish, nervures fuscous, distinct, except the base of the radius. Mesothorax minutely punctulate, and, with the scutellum, shining. Metathorax rugulose. Segment 1 subquadrate, faintly margined, truncated, rugulose, narrower than 2, which is half as long as 3, and smoother than 1, having only a few wrinkles; the rest are smooth, sericeous, iridescent. Terebra about $\frac{1}{2}$ as long as the abdomen, the valves stout, nearly straight. Valvula ventralis pallid, acuminate, not surpassing the anus. ♂ ♀. Length, 1—1 $\frac{1}{4}$; wings, 3—3 $\frac{3}{4}$ lin.

The dusky wings distinguish this species from *fuliginosus*, Wesm. From *riminctorum*, Wesm., it differs in having the 1st segment broader, not twice as long as wide, and more rugulose; the wings are more distinctly infumated. The rugulosity of the 2d segment is a doubtful character, varying in different individuals, and hence the difficulty of distinguishing by their descriptions the four species *tenebrosus*, Wesm., *fuliginosus*, Wesm., *infimus*, Hal., and *riminctorum*, Wesm. Of the first of these I have not seen any British example: those sent to me with the name *tenebrosus*, in Fitch's collection, have all dusky wings, and must be referred to the present species.

Five more in the same collection are labelled as having been bred from *Acrolepia pygmeana*, Haw. The only reason that hinders them from being considered the same as *Microgaster ensiformis*, Ratz., i., 70 (also from *A. pygmeana*) is that the terebra of the latter is as long as the abdomen. Reared by Elisha, one male and two females, from *Chauliodus charophylllellus*, Göze, Sept. 4th. I captured two pairs at Nunton, Salisbury, on Sept. 1st. Stated to have been bred by Brischke from *Pseudoterpna pruinata*, Hufn., and *Butalis noricella*, Zell.; "cocoon gregarious, yellow, woolly": the colour assigned renders some mistake probable.

46. *Apanteles exilis*, Hal.*Microgaster exilis*, Hal., Ent. Mag., ii., 247, ♀.*Apanteles exilis*, Reinh., Berl. ent. Zeit., 1881, p. 44,
♂ ♀.

Black; belly pitchy at the base; apex of the palpi pale; fore femora except at the base, middle femora at the apex, fore tibiæ, and 4 posterior tibiæ at the base, testaceous. Wings subhyaline, stigma dull testaceous. Thorax shining, punctulate. Segment 1 elongate, more than twice longer than broad, with parallel sides, broadly rounded behind, punctulate; 2 short, with two lateral oblique channels, smooth and shining like the rest of the segments. Terebra shorter than $\frac{1}{2}$ the abdomen; valves linear, straight. ♂ ♀. Length, $1\frac{1}{3}$; wings, $2\frac{2}{3}$ lin.

Differs from all the preceding in the linear and narrow shape of the 1st abdominal segment, which is not, however, attenuated posteriorly, as in the IVth Section. Brischke says "bred from a *Tortrix*; cocoons gregarious, white, woolly."

One ♂ was taken by me in Birch Wood.

47. *Apanteles gagates*, Nees.*Microgaster gagates*, Nees, Mon., i., 183, ♀; Wesm.,
Nouv. Mém. Ac. Brux., 1837, p. 57, ♀.*Apanteles gagates*, Reinh., Berl. ent. Zeit., 1881, p. 45,
♂ ♀.

Deep black; fore femora at the apex, fore tibiæ at the base or along the inside, and sometimes middle tibiæ at the base, testaceous. Wings fuscous, with a pale streak under the black stigma, nervures fuscous, distinct. Mesothorax and scutellum smooth, shining; metathorax the same, with a few scattered punctures, and subrugulose in the middle. Segment 1 of the ♂ a little longer than broad, of the ♀ quadrate, truncate, margined, rugulose at the apex; 2 much shorter than 3, and, with the others, smooth and shining. Body thinly clothed with short black hairs. Terebra a little shorter than the abdomen, with compressed subelavate valves, decurved at the apex, hairy. Valvula ventralis not surpassing the anus. ♂ ♀. Length, $1\frac{2}{3}$; wings, $3\frac{3}{4}$ lin.

This fine species was first discovered to be British by Bignell, who took several of both sexes near Plymouth, Aug. 21st, 1884; and on Aug. 29th—30th I captured three males by sweeping a hedge at Nunton, near Salisbury. According to Reinhard it has been bred from *Mimescoptilus bipunctidactylus*, Haw.; and also from flowers of the scabious.

48. *Apanteles Halidaii*.

Microgaster albipennis, Hal., Ent. Mag., ii., 243, ♂ ♀
(not of Nees and Ratz.).

Black; palpi pale, the 1st joint of the maxillary more or less fuscous; apex of fore femora, their tibiæ, and base of the posterior tibiæ, testaceous. Wings whitish hyaline, stigma pale with a fuscous border, or fuscous with the inner angle pale; costa fuscous, most of the nervures decolorous. Elongate, slender; mesothorax almost invisibly punctulate; scutellum smooth; metathorax punctulate; abdomen smooth and shining; segment 1 one-half longer than broad, punctulate towards the apex, margined, truncate; 2 half as long as 3; suturiform articulation curved, convex posteriorly. Abdomen ♀ at the apex acute, lanceolate. Terebra as long as the abdomen, falcate, the valves compressed. Valvula ventralis elongate, testaceous, acute, surpassing the anus. Anal forceps of the ♂ exerted. ♂ ♀. Length, ♂ 1; wings, 2½; ♀ 1¼—1½; wings, 2¾—3 lin.

Most like *albipennis*, Nees, but much smaller, more slender, with a differently coloured stigma and longer terebra. The stigma is variable, either pale flavo-piceous bordered all round with fuscous, or fuscous with the inner angle pale; the former variety was that known to Haliday; the latter differs in no other respect, and certainly belongs to the same species. Haliday compares it with his *candidatus*, i. e., *albipennis*, var. β, Nees, saying that it is one-half smaller, which is correct, but the insects are otherwise sufficiently distinct. The present species is easily recognised. It seems to be uncommon in England, and was not known to Reinhard.

Described from two females bred by W. H. B. Fletcher, of Worthing, from *Ptocheuusa inopella*, Zell.; their stigma is pale in the middle; two males and five females reared by the same at the end of July from *Coleophora limoniella*, Staint. (cf. E. M. M., 1884, p. 60); and a pair from *Gracilaria ononidis*, Zell.; their stigma is darker, with a pale basal dot.

49. *Apanteles confereæ*, Hal.

Microgaster confereæ, Hal., Ent. Mag., ii., 247, ♂ ♀.

♀. Black; palpi, tibiæ, tarsi, and fore femora, flavo-testaceous; coxæ black; intermediate femora with an abbreviated black line above and below; hind femora fuscous with a testaceous lateral stripe, or wholly fuscous; hind tibiæ at the apex, with their tarsi,

infuscated. ♂. Fore femora with a fuscous line above, the others almost entirely fuscous. Wings hyaline, squamulæ, stigma, and nervures flavo-testaceous; stigma with a pale fuscous border; exterior nervures colourless. Mesothorax smooth, sericeous, iridescent; scutellum and metathorax smooth, shining, the latter with some faint wrinkles. Segment 1 twice as long as broad, the sides parallel nearly to the apex (which is obtusely rounded), smooth and shining, minutely aciculated towards the apex; 2 shorter than 3, bifoveated in front, and, like the remaining segments, smooth and shining. Terebra hardly $\frac{1}{4}$ of the abdomen; the valves clavate. Valvula ventralis not surpassing the anus. ♂ ♀. Length, $1\frac{1}{2}$; wings, 3 lin.

Antennæ ♀ as long as the body. Belly entirely black and shining. I have only seen one ♀, in Fitch's collection, which agrees fully with the description, except that, whereas Haliday states the size to be equal to that of *glomeratus*, L., the present individual is somewhat larger.

Found by Haliday among larch trees, but rarely.

50. *Apanteles lineipes*, Wesm.

Microgaster lineipes, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 57, ♀.

Black; apex of palpi, a line on each side of the femora, fore tibiæ, middle tibiæ entirely or (like the hind pair) at the base only, testaceous; hind tarsi fuscous. Wings hyaline, stigma and nervures dark fuscous. Mesothorax very minutely punctulate, shining; scutellum, metathorax, and abdomen smooth and shining. Segment 1 half as long again as broad, with parallel sides, margined, truncate; 2 half as long as 3. Terebra as long as the abdomen, nearly straight; valves subclavate. ♀. Length, $1\frac{1}{2}$; wings, $3\frac{1}{2}$ lin.

Reinhard (Berl. ent. Zeit., 1881, p. 45) describes a species *lineatus*, which he says is very near *lineipes*, Wesm., differing only in smaller size, and in having a fusco-testaceous stigma. Wesmael gives the length of *lineipes* as $1\frac{3}{4}$ lin., in which respect only the British specimen fails to agree with the description. As the stigma is dark fuscous, I have not referred it to Reinhard's insect; though it is very probable that the two species ought to be united.

Two females are in Cameron's collection, taken in Cadder Wilderness, near Glasgow.

51. *Apanteles longicaudis*, Wesm.

Microgaster longicauda, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 54, ♀ (not of Ratz.)

Apanteles longicauda, Reinh., Berl. ent. Zeit., 1881, p. 45, ♂ ♀.

Microgaster terebrator, Ratz., Ichn. d. Forst., iii., 52.

Black; belly pitchy at the base; palpi, fore femora at the apex, and their tibiæ, middle and hind tibiæ at the base, pale testaceous. Wings whitish hyaline, somewhat greyish towards the tips, stigma and nervures fuscous, the latter distinct. Mesothorax very finely punctulate, rather shining; metathorax finely and thickly punctulate, or more or less smooth; scutellum and abdomen smooth, somewhat shining, especially the former. Segment 1 longer by one-half than its breadth, with parallel sides, truncate, sometimes coriaceous and dull towards the apex; 2 half as long as 3. Terebra as long as the abdomen, scarcely curved; valves almost linear. ♂ ♀ Length, $1\frac{1}{2}$ —2; wings, $3\frac{1}{2}$ — $4\frac{2}{3}$ lin.

I have seen no ♀, and only 1 ♂, in Fitch's collection, which was named by Reinhard. Ratzeburg reared the species in some numbers from *Recurvaria leucatella*, Clerck; and Hofmann, at Stuttgart, from *Atemelia torquatella*, Lien.

52. *Apanteles fuliginosus*, Wesm.

Microgaster fuliginosus, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 52, ♂ ♀ (not of Ratz.)

Apanteles fuliginosus, Reinh., Berl. ent. Zeit., 1881, p. 46, ♂ ♀.

Black; palpi at the apex, 4 anterior femora at the apex sometimes, their tibiæ wholly or at the base, and hind tibiæ at the base, testaceous. Wings hyaline, stigma dark fuscous, nervures paler but distinct, except the base of the radius. Mesothorax minutely punctulate and, with the scutellum, shining. Metathorax slightly rugulose, or smooth. Segment 1 a little longer than broad, with parallel sides, broadly truncate, punctulate, smooth at the base; 2 shorter than 3, and like the rest, smooth, sericeous, iridescent. Terebra $\frac{1}{4}$ abdomen, nearly straight; valves clavate. ♂ ♀ Length, 1— $1\frac{1}{3}$; wings, 3— $3\frac{3}{4}$ lin.

This species must be distinguished from *viminetorum*, Wesm., which has the 1st segment narrower, and attenuated towards the apex; and the 2d segment

rugulose. From *inifimus*, Hal., it may be known by the hyaline wings.

Two males and three females were bred by Bignell from *Gracilaria syringella*, Fab.; he has also captured the ♂. According to Giraud the species has been bred by Heeger from *Lyonetia Clerkella*, L. (?) A solitary parasite. Cocoons silky white, semitransparent.

53. *Apanteles sicarius*, n. s.

Niger, palpis, femorum anticorum apice, tibiis anticis, posteriorumque basi late, testaceis; maris tibiis anticis medio infuscatis. Alæ ♂ hyalinæ, ♀ levissime infumatæ, stigmatæ costa radiique basi nigricantibus, nervis cæteris fuscis, omnibus distinctis. Caput cum thorace nitidum, læve, omnium subtilissime punctulatum. Abdomen læve, nitidum, supra planum; segmentum Imum subtiliter punctulatum, sesquilongius quam latius, truncatum, marginatum, lateribus parallelis; 2dum 3tio duplo brevius, lineis duabus lateralibus antrorsum in bases foveas triangulares convergentibus impressum; cætera lævia; articulatio suturiformis curvata, postice convexa. Terebra abdominis dimidio æqualis, vel paulo longior, valvis compressis, fortiter clavatis. Valvula ventralis acuta, testacea, anum superans. Tibiarum posticarum calcaria metatarsi dimidio breviora.

Black; fore femora at the apex, their tibiæ, and the posterior at the base broadly, testaceous; fore tibiæ of the ♂ infuscated in the middle. Wings ♂ hyaline, ♀ very slightly infumated, stigma, costa, and base of radius, blackish, the other nervures fuscous, all distinct. Head and thorax smooth, shining, with almost invisible punctulation. Abdomen flat above, smooth and shining; segment 1 minutely punctulate, $\frac{1}{2}$ longer than its breadth, with parallel sides, truncate, margined; 2 half as long as 3, more strongly margined by two impressed lines curving inwards to a pair of triangular basal foveæ; the rest smooth; suturiform articulation curved, convex posteriorly. Terebra $\frac{1}{2}$ — $\frac{2}{3}$ abdomen; the valves compressed and strongly clavate. Valvula ventralis acute, surpassing the anus, testaceous. Spurs of hind tibiæ shorter than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{2}$; wings, $3\frac{1}{4}$ lin.

The ♂ is hardly distinguishable from the ♂ *longicaudis*, Wesm., determined by Reinhard: in the latter, however, the fovea at the base of the scutellum is obsolete, and most of the nervures decolorous; in *sicarius* the fovea is distinct, and all the nervures at least visible. The ♀ of

longicaudis is at once known by the terebra, which is as long as the abdomen.

Two males and four females were discovered by Bignell at Bolt Head, Devon, in July; and a ♂ was bred by him from *Diaemia literata*, Scop.

SECTION III.

54. *Apanteles octonarius*, Ratz.

Microgaster octonarius, Ratz., Ichn. d. Forst., iii., 52, ♀.

Apanteles octonarius, Reinh., Berl. ent. Zeit., 1881, p. 35, ♂ ♀.

Black; palpi pale; antennæ beneath towards the base fusco-ferruginous; belly at the base, and legs (except the coxæ and upper trochanters), rufo-testaceous; segments 1—2 margined laterally with the same colour; hind femora sometimes dusky at the tips, or with a fuscous line beneath, or nearly all fuscous; hind tibiæ darker at the apex. Wings hyaline, squamulæ and stigma fuscous, nervures fusco-testaceous. Mesothorax and scutellum nearly smooth, and, like the whole body, shining; metathorax rugulose; pleuræ smooth. Segment 1 longer by $\frac{1}{2}$ than its breadth, very slightly narrowed at the base, subrugulose at the sides and apex, broadly truncate; 2 transverse, shorter than 3, with two impressed lines converging towards the base, and enclosing a smooth subtriangular space. Terebra very short. Valvula ventralis not surpassing the anus. Hind coxæ smooth. Spurs of the hind tibiæ longer than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{2}$; wings, 3 lin.

Distinguished from all other species of Section III. by the rugulose metathorax.

Bignell reared 4 males and 3 females, July 23, from a larva of *Notodonta ziczac*, L., and Bridgman has taken both sexes at Norwich. In Germany Ratzeburg obtained 8 females at the end of May from a half-grown larva of *Gnophria quadra*, L., found on a beech tree. Observing 4 maggots arranged symmetrically on each side of the victim, and which appeared to be sucking it, he at first supposed them to be external parasites. "Very likely," he says, "I found the caterpillar just after the *Microgasters* had bored their way out of it. In about seven days the perfect insects appeared." According to Reinhard this species has frequently been reared from *Lithosia complana*, L., and *Tortrix rosana*, L.; from the

latter host by Brischke, who adds, "cocoon united in a flocky white heap." Cocoon white, faintly tinged with lemon-colour.

55. *Apanteles abjectus*, n. s.

Niger; venter basi concolor; palpi pallidi; pedes cum trochanteribus inferis testacei; coxæ nigræ; femora posteriora supra et infra fusca, vel fusca, plaga media testacea; tibiæ posticæ apice ipso cum tarsis infuscatæ. Alæ hyaline squamulis stigmatæ nervis fuscis. Corpus totum læve, nitidiusculum; abdominis segmentum I. unum solito latius, latitudine haud longius, truncatum, sutura inter hoc et 2dum profundius biimpressa; 2dum transversum, 3tio brevius, lineis duabus obliquis lateralibus antrorsum convergentibus impressum. Terebra brevissima. Valvula ventralis anum non superans. Coxæ posticæ læves. Calcaria postica metatarsi dimidio paulo longiora.

Black; base of the belly concolorous; palpi pale; legs, including the lower trochanters, testaceous; coxæ black; posterior femora fuscous above and beneath, or fuscous with a testaceous medial streak; hind tibiæ at the extreme apex, as well as their tarsi, infuscated. Wings hyaline, squamulæ, stigma, and nervures fuscous. Body entirely smooth, somewhat shining; segment 1 uncommonly wide, not longer than its width, truncate, the suture between it and segment 2 with a deep double impression; 2 transverse, shorter than 3, impressed with two oblique lateral lines, which converge forwards. Terebra very short. Valvula ventralis not surpassing the anus. Hind coxæ smooth. Spurs of the hind tibiæ a little longer than $\frac{1}{2}$ the metatarsus. ♀. Length, 1; wings, $2\frac{3}{4}$ lin.

This resembles *octonarius* in having the 2d segment shorter than the 3d, but the 1st segment is broader and shorter, the metathorax smooth, and the cocoons different. It answers to the description of *Microgaster nigriventris*, Nees, Mon., i., 178, except that the 2d cubital areolet of that species is said to be subinchoate, a difference of structure which forbids the union of the two.

Two females were bred by Bignell, May 27, from *Lophopteryx camelina*, L. Three males and four females are in Fitch's collection, bred from *Notodonta dromedarius*, L.; and four males, two females, bred from an unknown victim by F. Norgate; also three males and two females bred from *Notodonta dictæoides*, Esp., taken in the New Forest by Norgate, in Bridgman's collection. Cocoon brownish white.

56. *Apanteles immunis*, Hal.

Microgaster immunis, Hal., Ent. Mag., ii., 250, ♀.

Black; palpi pale, sometimes dusky at the base; belly at the base, femora, and tibiæ, flavo-testaceous; coxæ and upper trochanters black; middle femora with a blackish line above and below; hind femora blackish, with a longitudinal testaceous stripe; posterior tarsi, and hind tibiæ at the apex, fuscous. Wings hyaline, squamulæ, costa, and stigma fuscous. Thorax and pleuræ almost smooth: mesothorax iridescent; metathorax very minutely and sparingly rugulose. Segment 1 almost twice as long as broad, hardly rounded at the sides, truncated, smooth at the base, minutely aciculated towards the apex; that of the ♂ narrower, quite twice as long as broad, and smoother; 2 as long as 3, with two oblique impressed lines converging forwards and enclosing a subtriangular aciculated space; suturiform articulation marked with two impressions; the rest of the abdomen smooth and shining. Terebra very short. Valvula ventralis not surpassing the anus. Hind coxæ smooth. Spurs of hind tibiæ equal to half the metatarsus. ♂ ♀. Length, $1\frac{1}{3}$; wings, $3\frac{1}{2}$ lin.

Var. ♀. Abdominal segments 1—3 bordered with testaceous, 3 more broadly; legs without fuscous marks.

The dark lines on the femora are variously developed in 11 specimens, sometimes obliterated on the intermediate pair, on the hind pair always more or less present. The ♂ is much more slender than the ♀, and the antennæ are longer than the body.

A solitary parasite of Geometræ. Bred by Bignell from *Pseudoterpna pruinata*, Hufn., male, July 20; *Hyberuia marginaria*, Bork., and *H. leucophæaria*, Schiff., females, June 23; *Cheimatobia brumata*, L., the var. ♀; *Oporobia dilutata*, Bork., from Scotland, 2 females. Raynor obtained 2 females, July 7, from *Bupalus piniarius*, L. Bridgman, 1 male from an undetermined larva. Bignell and myself have captured females. The Scotch *Oporobia* also produced *Apanteles salebrosus*, No. 3, ante. Cocoons pale sulphur-yellow.

57. *Apanteles caberæ*, n. s.

Niger; ventris basi rufescente, palpis pallidis, pedibus testaceis, coxis nigris, femoribus posterioribus supra et infra plus minus nigro-lineatis, vel totis pallidis, tibiæ posticarum dimidio cum tarsis fusco, his prope basin testaceis. Alæ hyalinæ, squamulis

stigmatæ nervis fuscis. Corpus totum læve, nitidiusculum; segmentum 1mum latitudine sesquolongius, marginatum, lateribus parallelis, apice truncatum, angulis rotundatis; 2dum longius quam *A. abjecto*, 3tio æquale. transversum, lineis 2 obliquis antrorsum convergentibus aream triangularem lævem includentibus impressum. Terebra brevissima. Valvula ventralis anum non superans. Coxæ posticæ læves. Calcaria postica metatarsi dimidio paulo longiora.

Black; palpi pale; belly at the base rufescent; legs testaceous, with black coxæ; posterior femora more or less edged with black above and beneath, or wholly pale; apical half of hind tibiæ, with their tarsi, fuscous, the latter testaceous at the base. Wings hyaline, squamulæ, stigma, and nervures fuscous. Body smooth, slightly shining; segment 1 half as long as its breadth, margined, with parallel sides, truncate at the apex, the angles rounded; 2 longer than in *A. abjectus*, as long as 3, transverse, impressed with two oblique lines converging forwards and enclosing a smooth triangular space. Terebra very short. Valvula ventralis not surpassing the anus. Hind coxæ smooth. Spurs of hind tibiæ a little longer than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{4}$; wings, $3\frac{1}{4}$ lin.

This species is very near *immunis*, Hal., but certainly distinct; the triangular space on the 2d segment is smooth, and the cocoons different.

A solitary parasite of Geometræ. Bred by Bignell, ♂ ♀, from *Cabera pusaria*, L.; ♀, from *Iodis lactearia*, L.; ♂, from *Selenia bilunaria*, Esp., and *Lomaspilis marginata*, L. The cocoons, in which they remained, in one case, from September to April, are brownish white, like those of *abjectus*.

58. *Apanteles popularis*, Hal.

Microgaster popularis, Hal., Ent. Mag., ii., 250, ♂.

Black; palpi pale, fuscous at the extreme base; sides of segment 1 narrowly, fore femora at the apex, tibiæ, and fore tarsi, testaceous; posterior tibiæ at the apex, hind tibiæ also beneath, blackish. Wings whitish hyaline, squamulæ, costa, and stigma, dark fuscous; nervures pale, the outer colourless. Mesothorax smooth, sericeous, the punctulation almost invisibly minute; scutellum, metathorax and abdomen smooth, impunctate, shining. Segment 1 scarcely longer than broad, sides somewhat rounded, and slightly converging behind the middle to the truncated apex; 2 as long as 3, with two impressed lines converging forwards and enclosing a smooth subtriangular space. Terebra very short.

Valvula ventralis not surpassing the anus. Hind coxæ smooth. Spurs of hind tibiæ shorter than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{4}$; wings, $2\frac{2}{3}$ lin.

Smaller and less elongate than *immunis*, Hal., and further distinguished by the smoothness of the 2d abdominal segment, and colour of the wings. The 2d segment is longer than in *abjectus*; the 1st segment shorter than in *cabera*, from which last it may also be known by the colour of the legs.

Common. Gregarious. The habitual parasite of *Euchelia jacobæ*, L., from which it has been several times reared, by Bignell, Sotheby, and myself. In July and August the parasites issue from the body of their victim, to the number of 6—9 in each brood, and make white cocoons in an irregular mass, in which they hibernate. *Mesochorus facialis*, Bridgman, is their hyperparasite.

SECTION IV.

59. *Apanteles fraternus*, Reinh.

Apanteles fraternus, Reinh., Berl. ent. Zeit., 1881, p. 47. ♂ ♀.

Black; palpi pale; femora fuscous, tibiæ fusco-testaceous, paler at the base. Wings hyaline, often sublacteous, stigma fuscous or testaceous. Mesothorax and scutellum punctulate, scarcely shining; metathorax and abdomen smooth, shining. Segment 1 twice longer than its medial breadth, with sides parallel as far as the middle, afterwards lanceolate; segment 2 with two impressed lateral lines converging forwards into deep foveæ and enclosing a triangular space. Terebra very short. ♂ ♀. Length, 1; wings, 2 lin.

Similar to the following species, but much smaller, and less elongate in form.

Bred by Bignell in some numbers from *Aspilates ochrearia*, Rossi. The minute white cocoons are arranged in an alveariform mass, the shape of which is determined by the position of the victim at the time of its death. In one case the geometrical larva is stretched almost straight upon the twig, and the cocoons form three long rows, with a few irregularly added in the middle. A similar arrangement of cocoons is described under the genus *Microgaster* (q. v.), but does not seem to occur in any other species of *Apanteles*. Brischke confirms this: he says "cocoons as in *Microgaster flavipes*." According

to Reinhard, the cocoons of *A. fraternus* are sometimes more than 100 in number. Several masses of them, collected by Rogenhofer, are preserved in the zoological museum of Vienna. See Entom., xvi., 166.

60. *Apanteles triangulator*, Wesm.

Microgaster triangulator, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 62, ♂ ♀.

Apanteles triangulator, Reinh., Berl. ent. Zeit., 1881, p. 47, ♂ ♀.

Black; palpi and legs testaceous; coxæ black; fore femora black at the base; middle and hind femora edged with black above and beneath, or the last entirely black; tarsi and tips of the tibiæ fuscous. Wings hyaline, stigma and nervures fuscous; the former sometimes pale. Mesothorax very minutely punctulate, scutellum smooth, both shining, as also is the metathorax. Abdomen smooth and shining; segment 1 twice as long as broad, with sides parallel nearly to the apex (which is obtusely lanceolate, or rounded), smooth, rimulose at the apex; segment 2 somewhat shorter than 3, much broader than 1, with two impressed lines curving forwards and enclosing a smooth subtriangular space. Terebra very short. ♂ ♀. Length, 1½; wings, 3½ lin.

I captured one ♂ near Abergavenny, and a ♀ is in the collection of Billups. Giraud records it as a parasite of *Thecla W-album*, Knoch. Brischke bred it from *Stauropus fagi*, L., and from *Pseudoterpna pruinata*, Hufn.; he says the cocoons are yellowish, woolly, single or gregarious. Wesmael reared six males and two females from a bundle of pale yellow cocoons attached to a blade of grass near Boisfort, Belgium, in the middle of June. W. H. B. Fletcher bred a ♂ from *Psychoides Verhuelletus*, Heyd. Billups a ♀ from *Boarmia gemmaria*, Brahm, April 1st; its cocoon is white, without any perceptible tinge of yellow.

61. *Apanteles pallidipes*, Reinh.

Apanteles pallipes, Reinh., Berl. ent. Zeit., 1881, p. 48, ♂ ♀.

Black; antennæ at the base, belly at the base, palpi, and legs, pale testaceous; hind coxæ usually black at the base. Wings hyaline, stigma testaceous or fusco-testaceous. Mesothorax somewhat shining, very finely punctulate; metathorax rugulose, dull, with a medial carina. Segment 1 twice as long as its medial

breadth, narrowed towards the apex, forming an elongate triangle, rugulose; segment 2 a little shorter than 3, transverse, with two impressed lines converging forwards, and enclosing a triangular space; the other segments smooth. Terebra very short. ♂ ♀. Length, $1\frac{1}{3}$; wings, $3\frac{1}{2}$ lin.

This species looks very like *fulvipes*, Hal., from which it may be known by the form of the 1st segment, and by the rugose metathorax, bisected by a longitudinal carina. In *fulvipes* the 1st segment is more than three times as long as its medial breadth, and the metathorax smooth, or nearly so, without a longitudinal carina. Some specimens of *pallidipes* have the legs slightly varied with fuscous.

Abundant; attacking almost exclusively the larvæ of the genus *Plusia*: though, if there be no mistake, Brischke at Danzig has also obtained it from *Spilodes verticalis*, L., *Cucullia argentea*, Hufn., and *Vanessa urticæ*, L.

Bignell has bred series from *Plusia gamma*, L.; one of these broods remained 32 days in pupa, hatching out Oct. 16th; another set, bred by W. H. B. Fletcher, came forth August 9th; another, bred by J. E. Fletcher, on September 30th; Rogenhofer at Vienna, according to Reinhard, has reared it from the same. Also obtained by Bignell from *Plusia iota*, L., and *P. chrysitis*, L. Numerous examples are in Fitch's collection, bred by him from *Plusia gamma*, and by Meldola from *P. iota*, L. Goureaux bred 24, on August 23rd, from the white agglomerated cocoons surrounding a larva of *Plusia festucae*, L., collected on August 9th (Ann. Soc. Fr. (2), iii., 361; 1845). Cocoons white, enclosed by the gregarious maggots in an oval ball of flocculent texture, as large as a pigeon's egg; resembling the nest of *congestus*, N., except that the latter is smaller and yellow.

62. *Apanteles bicolor*, Nees.

Microgaster bicolor, Nees, Mon., i., 181, ♀; Ratz., Ichn. d. Forst., ii., 50, ♂ ♀.

Apanteles bicolor, Reinh., Berl. ent. Zeit., 1881, p. 48, ♂ ♀.

Microgaster circumscriptus, Nees, Mon., i., 181, ♀.

M. exiguus, Hal., Ent. Mag., ii., 249, ♀.

M. ardeapenella, Bouché, Naturg. (1834), 153, ♀.

M. lividipes, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 63, ♂ ♀.

Black; palpi pale; belly testaceous at the base; abdomen above often rufo-testaceous at the base or in the middle; legs testaceous;

hind coxæ, with their femora, often more or less infuscated. Wings hyaline, stigma testaceous. Mesothorax thickly punctulate, dull; metathorax more shining, punctulate. Abdomen ♀ compressed. Segment 1 more than twice as long as its medial breadth, slightly rugulose, with sides parallel as far as the middle, from thence to the apex converging, lanceolate; segment 2 nearly smooth, with 2 impressed lines converging towards the base, and enclosing a triangular space; the rest smooth and shining. Terebra as long as $\frac{1}{4}$ of the abdomen, subdecurved; valves subclavate, pilose. ♂ ♀. Length $1\frac{1}{2}$; wings $2\frac{3}{4}$ lin.

The colour of the abdomen and legs varies, even in the same brood; but the species is easily known by its structure. The antennæ are testaceous at the extreme base; those of the ♂ are also frequently dull rufous beneath.

An abundant parasite, living in small families, or solitary, according to the size of the larva attacked. Not common in *Geometra*, but once bred by Bignell (four males, five females) from *Gnophos obscuraria*, Hüb. Usually infesting singly the leaf-mining *Tineæ*. Reared twice by Elisha from *Lithocolletis lantanella*, Schr., March 14th; from *Gracilaria tringipennella*, Zell., May 31st; *semifascia*, Haw., July 17th; *Psychoides Verhuel-
lensis*, Heyd., *Catoptria æmulana*, Schl., Sept. 4th; and *Nannodia Hermannella*, Fab., June 9th. By Parfitt and Fletcher from *Lithocolletis vacciniella*, Scott. By W. H. B. Fletcher from *Elachista tenuatella*, Staint., May 9th. On the Continent, by Reissig and Ratzeburg, from *L. cavella*, Zell., *pomifoliella*, Zell., *emberizipennella*, Bouché, *Tischeria complanella*, Hüb., &c. By Brischke from *Plutella porrectella*, L., *Lithocolletis lantanella*, Schr., and *L. spinicoella*, Kol. Ratzeburg remarks that the parasitic maggot works its way through the dry epidermis of the leaf inhabited by the *Tinea*, and attaches its cocoon by a few threads to the under side. Bouché's "*ardeæpenella*" was from *Gracilaria syringella*, Fab., = *ardeipennella*, Tr. Captured frequently in England, by Dorville, Bignell, Bridgman, Haliday, &c. Cocoons white, according to Bouché; greyish brown, according to Ratzeburg; pale yellow, according to Parfitt; silky-white and single, according to Brischke. Those which I received from Bignell were of the usual silvery white.

63. *Apanteles formosus*, Wesm.

Microgaster formosus, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 60, pl., f. 1. (♀?).

Apanteles formosus, Reinh., Berl. ent. Zeit., 1881, p. 50, ♂ ♀.

Black; mouth, palpi, squamulae, 1st abdominal segment, belly at the base, and legs, flavo-testaceous; hind coxæ at the base, or wholly, black; hind femora and tibiæ darker at the tips, their tarsi also infuscated. Wings hyaline, stigma fuscous. Thorax very smooth and shining; metathorax with the apex produced, and a wide shallow depression on each side, giving it somewhat the form of a saddle. Segment 1 smooth and shining, more than twice as long as its breadth, the sides parallel nearly as far as the rounded apex, where it is somewhat rugulose; 2 shorter than 3, transverse, with two oblique basal impressions, smooth and shining, like the remaining segments. Terebra short. Valvula ventralis surpassing the anus. Internal spur of the middle tibiæ slightly curved at the apex. ♂ ♀. Length $1\frac{1}{2}$; wings $4\frac{1}{2}$ lin.

A species remarkable for structure, colour, and the doubt connected with its earlier state. In addition to the form of the metathorax above described, the 2d abdominal segment is peculiar. The two oblique basal impressions fail before reaching the posterior margin, and consequently do not enclose a triangular space; and the middle of the anterior margin is angularly produced. The 1st segment differs from that of *A. fulripes*, Hal., and its allies, in being broader, shorter, and not attenuated hindwards till just before the apex. The abdomen of the ♂ is smaller and narrower than that of the ♀, and the 1st segment infuscated towards the apex. The unknown *Ichneumon intercus*, Schr. (Enum. ins. Austr., 764), as to its description, agrees very closely with the ♀ of this insect.

Wesmael's original specimen, of doubtful sex, was taken near Liège. According to Reinhard, both sexes have since been reared at Vienna from *Orgyia antiqua*, L., making pure white cocoons. Bignell, in England, bred a ♀, June 20th, 1881, from a half-grown larva of *Tæniocampa stabilis*, View., which is preserved with it, together with a white cocoon of the usual appearance. But he has also reared the ♂ from *Uropteryx sambucaria*, L., and in this case the cocoon is totally different, being yellowish brown, of a shining gummy texture, and raised upon a long stiff footstalk of the same material. This is

entirely unlike anything constructed by a Braconid (see fig.), and rather resembles the pedicellate egg of a *Chrysope*. The cocoons of *Perilitus* cannot be compared, for they are suspended by a thread, not elevated upon a rigid peduncle. Bignell obtained several of these cocoons from *Uropteryx* in the same manner, although I have only three of his now before me. His observation is singularly confirmed by the fact that among insects kindly communicated by Parfitt for examination, I find a ♂ of *A. formosus*, accompanied by a similar pedunculated cocoon. This specimen is an old one from Dorville's collection. The Microgasterides do not avail themselves of pupa-cases made by other insects, but manufacture their own; nor is it likely that the ♂ of any species constructs a cocoon totally different in material and design from that of the ♀. Some further observations alone can explain this difficulty.



64. *Apanteles lautellus*, n. s.

Niger, palpis, pedibus, abdomine, flavo-testaceis; hoc apice nigro, interdum supra et apice, vel fere totum nigrum. Coxæ posticæ basi plus minus nigræ, vel totæ testaceæ; tibiæ posticæ apice infuscate. Alæ hyalinæ, squamulis, stigmatè, nervis, pallide piceis vel testaceis. Mesothorax et scutellum lævia nitidula; metathorax lævis. Segmentum 1mum læve, a basi ad apicem sensim angustatum, lanceolatum, apice rotundato, latitudine media plusquam duplo longius, rufum vel nigrum; 2dum transversum, 3tio brevius, 1mo latius, lineis duabus obliquis antrorsum convergentibus spatium triangulare includentibus impressum, cum cæteris læve. Terebra abdominis partem quintam æquans, valvulis crassiusculis subdecurvis. Valvula ventralis ampla, anum paulo excedens.

Black; palpi, legs, and abdomen flavo-testaceous; the last black at the apex, sometimes above, or almost wholly black. Hind coxæ more or less black at the base, or entirely testaceous; hind tibiæ infuscated at the apex. Wings hyaline, squamule, stigma, and nervures pale piceous or testaceous. Mesothorax and scutellum smooth, somewhat shining; metathorax smooth. Segment 1 smooth, gradually narrowed from the base to the apex, lanceolate, the apex rounded, more than twice as long as its medial breadth,

rufous or black; 2 transverse, shorter than 3, broader than 1, with two impressed oblique lines converging forwards and enclosing a triangular space, smooth like the remaining segments. Terebra $\frac{1}{2}$ of the abdomen, valves somewhat incrassated, subdecurved. Valvula ventralis large, a little surpassing the anus. ♀. Length, 1; wings, $2\frac{1}{4}$ lin.

Described from ten females. The form of the 1st segment refers this species to the IVth Section, and distinguishes it from the few others that are abnormally coloured. Typical specimens have segments 1—4 testaceous, the 1st rather more rufous, and the rest black; the coxæ are entirely pale. In two or three examples the abdomen is dark above, and the hind or even the middle coxæ fuscous at the base. But several are so placed on a card as to prevent their examination.

Bred April 27th by Elisha from *Lithocolletis lautella*, Zell. (five specimens); from *L. lantanella*, Schr. (five specimens); July 17th, from *Gracilaria semifascia*, Haw. (three specimens); and one dark coloured and in bad condition, but apparently of this species, from *Lithocolletis cavella*, Zell.

65. *Apanteles umbellatarum*, Hal.

Microgaster umbellatarum, Hal., Ent. Mag., ii., 247, ♀.

Black; palpi, sides of the abdomen, legs, squamulæ, stigma, and nervures, pale yellowish; 4 posterior femora with a line above and beneath, and tips of the hind tarsi, fuscous; coxæ also fuscous, the hind pair pale at the apex. Wings hyaline. Mesothorax smooth, sericeous, iridescent; metathorax and abdomen smooth, shining; the latter compressed in the ♀. Segment 1 twice as long as broad, with sides parallel as far as the middle, afterwards narrowed to the rounded apex; 2 much broader than 1, with two strongly impressed lines converging forwards and enclosing a subtriangular space. Terebra $\frac{1}{2}$ abdomen, decurved; valves clavate. Valvula ventralis large, triangular, but not surpassing the anus. ♀. Length, $\frac{3}{4}$; wings, $1\frac{1}{2}$ lin.

This species, one of the smallest of the genus, is intermediate between Sections II. and III.; the exerted terebra refers it to the former, and the abdominal structure to the latter. It most resembles *bicolor*, Nees.

Taken by Haliday in autumn on the flowers of *Angelica sylvestris*. Two females, bred by W. H. B. Fletcher, of Worthing, from *Lithocolletis spinicolella*, Kol., are the only specimens I have seen.

66. *Apanteles callidus*, Hal.

Microgaster callidus, Hal., Ent. Mag., ii., 248, ♀.

Apanteles callidus, Reinh., Berl. ent. Zeit., 1881,
p. 49, ♂ ♀.

Microgaster majalis, Wesm., Nouv. Mém. Ac. Brux.,
1837, p. 64, ♂ ♀.

Black; palpi, squamulæ, belly at the base, segments 1—3 at the sides, sometimes 3 entirely, and legs, testaceous; hind coxæ wholly or at the base, hind tibiæ at the apex, with their tarsi, fuscous. Wings dull hyaline; stigma fuscous, often pale. Mesothorax very finely punctulate, rather shining; metathorax punctulate, smoother in the middle. Abdomen compressed beneath; segment 1 slender, more than three times longer than its medial breadth, narrowed from the base to the apex, rugulose; 2 with two impressed lines converging forwards and enclosing a triangular rugulose space; the rest smooth. Hind coxæ large, granulated. Inner spur of the middle tibiæ slightly curved. Terebra very short. Valvula ventralis not surpassing the anus. ♂ ♀. Length, $1\frac{3}{4}$; wings, $3\frac{1}{2}$ lin.

Var. Hind femora and tibiæ fuscous at the apex, or the former with a fuscous line above.

The distinctive character lies in the punctulate, or granulated, and incrassated hind coxæ; in *lateralis*, Hal., they are smoother; moreover the ♀ of *lateralis* has a longer terebra. *A. ritripennis*, Hal., is larger, and the hind coxæ are smooth. The wings of *callidus* are very narrow.

Not very common. Reared by Bignell, in small broods of 3—6, from *Nemophila plantaginis*, L., *Abraxas grossulariata*, L., and *Triphæna orbona*, Hufn. Captured near Norwich by Bridgman. Cocoons white.

67. *Apanteles lateralis*, Hal.

Microgaster lateralis, Hal., Ent. Mag., ii., 248, ♂ ♀.

Apanteles lateralis, Reinh., Berl. ent. Zeit., 1881, p. 49,
♂ ♀.

? *Microgaster rufilabris*, Ratz., Ichn. d. Forst., i., 69, ♀.

Black; palpi, squamulæ, margins of segments 1—2, belly at the base, and legs, testaceous; hind coxæ black (sometimes pale at the apex), hind femora broadly, and tibiæ, fuscous at the apex. Wings hyaline, stigma fuscous. Mesothorax very finely punctulate, rather shining; metathorax with a few punctures, nearly smooth. Abdomen compressed beneath; segment 1 slender, three times

longer than its medial breadth, narrowed posteriorly, shining, almost smooth; 2 with the usual impressed lines converging forwards; the rest smooth and shining. Terebra as long as $\frac{1}{2}$ the abdomen, or a little less. Hind coxæ punctulate, shining. Valvula ventralis surpassing the anus. Inner spur of the middle tibiæ slightly curved. ♂ ♀. Length, $1\frac{1}{2}$ — $1\frac{1}{2}$; wings, $2\frac{2}{3}$ —3 lin.

Var. 1, ♂. Hind femora mostly black; middle tibiæ fuscous at the apex.

Var. 2, ♀. Stigma pale testaceous. Bred by W. H. B. Fletcher from *Elachista taniatella*, Staint.

This species closely resembles *vitripennis*, Hal., and the males are hard to distinguish, except by the smoother metathorax and larger size of the latter. Reinhard, in his 'Bestimmungs-Tabelle,' distinguishes the two species by the females only.

Common. Bred by Dorville from *Eupithecia assimilata*, Guenée; a ♀, Sept. 15th, by Bignell from *Symæthis oxyacanthella*, L. If the synonym from Ratzeburg be correct, it is also a parasite of *Hyponomeuta padellus*, L., bred by Kirchner. It is abundant in a wood close to my house, at Nunton, Salisbury, and is taken at Maldon by Fitch. Cocoons white.

68. *Apanteles vitripennis* (Cur.), Hal.

Microgaster vitripennis, Cur., B. E., 321; Hal., Ent. Mag., ii., 248, ♂ ♀.

Apanteles vitripennis, Reinh., Berl. ent. Zeit., 1881, p. 50, ♂ ♀.

Microgaster fuleriger, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 65, ♂ ♀.

M. flavilabris, Ratz., Ichn. d. Forst., i., 69, pl. ii., f. 19, ♀.

Black; palpi, squamulae, margins of segments 1—2, belly at the base, and legs, testaceous; hind coxæ at the base, or beneath, or wholly, black; hind tibiæ, and often hind femora, tipped with black; hind tarsi fuscous, the joints pale at the base. Segments 2—3 ♀ sometimes testaceous above, with a black patch common to both, not connected with the rest of the black surface. Wings hyaline, stigma fuscous. Mesothorax very finely punctulate, sericeous, shining; metathorax smooth, especially in the middle. Abdomen smooth and shining; segment 1 nearly three times as long as its medial breadth, attenuated from the base to the sub-rugulose apex, lanceolate; 2 with the usual impressed lines converging forwards, and a central ridge, continued from the 1st

segment, somewhat rugulose. Terebra very short. Hind coxæ shining, punctulate. Valvula ventralis surpassing the anus. Inner spur of the middle tibiæ slightly curved at the apex. ♂ ♀. Length, $1\frac{3}{4}$; wings, $4\frac{1}{4}$ lin.

The abdomen, as in *lateralis*, Hal., is short, narrow, and compressed, giving to the ♂ somewhat the aspect, as Haliday remarks, of *Evania*.

Not common. I have a ♂ taken at Abergavenny, and a ♀ from Leicestershire. Raynor has bred the ♂ at Brandon, May 16th, from *Thera variata*, Schiff.; the cocoon is accidentally stained at one end orange-red. Four males and a female were also reared by Sotheby, May 7th, from cocoons found sticking to heather; and a ♀ by Billups from *Boarmia gemmaria*, Brahm. Bignell obtained a ♂ on April 14th from a larva of *B. repandata*, L., not half-grown; it remained in the pupa-state about 20 days. According to Reinhard both sexes have been bred on the Continent from *Spilosoma fuliginosa*, L., and Brischke records it from *Lasiocampa pini*, L., but he probably refers to the next species. Cocoons white.

69. *Apanteles fulripes*, Hal.

Microgaster fulripes, Hal., Ent. Mag., ii., 249, ♂ ♀.

Apanteles fulripes, Reinh., Berl. ent. Zeit., 1881, p. 51, ♂ ♀.

Microgaster glomeratus, Nees, Mon., i., 179 (excl. syn.); Wesm., Nouv. Mém. Ac. Brux., 1837, p. 65, pl., figs. 6, κ (wing and base of abdomen), ♂ ♀.

M. nemorum, Hartig, Jahresb., 252; Ratz., Ichn. d. Forst., i., 69, ♂ ♀; pl. vii., f. 14, ♀.

Black; palpi, mandibles at the apex, squamula, and legs, flavo-testaceous; base of the belly pitchy-rufous; hind coxæ black, sometimes pale at the apex. Wings hyaline, stigma fusco-testaceous. Thorax very finely punctulate, moderately shining. Segment 1 very finely aciculated, nearly four times as long as its medial breadth, gradually narrowed from the base to the apex, lanceolate; 2 with the usual converging impressions enclosing a triangular aciculated space; the rest smooth and shining. Terebra very short. Hind coxæ shining, punctulate. Valvula ventralis not surpassing the anus. Inner spur of the middle tibiæ straight; spurs of hind tibiæ shorter than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{4}$; wings, $3\frac{1}{2}$ lin.

Smaller than *vitripennis*, Hal., with narrower wings and paler stigma; the abdomen is less compressed, the

triangular space on the 2d segment aciculated; the spurs of the middle tibiæ straight, and the legs uniformly testaceous, except that the hind tibiæ of the ♂ at the apex, and their tarsi, are sometimes darker.

Very abundant from about the vernal equinox, appearing earlier than the other species. It seems to be omnivorous, having been bred by Bignell in great numbers from *Vanessa Atalanta*, L., *Porthesia similis*, Fues., *Diloba cæruleocephala*, L., *Noctua xanthographa*, Fab., *Triphæna orbona*, Hufn., and *fimbria*, L., *Amphipyra pyramidea*, L., *Miselia oxyacanthæ*, L., *Xylocampa arcola*, Esp., *Nylina ornithopus*, Rott., *Asteroscopus sphinx*, Hufn., *Catocala nupta*, L., *Selenia bilunaria*, Esp., *Himera penunaria*, L., and *Larentia viridaria*, Fab. The broods from *Miselia* considerably outnumber the others. From *Diloba* only two parasites were excluded; from *Miselia* as many as 38; the average number is about 20. The period of pupation lasts about a fortnight. In certain cases they are carried under ground by the retreating caterpillar, and, when hatched, force their way upwards through the soil. Ratzeburg* says that in Germany they are the constant enemies of *Lasiocampa pini*, L.,

* The abundance of this species caused it to be employed by Ratzeburg as the subject of his experiments and observations. See Ichm. d. Forst., i., 62, for description and life-history of the larva and pupa: pl. vii., ff. 23, 24 represent a *Lasiocampa* larva opened, showing the position and appearance of the parasites in the inside, natural size; f. 25, another larva, with the same parasites recently emerged, and preparing to spin their cocoons, &c. Ratzeburg's great work on the parasites of insects affecting the cultivation of woods and forests, being written in German, is less extensively known in this country than it deserves to be. The following epitomized extract will show the interesting nature of his enquiries, so far as concerns *A. fulvipes*:—"The full-grown larva, at the time when it proceeds to spin its cocoon (on the outside of the dead caterpillar that has served for its victim), is 2-3 lines long, greenish white, with a green intestinal canal. The trophi are in a more rudimentary state than in other Ichneumon-larvæ that have been observed. The labial palpi consist of a single joint; the maxillæ are represented by two white processes; and the future mandibles are indicated by the thickened ends of a brownish curved streak, of a horny consistence. Of the clypeus and antennæ no rudiments appear. Of the 12 segments which compose the body, 1-3 are denoted by the absence of the lateral swellings which distinguish 4-10, each of which bears a spiracle. Each segment is furnished with a transverse row of minute black tubercles. The pupa (pl. vii., f. 31) is 2 lines long, showing all the organs of the perfect insect, packed into the smallest space; the antennæ lie

little less numerous than his *ordinarius*. The following additional names of victims are from Brischke:—*Ocneria dispar*, L., *Pygæra pigra*, Hufn., *Acronycta tridens*, Schiff., *Melanippe galiata*, Hüb., and *Chesias spartiata*, Fues. Cocoons white.

iv. MICROPLITIS, Först.

Först., Verh. pr. Rheinl., 1862, p. 245; Reinh., Berl. ent. Zeit., 1880, p. 358.

Maxillary palpi 5-, labial 3-jointed. Eyes villose. Antennæ 18-jointed. Mesopleuræ impressed with a crenate fovea. Abdomen sessile; suturiform articulation obsolete. Radius of the fore wing

along the belly between the legs; the colour is yellowish white, and no pubescence appears.—The larva of a *Microgaster* differs from that of most insects in undergoing several considerable changes of form in the course of its growth, presenting three principal stages. (1) At first, while less than 1 line in length, it is a slender vermiform creature, of 12 segments, without a distinct head, and destitute of the singular caudal vesicle which subsequently appears. (2) When about $1\frac{1}{2}$ lines long it is proportionally much thicker, and the head becomes well defined. At this time the spinning-organ may be discerned, consisting of a linear duct which commences at the head, and lies parallel to the alimentary canal as far as the middle, where it bifurcates, and is continued in two branches to the anal segment. The caudal vesicle just mentioned is a round bladder-like body attached to the last segment, and covered by a fine skin which the microscope shows to be studded with points or tubercles. It appears only during the middle life of the larva, becoming absorbed, like the tail of a young batrachian, before the attainment of full growth, and as soon as the tracheæ are developed. Hence it has been supposed to be an organ of respiration; but this seems to leave unexplained the earlier mode in which that function is performed. (3) The third stage differs from the two preceding in the exhibition of tracheæ, and the suppression of the caudal vesicle. The mouth now consists of a porrected haustellum, situated in the middle of four tubercular processes, the analogues of the future palpi.—The parasite derives its nutriment by sucking the adipose tissue of the victim. The latter, without being lacerated, is thus subjected to continual exhaustion and irritation, producing marasmus, which is at last precipitated into death by the breaking up of the tracheal system caused by the numerous perforations of the skin through which the parasites effect their egress.—The presence of a ravenous brood of *Microgasters* in the body of a larva of *L. pini* does not prevent the same larva from being struck by other Ichneumons. Ratzeburg has detected the maggot of an *Anomalon*, distinguished by its larger size, in the midst of these parasites: the fact is delineated in vol. iii., pl. 9, ff. 23, 24. As the *Anomalon* takes a much longer time to attain its full size than the *Microgasters*, it is probable that the deposition of the egg of the former took place before those of the latter; unless we suppose the *Anomalon* to perish prematurely by the exhaustion of its supply of nutriment.

almost complete; three cubital areolets, the 2d triangular, minute. Hind coxæ and spurs of hind tibiæ short, the latter not half the length of the metatarsus. Terebra very short, or concealed.

The 1st abdominal segment is furnished at the apex with a shining tubercle. The 2d segment is smooth and shining, only in two species dull and coriaceous. The cocoons are different from those of *Apanteles* and *Microgaster*. They are pergamentaceous or papyraceous, somewhat glossy, naked, grey, brown, yellow, and, in two instances, pea-green, but never pure white. They are either wrinkled, or strongly ribbed or fluted longitudinally, like the seeds of *Artemisia*, and found singly or in small clusters.

This genus and the following are comprised in Ruthe's posthumous paper on *Microgaster*, published by Reinhard in Berl. ent. Zeit., 1860, pp. 105—160. The descriptions are among the very best that are to be found in hymenopterous literature. The section of *Microgaster* characterised by Ruthe (*lib. cit.*, p. 125), containing sixteen species, received from Förster the name *Microplitis*. Reinhard (*lib. cit.*, pp. 358—360) has given a summary of Ruthe's work, with rectifications and a synoptical table, upon which the following is founded.

The species generally attack Lepidoptera, but Brischke states that he has bred *M. fumipennis*, Ratz., from two saw-flies, *Schizocera geminata*, L., and a *Macrophya*; while Ratzburg reports the same parasite from *Emphytus succinctus*, Kl.

TABLE OF SPECIES.

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|------|-----|---|------------------------------------|
| (14) | 1. | First abdominal segment never more than $1\frac{1}{2}$ times as long as its breadth, mostly shorter, not attenuated towards the apex, which is broadly rounded. | |
| (5) | 2. | Segment 2 dull, coriaceous. | |
| (4) | 3. | Hind tarsi blackish or fuscous | .. 1. <i>Spinolæ</i> , Nees. |
| (3) | 4. | Hind tarsi testaceous | 2. <i>xanthopus</i> , Ruthe. |
| (2) | 5. | Segment 2 shining, smooth. | |
| (7) | 6. | Segment 1 smooth and shining | .. 3. <i>ocellatæ</i> , Bouché. |
| (6) | 7. | Segment 1 punctato-rugulose. | |
| (9) | 8. | Stigma unicolorous, or only a little paler at the base | 4. <i>vidua</i> , Ruthe. |
| (8) | 9. | Stigma bicolorous, determinately pale at the base. | |
| (13) | 10. | Wings deeply infumated. | |
| (12) | 11. | Tibiæ obscure rufous; antennæ ♀ as long as $\frac{2}{3}$ of the body | 5. <i>tristis</i> , Nees. |
| (11) | 12. | Tibiæ rufo-testaceous; antennæ ♀ longer than $\frac{2}{3}$ of the body | 6. <i>dolens</i> , n. s. |

- (10) 13. Wings slightly infumated 7. *spectabilis*, Hal.
 (1) 14. First abdominal segment narrow, about twice as long as broad, attenuated towards the apex.
 (16) 15. Antennæ more or less testaceous .. 8. *mediator*, Hal.
 (15) 16. Antennæ black.
 (20) 17. Hind femora rufous; scutellum thickly punctulate and dull.
 (19) 18. Segment 2 testaceous at the sides; stigma broadly pale at the base; cocoons greenish white, almost smooth 9. *mediana*, Ruthe.
 (18) 19. Segment 2 wholly black; stigma unicolorous, or with only a small pale basal dot; cocoons ash-coloured, strongly ribbed 10. *tuberculifera*, Wesm.
 (17) 20. Hind femora mostly black; scutellum more or less shining.
 (22) 21. Metathorax punctato-rugose 11. *adunca*, Ruthe.
 (21) 22. Metathorax reticulato-rugose 12. *borealis*, n. s.

1. *Microplitis Spinolæ*, Nees.

Microgaster Spinolæ, Nees, Mon., i., 166; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 41, pl. (wing); Ruthe, Berl. ent. Zeit., 1860, p. 145, ♂ ♀ (not of Hal.).

Black; palpi pale; belly of the ♀ broadly pale at the base; legs rufo-testaceous; coxæ, upper trochanters at the base, hind femora at the extreme tips, and hind tarsi, nigro-fuscous, the last sometimes paler. Scape of the antennæ rufescent (black in the English specimens). Face covered with white pubescence. Wings infumated, squamule, stigma, and nervures dark fuscous, the stigma determinately yellow at the inner angle. Head more shining than the mesothorax and scutellum, which are ruguloso-punctulate and dull. Metathorax rugulose, subreticulated, carinated. Segment 1 rugulose, $1\frac{1}{2}$ times as long as its apical breadth, slightly and gradually narrowed towards the base, the apical half convex and subearinated; segment 2 uneven, more or less aciculated at the base, and with 2 indistinct arcuate impressions before the apex. Terebra concealed. ♂ ♀. Length, $1\frac{3}{4}$ —2; wings, $4\frac{1}{4}$ lin.

Var. ♂ ♀. Middle femora at the base, and hind femora entirely, black.

The ♀ is more slender than *xanthopus*, Ruthe, and distinguished from that species by the dark colour of the hind tarsi. Segment 1 is rather shining, flat on the basal half, and posteriorly gibbous, with or without a faint medial carina. Segment 2 is not always aciculated

at the base, nor are the arcuate impressed lines before the apex uniformly distinct. Segment 3 sometimes exhibits a transverse subtestaceous band. The sutures of the mesothorax are indistinctly visible. The ♂ differs in having the belly black at the base.

The ♂ was bred by Nees v. Esenbeck in July, 1809, from a cocoon found on an oak-twig, and from *H. oleracea*, L. It formed a green pearly cocoon, and remained in the pupa-state a fortnight. He also states that he captured several more of both sexes between June and August at Sickershausen. Brischke bred the species from *Miscia oxyacanthæ*, L., and *Plusia gamma*, L.; he describes the cocoon as being of a bright bluish green. According to Giraud, Rogenhofer reared it from *Habrostola tripartita*, Hufn. W. H. B. Fletcher, of Worthing, bred a pair, belonging to the var., from *Lyperina cespitis*, Fab. Wesmael procured four males and one female in Belgium, but, as he says the hind tarsi are sometimes testaceous, some of these may have been *xanthopus*. The ♀ has been twice taken at Maldon by Fitch, in August; and by Billups at Margate. I captured a ♂ near Barnstaple, another in Darenth Wood, a third at Cheltenham, a fourth at St. Albans, and a fifth in an osier-bed at Nunton, Salisbury, Sept. 3rd. The remarkable grass-green cocoons are made by two different species of this genus; those of *sordipes*, Nees, are described as similar (though not so by Brischke), and the species may probably be found in England, though I have seen no specimens.

2. *Microplitis xanthopus*, Ruthe. (Pl. V., fig. 7).

Microgaster xanthopus, Ruthe, Berl. ent. Zeit., 1860, p. 147, ♀.

Black; palpi and legs rufo-testaceous, including the hind tarsi; coxæ, upper trochanters, and claws, black. Wings infumated, with a testaceous tinge, squamulae piceous, nervures and stigma fuscous, the last determinately yellow at the inner angle. Head, mesothorax, and scutellum ruguloso-punctate and dull. Metathorax coarsely intricato-rugose, carinated. Segment 1 rugulose, not much longer than its apical breadth, considerably narrowed towards the base, where is a large oblong fovea. Segment 2 vaguely and indistinctly rugulose, without any arcuate impressions. Terebra very short. Valvula ventralis large, acuminate. ♀. Length, 2; wings, 4 lin.

Very nearly allied to the preceding, but doubtless distinct. Antennæ entirely black, scarcely shorter than the body. Face with scanty whitish pubescence. The 1st segment is not flat on the basal half, but longitudinally excavated, not remarkably gibbous posteriorly, and not carinated. The belly at the base is concolorous, or nearly so. The valvula ventralis is more conspicuous than in other species, reaching or even exceeding the anus. The terebra of the British specimen is subexserted, but not so long as in the four German females described by Ruthe, *viz.*, one-fifth or one-fourth of the abdomen.

A single specimen is in Bridgman's collection.

3. *Microplitis ocellatæ*, Bouché.

Microgaster ocellatæ, Bouché, Naturg. (1834), 161; Ratz., Ichn. d. Forst., ii., 48; iii., 48; Ruthe, Berl. ent. Zeit., 1860, p. 132, ♂ ♀.

M. canaliculatus, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 41, ♀.

M. ingratus, Hal., Ent. Mag., ii., 236, ♀; *cf.* Reinh., Berl. ent. Zeit., 1880, p. 359.

Black; palpi pale at the apex; antennæ beneath reddish fuscous; sides of segment 1 narrowly, and legs, testaceous; coxæ black; sometimes the base of the femora, the hind tarsi, and the last joint of the 4 anterior tarsi, blackish. Wings slightly infumated, with an obsolete darker stain beneath the fuscous stigma; squamulæ testaceous; nervures fuscous. Antennæ ♂ ♀ longer than the short, compact body. Head and mesothorax dull, granulated, the hind margin of the latter, and the punctulate scutellum, more shining. Metathorax short, rugulose, subreticulated. Abdomen smooth and very shining; segment 1 subquadrate, rounded posteriorly, anteriorly depressed and excavated. Terebra concealed. Valvula ventralis subtruncate. ♂ ♀. Length, $1\frac{1}{2}$ —2; wings, $3\frac{1}{2}$ — $4\frac{1}{2}$ lin.

Mandibles rufous, fuscous on the outer edge. Clypeus shining, the rest of the face dull. Mesothoracic sutures obsoletely indicated. Metathorax with an indistinct carina sometimes bifurcated hindwards. Abdomen oval, shorter than in the other species, everywhere smooth and shining. Stigma often with a pale dot at the inner angle. Legs short.

Described from 44 specimens, ♂ ♀. A common parasite of the hawk-moths, *Smerinthus ocellatus*, L., and *S. populi*, L. Has been bred on the Continent by Bouché, Ratzeburg, Reissig, Dahlbom, Giraud, and

Brischke; and in England by Bridgman, Bignell, Brown, Wilson, Fitch, and myself. The broods, consisting of a dozen individuals, or less, are excluded in the middle of September, and remain as pupæ till the following May or June. Cocoons greyish brown, rough, longitudinally and irregularly wrinkled, naked, strong, and closely agglutinated together. From one of Brischke's cocoons appeared the hyperparasite *Mesochorus splendidulus*, Gr. Ratzeburg reports that in Germany Bachmann obtained a ♀ on Sept. 22nd from *Acronycta psi*, L., which became an imago on the 14th of April following; but the observation is given doubtfully.

4. *Microplitis vidua*, Ruthe.

Microgaster viduus, var., Ruthe, Berl. ent. Zeit., 1860, p. 134, ♂ ♀.

Black; palpi more or less pale; sides of segment 1 narrowly, and legs, testaceous; coxæ and upper trochanters, fore femora at the base, the others wholly or partially, black; hind tarsi infuscated. Wings infumated, squamulæ black, stigma and nervures fuscous. Antennæ ♀ a little longer than the body. Head, mesothorax, and scutellum dull, finely granulated. Metathorax rugulose, subreticulated, subcarinated. Abdomen smooth and shining, except the 1st segment, which is rugulose, about $1\frac{1}{2}$ times longer than broad, with parallel sides almost to the apex, and then broadly rounded. Terebra subexserted, and, with the valvula ventralis, much shorter than the anus. ♂ ♀. Length, $1\frac{2}{3}$; wings, 4 lin.

The typical form, which I have not seen, differs, according to Ruthe, in being short and compact, for he compares it with the larger examples of *ocellata*, Bouché. The metathorax is less coarsely rugulose, the 1st segment a little broader, and its sculpture almost obsolete. The var. is intermediate between this form and *tuberculifera*, Wesm., from which it is distinguished by the broader 1st segment, not attenuated towards the apex; the posterior femora are black, the stigma unicolorous, and the cocoons different.

There are three British specimens at hand; one ♂ taken by me in Leicestershire, and a ♀ bred by Bignell from *Teniocampa incerta*, Hufn.; a ♂ April 28th from an unknown victim by Billups. Brischke bred it from *Smerinthus populi*, L. The cocoon is more or less brownish grey, and most resembles that of *M. tuberculifera*, Wesm., but is larger and more irregularly wrinkled.

5. *Microplitis tristis*, Nees.

Microgaster tristis, Nees, Mon., i., 168, ♂ ♀, where "abdomine toto rufo" is an evident misprint for "toto nigro" (not the vars.); Wesm., Nouv. Mém. Ac. Brux., 1837, p. 39 (not the var.); Ruthe, Berl. ent. Zeit., 1860, p. 138, ♂ ♀.

Deep black; palpi fuscous; tibiæ, fore femora at the apex, and anterior tarsi at the base, obscurely rufous; posterior tibiæ often black, except the base and apex. Wings fuscous, with an obsolete pale streak across the middle; squamulæ black, nervures and stigma fuscous, the latter determinately yellow at the inner angle. Antennæ ♀ $\frac{3}{4}$ the length of the body, filiform; those of the ♂ rather longer than the body, setaceous. Head and mesothorax punctulate, the latter rather shining, especially towards the hind margin; scutellum smooth and shining. Metathorax rugulose, subreticulated, carinated. Abdomen smooth and shining, only the 1st segment with a few minute exarations or scratches, a little longer than its mean breadth, with a shallow basal impression, and slightly widened from the base to the apex, which is broadly rounded. Terebra very short. ♂ ♀. Length, $1\frac{1}{2}$ — $1\frac{3}{4}$; wings, 3— $3\frac{1}{2}$ lin.

Var. ♂. Stigma unicolorous. Length, $1\frac{3}{4}$ lin.

This species strongly resembles *adunca*, Ruthe, but the 1st segment is shorter, and the antennæ of the ♀ longer. Nees and Ruthe describe the palpi as testaceo-rufous, black at the base; Wesmael, as dull testaceous; those of the English specimens are uniformly dusky. The var. ♂ differs only in size and the colour of the stigma, but may still prove to be a distinct species: the specimen is in Fitch's collection, labelled "*luctuosus*, Hal.;" it belongs, however, to the present genus.

Of the genuine *tristis*, Nees, Bignell has bred twenty from *Dianthæcia cucubali*, Fues.; their pupa-state lasted from Sept. 14th to May 22nd. In Ruthe's collection is a specimen from *Plusia moneta*, Fab. Brischke reared it from *Dianthæcia capsicola*, Hüb., *Cucullia verbasci*, L., *C. argentea*, Hufn., and *C. artemisiae*, Hufn. Besides these, Giraud records it as bred from *Plusia illustris*, Fab., by Bellier de la Chavignerie, and from *Plusia consona*, Fab., by himself. The cocoons are reddish brown or tan-coloured (sometimes greenish, according to Brischke) and not wrinkled, generally adherent to each other; they exactly resemble those of *spectabilis*, Hal.

6. *Microplitis dolens*, n. s.

Atra, palpi fuscis, pedibus rufo-testaceis, femoribus intermediis maximam partem, posticis totis, nigris; tarsis infuscatis. Alæ quales *M. tristi*, fuscae, aut perpaulo pallidiores, multo tamen saturatiores quam *spectabili*. Feminae antennæ longiores quam *tristi*, filiformes; maris corpore longiores, setaceæ. Cætera omnino ut in sp. præcedente.

Deep black; palpi dusky; legs rufo-testaceous, three-fourths of the middle and the whole of the hind femora, black; tarsi infuscated. Wings like those of *tristis*, fuscous, or less deeply tinged; but darker than in *spectabilis*. Antennæ ♀ more than three-fourths the length of the body, filiform; those of the ♂ longer than the body, setaceous. The rest as in the preceding species. ♂ ♀. Length, $1\frac{3}{4}$; wings, $3\frac{1}{2}$ lin.

The clear testaceous tibiæ and the longer antennæ of the ♀ distinguish this from *tristis*, Nees; from *spectabilis*, Hal., it differs in size and in the colour of the wings. There are four specimens, one male and three females. The ♂ belongs to Fitch's collection, and is ticketed "*spectabilis*, Hal.;" it might pass for a large var. with unusually dark wings, but corresponds better with the three females. One of these is in the same collection; the other two were taken by me, at Milford Haven and at Nunton, Wilts. Their wings are very dark, and the characters above noted, distinct.

7. *Microplitis spectabilis*, Hal.

Microgaster tristis, var. γ , Nees, Mon., i., 169, ♂ ♀;

M. tristis, var. 1, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 39, ♂ ♀.

M. spectabilis, Hal., Ent. Mag., ii., 236, ♀.

M. parvulus, Ruthe, Berl. ent. Zeit., 1860, p. 139, ♂ ♀.

Black; palpi and legs rufo-testaceous; femora more or less infuscated, anterior coxæ fuscous or testaceous; belly pitchy at the base. Wings nearly hyaline, with a testaceous, or sometimes a dusky, tinge; squamulae, nervures, and stigma fuscous, the latter at the inner angle determinately yellow. Antennæ ♂ ♀ longer than in *tristis*, sometimes rufescent beneath. Head and mesothorax granulated, obscure; scutellum more shining. Metathorax somewhat produced, rugulose, reticulated, and carinated. Abdomen smooth and shining, only the 1st segment minutely punctulate, subquadrate, with parallel sides and smooth apex, which is broadly rounded. Terebra very short. ♂ ♀. Length, $1\frac{1}{4}$; wings, 3 lin.

The smallest species; some German specimens, according to Ruthe, being only $\frac{3}{4}$ lin. long. It most resembles *dolens*, but differs both from that and *tristis* in the colour of the wings, which are very slightly tinted, and by Haliday described as pale ferruginous. The decolourous line which crosses the wing is hardly perceptible. The sides of segments 1—2 are narrowly dull testaceous.

Ruthe possessed 20 males and 36 females, taken between May and June in the neighbourhood of Berlin; Haliday only one ♀, and he says that it is very rare in the north of Ireland. I captured formerly about a dozen in Leicestershire; more recently a male near Abergavenny, and two females in Northamptonshire. Fitch has bred a ♀ at Maldon from an undetermined larva; in Bridgman's collection are four males and six females reared by Norgate from *Trichiosoma betuleti*, Kl.; these are a trifle larger than other specimens. Bred by Dorville from *Dianthæcia capsicola*, Hüb., one ♀ and four cocoons on a card. The cocoons are indistinguishable from those of *tristis*, Nees. According to Brischke bred from *Eupithecia succenturiata*, L., and *exiguata*, Hüb.; but as he says the cocoons are like those of *M. tuberculifera*, Wesm., there is probably some error.

8. *Microplitis mediator*, Hal.

Microgaster mediator, Hal., Ent. Mag., ii., 235; Ruthe, Berl. ent. Zeit., 1860, p. 126, ♂ ♀.

M. fulvicornis, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 44, ♂ ♀.

M. dorsalis, Nees, Mon., i., 170 (♂ only; not of Spin.; the ♀ is a true *Microgaster*, Hal. MS.).

Black; palpi pale; antennæ testaceous, towards the apex more or less fuscous, the scape black; legs testaceous, hind coxæ at the base, and tips of all the tarsi, blackish; abdominal segments 1—2, and base of 3, more or less testaceous, the disk or scutum of 1—2 usually black. Wings yellowish hyaline, dusky towards the tips, omitting the radial areolet; nervures fuscous, stigma black, its basal $\frac{1}{3}$ determinately pale. Head, mesothorax, and scutellum granulated, dull; metathorax reticulato-rugose, subcarinated. Segment 1 more than twice as long as broad, attenuated and rounded at the apex, minutely aciculated; the other segments smooth; 2 with two discal impressions converging forwards and enclosing a subtriangular space, which is generally black. Terebra very short. ♂ ♀. Length, $1\frac{1}{2}$; wings, 3 lin.

Var. 1. Scutum of the 1st abdominal segment at the apex, or entirely, pale. Taken by Ruthe as the typical form, but this is not so in England.

Var. 2. Segments 1—3 testaceous, only the scutum of the first black.

Var. 3. Coxæ, base of intermediate femora, and hind femora entirely, blackish.

It would be useless to multiply varieties; the narrow form of the 1st segment, taken in conjunction with the colour of the antennæ, will almost always determine the species.

Two broods, of five and six respectively, were bred by Bignell, June 30th, from larvæ of *Cerastis spadicea*, Hüb. Another set by Dorville from *Eupithecia subfulcata*, Haw. I formerly took several specimens in Leicester-shire and at Darenth Wood. Cocoons reddish brown, with some longitudinal wrinkles, clustered together.

Obs. To this species belong the specimens referred to by Reinhard (Berl. ent. Zeit., 1880, p. 360, No. 7) as *M. medianus*, Ruthe, by mistake for *mediator*, Hal. The colour of the antennæ and description of the cocoons render this a certainty. The insects alluded to were reared repeatedly from *Oporina croceago*, Fab., *Xylina furcifera*, Hufn., and *Hadena unanimitis*, Tr. The cocoons are described as reddish tan-coloured and naked. Reinhard remarks that in the ♂ the testaceous part of the 2d segment is often much diminished, and that the antennæ vary from testaceous to black.

9. *Microplitis mediana*, Ruthe.

Microgaster medianus, Ruthe, Berl. ent. Zeit., 1860, p. 127.

Black; palpi pale; antennæ black; legs testaceous, hind coxæ and tarsi, sometimes all the coxæ, black; hind femora sometimes tipped with fuscous; abdominal segments 1 at the sides, 2—3 entirely or mostly, and belly at the base, testaceous. Wings dusky hyaline, including the radial areolet; squamulæ testaceous, nervures and stigma blackish, the latter broadly pale at the inner angle. Head, mesothorax, and scutellum granulated, dull; meta-thorax reticulato-rugose, distinctly carinated. Segment 1 more than twice as long as broad, attenuated and rounded at the apex, minutely aciculated; the other segments smooth; 2 with two discal longitudinal impressions, between which is a slightly raised

space. Terebra very short. ♂ ♀. Length, $1\frac{1}{3}$ — $1\frac{1}{2}$; wings, $3\frac{1}{4}$ — $3\frac{1}{2}$ lin.

Var. 1. Only segment 2 at the sides testaceous.

? Var. 2. Antennæ testaceous, the apex, and scape above, fuscous; wings hyaline, basal third of the stigma, and squamulæ, pale; legs, including the hind tarsi, testaceous; hind coxæ black. Length, $1\frac{1}{4}$ — $1\frac{1}{3}$ lin. Ruthe, from four specimens.

Ruthe had eight specimens, but he does not distinguish the sexes. A ♂ bred by me differs only in having longer antennæ, and more dusky wings. The difficulty with this species is how to distinguish its darker varieties from *tuberculifera*, Wesm. It appears that the latter seldom has the 2d segment largely testaceous, and never, perhaps, the 3d. The stigma also of *tuberculifera* is not distinctly pale at the inner angle, but obsoletely, or more generally, unicolorous. No other tangible distinction can be pointed out, and the safest way is to breed the insects. It will then be found that *mediana* is a solitary parasite of young larvæ, and that it makes a greenish-white, almost smooth, cocoon; while *tuberculifera* is only occasionally solitary, and makes grey-brown cocoons, deeply ribbed from end to end.

I have seen fourteen specimens of *mediana*, Ruthe. In addition to those bred, four were taken at Norwich by Bridgman, and two or more formerly by me at Lamport Hall, Northants. Reared singly by Bignell from *Tæniocampa stabilis*, View., and *Polia flavicincta*, Fab.; and by me in 1884 from young larvæ of *Cucullia verbasei*, L. These larvæ were from 4—6 lines long when they produced each a parasite, July 8th—13th; the perfect insects to the number of five (four females and one male) appeared between July 21st and 26th. Brischke says that he bred it from *Melanippe galiata*, Hüb. The greenish-white cocoons are naked and longitudinally, but not deeply, wrinkled.

10. *Microplitis tuberculifera*, Wesm.

Microgaster tuberculifer, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 43, ♂ ♀ (not the vars.); Ruthe, Berl. ent. Zeit., 1860, p. 128, ♂ ♀.

Like the preceding in all respects, except that the stigma is unicolorous, or very narrowly pale at the base. Abdomen black, only the membranaceous sides of segments 1—2, and the belly at the base, testaceous. ♂ ♀. Length, $1\frac{1}{2}$ — $1\frac{2}{3}$; wings, $3\frac{1}{2}$ — $3\frac{3}{4}$ lin.

Common in autumn; taken frequently by Bignell, Bridgman, myself, and others. Twice bred singly by Bignell from half-grown larvæ of *Teniocampa miniosa*, Fab. But four from one larva have been reared by Parfitt out of *Eupithecia succenturiata*, L.; their cocoons are clustered together. According to Brischke, bred from *Phlogophora meticulosa*, L., *Eupithecia succenturiata*, L., *E. castigata*, Hüb., and *E. exigua*, Hüb.; in each case singly, and therefore probably the larvæ were all small. Bred by Giraud from *Apamea basilinea*, Fab., *Triphæna fimbria*, L.; and by Bellier de la Chavignerie from *Agriopsis aprilina*, L. The Ruthian collection contains a specimen with the base of the abdomen orange, bred from *Cerastis vaccinii*, L., at Grabow, in Mecklenburg. The cocoons are typical of the genus, and widely different from those of *mediana*, Ruthe. They are ash-coloured, naked, and deeply fluted or ribbed from end to end, like carraway seeds.

11. *Microplitis adunca*, Ruthe.

Microgaster aduncus, Ruthe, Berl. ent. Zeit., 1860, p. 129, ♀.

Deep black; apex of the maxillary palpi testaceous, the rest fuscous; anterior femora at the tips, their tibiæ, and basal half of the hind tibiæ, testaceo-rufous. Wings narrow, infumated; stigma, squamulæ, and nervures fuscous. Antennæ ♀ filiform, not much longer than half the body. Head, mesothorax, and scutellum thickly punctulate, the last, together with the hind edge of the mesothorax, somewhat shining. Metathorax coarsely punctatoprugulose, carinated. Abdomen smooth and shining, segment 1 only showing some minute exarations or scratches; this segment is twice as long as its breadth, scarcely narrowed posteriorly, and rounded at the apex; the apical tubercle very shining. Terebra subexserted, and, with the subtruncated valvula ventralis, not surpassing the anus. ♀. Length, $1\frac{1}{2}$; wings, 3 lin.

The antennæ are very like those of *tristis*, Nees, scarcely longer than the head and thorax; the joints diminish in length towards the apex, so that the few last are as broad as long, but their thickness remains the same; the scape is much thicker than the 1st joint of the flagellum. Segment 1 wholly black, including the membranaceous sides. Belly convex, compressed only at the base, where it shows the usual pellucid piccous spot. Stigma unicolorous. The minute 2d cubital areolet is almost semicircular, surrounded by a thickened nervure. Legs short, stout; hind tibiæ as thick as their femora, and hardly longer than their tarsi.

The unique British specimen answers well to Ruthe's description, except that the posterior tibiæ are more broadly black, having less than their basal half testaceous. It appears very like *tristis*, until the 1st abdominal segment is examined. Ruthe's description was made from a single ♀.

Taken by me on the banks of the Usk, near Abergavenny.

12. *Microplitis borealis*, n. s.

Niger, palpis fuscis, geniculis anticis rufo-testaceis, tarsis tibiisque omnibus fuscis, his summa basi rufescentibus. Ventris basis, segmentorum 1mi 2dique latera testacea. Alæ leviter infuscatae, squamulis nigris, nervis stigmatate nigro-fuscis. Antennæ maris corpore multo longiores, setaceæ. Caput cum mesothorace confertissime punctulatum fere opacum; scutellum paulo lævius; mesothorax subtricanaliculatus, suturis haud penitus obsoletis. Metathorax fortiter reticulato-rugosus, carinatus. Segmentum 1mum duplo longius quam latius, a basi ad apicem attenuatum, rotundato-lanceolatum, sicut cætera lævissimum. Segmentum 2dum basi intra marginis flavedinem utrinque oblique impressum.

Black; palpi fuscous; fore knees rufo-testaceous; all the tarsi and tibiæ fuscous, the latter narrowly rufescent at the base. Base of the belly, and sides of segments 1—2, testaceous. Wings slightly infumated, squamulæ black, nervures and stigma nigro-fuscous. Antennæ ♂ much longer than the body, setaceous. Head and mesothorax very thickly punctulate, hardly shining; scutellum somewhat smoother; mesothorax showing traces of the three sutures. Metathorax coarsely reticulato-rugose, carinated. Segment 1 twice as long as broad, attenuated from the base to the apex, which is lanceolate and rounded; all the segments very smooth. Segment 2 with an oblique impression on each side of the base, within the testaceous margins. ♂. Length, $1\frac{1}{2}$; wings, $3\frac{1}{2}$ lin.

The sex is shown by the length and form of the antennæ. It agrees in many respects with *lugubris*, Ruthe, especially the var. with dusky tibiæ; but I doubt its identity with that species, on account of the broad pale margins of the 1st segment, and base of the 2d. If not *lugubris*, it is at least closely allied.

Glenelg, Scotland. The specimen is in Cameron's collection.

v. MICROGASTER (*Latr.*).

Först., Verh. pr. Rheinl., 1862, p. 245; Reinh., Berl. ent. Zeit., 1880, p. 354.

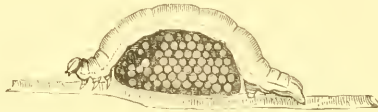
Maxillary palpi 5-, labial 3-jointed. Eyes villose. Antennæ 18-jointed. Mesopleuræ rarely with a rugulose fovea. Abdomen sessile; suturiform articulation distinct. Radius of the fore wing almost complete; three cubital areolets, the 2d often imperfect. Hind coxæ elongate; spurs of the hind tibiæ not shorter than half the metatarsus. Terebra more or less exerted.

Distinguished at a glance from *Microplitis* by the length of the hind spurs, and the distinctness of the suturiform articulation. The genus is placed last in the subfamily, as being upon the whole nearest to the *Agathidides*. It contains the largest and most typical forms, artificially associated, in consequence of the completeness of the 2d cubital areolet, with an inferior group, which might even be made a separate genus, with as much propriety as *Apanteles*.

- I. Abdomen narrow, subcompressed, slightly or not at all rugulose at the base. Terebra subexserted. Wings hyaline; radial areolet ample; 2d cubital subtriangular, often incomplete. Hind legs elongate. Middle-sized or minute species, allied to *Apanteles*, Sect. IV.
- II. Abdomen broader, deplanate, rugulose at the base. Terebra considerably exerted. Wings coloured; radial areolet narrower; 2d cubital stirrup-shaped, usually complete. Hind legs incrassated. Larger species.

The cocoons of *Microgaster*, so far as they have been observed, are white, or dirty white, glistening, papyraceous, and without a common envelope, or with a very scanty one. In the larger species, after the escape of the insect, one half of the cocoon is usually left semi-transparent, the lining being thrust into the hinder end. Some of the smaller species, which issue in great numbers from the same caterpillar, arrange their cocoons regularly, like the cells of a honeycomb, only their heads are not all turned in the same direction. Such species will always be found to have infested a geometrical larva, and the form of the cake of cocoons is determined by the space left between its body and the support to which it clings, as shown in the annexed outline by Bignell, from a photograph taken after the flies had

emerged. We have already seen that one or two species of *Apanteles* arrange their cases similarly. The fact, thus explained, indicates no special instinct on the part of these parasites, being merely an inevitable result.



Cocoons of *M. flavipes* ex *B. repandata*.

Of 23 European species of *Microgaster* described by Ruthe and Reinhard, the following seven have not yet been detected in England:—*nobilis*, Reinh., *sticticus*, Ruthe, *ruficornis*, Ruthe, *procerus*, Ruthe, *deprimator*, Nees, *Wesmäëlii*, Ruthe, and *dorsalis*, Nees. *M. deprimator*, Nees, which I have taken in the Pyrenees, is conjectured by Ruthe to be a parasite of *Bombus terrestris*, L. If this be correct, its occurrence here is very probable. Brischke says he has bred it from spiders' nests; but this is inconsistent with the known habits of the whole tribe, none of which are external parasites, but live within the body of a single victim larger than themselves.

TABLE OF SPECIES.

SECTION I. First segment distinctly longer than its apical breadth.

- | | | | |
|------|-----|---|------------------------------|
| (12) | 1. | Second segment not shorter than the 3d. | |
| (9) | 2. | Segment 2 without longitudinal impressed lines on the disk. | |
| (4) | 3. | Head and thorax more or less testaceous | 1. <i>alvearius</i> , Spin. |
| (3) | 4. | Head and thorax black. | |
| (6) | 5. | Metathorax rugulose; terebra exerted | 2. <i>posticus</i> , Nees. |
| (5) | 6. | Metathorax smooth; terebra very short. | |
| (8) | 7. | Legs (except the hind coxæ), and sides of the belly, testaceous; length, 1 line | 3. <i>flavipes</i> , Hal. |
| (7) | 8. | Legs pitchy-fuscous; sides of the belly black; length, $\frac{1}{2}$ line | 4. <i>minutus</i> , Reinh. |
| (2) | 9. | Segment 2 with two impressed longitudinal lines on the disk. | |
| (11) | 10. | Metathorax carinated | 5. <i>marginatus</i> , Nees. |
| (10) | 11. | Metathorax canaliculated | 6. <i>calceatus</i> , Hal. |
| (1) | 12. | Second segment much shorter than the 3rd. | |

- (14) 13. Sutureform articulation curved, concave behind 7. *connexus*, Nees.
 (13) 14. Sutureform articulation straight .. 8. *tiro*, Reinh.

SECTION II. First segment not, or hardly, longer than its apical breadth.

- (18) 1. Segment 2 rugulose.
 (7) 2. Abdominal segments 1—3 rugulose.
 (4) 3. Abdomen at the base, and coxæ, red 9. *russatus*, Hal.
 (3) 4. Abdomen at the base, and at least the hind coxæ, black.
 (6) 5. Squamulæ black 10. *rugulosus*, Nees.
 (5) 6. Squamulæ rufous 11. *scoticus*, n. s.
 (2) 7. Abdominal segments 1—2 rugulose.
 (11) 8. Anterior half of the belly testaceous.
 (10) 9. Stigma subbicolorous 12. *novicius*, n. s.
 (9) 10. Stigma unicolorous 13. *subcompletus*, Nees.
 (8) 11. Anterior half of the belly black or pitchy fuscous.
 (13) 12. Femora rufous 14. *globatus*, L.
 (12) 13. Femora more or less black.
 (17) 14. Antennæ ♀ setaceous.
 (16) 15. Wings more or less infuscated; metathorax carinated 15. *tibialis*, Nees.
 (15) 16. Wings hyaline; metathorax not carinated 16. *hospes*, n. s.
 (14) 17. Antennæ ♀ filiform 17. *crassicornis*, Ruthe.
 (1) 18. Segment 2 smooth.
 (20) 19. Segment 2 with two arcuate impressions diverging forwards 18. *spretus*, n. s.
 (19) 20. Segment 2 with no such impressions 19. *politus*, n. s.

SECTION I.

1. *Microgaster alvearius*, Fab.

Ichneumon alvearius, Fab., E. S., Suppl., 232; *Cryptus alvearius*, Fab., Piez., 90.

Microgaster alvearius, Spin., Ins. Lig., ii., 149; Cur., B. E., pl. cccxxi.; Nees, Mon., i., 172; Hal., Ent. Mag., ii., 240; Ratz., Ichn. d. Forst., iii., 50; Ruthe, Berl. ent. Zeit., 1860, p. 153, ♂ ♀. Cf. Réau., Mém., ii., 432, pl. xxxv., f. 7; Westw., Int., ii., 148, pl. lxxvii., f. 17 (cocoons).

Testaceous, variable; antennæ above, metathorax, disk of the abdomen, belly at the apex, knees of the hind legs, their tibiæ at the tips, and their tarsi, blackish. Wings hyaline, squamulæ pale, stigma and some of the nervures fuscous, the rest colourless. Head,

mesothorax, and scutellum finely punctulate. Metathorax smooth, shining, carinulated. Abdomen compressed beneath; segments 1—2 aciculated; segment 1 twice as long as broad, much narrower than 2, which is as long as 3. Terebra subexserted. Valvula ventralis not reaching the anus. ♂ ♀. Length, 1; wings, $2\frac{1}{3}$ lin.

Very like *flavipes*, but differently coloured. The sexes are similar. Antennæ about as long as the body, dusky above, the scape testaceous. Pleuræ smooth, punctulate only in front. Pectus infuscated posteriorly. Segment 1 with the sides parallel for about $\frac{3}{4}$ of its length, thence slightly converging to the truncated apex. Segments 1—3 with yellow lateral margins. Second cubital areolet interrupted and decolorous on the outer side. The white spurs of the hind tibiæ are barely half as long as the metatarsus.

A common autumnal parasite of *Geometræ*. Bred by Fabricius and Curtis from *Rumia luteolata*, L.; by Hofmann of Stuttgart, Dorville, Parfitt, and Bignell, from *Boarmia gemmaria*, Brahm.; the latter bred 95 on Sept. 3rd from a larva taken on August 19th. Parfitt states that he has repeatedly found the cocoons on twigs of the jessamine. Less frequent on the Continent; unknown to Wesmael and Brischke, not seen by Nees, spoken of by Ratzeburg as a rarity, and Ruthe only knew two females received from Ratzeburg. The last writer informs us that it also attacks *Nematus septentrionalis*, L., and has been obtained by Reissig, but females only, from that sawfly; a fact that requires further verification. Cocoons dirty white, regularly disposed in an alveariform mass beneath the victim-larva; the whole mass is bound together by a strip of web round the edge. The same habits belong to the larvæ of *M. flavipes*, Hal., and *minutus*, Reinh.

N.B.—Buckler's references to this species in E. M. M., iv., 252, vi., 165, xiv., 184, are incorrect.

2. *Microgaster posticus*, Nees.

Microgaster posticus, Nees, Mon., i., 172, ♀; Ruthe, Berl. ent. Zeit., 1860, p. 150, ♂ ♀.

M. marginellus, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 29, ♂ ♀.

♀. "Black, slender; palpi and coxæ whitish; antennæ beneath, and mandibles, rufescent; belly and legs pale luteous; hind knees, tips of the hind tibiæ, and hind tarsi, fuscous. Abdomen narrow, varied with luteous in the middle. Wings subhyaline, base and squamulæ luteous, stigma fuscous. Mesothorax very thickly

punctulate; scutellum shining; metathorax rugulose, carinated. Segments 1—2 substriato-rugulose. Terebra hardly as long as $\frac{1}{2}$ the abdomen."

"Head shining, indistinctly punctured; face almost rugose, with short erect hairs, in the middle with a cariniform elevation, somewhat dull, clypeus more shining. Antennæ nearly as long as the body, hairy, fuscous above, reddish testaceous beneath. Pleuræ in front and pectus punctured, with a narrow and hardly crenulate furrow. Segment 1 a little longer than broad, hardly wider behind, the basal half elevated and impressed in the middle; segments 1—2 rugulose, 2 flat, longer than 3; segments 1—2 black, the others more or less fusco-testaceous on the hind margin, seldom almost wholly testaceous. Belly entirely fusco-testaceous, almost whitish at the base. Valvula ventralis large, acuminate. First abscissa of the radius rather obliquely inserted in the stigma; 2d cubital areolet small, complete. Legs stout; trochanters almost whitish; hind coxæ incrassated."—Ruthe.

I have not seen the ♀, from which the ♂ differs in some respects. Abdomen black, the 1st segment edged with yellow at the sides; belly pale at the base. Hind coxæ infuscated above. Segment 1 $2\frac{1}{2}$ times longer than broad, margined, with parallel sides, the apex rounded; canaliculated in the middle and impressed with a basal fovea; segment 2 broader than 1, shorter than 3, aciculated in the middle, smoother at the sides. Antennæ longer than the body; scape testaceous at the base; flagellum reddish beneath. Second cubital areolet elongate, incomplete at both ends. Trochanters concolorous with the legs. ♂ ♀. Length, $1\frac{1}{3}$; wings, $2\frac{3}{4}$ lin.

Smaller than *marginatus* and *connexus*, Nees, from which it is distinguished by the rufous hind coxæ, rugulose metathorax, and exserted terebra of the ♀. Ruthe says little about the ♂, and, the proportions of the abdomen differing from those of the ♀, the specimens were for a long time doubtful.

Only two males are now at hand, but sixteen were bred by Bignell from *Porthesia similis*, Fues., July 25th, 1884. Not to be confounded with *M. connexus*, Nees, a commoner parasite of the same moth.

3. *Microgaster flavipes*, Hal.

Microgaster flavipes, Hal., Ent. Mag., ii., 241, ♀;
Ruthe, Berl. ent. Zeit., 1860, p. 152, ♂ ♀.

Slender, black; palpi, antennæ beneath, belly at the base, sides of segment 1 narrowly, and legs, pale testaceous; claws and hind

coxæ black, the latter sometimes pale at the apex. Wings hyaline, squamulæ and costa testaceous, stigma and nervures pale fuscous, or subferruginous. Head shining, sparingly punctulate; mesothorax thickly punctulate; scutellum smoother. Metathorax and pleuræ smooth, shining, the former carinated. Abdomen compressed beneath at the base, elongate; segments 1—2 aciculated: 1 almost thrice as long as its apical breadth, margined, the sides nearly parallel; 2 as long as 3, narrower at the base than the apex, the margins raised, and converging anteriorly. Terebra subexserted. Valvula ventralis not reaching the anus. ♂ ♀. Length, 1; wings, $2\frac{1}{3}$ lin.

The face is somewhat more punctulate than the rest of the head, subcarinated above, in the ♂ more distinctly. Antennæ ♀ about as long as the body, pale testaceous, dusky above and at the apex, the scape black. Ruthe makes segment 1 only $1\frac{1}{2}$ times as long as its breadth, which is certainly incorrect; he also says that the hind femora are black, evidently meaning the hind coxæ. Segments 2, 3 bear vestiges of a medial carina; and 3 is also sometimes subaciculated at the base. Second cubital areolet incomplete on the outer side. Hind coxæ incrassated, punctulate, more strongly in the ♀. Hind femora and tibiæ subinfuscated towards the apex, especially in the ♂.

Haliday had one ♀, taken on a hazel in north Ireland. Since then the species has been repeatedly bred from *Boarmia repandata*, L., by Kriechbaumer and Brischke on the Continent, and by Bignell here (see Entom., xiii., 244). In Fitch's collection is a brood of twenty reared from the same source by Cooper, of Folkestone, June 14th. Brischke also bred it from *Cleora angularia*, Thnb. The cocoons and habits of the larva are the same as those of *M. alvearius*.

4. *Microgaster minutus*, Reinh.

Microgaster minutus, Reinh., Berl. ent. Zeit., 1880, p. 357, ♂ ♀.

Like the preceding, but smaller. Pitchy-black; palpi, antennæ towards the base, and legs, pale testaceous; 4 posterior femora, and hind tarsi more or less, infuscated; hind coxæ fuscous; belly at the extreme base pitchy. Wings hyaline, squamulæ testaceous, stigma fusco-testaceous, almost all the nervures decolorous. Head and mesothorax punctulate, shining; scutellum, pleuræ, and metathorax smooth, shining, the last carinated. Abdomen compressed beneath; segments 1—2 aciculated; 1 twice as long as its breadth,

with parallel sides; 2 a little broader than 1, somewhat shorter than 3. Terebra subexserted. Anal forceps of the ♂ exserted. Valvula ventralis ♀ not surpassing the anus. ♂ ♀. Length. $\frac{3}{4}$ —1; wings, 2—2 $\frac{1}{2}$ lin.

This smallest species of the genus differs from *flavipes*, Hal., in the colour of the legs and belly, as well as the shorter 1st abdominal segment. Antennæ ♀ as long as the body; of the ♂ much longer and stouter. The 2d cubital areolet forms an isosceles triangle whose base is obsolete, so that nothing but the thickening of the other two sides hinders the insect from being joined to *Apanteles*. The spurs of the hind tibiæ are shorter than half the metatarsus.

Reinhard established the species from a pair of unknown origin. Bignell has since reared a brood of thirty from *Cleora glabraria*, Hüb., and in Fitch's collection are a ♂ and ♀ from the same larva, with cocoons of a larger number. The specimens were named by Reinhard himself. Five more broods in the same collection have been destroyed, but their cocoons remain, together with two caterpillars of *glabraria*. Cocoons and habits of the larva similar to those of *M. alvearius* and *flavipes*.

5. *Microgaster marginatus*, Nees.

Microgaster marginatus, Nees, Mon., i., 169, ♀; Ruthe, Berl. ent. Zeit., 1860, p. 155, ♀.

♀. "Black; palpi pale; lateral margins of segments 1—3—4 above and beneath, rufo-testaceous; base of the belly, and sometimes the posterior edges of segments 3, 4, yellowish; legs rufo-testaceous, the hind pair more obscure, their coxæ above more or less, the apex of their femora, their tibiæ at both ends, and their tarsi, black; 4 anterior tarsi black at the tips. Wings dusky hyaline, squamulæ testaceous, stigma and nervures dark fuscous. Antennæ longer than the body, fuscous above, ferruginous beneath, filiform. Mesothorax thickly and finely punctured, dull, scutellum with larger but more scattered punctures; metathorax rugulose, carinated. Segment 1 somewhat widened posteriorly, very little longer than broad, canaliculated, thickly punctato-rugulose; 2 subquadrate, rather longer than 3, finely rugulose, impressed with two longitudinal parallel lines, enclosing a raised cariniform space; 3 coriaceous, its hind margin, with the rest of the segments, smooth and shining. Terebra about $\frac{1}{3}$ the length of the abdomen. Valvula ventralis not surpassing the anus."—Ruthe.

I have not seen the ♀: the undescribed ♂ differs in some respects, as follows:—

♂. Black; palpi, lateral margins of segments 1—2 broadly, and belly at the base, yellowish; legs as in the ♀, but the hind pair are not darker. Antennæ entirely black, much longer than the body. Moderately shining; head, mesothorax, and scutellum thickly punctulate. Segment 1 attenuated from the base to the apex, narrowly truncated, about 3 times as long as its medial breadth, aciculated; 2 as long as 3, with two longitudinal impressed lines enclosing an aciculated space, and an oblique impression near each anterior angle, within the yellow margin; the rest smooth. Hind coxæ elongate, incrassated, thickly punctulate, hairy. Spurs of hind tibiæ straight, shorter than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{2}{3}$; wings, 4 lin.

Described from three males. Their abdomen differs structurally from that of the ♀ in about the same degree as in the case of *posticus*, Nees. *M. calceatus*, Hal., is not a synonym of this species, as given by Reinhard, but of *pubescens*, Ratz. The two species are closely allied, but in *marginatus* the metathorax is longitudinally carinated; in *calceatus*, canaliculated. The resemblance of the ♂ *marginatus* to *Apanteles vitripennis*, Hal., is very striking. The structure of the 1st segment is the same in both, and they are only separated by the areolet, the metathoracic carina, and the 2d segment, of *marginatus*. In fact, the *Microgaster*s of this section are hardly distinct from *Apanteles*. The difference between them is reduced to the areolet, and further attenuated by the fact that many *Microgaster*s have this areolet open on the outer side, while in *Apanteles* it is just as often well defined on the two inner.

One ♂ was bred by Bignell from *Larentia viridaria*, Fab., May 28th. The cocoon preserved with it probably belongs to another insect, being dusky brown, and woolly. Another ♂ was taken by Bignell at Bickleigh, Devon; and the third by me near Teignmouth.

6. *Microgaster calceatus*, Hal.

Microgaster calceatus, Hal., Ent. Mag., ii., 241, ♀.

M. pubescens, Ratz., Ichn. d. Forst., i., 67, ♂; ii., pl. ii., f. 13 (wing); Ruthe, Berl. ent. Zeit., 1860, p. 156, ♀.

Black; palpi flavescent with the apex dusky; lateral margins of segment 1, and 2 partly, belly at the base, and legs, testaceous;

hind coxæ, apex of their femora, their tibiæ at both ends, and their tarsi, black; 4 anterior tarsi blackish at the tips. Wings hyaline, somewhat dusky at the tips; squamulæ testaceous, with a brown spot; stigma and nervures dark fuscous. Antennæ entirely black, longer than the body. Moderately shining; head and mesothorax very finely, scutellum and metathorax more strongly, punctulate, the latter smooth at the apex, and indistinctly bisected by a longitudinal impression. Abdomen shining; segment 1 a little longer than broad, with parallel sides, rounded behind, smooth except a few punctures; 2 as long as 3, punctate, with two longitudinal channels, between which is an obtuse cariniform elevation; suturiform articulation bent, concave posteriorly; segment 3 sometimes with a few punctures. Hind coxæ large, punctulate. Terebra sub-exserted. Valvula ventralis not surpassing the anus. Spurs of hind tibiæ whitish, longer than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{2}{3}$; wings, 4 lin.

Var. ♀. Anterior coxæ blackish at the base.—Ruthe.

Described from two males and one female. The male has longer antennæ and a more slender abdomen. Haliday's description of *calceatus* agrees with that of *pubescens* by Ruthe much better than with that of *marginatus*, to which it is assigned by Reinhard. Thus Haliday gives the antennæ as entirely black, and says nothing of a carina on the metathorax, as he certainly would have done in speaking of *marginatus*. He describes the wings as dusky at the apex, which is true of this species, but hardly of *marginatus*. The three specimens have the canaliculated metathorax, and are undoubtedly *pubescens*, Ratz.; one of them has also been verified by Reinhard.

A ♀ was bred by Ratzeburg from a young larva of *Oeneria dispar*, L., and sent to Ruthe. In England Raynor has obtained the ♀ at Brandon, June 16th, from *Thera variata*, Schiff.; and Bignell the ♂ from the same victim, June 24th. The second ♂ was reared by Bignell from *Lobophora carpinata*, Bork., April 10th. Cocoons straw-coloured, or dirty yellowish white. Bignell's specimen from *Lobophora* is accompanied by a dark brown cocoon, lighter in the middle, and apparently belonging to an Ophionid.

7. *Microgaster connexus*, Nees.

Microgaster connexus, Nees, Mon., i., 174, ♀.

M. consularis, Hal., Ent. Mag., ii., 241; Ruthe, Berl. ent. Zeit., 1860, p. 158, ♂ ♀.

M. dilutus, Ratz., Ichn. d. Forst., iii., 49, ♀; Bairstow, E. M. M., 1879, p. 116, ♂.

Black; palpi, antennæ towards the base, lateral margins of segment 1, belly at the base, and legs, testaceous; hind femora and tibiæ at the apex, with their tarsi, blackish; hind coxæ often infuscated above; anterior tarsi tipped with fuscous. Wings subhyaline, squamulæ testaceous, nervures and stigma fuscous; the last with the inner angle pale only in the ♀. Head in front, and thorax, very thickly punctulate; metathorax more or less rugulose, carinated. Abdomen, except segments 1—2, smooth and shining; segment 1 twice as long as broad, with parallel sides, elevated from the base to the middle, rounded at the apex, finely striolated, sometimes almost smooth; 2 broader than 1, shorter than 3, also striolated, its fore and hind margins curved, preserving a uniform distance from each other; the remaining segments have a few minute punctures. Hind coxæ punctulate. Terebra subexserted. Valvula ventralis truncated before reaching the anus. ♂ ♀. Length, $1\frac{1}{2}$; wings, $3\frac{1}{2}$ lin.

The antennæ of the ♂ are a little longer than those of the ♀, and almost entirely black, except the scape. This and the next species are easily known by having the 2d segment distinctly shorter than the 3d. The rufous coxæ, bicolorous stigma of the ♀, &c., combine to render *connexus* unmistakable.

A common parasite of *Porthesia similis*, Fues., and in that respect resembling *M. posticus*, Nees. Reared in Germany by Nördlinger and Kriechbaumer. Bignell has obtained several large broods of both sexes; one of 18 individuals hatched August 18th, having been 37 days in the pupa-state; another, of 24, occupied the same number of days. In Fitch's collection are the remains of another brood. Nees v. Esenbeck, who only knew the ♀, assigns this parasite to a different victim, *Spilosoma fuliginosa*, L., and agrees with Ruthe and Haliday in stating that the caterpillar spins a covering for the protection of the Microgasters, mixed with its own dusky hairs; cf. Haliday, *l. c.*, note. This can only mean that the parasites did not cause the death of their victim until the latter had begun to weave its own pupa-case. In the instances

observed by Bignell the larva perished before attempting pupation. Cocoons white, with a satiny sheen, and slightly woolly. Brischke obtained only one parasite from a larva of *Porthesia*, and another from *Acronycta tridens*, Schiff., which he assigns to this species, calling the cocoon light brown, perhaps only another way of expressing impure white.

8. *Microgaster tiro*, Reinh. (Pl. VI., fig. 2).

Microgaster tiro, Reinh., Berl. ent. Zeit., 1880, p. 357,

♂ ♀.

Black; palpi pale; antennæ sometimes rufescent beneath; 4 anterior legs testaceous; hind legs blackish, with the trochanters, and base of the femora, of the tibiæ, and of the tarsi, testaceous; middle coxæ at the base, hind coxæ entirely, black. Lateral margins of segment 1, and base of the belly laterally, but not in the middle, testaceous. Wings hyaline, squamulæ and costa testaceous, nervures and stigma fuscous, the latter pale at the inner angle. Antennæ of the ♀ as long as the body; of the ♂, longer. Head, mesothorax, and scutellum shining, almost invisibly punctulate; pleuræ smooth; metathorax subrugulose, rather shining, carinated. Segments 1—2 punctato-rugulose; segment 1 wider than in any of the preceding species, about $1\frac{1}{2}$ times as long as broad, with parallel sides, excavated at the base, truncated at the apex; 2 broader than 1, half as long as 3, obliquely truncated at the anterior angles; suturiform articulation straight. Terebra longer than $\frac{1}{2}$ the abdomen. Valvula ventralis subacuminated, somewhat surpassing the anus. Hind legs elongate, their femora and tibiæ incrassated. ♂ ♀. Length, $1\frac{1}{3}$; wings, 3 lin.

Intermediate between the present section and the typical *Microgaster*s which follow. In the length of the 1st segment it resembles the former; in the breadth of the same segment, the compact form of the body, and length of the terebra, it approaches the latter.

Described from two males and one female. One male is in Fitch's collection, bred by Raynor, June 27th, from a *Tortrix*-larva feeding on chamomile. From this same larva issued a second and different parasite, *Apanteles emarginatus*, Nees. Another ♂ was bred by Fitch, April 26th, also from an unknown *Tortrix*-larva. The ♀ was captured by me in Northamptonshire. Cocoons white.

SECTION II.

9. *Microgaster russatus*, Hal. (Pl. VI., fig. 1).

Microgaster russatus, Hal., Ent. Mag., ii., 237; Ruthe, Berl. ent. Zeit., 1860, p. 109, ♂ ♀.

M. basalis, Ste., Ill. M., vii., Suppl. 4, pl. xxxvii., f. 1, ♀.

M. dimidiatus, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 28, ♂; pl., f. A (abdomen).

Black; palpi, flagellum, abdominal segments 1—3, belly, and legs, rufous; hind tibiæ at the apex, and their tarsi, more or less infuscated; claws black. Wings fusco-ferruginous, the basal half and the radial areolet more testaceous; 1st abscissa of the radius clouded; squamulæ, nervures, and stigma fuscous, the last at the inner angle determinately luteous. Head and thorax thickly punctulate, but somewhat shining; scutellum smooth; metathorax rugose, with or without a medial carina. Segments 1—3 rugulose; 1 subquadrate, its basal angles rounded, with an impression between them, the apex truncate; 2 transverse, longer than 3, both feebly carinated in the middle; the rest smooth and shining. Terebra hardly $\frac{1}{4}$ of the abdomen; valves subclavate. Inner spur of the hind tibiæ half as long as the metatarsus. ♂ ♀. Length, 2—2 $\frac{1}{2}$; wings, 4—5 lin.

Antennæ ♀ as long as the body, the two basal joints black; flagellum mostly fusco-ferruginous, the apex sometimes testaceous. Those of the ♂ are 4 lines long, and much darker. Face and clypeus granulated, dull; mandibles ferruginous, darker at the tips. Mesothorax depressed in the middle, and there almost rugulose, with vestiges of the thoracic sutures. Pleuræ and pectus punctate, the former smooth above the usual fovea. Abdomen ♂ longer than the thorax, depressed, with parallel sides; of the ♀ shorter and more rounded; the apical black segments taken together are not so long as the 1st segment. The wings of the ♂ are lighter than those of the ♀, which latter have a deeper stain beneath the stigma.

The most conspicuous species of this subfamily, and rare; the British Museum contains one male from Haliday (Ent. Soc. Coll.), two males and one female from Stephens' collection, and three males from that of Desvignes. Ruthe had inspected five males and two females from Berlin, Danzig, and Oranienburg; Wesmael captured a male near Brussels, and two others are recorded by S. v. Vollenhoven, taken at Rotterdam and the Hague. Haliday found both sexes very scarce on the muddy

coasts of north Ireland. I have seen two males taken by Billups at High Beech, Epping Forest. Brischke bred this species from *Orthotelia sparganella*, Thnb. Cocoons white, woolly, transparent.

10. *Microgaster rugulosus*, Nees.

Microgaster rugulosus, Nees, Mon., i., 163, ♂; Ruthe, Berl. ent. Zeit., 1860, p. 112, ♂.

M. infumatus, Hal., Ent. Mag., ii., 237, ♂.

M. opacus, Ruthe, *lib. cit.*, 1858, p. 5; and 1860, p. 111, ♀.

♀. Black; mandibles, abdominal segments after the 3d, and belly, reddish luteous; palpi and legs testaceo-rufous; coxæ and claws black. Wings infumated; squamulæ black; nervures and stigma fuscous, the latter nearly black. Body thickly punctulate, dull; scutellum shining, slightly punctulate; metathorax subreticulato-rugulose, carinated. Abdomen subovate, depressed; segments 1—3 dull, finely and densely rugulose; 1 impressed at the base; 2 twice as long as 3; the rest smooth; belly carinated. Terebra scarcely $\frac{1}{4}$ of the abdomen. Spurs of hind tibiæ shorter than $\frac{1}{2}$ the metatarsus. Valvula ventralis acuminate.

♂. Antennæ rufo-fuscous beneath; abdomen black at the apex; hind tibiæ sometimes at both ends, with their tarsi, fuscous. Metathorax more strongly reticulato-rugose. Abdomen somewhat longer than the thorax, hardly convex, with parallel sides; segment 1 impressed with a furrow; 3 hardly more than half as long as 2; the other segments obsoletely punctulate, shining, together not much longer than the 2d. Wings fuscous. ♂ ♀. Length, $1\frac{3}{4}$ —2; wings, $3\frac{1}{2}$ —4 lin.

Antennæ ♀ fuscous, filiform, the scape black. Pectus and pleuræ thickly ruguloso-punctulate, the latter above the longitudinal furrow, smooth and shining. Segment 1 coarsely rugose, almost reticulated, 2—3 more finely; 1, 2 of nearly equal length; 2 broader than 3 and about twice as long; 3 at the apex, and all the remaining segments, more or less reddish luteous. Coxæ at the apex and underneath rufo-testaceous; hind tibiæ at the base somewhat infuscated. The ♂ differs in the colour of the abdomen, the antennæ are $\frac{1}{2}$ longer than the body, the wings darker, and the legs varied with black.—Ruthe.

This species, of which Fitch possesses two males, is next in size to *russatus*, Hal., and apparently still rarer in England; there is a ♂ in the British Museum from Desvignes' collection. The only specimens of which any

notice exists were bred by Curtis singly from half-grown larvæ of *Acronycta rumicis*, L., taken at Dover. The confused account of them given in B. E., 321, No. 1, seems to mean that three of the parasites became pupæ in August, two of these hatched in September, and the third remained a pupa till the following May. One of these was the ♂ described by Haliday. Curtis saw in them the *M. deprimator*, Fab. and Panz., which is incorrect; neither is Panzer's fig. (F. G., lxxix., 11) a ♀, as he states it to be. On the Continent the species is better known; Nees had a ♂ from Berlin; Ruthe a male and two females from Freienwalde and Danzig; and Reinhard speaks of a plurality of specimens examined by him.

11. *Microgaster scoticus*, n. s.

Niger, palpis, ventris lateribus juxta basin, segmentique 2di margine utrinque, flavo-testaceis; pedibus cum coxis 4 anterioribus rufis. Femora postica apice summo, coxæque posticæ, nigra; tarsi omnes rufi, unguiculis fuscis. Alæ subfumato hyalinæ, squamulis testaceis, nervis fusciscentibus, stigmatè fuscis; fascia sub stigmatè, et apice, paulo obscurioribus. Antennæ crassæ, corpore fere duplo longiores. Caput nitidum, vix punctulatum. Mesothorax et scutellum confertissime punctulata, vix nitida. Metathorax punctato-rugosus, carinatus. Abdomen breve, coxis posticis cum trochanteribus non longius; segmentis 1—2 punctato-rugosis, 3tio exarato. Segmentum 1mum vix longius quam latius, basi excavatum, perpaulo angustatum, longitudinaliter canaliculatum, apice rotundato-truncatum; 2dum 3tio parum longius, hoc nitidum quidem, sed distincte exaratum et vage punctatum; cætera levissima. Areola cubitalis 2da subcompleta. Calcaria postica crassa, metatarsi dimidio longiora.

Black; palpi, sides of the belly near the base, and lateral margins of segment 2, flavo-testaceous; legs, with the 4 anterior coxæ, rufous; hind coxæ, and extreme tips of the hind femora, black; all the tarsi rufous, with black claws. Wings subhyaline, slightly infumated; squamulæ testaceous; nervures and stigma fuscous, the latter darker; a blotch under the stigma, and the apex of the wing, also darker. Antennæ stout, almost twice as long as the body. Head shining, scarcely punctulate. Mesothorax and scutellum very thickly punctulate, hardly shining. Metathorax punctato-rugose, carinated. Abdomen short, not longer than the hind coxæ with their trochanters; segments 1—2 punctato-rugose, 3 faintly rugulose. Segment 1 hardly longer than broad, excavated at the base, and very slightly narrowed, longitudinally canaliculated.

rounded and truncate at the apex; 2 scarcely longer than 3, which last is somewhat shining, although distinctly subrugulose and vaguely punctate; the other segments very smooth. Second cubital areolet almost complete. Spurs of hind tibiæ stout, longer than $\frac{1}{2}$ the metatarsus. ♂. Length, $1\frac{1}{2}$; wings almost 4 lin.

Distinguished from the two preceding by having testaceous squamulæ; with them it has little affinity, except the sculpture of the 3d segment. The antennæ are very stout, compressed, and, though broken, still nearly twice as long as the body. The abdomen is unusually small; belly pitchy-black, with a yellow pellucid streak on each side beneath segments 1—2; segment 1 is narrowly edged with yellow, 2 more broadly; 3 is much less coarsely sculptured than 1—2, but cannot be regarded as smooth. Legs elongate, stout; middle tibiæ longer than their tarsi, their spurs as long as the metatarsus; spurs of the hind tibiæ very stout, shorter than the metatarsus. Anal forceps exerted, pale testaceous. Areola complete, except at the outer lower angle.

One specimen taken in Scotland by Cameron.

12. *Microgaster novicius*, n. s.

Niger, palpis, segmentorum 1—2 lateribus, supra anguste, latius infra, testaceis; pedibus præter coxas et trochanteres superos rufotestaceis; femorum posteriorum apice ipso, tibiis iisdem tarsisque, infuscatis. Alæ fusco-hyalinæ, squamulis piccis; nervis, stigmatæ, fuscis, hoc bicolore. Caput et mesothorax nitida, subtilissime punctulata; scutellum læve; metathorax carinatus et segmenta 1—2 punctato-rugulosa. Segmentum 1mum subquadratum, basi haud angustatum; 2dum 3tio æquale, hoc et seqq. lævia, nitida. Terebra abdominis quadrantem æquans. Valvula ventralis acuminata, anum superans. Calcaria postica metatarsi dimidio paulo breviora.

Black; palpi, margins of segments 1—2 narrowly above, beneath more broadly, testaceous; legs, except the coxæ and upper trochanters, rufotestaceous; extreme tips of the hind femora, with their tibiæ and tarsi, infuscated. Wings fusco-hyaline, squamulæ pitchy; nervures and stigma fuscous, the latter bicolorous. Head and mesothorax shining, very minutely punctulate; scutellum smooth; the carinated metathorax, and segments 1—2, punctato-rugulose. Segment 1 subquadrate, not narrowed at the base; 2 as long as 3, which, with all the rest, is smooth and shining. Terebra $\frac{1}{4}$ of the abdomen. Valvula ventralis acuminated, surpassing the

anus. Spurs of the hind tibiæ rather shorter than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{4}$; wings, $2\frac{1}{2}$ lin.

The species may be known by the stigma, which is indeterminately pale at the inner angle, and the very smooth thorax and scutellum, the former being almost invisibly punctulate in front only. In one specimen segments 3—4 are narrowly bordered behind with testaceous. The belly is black, the edges of its segments piceous, and near the base is the usual pellucid lateral spot. The terebra, viewed from above, projects very little beyond the abdomen. The antennæ of the ♂ are not much longer than those of the ♀, which are not much longer than the body. Wings hyaline at the base, towards the apex somewhat dusky; 2d cubital areolet triangular. Hind tibiæ pale at the base.

There are five specimens, three males and two females, in Cameron's collection; one of the cards is marked "Cadder."

13. *Microgaster subcompletus*, Nees.

Microgaster subcompletus, Nees, Mon., i., 165; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 33; Ruthe, Berl. ent. Zeit., 1863, p. 114, ♂ ♀.

M. annulipes, Hal., Ent. Mag., ii., 238, ♀.

Black; palpi pale, with the basal joint black; antennæ rufescent beneath; belly testaceous or pale pitchy, darker behind; segment 2 margined laterally with testaceous; legs rufous, except the coxæ and upper trochanters; hind femora and tibiæ at the apex, with their tarsi, fuscous, the joints of the tarsi rufous at the base. Wings subfumato-hyaline, darker at the apex; squamule and stigma blackish, nervures fuscous. Face not shining, finely and transversely rugulose. Mesothorax and scutellum shining, minutely punctulate; metathorax punctato-rugulose, carinated, the hinder angles somewhat produced. Abdomen depressed; segments 1—2 substriato-rugulose; 1 subquadrate, very slightly narrowed at the base, margined; 2, 3 subequal, transverse; 3 and the following smooth and shining, 3 however is very faintly aciculated. Terebra $\frac{1}{3}$ or $\frac{3}{4}$ of the abdomen; valves almost linear. Valvula ventralis subacute, not surpassing the anus. Spurs of hind tibiæ longer than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{3}{4}$ —2; wings, $3\frac{2}{3}$ — $4\frac{1}{3}$ lin.

The resemblance of this species to the next is very close, but it may be distinguished by the following characters:—It is more slender and depressed; the

antennæ are not so stout, the flagellum is more or less rufous underneath, and the apical joints are almost twice as long as broad; the mesopleuræ and pectus are less visibly punctulate; the metathorax more finely rugulose; segment 2, and sometimes 1, is narrowly margined with testaceous; the belly in front is pale instead of black; segment 3 is never absolutely smooth, but always slightly aciculated; the terebra is longer and more slender; the hind femora and tibiæ are always dusky at the apex, and the joints of the tarsi testaceous at the base; the wings are more ample, and the 2d cubital areolet, if completed, would not be stirrup-shaped, as in *globatus*, but triangular.

Common; usually attacking *Vanessa Atalanta*, L., and several times bred by Bignell, as also by Norgate, Fitch and Sotheby, and by Giraud in France. Bignell has also obtained it from *Hypena proboscidalis*, L.; and Elisha from *Dicrorrhapha tanacti*, Ste. A single ♀ bred by Elisha from *Sericoris euphorbiana*, Freyer, June 9th, is only $1\frac{1}{2}$ lin. long, and its terebra one-third the length of the abdomen. According to Reinhard it likewise infests *Vanessa cardui*, L., *Cucullia scrophulariæ*, Esp., *C. verbasci*, L., and *Spilodes verticalis*, L. Brischke bred it from *S. verticalis*, L., and *Phoxopteryx derasana*, Hüb.; Giraud from *Acronycta rumicis*, L., and *Tortrix viridana*, L. Cocoons white, somewhat woolly, and with one half more opaque than the other.

14. *Microgaster globatus*, Nees.

Microgaster globatus, Nees, Mon., i., 163; Hal., Ent. Mag., ii., 237; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 31, pl., f. c; Ruthe, Berl. ent. Zeit., 1860, p. 120, ♂ ♀. The synonymy found in all older writers is doubtful.

Black; palpi pale, with 2 basal joints dusky; antennæ wholly black; belly black, or only slightly pellucet at the base; legs rufous, except the coxæ and upper trochanters; hind femora sometimes at the apex, with their tarsi, fuscous. Wings fumato-hyaline, darker at the apex, squamulæ and stigma blackish, nervures fuscous. Face dull, thickly punctulate. Mesothorax and pleuræ finely and thickly punctulate, subrugulose; scutellum more sparingly, rather shining; metathorax rugulose, subreticulated, carinated. Abdomen more or less depressed, somewhat narrowed at the base and apex; segments 1—2 rugose, subreticulated,

margined; segment 1 subquadrate, 2—3 subequal, transverse; 3 and following smooth and shining. Terebra shorter than $\frac{1}{2}$ the abdomen. Valvula ventralis acuminate, not surpassing the anus. Spurs of hind tibiæ longer than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{2}{3}$ —2; wings, $3\frac{2}{3}$ — $4\frac{1}{3}$ lin.

Var. Legs unicolorous, rufous, &c. *Microgaster rufipes*, Nees, Mon., i., 164, ♂ ♀; *M. subincompletus*, Ratz., Ichn. d. Forst., iii., 49, ♂.

The stout antennæ of the ♀ are about as long as the body; the ♂ differs only in having them longer and more setaceous, and a more depressed abdomen. The base of the clypeus, and tips of the mandibles, are rufescent. Labial palpi sometimes dusky. Wings sometimes almost hyaline, tinged towards the base and on the costa with testaceous. The hind femora, and, less often, their tibiæ, are liable to be fuscous, or even black, at the tips, and the same tibiæ are generally very pale at the base. A var. with the fore femora black at the base is conjectured by Ruthe to be *M. anthomyiarum*, Bouché (Naturg., 1834, 160); and those with more hyaline wings are *M. amentorum*, Ratz. (i., 68). The difficulty of recognising the present species, as well as the preceding and following, is very great, in consequence of slight variations. Ruthe states the result of his experience to be, that uniformity in the colour of the legs and wings always prevails in the same brood; in another brood from the same species of larva will be seen, perhaps, a small variation; while a brood proceeding from a different species will present more marked deviations, not only in colour, but in size, form, and degree of punctuation. Individuals occur with the femora and tibiæ more or less blackened, which can neither be referred with certainty to this species, nor to *tibialis*, Nees, and, as their cocoons are indistinguishable, it is not very unlikely that the two species ought to be united.

Like *tibialis*, Nees, it seems to be a solitary parasite of the smaller moths, and therefore cannot be the *Ichnemon globatus*, L.; there are, however, hardly any bred specimens at hand. A ♀ in Fitch's collection was bred by Elisha, June 9th, from *Scricoris euphorbiana*, Freyer, a ♂ from *Conchylis Smeathmaniana*, Fab., May 16th; and S. v. Vollehoven reared one from *Spilodes verticalis*, L., in July. Brischke bred it singly from *Eupithecia linariata*, Fab., *E. campanulata*, Schöff.,

Spilodes verticalis, L., and *Tachyptilia populella*, Clerck. Ratzeburg's *M. amentorum* was bred singly in some numbers from the foreign *Tortrix amentana*, Ratz.; and by Brischke from *Phloxodes immundana*, Fisch. The dubious *M. anthomyiarum*, Bouché, was obtained from *Anthomyia ceparum*, Bouché. Cocoon white, not woolly.

15. *Microgaster tibialis*, Nees.

Microgaster tibialis, Nees, Mon., i., 168; Ste., Ill. M., vii., Suppl. 3, pl. xxxvii., f. 2; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 35; Ruthe, Berl. ent. Zeit., 1860, p. 122, ♂ ♀.

M. nigricans, Nees, Mon., i., 167, ♂.

M. meridianus, *messorius*, ♂ ♀, and *luctuosus*, ♂, Hal., Ent. Mag., ii., 239.

Black, including the palpi, or these may only be black at the base; legs also black, or black and red in various proportions. Wings infumated, paler at the base; squamulæ black, nervures and stigma fuscous. Antennæ subsetaceous. Face dull, thickly punctulate. Body rather shining; mesothorax finely and thickly punctulate; metathorax and segments 1–2 rugose, the former carinated. Terebra shorter than $\frac{1}{2}$ the abdomen. ♂ ♀. Length, $1\frac{1}{4}$ –2; wings, $2\frac{3}{4}$ – $4\frac{1}{2}$ lin.

All writers agree in separating this from *globatus*, Nees, although no intelligible difference can be pointed out, except the colour of the legs. The structure of both forms is the same, and subject to the same variations; usually the ♀ of *tibialis* is a little more slender, but sometimes the reverse is the case. So also with respect to the rugosity of the metathorax and abdominal segments. The antennæ appear a little shorter than those of *globatus*, and the last joints are subquadrate. The wings are more or less deeply tinged; sometimes almost hyaline. As to the legs, the only remaining means of distinction, they are (at least the hind pair) either altogether black, or the femora only; or the femora are rufous with black streaks, or finally altogether rufous, in which case the species become merged in *globatus*. The following are the leading varieties:—

Var. 1, *M. ambiguus*, Ruthe. Metathorax and segments 1–2 finely rugulose; palpi testaceous with the basal joint dusky; legs rufous, coxæ and hind tarsi black. Length often only $1\frac{1}{2}$ lin.

Var. 2, *M. maculatus*, Ruthe. Metathorax and segments 1–2 more or less finely rugulose; palpi testaceous, or dusky at the base;

femora black at the base, or with a black stripe above and beneath, most conspicuous on the middle, and least on the hind pair. Length, about $1\frac{2}{3}$ lin.

Var. 3, *M. vulgaris*, Ruthe. Metathorax and segments 1—2 more finely rugulose; coxæ and femora black; fore femora with the apical half, middle femora only at the tips, and hind femora entirely, black or fuscous; anterior tibiæ and tarsi entirely rufous; hind tibiæ at the tips, and their tarsi, generally black, or the last wholly rufous. Length, $1\frac{2}{3}$ —2 lin.

Var. 4, *M. luctuosus*, Hal., ♂. Palpi fuscous; fore legs with the knees, tibiæ, and tarsi, rufescent; middle tibiæ the same with the apex fuscous; hind tibiæ rufescent only at the base; wings very dark; lateral margins of segment 1 narrowly testaceous. Length, 2 lin.

Very common. A solitary parasite of small Lepidoptera. Bred by Bignell from *Emmelesia decolorata*, Hüb. The pupæ were buried during the winter. A ♀ in Fitch's collection, answering to *messorius*, Hal. (tibiæ testaceous, wings very dark), was reared by Elisha, June 9th, from *Peronea Shepherdana*, Ste. Brischke bred it from *Tachyptilia populælla*, Clerck. I possess 19 specimens, including most of the above varieties, collected throughout the country, from Rannoch to the Isle of Wight. Cocoons white.

16. *Microgaster hospes*, n. s.

Niger, palpis fuscis, tibiis rufis; femoribus feminae anterioribus apice, posticis etiam lateribus, rufis, maris totis nigris. Alæ hyalinæ, squamulis nigris, nervis et stigmatibus ferrugineo-fuscis. Caput cum mesothorace nitidum subtilissime confertim punctulatum; scutellum læve; metathorax et segmenta 1—2 punctato-rugulosa, ille haud carinatus. Segmentum unum subquadratum, basi non angustatum; 2dum 3tio æquale, hoc et seqq. lævia nitida. Terebra abdominis dimidio æqualis, curvata, valvulis clavatis. Valvula ventralis magna, picea, acuta, antrum non superans. Pedes quam *M. novicio* crassiores, breviores, præsertim feminae. Calcaria postica metatarsi dimidio breviora.

Black; palpi fuscous, tibiæ rufous; anterior femora of the ♀ at the apex, hind femora also at the sides, rufous, those of the ♂ entirely black. Wings hyaline, squamulæ black, nervures and stigma reddish fuscous. Head and mesothorax shining, thickly and very finely punctulate; scutellum smooth; metathorax and segments 1—2 punctato-rugulose, the former not carinated. Segment 1 subquadrate, not narrowed at the base; 2 as long as 3,

which, with the remaining segments, is smooth and shining. Terebra as long as $\frac{1}{2}$ the abdomen, curved; the valves clavate. Valvula ventralis large, pitchy, acute, not surpassing the anus. Legs stouter and shorter than those of *M. novicius* (sp. 12), especially in the ♀. Hind spurs shorter than $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, $1\frac{1}{2}$; wings, $3\frac{1}{2}$ lin.

Described from one male and two females. The belly is not pale at the base. Antennæ ♀ setaceous, attenuated towards the apex. Certainly distinct from *globatus-tibialis*, having a different facies; the wings are hyaline, or nearly so; the metathorax is without a carina, the terebra somewhat longer, and its valves more clavate.

From Scotland; Cameron's collection.

17. *Microgaster crassicornis*, Ruthe.

Microgaster Spinolæ, Hal., Ent. Mag., ii., 238, ♂ ♀
(not of other authors).

M. crassicornis, Ruthe, Berl. ent. Zeit., 1860, p. 124, ♀.

Black; palpi blackish; legs rufo-testaceous, coxæ, trochanters, femora at the base, and tarsi, black. Wings infumated, squamulæ black, nervures and stigma fuscous. Antennæ ♀ filiform, stout, hirsute, the 3 penultimate joints subquadrate; of the ♂ stouter, longer than the body, subsetaceous. Face thickly punctulate, gibbous above the clypeus. Mesothorax and scutellum smooth and shining. Pleuræ sparingly punctulate in front. Metathorax and segments 1—2 rugulose, subreticulated, the former carinated. Segment 1 subquadrate, narrowed at the base, with a shining tubercle at the apex; 3 and following smooth, shining. Terebra almost $\frac{1}{2}$ the abdomen; valves stout, subclavate. Valvula ventralis acuminate, not reaching the anus. Legs stout; spurs of hind tibiæ as long as $\frac{1}{2}$ the metatarsus. ♂ ♀. Length, 2; wings, $4\frac{1}{2}$ lin.

This, like the preceding, is not easily distinguished from *tibialis*. It equals the largest of that species in size; the antennæ of the ♀ are of uniform thickness to the apex, rather shorter than the body, and beset with black hairs. Face covered with hoary pubescence. The chief distinction in both sexes is the smoothness of the thorax, without visible punctures as in *globatus-tibialis*. The rufous legs appear not to vary much; the fore femora are black at the base more or less, the 4 posterior have a black basal streak above and below, broader on the middle pair, which are sometimes altogether black.

Haliday calls the palpi rufous, but this is within the limits of usual variation.

Found rarely by Haliday on muddy coast of north Ireland. In Cameron's collection are two males and three females from Glenlyon, Scotland; also captured by Sharp at Thornhill, and by me formerly at Loch Rannoch. Brischke bred it at Danzig from *Eupithecia campanulata*, Schöff., and describes the cocoon as solitary, thin, silky, white.

18. *Microgaster spretus*, n. s.

Niger, palpis pallidis, pedibus anterioribus rufo-testaceis, posticis piceis, tibiis iisdem medio rufescentibus, coxis omnibus nigris, tarsis anterioribus apice ipso, posticis totis, fuscis. Alæ hyalinae, squamulis, nervis, stigmatibus, piceis. Antennæ perbreves, capite cum thorace vix longiores, submoniliformes. Corpus totum subnitidum. Caput subtilissime, mesothorax fortiter confertim punctulatus; scutellum medio læve; metathorax subtiliter dense punctulatus, carinatus. Segmentum 1mum vix longius quam latius, lateribus fere parallelis, ruguloso-punctatum, truncatum, apice medio emarginatum, longitudinaliter canaliculatum; segmentum 2 et seqq. lævia, nitida, illud canaliculis 2 arcuatis antice divergentibus in longitudinem tripartitum, articulatione suturiformi curvata, postice concava. Terebra brevissima. Valvula ventralis anum non attingens. Pedes breves, crassi; posticorum calcar internum metatarsi dimidio multo longius.

Black; palpi pale; 4 anterior legs rufo-testaceous, hind legs piceous, their tibiæ rufescent in the middle; all the coxæ black; anterior tarsi at the tips, hind tarsi wholly, fuscous. Wings hyaline, squamulæ, nervures, and stigma fuscous. Antennæ very short, hardly longer than the head and thorax, submoniliform. Body rather shining. Head very finely, mesothorax thickly and more strongly, punctulate; scutellum smooth in the middle; metathorax thickly and finely punctulate, carinated. Segment 1 hardly longer than broad, the sides nearly parallel, ruguloso-punctate, truncated, emarginate behind in the middle, longitudinally canaliculated; segment 2, and the rest, smooth and shining; 2 longitudinally trisected by two curved impressed lines which diverge in front; suturiform articulation curved, concave behind. Terebra very short. Valvula ventralis not reaching the anus. Legs short, stout; inner spur of hind tibiæ much longer than $\frac{1}{2}$ the metatarsus. ♀. Length, $1\frac{1}{4}$; wings, $2\frac{2}{3}$ lin.

This and the following species are very distinct from all described Microgasters, having the 2d segment smooth, and free from rugosity.

Anterior legs somewhat dull testaceous; hind pair piceous, with pale trochanters, and their tibiæ somewhat reddish in the middle. Belly black, except a pellucid lateral basal spot. Antennæ unlike those of any other species; all the joints are short, and, after the 4th, moniliform, slightly tapering towards the apex, and not longer than broad. Second segment shining, with only a few scattered punctures; divided into 3 lobes by two arcuate channels which commence near one another on the hind margin and diverge to the anterior angles. Four anterior legs very short, their tarsi longer than the tibiæ, and the spurs almost as long as the metatarsi; hind legs incrassated and longer, their spurs also nearly equal to the metatarsi. Areolet minute, incomplete on the outer side, the other 2 sides closely approximated, and, with the 1st abscissa of the radius, much incrassated; outer nervures decolorous.

The only specimen was bred by Bignell from *Rhodophaea consociella*, Hüb. Cocoon not preserved.

19. *Microgaster politus*, n. s.

Ater, palpis pallidis basi fuscis, ventre toto pedibusque nigris, his flavo-variis. Alæ hyalinæ, apicem versus subinfuscatæ; squamulæ nigrae; nervi cum stigmatate fuscis; areola cubitalis 2da triquetra, modo non completa. Corpus totum nitidum. Caput, mesothorax, scutellum, subtilissime parcius punctulata, fere lævia. Metathorax subrugulosus, haud carinatus. Abdomen depressum, ventre leviter convexo, basi compresso; segmentum 1mum non longius quam latius, basi impressum, marginatum, subtilius striolatum, apice rotundato-truncatum; segmentum 2dum transversum, 3tio æquale, marginatum, cum cæteris lævissimum. Pedes subgraciles; calcaria posticæ metatarsi dimidio paulo longiora.

Deep black; palpi pale, fuscous at the base; belly entirely, and legs black, the latter partly flavo-testaceous. Wings hyaline, somewhat dusky towards the apex; squamulæ black; nervures and stigma fuscous; arcelet triangular, almost complete. Entire body shining. Head, mesothorax, and scutellum rather sparingly and very finely punctulate, almost smooth. Metathorax subrugulose, not carinated. Abdomen depressed, belly convex, compressed at the base; segment 1 not longer than broad, impressed at the base, margined, finely striolated, rounded and truncate at the apex; 2 transverse, as long as 3, margined, and very smooth, like all the rest of the segments. Legs rather slender; spurs of hind tibiæ a little longer than $\frac{1}{2}$ the metatarsus. ♂. Length, $1\frac{1}{3}$; wings, $3\frac{1}{3}$ lin.

Remarkable on account of the smoothness of the 2d abdominal segment. It resembles *Apanteles longicaudis* ♂, with the wings

of a *Microgaster*. The shining body, smooth abdomen, and colour of the legs are the chief peculiarities. Femora black, the 4 anterior flavo-testaceous at the apex; all the lower trochanters flavo-testaceous; 4 anterior tibiæ flavo-testaceous at both ends, the fore pair inclining to fuscous in the middle; hind tibiæ black, except the base; tarsi infuscated, hind pair darkest. Antennæ longer than the body, setaceous. Entire abdomen smooth and shining, only the 1st segment minutely aciculated; segment 2 not half as long as broad, with two marginal channels somewhat converging in front; 3 about as long as 2. Second cubital areolet triangular, the sides not much incrassated, outer side interrupted as usual near the lower angle.

I captured this insect in a wood near my house at Nunton, Wilts, in 1884.

XII. AGATHIDIDES.

Clypeus entire; mouth closed. Maxillary palpi 5—6, labial 3—4-jointed. Vertex short; occiput excavated. Mesothoracic sutures distinct. Abdomen sessile; sutures distinct. Cubital areolets 2 or 3; in the latter case the 2d is minute, subquadrate or triangular; radial areolet minute, narrow, lanceolate, not nearly reaching the apex of the wing; nervures distinct; recurrent nervure rejected; pobrachial areolet as long as the præbrachial, or longer. Terebra elongate.

This subfamily, comprising the rest of Wesmæel's *Aréolaires*, is easily known from the *Microgasterides* by the small radial areolet, scarcely broader, and not much longer, than the stigma, ending long before the apex of the wing. The number of joints in the antennæ is variable in the species and sexes; the mesothorax trilobate; the 1st abdominal segment with hardly any, or with no, membranaceous edges; the abdomen longer, and in the ♀ not strongly carinated beneath; the valvula ventralis less conspicuous, being flattened against the belly; and the terebra never very short.

The *Agathidides* are somewhat poorly represented in Europe, and especially in Great Britain; but in the equatorial regions, where they supplant the *Microgasters*, the number of species, rivalling the Bracons in size and colours, is incalculable.

The genus *Agathis* was founded by Latreille in 1805, to include species which have the face triangularly produced. Those without this peculiarity were arranged by Nees v. Esenbeck, in 1814, under his genus *Microdus*.

In 1837 Wesmael divided *Microdus* into two subgenera, *Earinus* and *Therophilus*, characterised by the presence or absence of the nervure dividing the 1st cubital areolet from the prædiscoïdal. Förster, in 1862, published the same two divisions as genera, but with new names, *Diatmetus* and *Eumicrodus*.* Reinhard, the latest writer upon this group, has judiciously sanctioned the names *Earinus* and *Microdus*, which are here adopted. In Förster's Synoptical Table we find *Microdus* and its allies erected into a new subfamily, distinct from *Agathis*, which he calls *Eumicrodoïdæ*, but which others might prefer to write *Eumicrodontoïdæ*. The alleged ground of separation is nothing but the comparative length or shortness of the face, which in our opinion is not a sufficient reason for the establishment of a subfamily, the rest of the structure in both groups being similar. At this rate *Vipio* must constitute a new subfamily apart from *Bracon*, and our *Apanteles naso* (ante, sp. 43), with two cognate species described by Reinhard, should form another group equal in value to the Microgasterides. Declining to admit this inconsistency, we have regarded *Agathis*, *Microdus* and their allies, as forming one natural subfamily, *Agathidides*. The genus *Orgilus*, Hal. (*Ischius*, Wesm.), was invented for the reception of *Microdus obscurator*, Nees, having only two cubital areolets, and otherwise aberrant; to which have since been added a few more species.

TABLE OF GENERA.

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|---|--------------------------|
| (6) 1. Three cubital areolets in the fore wings. | |
| (3) 2. Face triangularly produced, rostriform | .. i. AGATHIS, Latr. |
| (2) 3. Face of the usual form. | |
| (5) 4. First cubital areolet separated by a distinct
nervure from the prædiscoïdal | ii. EARINUS, Wesm. |
| (4) 5. First cubital areolet not so separated | .. iii. MICRODUS, Nees. |
| (1) 6. Two cubital areolets in the fore wings | .. iv. ORGILUS, Hal. |

* Förster objected to *Microdus* that it had already been used as the name of a genus of fishes, and therefore proposed to call it *Eumicrodus*. According to entomological rules this is not necessary, for the name in ichthyology is *Microdon*, which is not quite the same; and further, *Microdon* (like *Mastodon*, *Megalodon*, and many more) being wrongly formed, should not take precedence over the correctly-spelt *Microdus*.

i. AGATHIS (Latr.).

Wesm., Nouv. Mém. Ac. Brux., 1837, p. 23.

Maxillary palpi 5-, labial 4-jointed. Face, maxillæ, and labium produced, rostriform. Mesothorax distinctly trilobate. Mesopleuræ with traces of a longitudinal furrow. Three cubital areolet, the first (as in *Microdus*) confused with the prædiscoidal.

Viewed in front, the head is elongate-triangular, obtusely carinated, with a fovea on each side above the labium; face perpendicular; eyes naked, globose, prominent; occiput obscurely margined. Body elongate. Abdominal segments 1—3 longer than the rest taken together; segment 1 slightly narrowed towards the base, and rugulose; 2 with a deep fovea at each hinder angle, between which foveæ is a gibbous space. Segments 2 and 3 marked with a curved transverse impression, which in the small British species is not very conspicuous. Wings infuscated, with a decolorous streak under the stigma, breaking the continuity of the nervures. The wings being identical with those of *Microdus*, only the form of the head can be used as a divisional character.

The *Agathides* are not common in this country. Only 28 specimens have come to my knowledge belonging to two nearly-allied species, both of which have been bred from Lepidoptera.

TABLE OF SPECIES.

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|---|--------------------------------------|
| (2) 1. Abdomen rufous in the middle .. | 1. <i>malvacearum</i> (Latr.), Nees. |
| (1) 2. Abdomen entirely black. | |
| (4) 3. Rostrum longer than the head;
wings very dark | 2. <i>nigra</i> , Nees. |
| (3) 4. Rostrum not longer than the head;
wings lighter. | |
| (6) 5. Palpi rufous, black at the base .. | 5. <i>rufipalpis</i> , Nees. |
| (5) 6. Palpi blackish. | |
| (8) 7. Areolet quadrangular; terebra as
long as the abdomen | 4. <i>brevisetis</i> , Nees. |
| (7) 8. Areolet triangular, subobsolete;
terebra as long as the body .. | 3. <i>anglica</i> , n. s. |

1. *Agathis malvacearum* (Latr.), Nees.

Agathis malvacearum, Latr., H. N., xiii., 175; Nees, Mon., i., 137, ♂ ♀.

Ichneumon Panzeri, Jur., Hym., pl. viii., f. 2.

Black, shining; abdomen in the middle, and legs, rufous; coxæ, trochanters, femora at the base, posterior tibiæ at the apex, and tarsi, black. Wings pale at the base, darker at the apex; 2d cubital

areolet small, subquadrate. Terebra longer than the body. ♂ ♀ Length, $3\frac{1}{2}$ lin.

Metathorax bicarinated, each carina with a row of punctures on both sides; the space between the carinæ transversely striolated. Segment 1 striato-rugulose at the base; its apical half rufous; segment 2 rufous with the hind margin black. Wings whitish from the base to about the middle, afterwards darker; areolet forming a truncated triangle.

A species of central and southern Europe, but said by Stephens to have been taken by himself in the London district, though no recent captures are recorded. A male and two females are in Walker's collection at Oxford, as I am informed by Westwood, but some proof is required to show that Walker took them in this country.

Giraud bred it in France from *Parasia lappella*, L., and Goureau, in great numbers, from *P. carlinella*, Dougl. (Ann. Soc. Fr., 1858, p. 275).

2. *Agathis nigra*, Nees.

Agathis nigra, Nees, Mon., i., 128; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 23, ♂ ♀; S. v. Voll., Pinae., pl. 29, f. 4, ♀.

Black, with black palpi; anterior femora at the apex broadly, and all the tibiæ, rufo-testaceous; posterior tibiæ tipped with black. Wings fuscous, with a whitish streak below the stigma, which, with the squamulæ and nervures, is black. Antennæ ♂ ♀ 22—24-jointed. Rostrum longer than the head. Head and thorax smooth and shining; mesothorax with a few vague punctures; metathorax uneven, with two longitudinal carinæ and a few transverse lateral wrinkles. Segment 1 with a deep basal fovea, longitudinally convex from thence to the apex, weakly striolated at the base, the rest of the abdomen smooth and shining. Radial areolet longer and more acute than that of *A. anglica*; 2d abscissa of the radius obsolete; 3d abscissa straight; 2d cubital areolet triangular, petiolated, sometimes irregular or obsolete. Terebra $\frac{1}{2}$ longer than the body. ♂ ♀. Length, 2; wings, $3\frac{1}{3}$ lin.

Distinguished from other species by the longer rostrum, and intense colour of the wings. Coxæ and trochanters black; 4 posterior femora in British examples concolorous; in two cases the hind tibiæ bear vestiges of a dusky ring near the base; intermediate tibiæ also black at the tips. The 2d cubital areolet is very irregular.

Rare; but eleven specimens, five males and six females, have fortunately been bred by Elisha from *Eupæcilia roseana*, Haw., August 18th.

3. *Agathis anglica*, n. s.

Ater, femorum anteriorum apice late, tibiisque, testaceis, posterioribus apice fuscis, ante basin obsolete fusco annulatis, tarsis fuscis. Alæ infuscatæ, squamulis, stigmatate, nervis, nigricantibus. Antennæ ♂ ♀ 29—31-articulatæ. Rostrum quam *A. nigra* multo brevius. Caput, mesothorax, scutellum, lævia, nitida; metathorax subrugulosus, feminae nonnihil lævior, carinis 2 longitudinalibus approximatis, postice divergentibus. Segmentum 1mum ut in sp. præcedente conformatum, sed basi læve, alioquin aciculatum; cætera lævia, nitida; segmentum 2 ut in sp. præcedente. Areola radialis minuta, stigmatate minor; radii abscissa 2da obsoleta, 3tia nonnihil curvata, introrsum concava; areola cubitalis 2da tenuissima, fere obsoleta, subtriangularis. Terebra corpori longitudine æqualis.

So like the preceding that it will suffice to point out the differences. Posterior tibiæ with a dusky ring before the base; wings less deeply tinted; antennæ with more joints; rostrum much shorter; segment 1 smooth at the base, aciculated behind; radial areolet shorter, 3d abscissa of the radius curved; areolet not petiolated; terebra not longer than the body. ♂ ♀. Length, $1\frac{2}{3}$; wings, $3\frac{1}{4}$ lin.

Commoner than *A. nigra*; I have taken several specimens, though only one male and two females now remain, captured at Milford Haven. W. H. B. Fletcher has bred a ♀ from *Coleophora albitarsella*, Zell., or *discordella*, Zell., and a ♂ from *Depressaria nervosa*, Haw.

4. *Agathis brevisetis*, Nees. (Pl. VI., figs. 3, 3 a).

Agathis breviseta, Nees, Mon., i., 131, ♂ ♀; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 25, ♀; S. v. Voll., Pinac., pl., 29, f. 5, ♀.

Black; anterior femora at the apex broadly, and tibiæ, testaceous, posterior tipped with black and with a black ring before the base; tarsi black, testaceous at the base. Wings infuscated, squamulæ, stigma, and nervures blackish. Antennæ ♂ ♀ 27—32-jointed. Head, mesothorax, and scutellum smooth and shining; metathorax subrugulose, with 2 smooth discal spaces, sometimes obsolete, between which are 2 faint carinæ, somewhat diverging hindwards. Segment 1 with a smooth basal excavation, the rest aciculated; the other segments smooth and shining. Radial areolet broader and

longer than in the preceding; 2d abscissa of the radius not quite obsolete, punctiform, being the upper side of the subquadrate areolet. *Terebra* as long as the abdomen. ♂ ♀. Length, 2; wings, $3\frac{1}{2}$ lin.

Distinguishable from the last only by the shorter *terebra*, and a small difference in the wings. Third abscissa of the radius straight; 2d cubital areolet quadrangular, narrowed towards the stigma; radial areolet larger. It is also very like *Microdus cingulipes*, Nees, but, besides the generic distinction, the latter may be known by having the areolet stirrup-shaped and petiolated, and the hind tibiæ whitish.

W. H. B. Fletcher bred a ♂ from *Euchromia mygindana*, Schiff., June 18th; Snellen three males in July from *Chrosis rutilana*, Hüb.; Brischke, from *Cleodora striatella*, Hüb.; Bouché, from *Pyrausta purpuralis*, L., according to Ratzeburg. Three males were taken by me, and two males and three females by Bignell, in Devonshire; three females in Scotland, by Cameron.

5. *Agathis rufipalpis*, Nees.

Agathis rufipalpis, Nees, Mon., i., 129; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 24, ♂ ♀.

Black, shining; maxillary palpi, except the base, and legs partly, rufous. Wings fuscous; areolet sessile. Segment 1 striolated. *Terebra* longer than the body. ♂ ♀. Length, 2 lin.

First joint of maxillary palpi wholly, and 2d at the base, black; labial brownish black. Abdomen subrugulose at the base, not carinated. Legs variable; fore pair testaceous, their trochanters, and femora beneath at the base, black, their tarsi (and those of the middle pair) fuscous, the 1st joint testaceous; middle legs black, their femora at the apex, and their tibiæ, testaceous; hind legs black, tibiæ testaceous, the apex black.

I have seen but one of this species, which Curtis (Guide, 2d ed., column 116) reported to be British, and in his collection. Taken originally by Nees at Sickershausen, and by Bonelli in Italy. Bred by Brischke from *Nannodia Hermannella*, Fab. Elisha reared one ♀ from the same victim, July 6th.

ii. *EARINUS*, *Wesm.*

Wesm., Nouv. Mém. Ac. Brux., 1837, p. 8.

Maxillary palpi 5-, labial 3-jointed. Face not produced or rostriform. Mesothorax obsoletely trilobate. Mesopleuræ without a furrow. Three cubital areolets, the 1st separated from the prædiscoidal.

To this genus belong a few rather large species with hyaline wings. The nervure separating the 1st cubital from the prædiscoidal is largely interrupted. According to Reinhard the mesothorax is not trilobate; nevertheless the sutures are always slightly indicated.

TABLE OF SPECIES.

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| (2) 1. Mesothorax rufous | 3. <i>nitidulus</i> , Nees, var. |
| (1) 2. Mesothorax black. | |
| (4) 3. Second abdominal segment rufous .. | 2. <i>zonatus</i> , n. s. |
| (3) 4. Second abdominal segment black. | |
| (8) 5. Hind coxæ rufous. | |
| (7) 6. Hind tibiæ rufous, white at the base;
terebra as long as the abdomen .. | 3. <i>nitidulus</i> , Nees. |
| (6) 7. Hind tibiæ whitish, the tips and a
basal ring fuscous; terebra as long
as the thorax and abdomen .. | 1. <i>glorimatorius</i> , Panz., var. |
| (5) 8. Hind coxæ black | 1. <i>glorimatorius</i> , Panz. |

1. *Earinus glorimatorius*, Panz. (Pl. VI., fig. 4).

Bassus glorimatorius, Panz., F. G., cii., 17, ♂ (1809).

Microdus gloriator, Nees, Mag. Ges. Berl., 1814,
p. 188; Mon., i., 145, ♂.

M. (Earinus) affinis, *Wesm.*, Nouv. Mém. Ac. Brux.,
1837, p. 11; *delusor*, *Wesm.*, *lib. cit.*, p. 12 (var.
with rufous coxæ and trochanters), ♂ ♀; S. v.
Voll., Pinac., pl. 29, f. 7, 7 a, 7 b (details of head,
thorax, and hind leg).

Black; palpi yellowish; legs rufo-testaceous, hind tibiæ yellow, their tips, a spot or ring near the base, and all the tarsi, fuscous; coxæ usually black, sometimes rufo-testaceous. Wings hyaline, squamulæ and base of the nervures testaceous, the rest and the stigma rufo-fuscous. Body shining, thinly beset with white hairs, those on the head and thorax blackish. Antennæ ♂ ♀ 31—35-jointed. Labial palpi 3-jointed. Head and mesothorax with minute scattered punctures; sutures of the latter just visible, converging posteriorly into a smooth fovea before the scutellum, which is also smooth; metathorax almost smooth, margined, bicarinated,

the apical angles somewhat produced. Segment 1 striolated, with 2 carinæ vanishing before the apex; basal fovea large, oblong, smooth; segment 2 more or less striolated in the transverse depression. Terebra as long as the body without the head. ♂ ♀ Length, 2¼; wings, 5 lin.

The sexes are similar; the antennæ of the ♂ have only 2—3 more joints than those of the ♀. Segments 1—2 are always more or less aciculated, never quite smooth. Wesmael's *delusor* is certainly not distinct; I have taken it commonly with the others at the same time and place.

Common in Devonshire; taken by Bignell and myself near Plymouth and Teignmouth; also in numbers on the banks of the Usk at Abergavenny, in May and June; by Bridgman at Norwich, and Fitch at Maldon.

2. *Earinus zonatus*, n. s.

Niger, ore, palpis, flagelli dimidio basali, macula pone oculos orbitali, abdominis segmento 2do, pedibusque totis, rufo-testaceis. Alæ leviter infumatae, squamulis rufo-testaceis, nervis, stigmatæ, fuscis. Antennæ maris 32-articulatae. Metathorax transversim rugosus, carinis 2 basi et apice junctis medio divergentibus instructus. Mesopleuræ nitidæ, punctulatae, fovea crenata nulla. Segmentum 1mum striolatum, basi excavatum; cætera lævia nitida. Areola cubitalis 1ma a prædiscoïdali nervo distinctissimo sejuncta; cubitalis 2da triquetra, petiolata, incompleta.

Black; mouth, palpi, basal half of the flagellum, an orbital spot behind the eyes, 2d abdominal segment, and legs entirely, with coxæ and tarsi, rufo-testaceous. Wings slightly infumated, squamulæ rufo-testaceous, nervures and stigma fuscous. Antennæ ♂ 32-jointed. Metathorax transversely rugose, with two carinæ diverging in the middle, united at each end. Mesopleuræ shining, punctulate, without a crenate fovea. Segment 1 striolated, excavated at the base; the rest smooth and shining. First cubital areolet very distinctly separated from the prædiscoïdal; 2d petiolated, imperfect. ♂. Length, 1¾; wings, 3½ lin.

Described from two specimens in Fitch's collection. Their mesothorax is damaged by pins, but the trilobed structure is discernible, imperfect and effaced in front. The legs are entirely rufo-testaceous, only the claws dusky. The 2d segment is rufo-testaceous, transversely bisected by an impressed line, fainter in the middle.

Bred from *Eupæcilia notulana*, Zell.

3. *Earinus nitidulus*, Nees.

Microdus nitidulus, Nees, Mon., i., 144; *M. (Earinus) nitidulus*, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 8, pl. (wing), ♂ ♀.

Var. *M. thoracicus*, Nees, Mon., i., 143, ♀; *M. (Earinus) thoracicus*, Wesm., *lib. cit.*, p. 9, ♀ (mesothorax rufous); S. v. Voll., Pinae., pl. 29, f. 6, ♀.

Black; palpi testaceous; legs rufous, hind tibiæ broadly whitish at the base, tarsi black. Wings hyaline, squamulæ testaceous, stigma blackish; 3d abscissa of the radius sinuated. Antennæ ♂ ♀ 36—37-jointed. Head and thorax beset with whitish pubescence; mesothorax finely punctulate, the sutures faintly traced; metathorax with 2 carinæ, which diverge near the base and thence run parallel to each other to the apex; between them sometimes is a third imperfect carina. Abdomen smooth, shining; segment 1 tricarinated, the middle carina not touching the base. Terebra as long as the abdomen. ♂ ♀. Length, 3 lin.

Unknown to me; the only authority for its occurrence in England is Cur., Guide, 2d ed., column 116. Brischke describes the cocoon as "6 mm. long, 2 mm. broad, almost cylindrical, moderately hard, white, somewhat rough"; there is such a specimen in the Ruthian collection.

iii. *MICRODUS*, Nees.

Nees, Act. Ac. L. C., 1818, p. 304; Reinh., Berl. ent. Zeit., 1867, p. 351.

Maxillary palpi 5-, labial 4- or 3-jointed. Face not produced or rostriform. Mesothorax more distinctly trilobate. Mesopleuræ with a rugulose furrow. Three cubital areolets, the 1st confused with the prædiscoidal.

The only available character for distinguishing this genus from the preceding is the absence, or rather the incompleteness, of the nervure which divides the 1st cubital areolet from the prædiscoidal. As all writers since Wesmæl are agreed to sanction this principle, it is here admitted. Nevertheless the character is of no more than sectional or specific value, and begins already to lead to inconvenient results. I am acquainted with one species which is technically excluded from *Earinus* by its distinct mesothoracic sutures, and equally from *Microdus* because it exhibits the dividing nervure.

TABLE OF SPECIES.

- (12) 1. Second abdominal segment smooth, or with only some faint rugulosity at the base of the curved transverse impression.
- (3) 2. Mesothorax rufous 5. *calculator*, var.
- (2) 3. Mesothorax black.
- (5) 4. Hind coxæ rufous 3. *tumidulus*, var.
- (4) 5. Hind coxæ black.
- (11) 6. Hind tibiæ rufous, their apex fuscous.
- (8) 7. Segment 2 more or less testaceous; (length, 3 lines) 1. *linguarius*, Nees.
- (7) 8. Segment 2 entirely black.
- (10) 9. Orbits and squamulæ black; length, 3 lines 2. *Clausthalianus*, Ratz.
- (9) 10. Orbits partly, squamulæ wholly, rufous; length, $2\frac{1}{2}$ lines 3. *tumidulus*, Nees.
- (6) 11. Hind tibiæ white and black 4. *cingulipes*, Nees.
- (1) 12. Second abdominal segment wholly or partially striolated.
- (16) 13. Third segment entirely smooth.
- (15) 14. Mesothorax rufous 5. *calculator*, Panz.
- (14) 15. Mesothorax black 6. *brevicaudis*, Reinh.
- (13) 16. Third segment with one half at least rugulose.
- (18) 17. Hind coxæ rufous; sometimes black at the base 7. *rufipes*, Nees.
- (17) 18. Hind coxæ black.
- (20) 19. Hind tibiæ half white, half black .. 8. *rugulosus*, Nees.
- (19) 20. Hind tibiæ rufous, their apex black 9. *mediator*, Nees.

1. *Microdus linguarius*, Nees.

Microdus linguarius, Nees, Mon., i., 149; Reinh., Berl. ent. Zeit., 1867, p. 149, ♂ ♀.

Black, shining; palpi black; legs rufo-testaceous, coxæ and trochanters black, hind tibiæ sometimes, and tarsi always, fuscous at the apex; segment 2 rufo-testaceous at the sides and above, where there is a more or less extended, isolated, black patch. Wings rufo-fuscescent, squamulæ black, nervures and stigma fuscous. Face triangular, subproduced. Antennæ 27—30-jointed. Mesopleuræ subrugulose beneath, with a crenulate fovea. Metathorax reticulato-rugulose, with 2 approximate carinæ, diverging in the middle. Segment 1 striolated, depressed at the base, where the margins are obtusely raised, emitting 2 faint carinæ, which are effaced before the middle; gibbous posteriorly; the other segments smooth and shining. Nervure between the 1st cubital areolet and the prædiscoidal widely interrupted. Terebra longer than the body,

or thrice the length of the abdomen. ♂ ♀. Length, ♂ 2, ♀ 3; wings, 4—5½ lin.

Described from one male and two females. The male differs in having the 2d segment entirely black above; the antennæ are 27-jointed. Those of the females are 29- and 30-jointed respectively. In one the 2d segment is margined with black posteriorly. Belly pale at the base. Second cubital areolet triangular, petiolated. The species is next in size to *Clausthalianus*.

I captured the ♂ at Milford Haven, and one ♀ near St. Albans; the other is of unknown origin. Nees v. Esenbeck records a pair taken by him at Sickershausen.

2. *Microdus Clausthalianus*, Ratz.

Microdus Clausthalianus, Ratz., Ichn. d. Forst., i., 58, pl. vii., f. 12, ♀; Reinh., Berl. ent. Zeit., 1867, p. 354, ♂ ♀.

Black; mandibles, palpi, and legs, rufo-testaceous, including the trochanters; coxæ black, the anterior sometimes pitehy beneath; hind tibiæ at the tips, and their tarsi, fuscous. Wings infumated, squamulæ black, nervures and stigma fuscous. Antennæ ♂ ♀ 35-jointed, rather longer than the body. Mesopleuræ smooth and shining, rugulose only in front, and beneath the crenulate fovea. Metathorax reticulato-rugulose, with vestiges of the usual carinæ; evenly convex, and not, as in *tumidulus*, gibbous behind the middle. Segment 1 striolated; 2 with a medial, transverse, arcuate, impressed line, smooth and shining, like the remaining segments. Terebra as long as the body; its valves setaceous. ♂ ♀. Length, 3; wings, 5½ lin.

Three males and five females are in Fitch's collection. The species looks like a large *tumidulus*; but the squamulæ are black instead of rufous, the palpi wholly pale, the orbits without a rufous spot; the antennæ have a few more joints, and the metathorax is differently shaped; but the last character is difficult to seize. Ratzeburg describes it as 3 lines long, which is correct, but his fig. represents it 2½ lines, or nearly the size of *tumidulus*, raising a doubt whether the real *Clausthalianus* has been used for the illustration. The rufous orbits of *tumidulus* are not a constant character, and probably the size of this species and the colour of the squamulæ are the only real means of discrimination.

Two males and three females were bred singly from

Semasia rufillana, Wilk., in July; and another pair from *Depressaria scopariella*, Hein. Also a ♀ by W. Bennett from *Ephippiophora scutulana* (i. e., either *cirsiana*, Zell., or *Pflugiana*, Haw.). Ratzeburg records that several females were reared by Saxesen from *Tortrix hercyniana*, Tr., in the Harz mountains. Cocoon 5 lines long, resembling tissue-paper.

3. *Microdus tumidulus*, Nees. (Pl. VI., fig. 5).

Microdus tumidulus, Nees, Mon., i., 147; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 16, pl. (wing); Reinh., Berl. ent. Zeit., 1867, p. 354, ♂ ♀.

Black; maxillary palpi dusky, or pale with the basal joint dusky; labial dusky with the apical joint pale; a spot on the posterior orbits, and the legs, rufo-testaceous; coxæ, upper trochanters, hind tibiæ at the apex, and their tarsi, black; sometimes the hind tibiæ are obsoletely ringed with dusky near the base. Wings infuscated, squamulæ testaceous or pitchy, nervures and stigma fuscous. Antennæ ♂ ♀ 28—30-jointed. Metathorax somewhat gibbous behind the middle, and sloping thence abruptly to the apex, rugulose, with 2 carinæ diverging in the middle and enclosing an ovate space. The rest as in the preceding species. Terebra as long as the body. ♂ ♀. Length, $1\frac{1}{2}$ — $2\frac{1}{4}$; wings, $2\frac{3}{4}$ — $4\frac{1}{4}$ lin.

Var. 1, ♀. Hind coxæ rufo-testaceous.

Var. 2, ♂ ♀. Orbits entirely black.

Five specimens, two males and three females, taken near St. Albans; and one male bred by W. H. B. Fletcher, of Worthing, from *Ptocheusa inopella*, Zell.; the last belongs to var. 2. According to Reinhard bred once by Möschler from pupa (?) of *Phthoroblastis acuminatana*, Ill., which feeds on *Chrysanthemum leucanthemum*.

4. *Microdus cingulipes*, Nees.

Microdus cingulipes, Nees, Mon., i., 148, ♀; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 18; Reinh., Berl. ent. Zeit., 1867, p. 354, ♂ ♀.

Black; palpi dusky, hardly paler at the apex; 4 anterior femora at the apex, and their tibiæ, rufo-testaceous; hind tibiæ white, the apex, and a ring near the base, blackish; hind tarsi white at the base; the other tarsi darkened towards the last joint, which is black. Wings slightly infuscated, squamulæ black, nervures and stigma fuscous. Antennæ ♂ ♀ 30—31-jointed. Metathorax rugulose, with 2 more or less obsolete carinæ, effaced before the apex,

enclosing a somewhat raised area. Second segment smooth, with a transverse impression; the following segments also smooth and shining. Second cubital areolet petiolated, stirrup-shaped. Terebra as long as the body. ♂ ♀. Length, 2; wings, $3\frac{2}{3}$ lin.

Extremely like the preceding, but, besides the colour of the legs, it may be known by the radial areolet, contracted into a mere line, the curved radius following the contour of the stigma; the areolet is more distinctly petiolated; the squamulæ black; the body shorter and broader; and the 1st abdominal segment rather narrower at the base.

Common; generally found on Umbelliferæ. Two females are in Fitch's collection; and I took a pair at Niton, Isle of Wight, in 1884; several specimens formerly in my collection have perished.

According to Giraud bred by Fallou from *Eupithecia helveticaria*, Boisdu., found feeding upon juniper at Fontainebleau.

5. *Microdus calculator*, Fab.

Ichneumon calculator, Fab., E. S., Suppl., 225; *calculatorius*, Panz., F. G., lxxxiii., 13, ♀.

Bassus calculator, Fab., Piez., 98; Cur., B. E., pl. lxxiii., ♂.

Microdus calculator, Nees, Mon., i., 144; Reinh., Berl. ent. Zeit., 1867, p. 355, ♂ ♀.

M. abscissus, Ratz., Ichn. d. Forst., i., 58; ii., 46, pl. ii., f. 22; iii., 45.

Black; mandibles, palpi, mesothorax, anterior pleuræ, fore and middle legs, rufo-testaceous; coxæ black (anterior coxæ of the ♂ rufo-testaceous); hind legs black, their femora tipped with rufous and the base of their tibiæ dirty white. Wings only slightly infumated, iridescent, with the usual hyaline streak, stigma and nervures fuscous. Metathorax rugose. Segments 1—2 striolated, 2 with a transverse impressed line, the apex and the remaining segments smooth and shining. Terebra as long as the thorax and abdomen. ♂ ♀, Length, $2\frac{3}{4}$ —3 lin.

A typical species, the wings having no vestige of the nervure dividing the 1st cubital areolet from the præ-discoidal. Ratzburg says the antennæ of the ♂ are shorter than the body, but they are not so represented by Curtis. Belly whitish at the base, and cariniform throughout its length. Segment 1 narrowly edged with pale colour at the sides and apex.

This species seems to have been found in England only by Curtis, and no recent specimens are forthcoming. The locality named is the New Forest, about a mile to the north of Lyndhurst, where early in September, 1822, Curtis captured both sexes alighting on the flat stump of a felled tree. Others have been taken in central Europe and Italy. The ♂ was bred by Ratzeburg from buds of pine-tree occupied by *Pissodes notatus*, Fab., at Borutin, in Upper Silesia. The ♀ by Tischbein from *Orchesia micans*, Panz. By Giraud also from a *Boletus* with *Seardia boleti*, Fab., and *Tinea parasitella*, Hüb. By Schönbach from galls of the beech-tree.

6. *Microdus brevicaudis*, Reinh.

Microdus brevicaudis, Reinh., Berl. ent. Zeit., 1867, p. 356, ♀.

♀. Black; palpi at the apex testaceous; anterior femora at the apex, and their tibiæ, rufo-testaceous, hind tibiæ whitish, fuscous at the tips and below the base. Wings infumated. Antennæ 29-jointed. Mesothorax distinctly trilobate. Mesopleuræ shining, impressed with a crenate furrow. Segments 1—2 rugulose; 2 at the apex, and all the following segments, smooth. Terebra a little longer than $\frac{1}{2}$ the abdomen. Areolet sessile, subquadrate, Length, $1\frac{2}{3}$ lin.

The 1st segment is longitudinally rugose, the rugulosity of the 2d is very fine, consisting of transverse curved lines, concave anteriorly. Hind tarsi blackish brown, whitish at the base.

The above is Reinhard's description of the ♀, which I have not seen. The following is very likely to be the ♂, but from the nature of the case there can be no certainty:—

♂. Palpi black; hind tibiæ the same colour as the others, fuscous at the tips and below the base. Antennæ 29-jointed. Second segment with a triangular striolated discal patch, the apex of which reaches the hind margin; the sides smooth; striæ somewhat sinuated, but not transverse, nor concave anteriorly. In other respects the specimen agrees with Reinhard's description, and, according to his table, it is *brevicaudis*.

Reinhard does not say much about the wings. Those of the ♂ have the 1st cubital areolet divided from the prædiscoidal by a visible nervure, contrary to the law of the genus *Microdus*; while the trilobate structure of the mesothorax excludes the species from *Earinus*.

The specimen is in Fitch's collection, and was bred, July 24th, from the larva-case of *Coleophora troglodytella*, Dup., at Guestling, near Hastings.

7. *Microdus rufipes*, Nees.

Microdus rufipes, Nees, Mon., i., 146; Wesm., Nouv. Mém. Ac. Brux., 1837, p. 15; Ratz., Ichn. d. Forst., ii., 47; Reinh., Berl. ent. Zeit., 1867, p. 356, ♂ ♀.

Black; palpi dull testaceous; legs, including the coxæ, rufotestaceous; posterior, or only the hind tibiæ, and their tarsi, tipped with fuscous. Wings slightly infumated, squamulæ subtestaceous, or pitchy, nervures and stigma fuscous. Antennæ ♂ ♀ 32—34-jointed. Mesothorax deeply trilobate. Metathorax rugose, with a medial carina not reaching the hind margin. Mesopleuræ with a crenate fovea. Segments 1—2, and half of 3, striolated; 2 with a curved, and 3 with a straight, transverse impressed line. Second cubital areolet stirrup-shaped, shortly petiolated; nervure separating the 1st cubital areolet from the prædiscoidal inchoate at both ends. Terebra as long as the body without the head. ♂ ♀. Length, 2—2½; wings, 4—4¾ lin.

Var. Anterior half of the 2d abdominal segment rufous.

The 2d segment in some specimens is pitchy, or sub-ferruginous; in one ♂ the hind coxæ are black at the base. But the general colour of the legs, together with the extended rugulosity of the abdomen, are good characters by which to determine the species. According to Nees all the tibiæ are tipped with fuscous, and the terebra is as long as the body; hence Wesmael doubts whether his own *rufipes* is the same; but such discrepancies are not of much consequence.

Four males and two females from Darent Wood, and a male bred by Elisha, July 31st, from *Coleophora gryphipennella*, Bouché. Giraud also bred it from a *Coleophora*, and Goossens from *Pardia tripunctana*, Fab. According to Ratzeburg, Bouché reared male and female from *Hedya ocellana*, Fab.; and again from *Andricus terminalis*, Fab., in which several lepidopterous larvæ are to be found.

8. *Microdus rugulosus*, Nees.

Microdus rugulosus, Nees, Mon., i., 148, ♀; Reinh., Berl. ent. Zeit., 1867, p. 357, ♂ ♀.

Black; palpi fuscous, the maxillary rufous at the tips; anterior femora and tibiæ rufous; basal half of hind tibiæ white with a fuscous ring, the other half black; spurs white; hind tarsi black, white at the extreme base. Wings infumated. Segments 1—3 punctulato-rugulose, 2—3 in the middle transversely impressed; the other segments smooth and shining. Second cubital areolet sessile. Terebra as long as the body without the head. ♂ ♀. Length, 2 lin.

Var. Anterior coxæ and hind femora rufous, the latter tipped with black; segment 2 rufescent at the base.

Introduced as British on the authority of Curtis, Guide, 2d ed., column 116; no specimens being at hand. The description is from Nees and Reinhard. According to Nees it differs from *cingulipes* in the rugulosity of the abdomen, and the form of the 2d cubital areolet. Segment 1 rimuloso-striate; 2—3 punctulato-rugulose and dull, each with a straight transverse medial depression; 3 on the hind margin, and all the following, smooth and shining. Reinhard says the terebra is as long as the body. Coxæ and upper trochanters black, the lower rufous. Anterior legs rufous, their femora narrowly black at the base.

One ♀ was taken by Nees v. Esenbeck at Sickershausen. Subsequently, according to Reinhard, obtained at Hambach by Eichhoff, in July, from bark at the roots of oaks, together with *Bostrychus villosus*, Fab.; and by Von Heyden from rotten wood in forests, and on the trunks of oaks.

9. *Microdus mediator*, Nees.

Microdus mediator, Nees, Mon., i., 146; Reinh., Berl. ent. Zeit., 1867, p. 357, ♀.

Black; palpi concolorous; femora and tibiæ rufo-testaceous, hind tibiæ with a ring near the base, and the apex, blackish; tarsi fuscous. Wings infumated, squamulæ black, nervures and stigma fuscous. Antennæ 29-jointed. Metathorax finely reticulato-rugulose, with 2 longitudinal carinæ. Segment 1 rugulose, 2, and 3 at the base, minutely rimulose, more punctulate at the sides; the rest smooth and shining; segment 2 distinctly shorter than broad, and with a medial transverse depression, more faintly repeated on the

3d. Second cubital areolet sessile, quadrangular. Terebra as long as the abdomen. ♀. Length, $2\frac{1}{4}$ lin. The British specimen is only $1\frac{1}{2}$ lin. long; wings, 3 lin.

Distinguished by the shortness of the terebra and of the 2d segment. In the British specimen the femora are narrowly infuscated at the base; the intermediate tibiæ, as well as the hind pair, are infuscated at the tips, and faintly annulated below the base with the same colour.

One ♀ taken at Maldon by Fitch, August 11th.

iv. ORGILUS, Hal.

Hal., Ent. Mag., i., 262; iii., 143; Reinh., Berl. ent. Zeit., 1865, p. 260.

Maxillary palpi 6-, labial 4-jointed. Face not produced or rostriform. Mesothorax trilobate. Mesopleuræ with a crenulate furrow. Two cubital areolets, the 1st distinct from the prædiscoidal.

Form narrow, linear. Head scarcely as wide as the thorax; occiput distinctly margined; face with 2 deep foveæ above the clypeus. Wings short, narrow; stigma lanceolate, not bulging beyond the costa; radial areolet narrow, cuneiform, yet broader than in the preceding three genera, ending much before the apex of the wing; radial originating beyond the middle of the stigma; 1st intercubital nervure oblique, almost in a line with the 3d abscissa of the radius. Hind coxæ, spurs of the hind tibiæ, and terebra, elongate; the coxæ also incrassated.

In the 'Magazin der Gesellschaft naturf. Freunde zu Berlin,' Nees v. Esenbeck, in 1814, described four species of this genus, forming Section II. of his *Microdus*, viz., *M. punctulator*, *levigator*, *obscurator*, and *annulator*. These he repeated in his Monograph in 1834, with the addition of another species, *rugosus*, which he inconsistently placed under *Microgaster*. Haliday, in 1833, established the genus *Orgilus* for *Microdus* Sect. II. of Nees, and in 1835 described the British species *obscurator*, regarding *levigator* and *annulator* as synonyms. He placed *Orgilus*, on account of the number of joints in the palpi, in the same group as *Zele* and *Macrocentrus*; an arrangement which is supported by the general resemblance of those genera. The affinity of *Orgilus*, however, to the *Agathis-Microdus*-group is much more striking, and those who regard the palpi of Hymenoptera as affording characters of only secondary value, will

probably agree with Nees, Wesmael, Ratzeburg, and Förster in considering the genus here rightly placed. Wesmael, in 1837, published it under the name *Ischius*; Hartig in the same year united it with *Eubadizon*; and Ratzeburg (1844—52) distributed the three species known to him under *Ischius*, *Microdus*, and a new genus named *Macropalpus*. *Orgilus* is fully discussed, and four species described, by Reinhard, *l. c.*

Orgilus obscurator, Nees. (Pl. VI., fig. 6).

Microdus obscurator, Nees, Mon., i., 151; *lavigator*, 150; *annulator*, 152, ♀.

Orgilus obscurator, Hal., Ent. Mag., iii., 145; Reinh., Berl. ent. Zeit., 1865, p. 263, ♂ ♀; S. v. Voll., Pinac., pl. 29, f. 9 (♀ abdomen).

Ischius obscurator, Wesm., Nouv. Mém. Ac. Brux., 1837, p. 21, pl. (wing); Ratz., Ichn. d. Forst., ii., 46, ♂ ♀.

Eubadizon leptocephalus, Hart., Jahresb., 1837, p. 268, ♂ ♀.

Macropalpus leptocephalus, Ratz., Ichn. d. Forst., i., 57, ♂ ♀, pl. vii., f. 9 (with parts of the mouth).

Black, with black palpi; 4 anterior femora at the apex and underneath, and the tibiæ more or less, rufescent. Wings infumated, with a decolorous angulated mark beneath the stigma, which, as well as the nervures, is fuscous. Antennæ 27—33-jointed, of the ♀ as long as the body, of the ♂, longer. Head and thorax hardly shining; mesothoracic sutures shallow. Mesopleuræ, at least above the fovea, smooth. Metathorax rugulose. Segments 1—2 minutely and thickly exarated, dull; the apex of both, and sides of the latter, with the remaining segments, smooth and shining; segment 2 not shorter than its basal breadth. Hind coxæ dull, pubescent. Terebra sometimes as long as the body; usually somewhat shorter. ♂ ♀. Length, $1\frac{1}{2}$ — $2\frac{1}{4}$; wings, $2\frac{1}{2}$ — $3\frac{1}{2}$ lin.

Var. ♂. Antennæ at the base, and 2d abdominal segment at the sides, rufous.

The variations are trifling, and never such as to obscure the species. The wings are more or less dark, and segments 1—2 sometimes nearly smooth.

Not uncommon, especially on sandy coasts; found by Haliday in England and Ireland; by me often at Milford Haven, in the Isle of Wight, and in the Forest Hills, Leicestershire; also at Rannoch; in Corsica, and the

Pyrenees. Bred singly by Elisha and W. H. B. Fletcher from *Coleophora alcyonipennella*, Kol.; by J. Sang from *Lita acuminatella*, Sircom; by Colquhoun from *Coleophora discordella*, Zell.; by W. H. B. Fletcher from *Euchromia mygindana*, Schiff.; *Coleophora niveicostella*, Fisch.; *Larerna miscella*, Schiff., and one undetermined larva; and by Weston from galls of *Cynips Kollari*, Hart., inhabited by various *Tortricidæ* (Entom., 1880, p. 259). According to Reinhard it is most commonly obtained from *Retinia buoliana*, Schiff., and other *Tortricidæ*; Brischke bred it from this host and from *R. resinana*, L.: in the Vienna Museum is a ♀ from *Anacampsis anthyllidella*, Hüb. According to Ratzeburg, bred by Reissig and Heyer from *R. buoliana*; also by Dr. Giraud. At the Hague, according to S. v. Vollenhoven, July 4th, from *Depressaria hypericella* [*i. c.*, either *liturella*, Hüb., or *conterminella*, Zell.], and, July 27th, from a *Coleophora*.

EXPLANATION OF PLATES.

PLATE I.

- FIG. 1. *Bracon lævigatus*, Ratz., ♀.
 1 a. ,, *brevicornis*, Wesm., ♀,
 1 b. ,, ,, , wing.
 2. *Phanomcris catenator*, Hal., ♀.
 3. *Xenarcha lustrator*, Hal., ♂.
 4. *Bathystomus functus*, Hal., ♀.
 5. *Rhysipolis mediator*, Hal., ♀.
 6. *Rhyssalus indagator*, Hal., ♀.
 6 a. ,, ,, , ♂ leg.

PLATE II.

1. *Colastes decorator*, Hal., ♀.
 2. *Oncophanes lanccolator*, Nees, ♀.
 3. *Spathius rubidus*, Rossi, ♀.
 4. *Hecabolus sulcatus*, Curt., ♀.
 4 a. ,, ,, , ♂ wings.
 5. *Dimcris mira*, Ruthe, ♀.
 6. *Cæloides scolyticida*, Wesm., ♀.
 7. *Doryctes Heydenii*, Reinh., ♀.

PLATE III.

- FIG. 1. *Histeromcrus mystacinus*, Wesm., ♀.
 2. *Chremylus rubiginosus*, Nees, ♀.
 3. *Hormius moniliatus*, Nees, ♀.
 4. *Clinocentrus exsertor*, Nees, ♀.
 5. *Petalodes unicolor*, Wesm., ♀.
 6. *Pelecystoma lutea*, Nees, ♀.
 6 a. " " , maxillary palpus.

PLATE IV.

1. *Heterogamus dispar*, Curt., ♂.
 2. " " , ♀.
 3. *Rhogas irregularis*, Wesm., ♀.
 3 a. *Zygena filipendulæ* larva from which *Rhogas bicolor*
 has emerged.
 4. *Allodorus lepidus*, Hal., ♂.
 5. *Sigalphus obscurellus*, Nees, ♀.
 6. *Phanerotoma dentata*, Panz.

PLATE V.

1. *Chelonus cancscens*, Wesm., ♀.
 1 a. " *sulcatus*, Nees, ♂ abdomen.
 2. *Ascogaster instabilis*, Wesm., ♂ var.
 3. *Sphæropyx irrorator*, Fab.
 4. *Mirax spartii*, Hal., ♀.
 5. *Acalius subfasciatus*, Hal., ♂.
 6. *Apanteles ferrugineus*, Reinh., ♀.
 7. *Microplitis xanthopus*, Ruthe, ♀.

PLATE VI.

1. *Microgaster russatus*, Hal., ♂.
 2. " *tiro*, Reinh., ♀.
 3. *Agathis brevisetis*, Nees, ♂.
 3 a. " " , head.
 4. *Earinus gloriatorius*, Panz., ♀.
 5. *Microdus tumidulus*, Nees, ♀.
 6. *Orgilus obscurator*, Nees, ♀.

- II. *Further notes upon the markings and attitudes of lepidopterous larvæ, together with a complete account of the life-history of Sphinx ligustri and Selenia illunaria (larvæ).* By EDWARD B. POULTON, M.A., F.G.S., F.Z.S., of Jesus and Keble Colleges, Oxford.

[Read September 3rd, 1884.]

PLATE VII.

IN the following paper I have described the segments of larvæ as follows:—Head, 1st, 2nd, and 3rd thoracic segments (or prothorax, mesothorax, and metathorax), followed by the abdominal segments numbered one to nine. It seemed better to adopt this more accurate method of description than to number the segments from the head backwards after the ordinary manner (which was used in my last paper in this Society's 'Transactions,' 1884, pp. 27—60).

1. THE ONTOGENY OF SPHINX LIGUSTRI.—I was enabled to obtain ova through the kindness of Mr. Meldola and Mr. William White (who informed me that Messrs. W. and J. Davis, of Dartford, had fertile ova for sale). This was very fortunate, as I was anxious to work out the ontogeny, and fertile ova of *Sphinx ligustri* have always been difficult to obtain.

Ocum.—The ova were laid July 8th (1884): they are oval, but without much difference between the two sexes (about 1.75 mm. long and 1.5 mm. wide). They are slightly flattened from above downwards; the colour is a bright yellowish green, evidently harmonizing better with the under than the upper sides of the leaves of its food-plants, and especially so with regard to privet. Twenty of the eggs sent to me were fixed to privet-leaves, and of these seventeen were attached to the under side and only three to the upper. Of course these were laid in confinement, and it is very likely that all the ova are fixed to the under side in a state of nature. There is also a probably more important

reason why this should be the case, for the ova are thus protected to a large extent from rain and sun, besides being sheltered from observation. After a few days a depression appears on the upper surface, and the colour becomes less delicate and transparent. Soon afterwards the ovum is opaque, yellowish, and mottled with bright green. The young larvæ emerged July 16th—18th, their development being thus very rapid.

Stage I.—The following statements depend upon the observation of about fifty larvæ fed in separate divisions upon privet, lilac, and ash. It may be regarded as certain that these young larvæ generally eat part of the egg-shell after emergence. I did not see this actually taking place, but I watched it in the case of *Smerinthus ocellatus*, and a comparison of what was left of the shells in both cases showed that *S. ligustri* has the same habit. The amount eaten was very variable, but was never more than three-quarters of the whole, and often there was an aperture barely large enough for emergence. In such cases the larvæ cannot have eaten the shell after hatching.

The larva just after emergence was 5.25 mm. long when extended in walking, and the horn was 3 mm. long. Sometimes, however, the horn was very nearly as long as the body. The colour of the body is a pale, transparent, very slightly greenish yellow, the head being much greener than the body (see fig. 1, \times 4, Plate VII). The horn is black, but the upper half of its length is transparent and greenish, because the green internal fluid shines through the dark exterior. It certainly cannot be called "green," as Kleemann states. The horn tapers very slightly and is straight, except that the upper part is bent downwards in a gentle curve. The blunt tip is bifid, and each process ends in a fine and fairly long bristle, so that the structure is prong-like when viewed from above. The body is thinly clothed with long fine black hairs. These are arranged in four rows, two dorsal (one on each side of the middle line), and two lateral (a little above the spiracles). Each of these four rows is made up of two hairs on each segment, from the 1st to the 7th abdominal (both inclusive). Posterior to the latter the hairs are more abundant, but still thin, and without definite arrangement. Upon the thoracic segments the hairs are arranged so as to continue the four lines described above, but they are less numerous (at any rate

in the case of the two upper rows, where there is only one hair to each row on each segment). The head is thinly covered with similar hairs.

In addition to these long hairs there must be a comparatively thick coating of much smaller ones. I was able to prove their existence at a later date by the use of the compound microscope, or even by a powerful hand lens; but I was away from home and without a sufficiency of appliances when the larvæ were in the first stage. There can be no doubt of their presence, and they cover the horn as well as the body. The two bristles forming the terminal prong are also hairs. The mandibles are green with the cutting edges black: the ocelli are black and distinct. The spiracles are hard to make out, and the dorsal vessel is visible but not distinct. The head is rounded and of a generalised larval shape and not *Sphinx*-like. The horn is flexible and movable. It soon becomes straight, and may be held at an angle or parallel with the back. The young larvæ spin webs for foot-hold, and readily suspend themselves by threads. This fact has already been observed by Kleemann, and it is very interesting, as the habit is so entirely abandoned later, although it appears again before pupation. The disappearance of this habit probably follows from the great size and weight of the larva, which render this method of attachment and suspension comparatively useless. It is of especial use when the larva clings to the flat under side of the leaf at any point except (that usually selected) the projecting midrib. Later the larva gains security by the extreme power of its claspers. A similar change of habit is better seen in the larva of *Dicranura vinula*, because here the presence of the web exactly corresponds to foot-hold upon the leaf. It is to be noted, however, that this larva does not lose the habit to the same extent as *S. ligustri* (or *S. ocellatus*), and that when young it clings to the smooth upper surface of the leaf. The protective resemblance is to the under side of the leaf, and the larvæ are especially hard to distinguish when seated on the midrib, and in this position they seem nearly always to rest. The dorsal vessel becomes very distinct after the larvæ have fed for a short time, and the tracheal system is visible. The larva becomes greener, and the first trace of marking appears with the formation of a white circular patch round the base of

each long hair in the four rows. The patches are especially distinct on the dorsal rows, and the larva therefore shows four spots on the back of each abdominal segment in front of the 8th, and two spots on the back of each thoracic segment. Weismann describes and figures similar spots on the thoracic segments of a larva of *Smerinthus populi* in the first stage. These white patches are the first readily seen shagreen dots. Then minute white spots appear all over the body, which are the white areas round the bases of the smaller hairs. Then by a linear arrangement of the white spots (in which both large and small take part) the essential markings are established (see fig. 2, $\times 3$, Plate VII.). The subdorsal becomes distinct before the oblique stripes, and the latter are rather faint during the whole of this stage. The white subdorsal is perfectly normal, extending the whole length of the body and bending gently upwards anteriorly in the 1st thoracic segment, and posteriorly into the base of the horn (being continuous with the 7th oblique stripe). The subdorsal may be seen to be formed of white dots, which are also present over the whole surface, but are not conspicuous. So also with regard to the oblique stripes, but here there is an interesting relation to the larger spots. The anterior dorsal pair on each segment always form part of the stripes, but the latter, converging posteriorly, fall within the hinder pair. So also the anterior spots only of the lateral rows on each segment fall into the oblique lines. The long hairs can still be seen on the spots while the latter are contributing to the oblique lines. There is a very minute and faint "8th stripe" in front of the 1st oblique stripe on the 1st abdominal segment. It does not extend downwards far enough to meet the subdorsal. The effect of the series of large dorsal dots on the thoracic segments (two on each) is to produce the appearance of a very indistinct line above and parallel with the anterior part of the subdorsal. This line is also contributed to by the smaller dots. As the small anterior oblique stripe does not reach the subdorsal, but stops at about the level of the hinder end of this indistinct line, there is an appearance of continuity between the anterior stripe and the line. This, however, does not really take place, as the former stripe is prolonged for a very slight distance below the posterior end of the horizontal line. These markings are very

persistent in after stages, and they are therefore described in detail. This stage lasts about six or seven days in most instances. At the close of the stage (before changing the skin) the larvæ are about 12 mm. long when extended in walking. (Fig. 2, $\times 3$, Plate VII., shows a larva at this period of growth). The larva is about 10.5 mm. long when rather retracted at rest, the horn 4 mm. long.

Stage II.—The markings of this stage almost exactly resemble those of the last (see fig. 3, $\times 2$, Plate VII.), and the origin of the lines and stripes from linear series of shagreen dots is equally obvious. The large spots and long hairs have now disappeared, except those that enter into the 8th stripe and indistinct line above the subdorsal on the thoracic segments. This line is whiter than the other markings, which are yellowish white (see fig. 8, $\times 3$). Minute hairs still terminate the shagreen dots, whether arranged in lines or covering the surface of the body. This fact is true of the dots whenever they appear in any stage. The margins of the claspers, tips of true feet, and spiracles have a pinkish tinge. The horn is pink immediately after the change of skin, but it soon darkens, and possesses a brownish-red ground colour covered with dark tubercles (shagreen dots) pointing upwards and terminated by minute hairs. The apical pair is arranged so as to cause a bifid termination, but this is not nearly so distinct as in the last stage. On each side of the base the ground colour of the horn is free from tubercles, and hence appears as a brownish red continuation of the 7th oblique stripe. The horn is movable, and is sometimes depressed, so as to become parallel with the line of the back, while at other times it is elevated to the usual position of an angle of 45° . The same thing occurs in the first stage. The larva still rests, as a rule, on the midrib of the under side of a leaf. The head is shagreened, and shows indications of its ultimate appearance in the occurrence of a marginal line (white) round the face. In this stage the oblique stripes are very distinct, and the subdorsal indistinct, except anteriorly. The length of a full-grown larva comfortably stretched at rest is about 18 mm. After ecdysis the skin is, I believe, always eaten, except the head and horn, which seem to be invariably rejected. This stage lasted about nine days in most cases.

Stage III.—After the second ecdysis the larvæ very much resemble the previous stage. The chief difference is in the subdorsal, which has disappeared except anteriorly, and is indistinct even where it is retained. The horizontal stripe above the subdorsal is distinct, and so are the prominent white spots on the thoracic segments (one pair on each). This line has the same relation to the 8th stripe, but the continuity is only apparent, for careful observation shows that the latter extends below the posterior extremity of the former. This is also true of previous stages. At this time, and in the second stage, the larva bears the closest resemblance to a *Smerinthus* larva in every respect, except the dark colour of the horn and the shape of the head. In this stage the larva habitually rests (still upon the mid-rib) in the *Sphinx* attitude, which is also assumed, though exceptionally, in the second stage, and is even seen in the first. There is still a trace of the bifid termination to the horn (see fig. 10, $\times 50$, Plate VII.). Shortly after ecdysis the colours darken in certain parts: the pink horn becomes dark brown with black tubercles, as before, the effect being nearly black, except at the sides of the base. A black cloud appears on the side of the head and extends downwards behind the yellow line at the margin of the face. There is much variability in this respect, some larvæ having no trace of black on the head. The spiracles are ochreous, as in the adult, but more faintly. The true legs become red, and a dark purplish margin appears round the claspers. The anal flap has a white margin. The ground colour is yellowish green above, darker green below, and this latter extends upwards in front of the oblique stripes as a dark shading for one-third of their length. (The depth of colour is very variable). The shagreen dots are yellowish white, those forming the stripes being much larger and whiter than the others. At first the component dots of the stripes are distinctly separate, but later they enlarge and fuse, producing the appearance of a white band, upon which is a single row of tubercles, each emitting a minute hair. These tubercles are the original shagreen dots, and each is placed in the centre of a white area, which has spread from the base of the former into the ground colour. The areas form the white stripe, and they can be readily distinguished, as each is situated upon one of the secondary rings into which each

segment is divided. The secondary annulation began in the first stage, and is present throughout larval life. There are eight of these annuli on each of the segments that bear the oblique stripes, except the 8th abdominal. Where this latter segment is crossed by the upper part of the 7th stripe entering the base of the horn the annulation is not present, and the adjacent areas are not separated by furrows (between the annuli on other segments), and therefore fuse at an early date. The 7th stripe is also much whiter and more conspicuous than the others. As the larva advances in this stage the subdorsal and the stripe above it become indistinct, but the 8th stripe becomes more prominent, and is especially well seen as a V when the larva is looked at from above. The head is shagreened, as in previous stages.

But the most interesting fact about this stage is the appearance of the purple borders to the white stripes. These were never present at ecdysis, and in some instances they did not appear at all in this stage (in the case of very light varieties). So also the time at which they made their appearance varied greatly, and the extent to which they were developed. The stripes are linear and very narrow: they first appear as a brownish rather than purple edge to the central part of the 1st and 7th stripes. Then they appear in front of the others nearly at the same time, and without any definite order. It seemed that the 1st stripe gained a border rather before the 7th. The purple edge is not a modification of the white stripe, but is distinctly due to a darkening of the ground colour. So far from the shagreen dots having any relation to the border, they are either absent from it or very small (which is also true of the ground colour anterior to the whole length of the stripe). There is nothing spot-like in the first appearance of the border; it is always very narrow and linear. Its first appearance confirms the view that I expressed last year (*Trans. Ent. Soc. Lond.*, pt. I., 1884), *i. e.*, that the border is a modification of the ground colour in front of the white stripe, and is not due to the drawing out of patches of colour that appear in this position: in fact that the border is linear primarily and not secondarily. Kleemann states that the larvæ acquire the purple borders in the fourth stage, and Weismann says that he has observed the same thing. Nearly all my larvæ acquired the borders in the third stage, as

above. At the conclusion of this stage the larva is about 25 mm. long, when stretched comfortably at rest. This stage only lasted about six days. A larva at the end of this stage, comfortably extended at rest, is shown at fig. 4, $\times 2$.

Stage IV.—The larva at the beginning of this stage is exactly similar to one in the last, except for the greater size of the purple borders. The subdorsal and line above it are present at first, but subsequently disappear, while the 8th stripe remains. The pair of distinct dots are at first visible on each thoracic segment, but they afterwards cease to be recognisable, together with the line of which they form part. The 7th stripe is continuous, and so also are the central parts of the others where the purple border is present. The latter varies in amount, and I have seen it almost absent, except on the 1st and 7th stripes. Immediately after ecdysis the dots of the stripes are separate (fig. 9, $\times 4$). The stripes are pure white where they are bordered with purple, but yellowish above this part, while the purple gives place to dark green. The purple and pure white change to the other colours before reaching the posterior limits of the segment they are crossing, while in the fifth stage the change takes place in the next segment posteriorly. The white stripes are continued inferiorly and anteriorly into a very distinct row of white tubercles on the next segment anteriorly (as in the adult). The ground colour of the part of the surface on which the oblique stripes run (except the inferior continuations just mentioned) is a much brighter and yellower green than the rest of the body. The upper yellowish part of the oblique stripes is formed of distinct and separate yellow tubercles. This is the stage of the *Sphinx* attitude, and the head is held higher and further back than at any other time. As the larva approaches the end of the stage it becomes very adult-looking, this effect being especially produced by the shagreen dots becoming less conspicuous. There is great variation in the darkness of the larvæ, the dark forms having black sides to the head, while the purple borders deepen anteriorly and inferiorly into very nearly black. The lightest larvæ have hardly any black on the head, and the purple only deepens to brownish. There is every shade of difference between these extremes. A full-grown larva in this stage is about 33 mm. long in the *Sphinx* attitude, but much longer when extended

(see fig. 5, rather over natural size). This stage lasts about six days.

Stage V.—At the beginning of this stage the larva is about 33 mm. long when at rest in a rather contracted state after the effort of ecdysis. This is the last stage, and the larva is, of course, well known. Nevertheless, there are some extremely interesting facts about it, especially concerning the change from a shagreened to a very smooth larva. Immediately after ecdysis the body is shagreened all over with minute dots, which still terminate in hairs (see fig. 6, Plate VII., natural size). I formerly suggested (in the paper already referred to) that the row of white dots continued anteriorly and inferiorly from the white stripes were the remnants of the shagreen dots. This is now certain, for they have been traced through the ontogeny, and further, even in this stage, each one of them terminates in a minute hair, which is retained to the end. The shagreening very quickly disappears, but it can be detected with a powerful lens, and always remains visible (though very minute) upon the under surface of the body. Although the horn is so smooth and shining in this stage, traces of the tubercles can still be made out. The 8th stripe is always present after ecdysis, but it quickly disappears. The deep black of the horn and sides of the head are replaced by dark green after ecdysis, but the latter darkens in a few hours. The shagreening seems to disappear by a change of colour into that of the surrounding ground colour, and a gradual disappearance of the raised eminence which forms each dot. There is the same variability in darkness as shown by the different degrees of depth attained by the lower part of the purple border. When this becomes very dark some patches appear on the other (inferior) side of the white stripe. I described this variety last year from a single instance found in the field, but it was quite common among the larvæ reared during the past summer. The larvæ turned brown in many cases on August 21st, this stage having lasted about nine days. Thus the whole larval life lasts about five weeks. There were many exceptions to the periods given for each stage (which were, as far as possible, average instances).

Summary.—There are many interesting points about this life-history. Such are the well-developed subdorsal in the early stages (for the probable existence of which

Weismann argued, although it had not been observed by Kleemann), the 8th stripe and horizontal stripe above the subdorsal (anteriorly), the relation of the large shagreen dots to the markings in the first stage, and their long persistence on the thoracic segments, the appearance of the purple stripes in the course of the third stage, the change from a shagreened to a smooth larva in the fifth stage, and the immense size of the horn in the first stage, its bifid tip, and the fact that it is movable. The great resemblance to a *Smerinthus* larva is also very interesting, the only essential differences being the loss of shagreen in the last stage and the acquisition of purple borders in the third, and the shape of the head. It is probable that the ontogeny is in some respects more primitive than that of *Smerinthus* larvæ. It is certainly more advanced in the later stages, as is proved by the purple borders, the change to a smooth skin, and the relatively early and complete disappearance of the subdorsal. Nevertheless, in the first stage the subdorsal predominates over the oblique lines to a greater extent than in *Smerinthus*, and the horn is far larger, more distinctly bifid and it is movable. It is very probable that all these are primitive characters. It is certain that relative size is primitive, for the horn is universally largest in the earliest stages. In this respect *S. ligustri* is probably the most primitive *Sphinx* larva known. It is therefore likely that the other characters are also primitive, and that additional knowledge concerning the horn of the ancestral *Sphinx* larva is afforded in the early stages of this ontogeny. I shall presently give reasons for the belief that the bifid termination is a primitive feature, derived from a comparison of the larvæ in which it has been observed. It will further be rendered probable that the power of movement is also primitive.

2. FURTHER NOTES UPON THE ONTOGENY OF SMERINTHUS OCELLATUS. — AS I WAS rearing a number of these larvæ from the egg for the purpose of experimenting upon phytophagic coloration, there was a good opportunity for noting any additional facts in their ontogeny (which is systematically given by Dr. Weismann).

Stage I.—I have seen the young larva eating its egg-shell after emergence, but it is never completely eaten, and sometimes only enough for escape. Sometimes a

larva eats part of another empty shell lying close to the one from which it has just emerged. In one case I saw a newly-hatched larva attack a thread of the gauze to which the eggs were attached, but it soon left this and ate its shell. The process of gnawing through the shell can be watched with a lens. Very slow progress is made as long as the larva is completely within, and is biting at the concave surface of the shell. When a small hole has been made one mandible is thrust outside, and the shell is very quickly eaten away from the edge of the aperture, until the larva can emerge. The young larva is of a beautiful yellowish-green colour upon the body, while the horn is red. (The length is 5.5 mm. when extended in walking; the horn 2 mm. long, and thus much shorter than that of *S. ligustri*). The horn is bifid, like that of *S. ligustri* (but to a less extent), and terminates in two bristles, while the rest of its surface and that of the body is densely covered with short whitish hairs. There were never any indications that the horn could be moved. The head is thinly covered with similar hairs. The larva spins a web in the same manner as *S. ligustri*. (It should be mentioned that these webs are very slight, and only detected by careful watching. This may explain the failure of other observers in finding them). The ocelli are black and very distinct on the light green head. The oblique stripes and subdorsal can be just made out with difficulty in a newly-hatched larva, but there is no darkening of the ground colour in front of the stripes, although this appears at the end of the stage. The usual attitude on the leaf was as in *S. ligustri*, and with the same protective significance. At the end of the stage the regular markings are very distinct. Even at this time the subdorsal is more distinct anteriorly than in the rest of its extent. I was very much astonished to find a very small proportion of the larvæ with the head of the typical *Smerinthus* shape, while the others possessed the more generalised round shape. I could at first hardly believe the accuracy of the observation, but it was subsequently confirmed, and there can be no doubt that this is an instance of the passage backwards of a character in the ontogeny actually taking place before us. The shagreen dots are very numerous, and each hair springs from the summit of a dot. The markings are caused by the dots becoming arranged in a linear series, without the ground

colour being as yet affected. The annulation of the segments is very distinct and continues throughout. The 8th stripe is present. The markings are yellowish. Weismann has stated that there are no markings on the newly-hatched larvæ. This is certainly the general effect of the larvæ, but a lens and a good light will prove that the markings are really present.

Stage II.—In this stage the markings are whiter. On the summit of the head are two prominent light red tubercles; these are only enlarged shagreen dots, and each has a hair upon it. The apical tubercles are the topmost of the two rows that form a marginal line round the head as seen from the front. The horn is red and bifid. It is covered with hair-bearing tubercles, which persist upon it and upon the body throughout the whole of larval life. The gradual spreading of a white area from the base of a tubercle in the oblique stripes is well seen in this stage. At the beginning the stripes are only rows of separate tubercles, except where the 7th stripe enters the 8th abdominal segment. In this case the ground colour is white from the first (and here there is no annulation to keep the dots apart). Although the tubercles enlarge in this stage they do not coalesce, except in the 7th stripe, and here they ultimately coalesce where the stripe crosses the 7th as well as the 8th abdominal segment. The markings are exactly on the plan of the adult, except that the subdorsal is faintly continued posteriorly between the oblique stripes (and even this is sometimes present in the adult). The best way of seeing the hairs of this larva is to hold it up to the light and examine some surface (*e. g.*, the back) in profile with a lens. It is then seen to be densely covered with very short hairs, each projecting from the summit of a shagreen dot.

Stage III.—Almost exactly similar to the last. The subdorsal has disappeared, except anteriorly. The horn is bifid in many cases, and is red above, faintly so below, white at the sides. There is much variability in the amount of red on the horn. The red tubercles on the head are rather less defined in shape, and the colour often spreads on to the smaller tubercles near the two large ones (see fig. 12, $\times 3$, Plate VII.). The 8th stripe is barely indicated by a linear arrangement of tubercles. There is a linear arrangement of dots on each side of the dorsal vessel, which is very conspicuous when the

larvæ are seen from above. The darkening of the ground colour in front of the oblique stripes takes place from above downwards: in *Sphinx ligustri* it was in the reverse direction (but the purple appeared in front of the middle of a stripe). The *Sphinx* attitude of this larva is somewhat geometriform, the last two and sometimes three pairs of claspers being used, the others retracted very completely. This is also true of the other stages. On examining the hairs upon the shagreen dots with a compound microscope (using a lens of about fifty diameters) it is seen that nearly all of them are forked at the tip. The fork generally consists of two prongs, but occasionally of three or even four, and sometimes the hairs end simply. With higher powers (200 diameters) it is seen, in optical section, that the base of the hair penetrates the apex of the shagreen tubercle (see fig. 11, $\times 188$, Plate VII.). The hairs on the red tubercles (on the summit of the head) seemed to be rudimentary, and were not forked in any larvæ that I examined. The ends of the hairs often appeared as if they were cut off short, while the sides were produced into slight horns: this is evidently a form of two-pronged fork. These appearances are found on the hairs of the whole surface. I do not yet know how far these facts about the hairs are true of all the other stages.

Stage IV.—The markings are similar to those described in the last stage. The darkened ground colour in front of the stripes has no dots on it, or only very small ones. So also with the dark dorsal line, which has a row of dots on each side of it, producing altogether a very midrib-like appearance. Thus in a larva uniformly dotted with white tubercles, the linear arrangement of the tubercles produces white stripes, while their linear disappearance produces dark lines. The red tubercles are still present, and their colour tinges a few small ones near to them. Towards the close of the stage their colour becomes less conspicuous, and often inclines towards orange. It is now noticed for the first time that the first spiracle is concealed beneath a fold of the contracted prothorax in the protective attitude. The horn is still red and white. The hairs, which are so minute over the general surface, are at all times much longer upon the anal flap and last pair of claspers. At the close of the stage the horn becomes light blue, but

its tip is sometimes green. Before ecdysis the light red tubercles on the head of the last stage can be seen through the skin of the fourth.

Stage V.—A faint pink tinge is very common upon the white stripes of this species, and it is especially noticeable in this stage, although it also occurs in the fourth. It occurs on the tubercles and ground colour, and is chiefly developed on the 7th stripe, although it is often present on the others, and even on the remnant of the subdorsal. The two tubercles on the head are now blunt, but still large: their summits are red at the beginning of the stage, the bases yellow (see fig. 13, $\times 2$, Plate VII.). Very soon the red is entirely replaced by yellow (see fig. 14, $\times 2$, Plate VII.). The head is not generally a bright blue, like the tail, but is greenish at first, becoming greenish blue later (sometimes it is bright blue). My larvæ did not, as a rule, nibble off each other's horns, but a few were treated in this way. I found seven larvæ on one small tree of *Salix Babylonica*, and nearly all of them had lost more or less of the horn. This injury may take place quite early in the life-history, and I think that it is often extremely hurtful or even fatal, as a considerable amount of fluid is lost. The midrib-like appearance often occurs in this stage also, produced by the dark dorsal line with a row of white tubercles on each side.

Conclusions.—I formerly suggested that the red spots which sometimes appear in *Smerinthus* larvæ are due to reversion to a more brightly coloured condition. It is possible that the pink tinge to the white stripes is to be explained in the same manner. But the brightly-coloured and prominent tubercles on the head can only be interpreted as of historic significance, indicating that the shape and colour of this larva have become subdued for protective purposes. The tubercles are important both in shape and colour in the second and third stage; the colour becomes faint at the close of the fourth, and in the last stage their shape has altered, becoming inconspicuous, while the bright colour which now only appears on the tips of the tubercles, disappears soon after the beginning of this period. Thus we have a character that strongly supports the interpretation of the bright spots as due to reversion. The difference seems to be that the history of the disappearance of the head tubercles can be traced in every ontogeny, while the

spots have ceased to form any part in the average ontogeny. Nevertheless, when they are present, their variability is so excessive that the various steps towards the disappearance of the system can be made out with a fair degree of probability. It is also likely that the history of the rise in both cases has been similar to that of the decline. Certainly this is true of the head tubercles. They are enlarged and brightly-coloured shagreen dots; the topmost of each row that forms a yellow margin to the face. This is proved by the hair that still remains on their summits. As they disappear each red tubercle again becomes yellow and similar to the others, except for its greater size. So also the simplest form of the system of red spots is seen in those larvæ with a very small patch on each side of the spiracles (except the 1st), and perhaps a small patch on each of the four anterior pairs of claspers. Then we have larvæ with these rows formed of large and conspicuous patches, and with another series of patches above the spiracular row. The spiracles are in all larvæ surrounded by a reddish line, and the simplest form of the system seems to consist in a slight peripheral spreading of this colour. These coloured patches consist of modified ground colour, although shagreen dots may be found upon them. The apparently uniform occurrence of the patches in the later stages is certainly an argument against my explanation, and is in favour of that offered by Weismann. Mr. William White's observations upon this subject render it probable that the spots often appear at a much earlier date than that at which they were noticed by Weismann. The uniformity of this ontogeny is very remarkable. There is practically no difference between the first and last stages, except the more obvious hairs and complete subdorsal of the former and the triangular head of the latter. Two of these distinctions occasionally fail, as has been shown. This uniformity may point to very long-continued protection by the existing form of markings. Traces of other conditions are seen in the hairs, head-tubercles, and reddish spots. It will probably be very instructive to examine the hairs of the young larva with fairly high powers. At present I have only used the hand-lens (except in more advanced stages). It will be interesting to ascertain the form of the forked ends of the hairs in the early stages (if, indeed, they are forked at such times).

Since writing the above I have examined the larvæ in the first stage under high powers, and I find that both *S. ocellatus* and *S. populi* are covered with minute hairs with highly forked ends, while there are more thinly scattered longer hairs some of which are not forked at all, while others terminate in a comparatively small and simple fork. These longer hairs are arranged upon the back in the same way as the long hairs of the first stage of *S. ligustri*, and in *S. ocellatus* there are similar dorsal rows of white spots, which form part of the oblique stripes, as in *S. ligustri*, except that the spots of the posterior pair are included in the stripes of the former, while they fall outside them in the latter. These facts bring the young stages of *Smerinthus* and *Sphinx* very near together. There is also a specially prominent row of the longer hairs upon the prothorax, just behind the head, of the young *Smerinthus* larvæ, and these leave their effects, much later in the ontogeny, as a row of conspicuous shagreen dots in this situation.

Mr. Meldola describes from Mr. Roland Trimen, in the Appendix to his translation of Weismann's book ('Studies in the Theory of Descent,' part ii., p. 527), a very remarkable larva of a Smerinthine hawk-moth, *Lophostethus Dumolini*, which seems to throw some light upon the appearance of *Smerinthus* larvæ, when the forked bristles remained of appreciable size throughout the ontogeny. This larva bears on all segments (except the head and prothorax) black spines, springing from *tubercular bases*. The longest spines form *two dorsal rows* from the metathorax to the 7th abdominal segment. Some of these spines are beset with prickles for the upper three-fourths of their length, and the caudal horn is also *covered with prickles*. There are also lateral rows of spines. The young larvæ have longer spines with long prickles on them, and the caudal horn and the spines on the meso- and metathorax are *distinctly forked*. I expect that it will be proved that the caudal horn does not correspond to a spine, but that the prickles upon it represent dwarfed spines. This is certainly so in *Smerinthus*, where traces of the long and short hairs with their forked extremities are found upon the horn in the first stage. The points of special resemblance have been italicised in the above description.

3. NOTES UPON THE ADULT LARVA OF SMERINTHUS POPULI.

—The anterior spiracle is hidden when the larva is at rest, as in *S. ocellatus*, and it is also less conspicuous when exposed. There is hardly any ground colour in the oblique stripes, except the 1st and 7th, and only a fair amount in the upper part of the 7th (extending anteriorly through the 7th abdominal segment). There is just a trace of the subdorsal anteriorly, but it is barely visible, and only consists of dots. The 7th stripe is continued anteriorly and inferiorly on to the 6th abdominal segment by a line of dots. So also similar lines of dots are seen upon the 3rd, 4th, and 5th abdominal segments, but they are not as continuous with the oblique stripes behind them as in the former instance. In all cases they are less oblique than the normal stripes, and they have the appearance of a subspiracular line which has been diverted upon each segment into approximate parallelism with the oblique lines. There is the usual annulation of the segments. I could not feel sure about the existence of apical tubercles on the head during previous stages. There is no 8th stripe. The shagreen dots terminate in the usual (simple) hairs. These observations were made upon two larvæ in the last stage found upon two species of *Salix*. Both larvæ were yellowish green.

4. NOTES UPON AN ADULT LARVA OF SMERINTHUS TILLE.—

The ontogeny of this species is described by Weismann, but it was important for me to examine the larva, especially concerning the question of the origin and structure of shagreen dots. An adult larva was found at Oxford, August 13th, 1884. There was no trace of an 8th stripe or of the subdorsal. The shagreen dots are not nearly so rough as those of *S. ocellatus* or *populi*, and yet they terminate in hairs in nearly all cases. The hairs are short and bristle-like, with simple ends. The curious and brightly-coloured plate above the anus is simply composed of large coalesced tubercles still retaining their hairs. The horn is covered with hair-bearing tubercles. The yellow stripes have rather dark anterior margins formed by a deepening of the ground colour. There are two blunt apical tubercles on the head, of a rather darker orange than the band round the face, which has now spread into the ground colour, although the scattered hairs upon it show its origin in

shagreen dots. The annulation of the segments is very regular and distinct, and the shagreen dots are arranged in rings, one to each annulation (this is always the case in shagreened larvæ). The prothorax has three or four such rings, but they are rather confused; the mesothorax has five, the metathorax six, the 1st abdominal seven, and the succeeding six segments eight rings each. Posterior to these there are no rings or annuli, with the exception of three rings upon some irregular folds behind the caudal horn, which represent (I believe) the 9th abdominal segment.

5. NOTES UPON THE ADULT LARVA OF *MACROGLOSSA STELLATARUM*.—This ontogeny has been given very fully by Weismann. I received a large number of larvæ in the last stage from Malvern during the past summer. The bifid termination of the horn could be traced in several individuals, even at this late stage. It is probably very distinct at earlier periods. The spiracle upon the prothorax is red, while the eight others are black and far more distinct. There is a black line round the former, which can only be seen by careful searching. I have not before noticed an instance of different coloration among the spiracles. The segments are distinctly annulated, except the 8th abdominal, and the number of rings seems to be as in the larvæ described (eight upon most of the segments). In a rather contracted attitude the segments taper rapidly from the 1st abdominal to the small head. When startled the head and thoracic segments are sharply retracted into the 1st and 2nd abdominal, which become swollen. (This is especially true of the former segment.) When the larva is stretched the tapering is not so distinct, and extends further back. Thus we have a behaviour identical with that of *Chærocampa elpenor* without the modification of marking which have appeared in the latter. Weismann and Meldola give instances of such terrifying attitudes without the co-operation of terrifying markings, but it is probable that the object of *M. stellatarum* is simply that of a rapid withdrawal from danger, and perhaps a partial protection of the head. It is thus likely that the first stage in the evolution of the terrifying attitude (such as that of *C. elpenor*, &c.), is a case of protection in one of its simplest forms. The habit becoming fixed and producing further structural modifications as the

withdrawal of the anterior part of the body became more complete, the attitude acquired an entirely new significance when the sudden swelling of the segments became a source of terror to enemies. After this the course taken must have been that described by Weismann. I do not think that *M. stellatarum* has yet reached the point at which terror is caused by its attitude. The white shagreen dots are terminated by minute and simple hairs, and the relation of the larval markings to the shagreen dots is exactly similar to that described in *S. ocellatus*, &c. Anteriorly the subdorsal consists of a linear series of enlarged dots only; posteriorly the effect of the dots is heightened by a whitening of the ground colour. These two conditions gradually shade into each other. Above the line there are no dots upon the shading of darkened ground colour. The subspiracular line has no doubt a similar history, but it does not show the whole origin in its different parts as is the case with the subdorsal. The shagreen dots upon the horn are black.

6. THE ORIGIN OF SHAGREEN DOTS IN SPHINGIDÆ.—This is rendered apparent by an examination of a larva of *S. ligustri* or *S. ocellatus* in the first stage. In both species the dots are terminated by hairs which are of considerable length; they are hairy larvæ with tubercles at the base of the hairs. In later stages the tubercles are alone apparent to the naked eye, but the use of a lens at once shows that a rudimentary hair is present upon the summit of each, and this remains true throughout the ontogeny. This explanation holds good for all shagreened *Sphinx* larvæ yet examined from this point of view (the genera *Smerinthus*, *Sphinx*, and *Macroglossa*), and there can be no doubt about the validity of this interpretation of the shagreen dots of *Sphingidæ*. Shagreen dots are the persistent tubercles at the bases of hairs which have become so shortened as to escape notice.

Weismann mentions the presence of small warts, each emitting a single bristle, upon the larva of *Deilephila euphorbiæ* in the first stage (page 202 of the English translation of his Essay on the markings of Caterpillars, &c.). Although these warts must be the origin of the shagreen dots in this species, Weismann does not take such a view, for he describes the independent origin of

the shagreened appearance in the third stage (page 203). So also, on page 246, he describes the larva of *Macroglossa stellatarum* in the first stage as "set with small single bristles," and he figures tubercles at the base of the bristles (plate iii., fig. 1); but he describes the shagreening as appearing for the first time in the fourth stage (page 247). Inasmuch as I have proved that the shagreen dots of the adult *Macroglossa* larva terminate in minute hairs, there can be no doubt of the real origin of the dots in the first stage, where the hairs are more apparent.

7. THE ORIGIN OF THE OBLIQUE AND OTHER LINES IN SPHINGIDÆ.—Last year I suggested that these stripes were primarily due to the linear arrangement and large size of some of the shagreen dots, and that secondarily the ground colour became affected. This suggestion followed from an examination of a larva of *S. ocellatus*, in which the colours had undergone the changes which precede pupation. It was then seen that all the white had faded from the ground colour of the oblique stripes, but that the latter could still be distinctly traced by the disposition of large shagreen dots. The paragraph upon this subject concluded with the words, "It is very probable that the origin of the white markings from the shagreen dots can be proved in the ontogeny." It seems to me that this suggested origin is now abundantly proved in the ontogenies described in the present paper. In *Sphinx ligustri* it is very marked in all stages except the last, and it occurs even in this (in the anterior inferior extremities of the stripes). In the other stages, directly after ecdysis, the oblique stripes consist of dots only without any change in the ground colour (see fig. 9, \times 4, &c., Plate VII.). Later, in some of the stages, the bases of the dots spread into the ground colour, so that the latter is affected peripherally from the base of each dot. As this process continues the areas meet, and a continuous stripe results. Thus the history is repeated in most of the stages in the ontogeny. Some markings may remain in the condition of a row of dots only, even in the adult larva. This is the case with nearly all the markings of *S. populi*, or of the lines which border the dorsal vessel of *S. ocellatus*, &c. Or the same marking may show both conditions transitional into each other, as in the subdorsal of *M. stellatarum*,

&c. There is one fact about the formation of the oblique stripes that strongly confirms this opinion. It has already been pointed out that the 7th stripe is always the first to have its ground colour altered to the tint of the dots, and the first part of the stripe to undergo this change is that which crosses the 8th abdominal segment and enters the base of the horn. Now this is the only segment crossed by the oblique stripes which is not annulated. All segments anterior to the 8th abdominal are divided into rings (generally eight in number), and upon these shagreen dots are arranged in regular rows, one upon each ring. It follows that the rows of dots are separated by the deep furrows that intervene between the rings, and the enlarged dots that form the oblique stripes are therefore similarly separated. Hence these dots are rendered distinct, and the constitution of the stripe is quite apparent, when fusion would have taken place (producing quite different appearances), if the segments were not annulated. But the 8th abdominal segment is not annulated, and here therefore the spreading area round the base of each dot has not to cross a furrow in order to coalesce with that of the next dot. Consequently fusion takes place at an early date, and this stripe is generally much larger and more distinct than the others, being the oldest continuous stripe in the individual ontogeny, and doubtless in the phylogeny also. Some appearances led me to suspect that the stretching of the larval skin during growth in each stage was one factor in causing the dots to spread and fuse. It was at all times obvious that the dots were most entirely separate immediately after ecdysis. Again, the rapid disappearance of the small dots upon the back, at the beginning of the fifth stage of *S. ligustri*, seems to be chiefly due to this process.

The importance of the shagreen dots in this respect is seen in the fact that most of the larval markings of all the English species of *Smerinthus*, of *Macroglossa*, and of *Sphinx ligustri*, are due to their arrangement, size, and fusion (in many cases). The same thing is probably true of many other *Sphingidæ*, but they have not hitherto been examined from this point of view.

Since writing the above I find that Weismann attributes importance to the shagreen dots in relation to markings in *Deilephila euphorbiæ* and *D. hippophaës*, suggesting

the origin of certain marks by the gradual crowding and coalescence of the dots in the former species, and the special coloration and fusion of two dots upon a variable number of segments in the case of *D. hippophaës* (see pp. 204 and 221 of the English translation of the Essay on the markings of Caterpillars).

8. THE ORIGIN OF THE COLOURED BORDERS TO THE OBLIQUE AND OTHER LINES IN SPHINGIDÆ.—These borders seem to be always formed of modified ground colour. Dots are either absent from the borders, or, when present, very small. It seems probable that the first trace of a border arose in the diminishing in size of the dots. This alone makes a relatively dark stripe, for the colour of the larva elsewhere is due to the ground colour modified by the closely-set light-coloured dots. After this the effect must have been increased by a special darkening of the ground colour, and in some instances (e. g., *Sphinx ligustri*) by a change of colour altogether. The dark superior border to the subdorsal of *M. stellatarum* has a similar history. This theory of the origin of the dark borders is borne out by the ontogeny of those species which I have been able to observe.

9. SOME CHARACTERS OF THE HORN IN THE PRIMITIVE SPHINX LARVA.—It has been seen that the horn of *S. ligustri* is distinctly bifid in the first stage (see figs. 1 and 2, Plate VII.), and less markedly so later (see fig. 3). The same was true of *S. ocellatus*, and this character persists through a considerable part of the ontogeny. (This summer, 1885, I have found that the horn of the young larva of *S. populi* is also forked). The same structure is described by Weismann in the first and second stages of *Anceryx pinastris*. The fork is so marked in this species that I have no doubt that it really exists in more advanced stages, but requires a lens for its detection. Weismann also figures, in his Essay on the markings of Caterpillars (plate v., fig. 38), the margined larva of *Deilephila euphorbiæ* shortly after emergence from the egg, with the horn terminated by two diverging bristles. Mr. Meldola also, in an editorial appendix to his translation of Weismann's essay, quotes from Mr. Roland Trimen the fact that the caudal horn of the young larva of *Lophostethus Dumolini* is forked at the

extremity (page 528). Finally, in certain individuals of *M. stellatarum*, I found distinct traces of the fork in the last stage. Comparing these observations, the structure appears to be most persistent in the larva (*M. stellatarum*) with a primitive form of marking, longitudinal stripes; and especially prominent in early stages of another larva with the same marking (*A. pinastri*). I have no doubt that it is largely developed in the first stage of *M. stellatarum* also. It further occurs in the earlier stages of the larvæ with the more advanced oblique stripes at the time when the primitive markings (afterwards lost or much diminished) are well developed upon them. This is especially well seen in *S. ligustri*, where the fork is very distinct in the first stage, when the subdorsal is also the most prominent marking, while the fork ceases to be recognisable about the time when the last traces of the subdorsal disappear (after the third ecdysis). We are thus led to the conclusion that the forking of the horn is a primitive character, of historic value only in the ontogeny, and remaining longest in forms that have other primitive features persistent. The horn was also covered with hairs (in common with the rest of the body), each of which projected from a tubercle. The terminal prong consisted of two enlarged diverging tubercles terminated by large hairs or bristles. In the difficult question of assigning a function to this structure the bifid termination must be taken into consideration. So also the immense size of the primitive horn must be remembered, shown by its greater relative predominance in the earlier stages of the ontogeny, especially in the case of *S. ligustri*. Finally, great importance must be attached to the fact that the horn is movable in the two first stages of *S. ligustri*, and entirely under the control of the animal's will. These facts seem to indicate that the horn was primarily a defensive structure. Further, Mr. Meldola, in the above-mentioned Appendix (page 527), states that the caudal horn of *Cherocampa Lyctus* is freely movable, and he suggests that the horn may be "a remnant of a flagellate organ having a similar function to the head-tentacles of the *Papilio*-larvæ, or to the caudal appendages of *Diceranura*." A curious point was incidentally discovered in examining the larvæ under a compound microscope. The caudal horn exhibits distinct movements synchronous with the contractions of the dorsal

vessel. This was often seen in *S. ligustri* and *S. ocellatus*, by the use of a lens magnifying fifty diameters. The movement always took place, and was a source of considerable difficulty when I tried to obtain an outline drawing of the horn by means of the camera lucida. It seems that this movement (which is in the vertical plane) is less in amount before ecdysis.

10. INSTANCES OF THE PROBABLE PASSING BACKWARDS OF CHARACTERS IN THE ONTOGENY.—In the above-described ontogenies there were certain cases in which we seem to witness the actual passage of characters backwards into an earlier stage than that in which it had previously appeared for the first time. Thus in *S. ocellatus* a very small proportion of the larvæ in the first stage possessed the specialised head of the genus, the others having a rounded head. The gradual acquisition of this character by the first stage is to be expected, for this period has already acquired everything else that is distinctive of the second or even later stages. Again, in *S. ligustri* the purple borders to the oblique stripes appear, as a rule, in the third stage, but the time at which they appear and the extent to which they develop are very variable, and sometimes they are not present at all. The instances in which the borders did not appear until the fourth stage were, however, rare in my experience, but they seem to have been universal in the case of other observers. Here, then, is a character which has nearly, but not quite, established itself in the third stage. So also with the forked termination of the caudal horn in *S. ocellatus* and *S. ligustri*. This character is fading out of the advanced stages of these two ontogenies. In the first stages it is always present, but later the structure is very irregular in the degree to which it is developed, and it is only present in a certain proportion of the larvæ, that proportion becoming smaller as the stages advance.

11. THE IMPORTANCE OF MAINTAINING THE CONTINUITY OF SERIAL MARKINGS.—I have already pointed out (last year) that a slight suggestion may produce the effect of a continued series when the marking has been repeated sufficiently often. If the series be of protective value such suggested continuity may be of great importance to the species. Conversely a very decided break in an

otherwise complete series must tend to attract attention. Such a break is rendered necessary by very deep-seated anatomical facts in any series of markings that arise round the spiracles, because of the absence of these latter upon the meso- and metathorax. The series could be rendered continuous in either of the following ways:—(1) by concealing the spiracle on the prothorax (which is the real difficulty, for the series is complete, and ends at the 1st abdominal without it); (2) by acquiring a different mark round this spiracle so as to prevent it from forming part of the series; or (3) by continuing the marks upon the meso- and metathorax regardless of the absence of spiracles. This latter is seen in the extreme forms of the spotted varieties of *S. populi*. The second is seen in *M. stellatarum*, where the anterior spiracle is red (and far less conspicuous); the others black. The very interesting cases of *S. ocellatus* and *populi* are instances of the first method. In the protective attitude the anterior spiracle is completely concealed by approximated folds of skin. In *S. populi* also it is less conspicuous at all times. This is very interesting, because the spiracles are brightly coloured (in both species), and that upon the prothorax would be far more conspicuous than the others in the *Sphinx* attitude. In *S. ligustri* the spiracles are far less conspicuous, and the interruption does not attract attention. There are probably many other instances of the different methods by which a series of spiracular markings may be rendered continuous. In many *Noctua* larvæ the first and last spiracles are much larger than the others, but this is probably due to physiological needs, and the series is not rendered conspicuous by size or colour.

12. PHYTOPHAGIC COLORATION.—(1) *S. ocellatus*.—During the past summer I bred a number of larvæ from the egg, and I certainly found some considerable difference produced by the different food-plants. Thus apple and crab caused whitish-green larvæ; while *Salix cinerea*, and especially *S. rubra*, produced adult larvæ tending towards the yellowish form. *S. riminalis* did not produce nearly such white larvæ as the apple, but, contrary to my expectation and experience, the larvæ were almost intermediate. Thirty larvæ were experimented upon, in five batches, fed respectively upon the food-plants mentioned above. All the larvæ, except two or

three, arrived at maturity. At the same time the effect produced was not so great as I expected in the case of the yellowish forms, which were hardly more than intermediate varieties. But there can be no doubt that some effect was produced, and the subject must be considered settled to that extent. The ova were bought from Mr. Davis, of Dartford, and the numbers selected were too great for accident to have caused the results (which were uniform in each of the five lots). At the same time my experience in the field this year has been different from that of previous years (recorded in my last paper), in that I have come across many instances of larvæ upon food-plants which tended towards the variety other than that found. The most noteworthy instance was that of a bright yellowish variety upon apple, and of two opposite varieties on a tree of *Salix ferruginea* (?).

Hence the question is more complicated than it formerly appeared to be. It seems that the only way in which the results of the breeding experiments and experience in the field can be correlated is by supposing that phytophagic effects are hereditary and gradually accumulate until the influence of a food-plant during a single larval life may not be sufficient to overcome the inherited tendencies following from the effects of another kind of food upon many generations of larvæ. Thus in my breeding experiments there was a much greater tendency towards the whitish rather than the yellowish variety. I was unable to ascertain if this was due to the food of the parents, as Mr. Davis informed me that his larvæ had been kept together (having been found upon various species of food-plants). As a matter of fact, however, there was already evidence before me (last year) that the solution of the difficulty is not so simple as it appeared to be. I read Mr. Meldola's notes upon this subject (in Weismann's 'Studies in the Theory of Descent,' part ii.), and assumed that his instances pointed in the same direction as my own observations. On reading them a second time I found that I had made a mistake (reversing in my mind the effects of the two food-plants), and that the instances are in exact opposition to what I should have expected. He quotes instances of numerous yellow-green larvæ being found upon *S. viminalis* and white-green upon *S. triandra*. Now these results are the very reverse of protective, for *S. viminalis* has leaves with very white under sides, and

those of *S. triandra* are green underneath, as in *S. rubra*. My own observations being very strongly in favour of the protective value of the coloration in this species, and Mr. Meldola apparently believing the same thing, I had fallen into the error of supposing that his instances agreed with my own. Furthermore, all the larvæ I had found upon *S. viminalis* had been white-green, and those upon willows (*S. rubra*) with green under sides, like *S. triandra*, had been yellow-green; so that my observations were the exact reverse of those quoted by Mr. Meldola. But even without observations upon the particular species (*S. viminalis*) I should have doubted whether the instances alluded to were entirely normal, and expressed the real phytophagic tendency of the two plants. Such doubts would follow from the general conclusions arrived at concerning the effect of leaves, with certain colours and surfaces. The same opposition in experience is also indicated by Mr. Meldola when he speaks of six larvæ being found upon a species of willow, four of them being bright green and two bluish green. Nevertheless, my experiments rather supported Mr. Meldola's instances than my own view, for the *S. viminalis* larvæ were not nearly so whitish as those fed upon apple. I am hoping to experiment upon the effect of this food-plant and of *S. triandra*, on a large scale during the present summer (1885).

(2) *S. ligustri*.—Mr. Meldola quotes two instances of phytophagic coloration in this larva. In one case the larvæ feeding on laurustinus were darker than those upon privet; in the other instance ash produced a more greyish green than either lilac or privet. I have noticed the same thing with regard to larvæ found upon ash, but I should say that these larvæ resembled the lilac forms, and differed from the privet. Mr. W. Davis's expression "greyish green," quoted by Mr. Meldola, applies extremely well to the larvæ which I have found upon lilac. It is now many years since I have observed this difference (at Reading, Oxford, and this year at Great Malvern) between the adult larvæ found upon privet and lilac. The difference is very hard to define, but very real. The green ground colour and the purple stripes are duller in the lilac larvæ, and the difference is independent of the lightness or darkness of the larvæ, for light and dark individuals occur in both varieties. This year I reared twenty-four larvæ from the egg, in two separate

lots, fed respectively upon lilac and privet. I also fed a detachment upon ash, but the larvæ did not thrive. In the fifth stage the difference appears, and is quite obvious, although much less so than that of *S. ocellatus*. An attempt has been made to show the effects of this experiment in fig. 7A (lilac) and B (privet), natural size (Plate VII.). This phytophagic effect is also protective, for the under sides of privet leaves are of a yellower brighter green than in the case of lilac, and the total effect of the two bushes is in the same direction, especially when looked at from a little distance. The difference is made by texture rather than colour. The protective nature of the two colours is also very apparent when the larvæ are found upon the bushes.

(3) *S. populi*.—There are very great differences in the ground colour of these larvæ, quite equal to those of *S. ocellatus*, but it is not known whether there is any relation with the food-plant. The two chief varieties are similar to those of *S. ocellatus*, a bright yellowish green and a very white bluish green. I feel sure that many years ago I found the latter variety with a blue horn, and so resembling *S. ocellatus* that they could not be distinguished for certain (until pupation). *S. populi* is occasionally found upon various species of *Salix*, and this year I have come across one upon *S. Babylonica* and one upon a tree evidently allied to *S. cinerea*. Both larvæ were light yellowish varieties, and this would be the tendency of the food-plants in the case of *S. ocellatus*. On the other hand, the larvæ bred from the same batch of eggs may vary greatly, even if fed upon the same plant. During the past summer Mr. A. Sidgwick proved this, poplar being the food used. It is very likely that further work upon this larva may throw light upon the case of *S. ocellatus*. It will be especially interesting to note the relation of the red spots (which are more common and more developed in this species than in *S. ocellatus*) to the ground colour. I believe that in this species the spots have no relation to any particular shade of ground colour. I certainly remember yellowish larvæ with the spots, and in my paper in the 'Transactions' of this Society (Part I., April, 1884, Plate I., fig. 2) an extremely pale larva is figured with the spots developed to a very remarkable extent (I am indebted to the kindness of Mr. G. C. Bignell for the loan of the drawing which was figured). These facts would favour

the suggestion that there is no significance in the red spots occurring only upon the yellowish variety of *S. ocellatus*.

A more detailed account of the experiments upon *S. ocellatus* and *S. ligustri*, together with a consideration of the difficulties attending the interpretation of many facts by a theory of "phytophagic" coloration, and an account of the structural basis of colour in larvæ and its dependence upon the food-plant, will be found in my paper, "On the essential nature of the colouring of phytophagous larvæ," &c., Proc. Roy. Soc., vol. xxxviii., No. 237, pp. 269—315.

13. THE ONTOGENY OF THE LARVA OF SELENIA ILLUNARIA. —The eggs were laid (April 4th and 5th, 1884) by a captured female of the spring brood, and were kindly sent to me a few days later by Mr. W. Holland, of Reading. They are oval, 1 mm. in their longer, and .75 mm. in their shorter diameter, and a little flattened from above downwards. The eggs were all red-brown in colour when they reached me, but subsequent observations upon the later brood showed that they are first light yellow, and that they darken to red-brown in two or at most three days after being laid. Just before hatching the eggs again change colour, becoming very dark grey, almost black. This darkening is generally complete in one day, but it takes place more rapidly in the ova which hatch latest. The larvæ emerge in from one to three days after the last darkening is complete. The larvæ first appeared May 2nd, and all had emerged by May 11th, but a large proportion of the ova (23 out of 57) were hatched on the first two days of this period, while the rest of the eggs gradually hatched on the remaining days.

The chief object in working out this ontogeny was to test further the theory I suggested last year (after work on the *Ephyridæ*) that young Geometer larvæ assume attitudes conducing towards protection during rest upon the surface of leaves, which will, of course, be very different to the well-known positions taken up in later life, when the larvæ cling to branches of the food-plant.

Stage I.—The young larvæ (fig. 15, $\times 6$, Plate VII.), when first hatched, are about 2.75 mm. long when extended, and are rather stout. They have the habit (very common among Geometer larvæ) of moving the

anterior part of the body rhythmically to and fro for a considerable time, while holding by their claspers. When disturbed they sometimes fall with a thread, but generally quite passively, bending the body into a (ventrally concave) U, and remaining in that position for a long time. In this attitude the head and three thoracic segments are bent backwards, and the true legs folded upwards towards the head, while the anterior pair of claspers are bent backwards towards the last pair. This attitude is sometimes imperfectly assumed, but, if the larva be further disturbed, all the details are carried out in full. The favourite attitude of rest is that shown in fig. 15, Plate VII., the back being curved so that the head is only slightly raised above the supporting surface. In this position the rhythmic lateral movements often result from gentle disturbance, and also occur spontaneously. The body of the larva is nearly cylindrical, the head being much the widest part, and, after this, the region of the posterior claspers; the intermediate part being nearly uniform, but becoming slightly wider towards the extremities. The ground colour is black, as seen from above, but in many specimens the two anterior thoracic segments, and those behind the 5th abdominal, are lighter in colour, the hind part of the hind claspers and anal flap being lightest. The sides and ventral surface are brown, of which the shade varies in depth in different individuals. There are four white intersegmental bands across the back, in the central part of the body, separating the segments from the 1st to the 5th abdominal inclusive. These bands are made up of irregularly-shaped white spots, which produce the effect of a continuous stripe upon a superficial examination. The first band is the most distinct, but they are all very prominent, because of their strong contrast with the ground colour. Only the first band is continued ventrally (much less broad), while the others cease at the spiracular level, where they are broadest. The head is not of the common Geometer shape, with a deeply-notched crown, nor does it present any of the other irregularities so often met with in this group. It is rounded and lobed by a mesial line, which divides below enclosing a white or greyish triangular mark (the clypeus) above the labrum, which is also light-coloured. The rest of the head is black. The whole of the body is thinly clothed with fine long hairs. There

is a small tubercle with a few prominent hairs on each side of and above the anus. The spiracles cannot be distinguished with the naked eye. After twenty-four hours' feeding the larvæ are about 4 mm. long, and they are not quite so stout proportionately. When disturbed they now let themselves down with a thread. In the bent-up (U-like) attitude a slight lateral bend of the head is sometimes seen. This is an interesting fact, as it exhibits a tendency towards the greater asymmetry afterwards more commonly observed. A light line now appears on the sides of the three thoracic segments, and the white markings of the four bands at the same level appear to continue this line backwards as an interrupted spiracular line. There are traces of a fifth band between the 5th and 6th abdominal segments. The anterior band is, as before, far more distinct than the others. The light ground colour which appeared anteriorly and posteriorly in some specimens has now generally darkened. This seems to take place directly after feeding for the first time. In two days the length is 5 mm., and the larva is very uniformly cylindrical. There is no change in the markings or habits. A little later the ground colour of the larvæ becomes less black, though still remaining dark. In six days the larvæ are about 7 mm. long, and in nine days most of them (eight out of twelve) changed their skins for the first time.

Stage II.—(See fig. 16, $\times 2$, Plate VII.). I was not able to observe whether the skins were eaten, but this is probably the case, as no traces of the cast skins could be found. In this and succeeding stages the same lateral movements occur, although they are less often seen after the second stage. The larvæ are stout and about 8 mm. long at the beginning of this stage. During rest the head (which is unchanged in colour and shape, except for a little flattening) and two anterior thoracic segments are bent backwards, and the bend pointed and made apparently angular by the 3rd pair of true legs, which are held out straight. Thus this position is assumed *before* the appearance of the ridge bearing the 3rd pair of true legs in later stages, which makes the same attitude so much more irregular and effective. The irregular spiral attitude is also often seen in this stage, and when this is the case the head and two anterior thoracic segments are bent on one side as well as

backwards. There is not much tendency towards falling after disturbance, but a thread is always ready if the larva should be roughly shaken from its hold. The larva is still hairy, but the hairs are less prominent. There is the same pair of small tubercles posteriorly, and they remain throughout larval life. The markings are very similar to those of the last stage. The anterior white band is by far the most distinct, and consists of two chief rather yellowish patches with smaller dots. It is continued underneath, but is interrupted at the sides. The two succeeding bands are comparatively inconspicuous, and are formed of small dots. The fourth is not sharply defined and bright, but is much broader than any of the others, being continued on to the 5th abdominal segment as a light greyish cloud. This cloud is continued (becoming narrower) on to the ventral surface. There is a light line on the sides of the first three thoracic segments, and traces of the same line further backwards at the junction of the lighter ventral and darker dorsal ground colours. There is also a very faint white line in the position of the sub-dorsal, extending from the 2nd abdominal segment to the posterior end of the body. The dorsal ground colour is very dark brown, becoming dull black behind the 5th abdominal segment. The colour is darker in front of and behind the first white band and anterior to the last band. The depth of the ground colour varies in different individuals. The ventral ground colour is lighter brown. The darkening in front of the posterior white band is continued on to the sides, but not ventrally. The protective resemblance (in colour and attitude) is evidently to the excrement of birds. The size is rather small for this, but it is probable that both the colours and the habit have been handed backwards from more advanced stages. It is, however, very likely that the resemblance is of use in this stage, although the small size must be the chief protection, at any rate, from some enemies. Towards the close of the stage there are some changes which anticipate the appearances which follow the next ecdysis. Thus the 4th and 5th abdominal segments become rather swollen, and the light cloudy colour extends and produces a somewhat mottled appearance on this part of the larva.

Stage III. — (See fig. 17, natural size, Plate VII.). This stage began sixteen days after hatching in the case

of nearly all the larvæ observed. Only at this point in the ontogeny are there considerable changes in the larvæ, for the first two stages were very similar to each other, and the last two are practically the same as the third. The length is about 11 mm. when the second ecdysis is taking place, and the larva is fairly stout on entering the third stage. It is very difficult to accurately measure the larvæ in this and (to a less extent) in succeeding stages, because the body is so rarely extended. The important structural characters of the larva from this time forward concern the head, the 3rd pair of thoracic legs, and the 4th and 5th abdominal segments. The head is much flattened, and appears merely as a continuation of the body, the constriction between it and the 1st thoracic segment becoming quite inconspicuous. The 3rd pair of thoracic legs are placed upon the summit of a very large and prominent transversely-directed ventral ridge. The importance of this structure is to render conspicuous the dorsal bend of the body at the 3rd thoracic segment in the protective attitude assumed during rest. At such a time the head and 1st and 2nd thoracic segments are bent backwards so far as to be almost parallel with the anterior abdominal segments, while the 3rd pair of legs are held straight out from their ridge on the convexity of the abrupt bend in the 3rd thoracic segment; but the extremities of the legs are generally curved inwards so as to nearly meet. The effect is greatly increased by lateral swellings on the 2nd thoracic segment, and by the 1st and 2nd pair of legs being bent up towards the head, and thus becoming invisible except on a close inspection. The colours, as will be seen, greatly aid the effect of this extremely irregular and unlarva-like attitude. The protection is by resemblance to a brown and crumpled leaf-fragment, or to the excrement of birds, according to the colour; and at this stage the larva is generally at rest upon the leaves. The 1st, 2nd, and 3rd abdominal segments are extremely round and cylindrical, and it is difficult to detect the furrows between them. The 4th and 5th abdominal segments are much swollen, and each has two small dark dorsal tubercles terminated by a single hair. These two segments are held in a slight curve with the concavity below. Other similar, but much smaller, tubercles are sparingly scattered over the body of the larva. There are also the two posteriorly-directed

anal tubercles. The lateral margins of the anal flap are invisible, except upon careful observation. A few scattered hairs are still present, and are rather more abundant anteriorly and posteriorly. The ground colour varies from red-brown to dull yellow; in all cases mottled with lighter tints. The anterior white ring of earlier stages is present as two short transverse pale yellow lines, one on each side of the dorsal middle line in the anterior part of the 2nd abdominal segment. An inconspicuous lightish cloud sometimes extends backwards from these marks for a short distance. The transverse markings are sometimes covered by the reflected posterior part of the 1st abdominal segment in the protective attitude. There are no traces of the next two bands, but the light colours on the side of the swollen 4th and 5th abdominal segments are the remains of the fourth band, which became diffuse and cloudy in the second stage. The 4th abdominal segment is not covered with the light cloud to such an extent as the 5th. There is a tendency towards a longitudinal arrangement of the lighter markings, especially in the more cylindrical parts of the larva. The under side of the head and 1st and 2nd thoracic segments is much lighter, and of a dull yellow colour. This of course becomes the upper side in the protective attitude (see fig. 17, Plate VII.). The spiracles are *very* indistinct at all stages. The segments behind the fifth abdominal are darker in colour, generally showing a combination of very dark grey and rich brown. The ventral surface of the first four abdominal segments is rich brown with creamy mottlings longitudinally arranged, the colours being continued on to the under side of the transverse ridge bearing the 3rd pair of true legs. The upper surface of this ridge is very dark. In many larvæ the brown is replaced by greyish tints. The protective attitude of Stage III. is remarkable for its excessive irregularity in the vertical plane. Occasionally there is a deviation to one side, especially in the bend at the 3rd thoracic segment; but this is exceptional, and the efficiency of the attitude is not, as a rule, due to a spiral or bilaterally asymmetrical position, as in the case of the *Ephyridæ*. Nevertheless, the larva at rest is wholly unlike a Geometer in the usual position of resemblance to a twig, although this attitude is assumed during later stages. During the maintenance of the

former attitude the larva nearly always clings to the leaf on which it is feeding, and does not return to the twig in the intervals of rest (as during the succeeding stages). The great feature of the attitude is the remarkable bend in the 3rd thoracic segment, and the intensely exaggerated effect produced by the 3rd pair of thoracic legs projecting from their prominent ridge. There is also a bend (in the opposite direction, dorsally concave) in the 2nd abdominal segment, and another (ventrally concave) between the 4th and 5th, pointed by the pair of dorsal tubercles on each of these segments. The larva is supported by a thread of silk in the protective attitude. When the thread is cut in two the larva falls into another position, showing that there is considerable tension on the thread. In this second position it remains steady for some time, but eventually the first attitude is again assumed, usually after the appearance of the lateral movements. When a larva is disturbed it is most remarkably passive, thus carrying out its resemblance to immovable objects; but if the disturbance be increased the lateral movements begin.

Fourth and Fifth Stages. — The colours and markings of the last two stages are quite similar to those of the third in nearly all cases (see fig. 18, natural size, Plate VII.; end of fifth stage). Occasionally the white band on the 2nd abdominal segment seems to be absent, and sometimes it is concealed beneath the reflected hinder part of the 1st abdominal segment. The attitude is, however, quite different from that assumed in the third stage, and is of the type most usual among Geometers, protection being gained by resemblance to a twig. The head and first two thoracic segments are bent back, as in the third stage, but not to an equal extent, and the 3rd pair of thoracic legs are held as before, and the supporting thread often passes between them. The bend is, as before, rendered more effective by the swollen sides of the 2nd thoracic segment. The rest of the body is held straight, especially the cylindrical 1st, 2nd, and 3rd abdominal segments. The resemblance to a twig, with a projection on one side of the extremity, is very striking. The projection is formed by the head and first two thoracic segments, for by position, shape, and colouring the line of the body is continued into the ridge on the 3rd thoracic segment and the 3rd pair of thoracic legs, which appear as the real termination of the object.

When the larva is not at rest the ridge bearing the 3rd pair of thoracic legs is bent upwards, so as to be nearly parallel with the head and two anterior thoracic segments, presenting a remarkable appearance. The colouring of the whole, the swollen 4th and 5th abdominal segments with their tubercles, and the manner in which the claspers are applied to the branch,—all assist in forming a very perfect imitation of a twig. Just before spinning up the larva becomes very stout and short. The fourth stage began twenty-three days after hatching in the case of most of the larvæ, but press of work prevented me from ascertaining the length of this stage and the one succeeding it. The duration of the stages is, however, extremely variable. Thus out of seventeen larvæ hatched in the same twenty-four hours, one was changing the first skin, several the second, while many had already entered the third stage. Four larvæ (out of the seventeen) spun slight cocoons just thirty days after hatching. In these instances the whole period was shorter than usual, and hence each of the stages mentioned above (as far as possible average) was also abbreviated. The larvæ of this and other batches pupated after variable periods all greater than thirty days, but most of them less than forty. In some few instances, however, the two last stages (especially) were immensely prolonged, so that larvæ which hatched about May 5th had not spun up at the end of July. Although these last larvæ died before pupation there can be little doubt that in this greatly prolonged larval period, in a few cases, and in the extreme irregularity altogether, there are indications of an older monogonetic condition. This is all the more interesting in a species which exhibits seasonal dimorphism to such a marked degree as *S. illunaria* (in the perfect state). This dimorphism must, of course, have arisen gradually, long after a digoneutic condition had been established; and the very exceptional degree which is shown by the former implies immense antiquity for the latter. Furthermore, the species has been polygoneutic in the present year (1884), but the indications of the ancient monogoneutic condition are less remarkable in relation to polygoneutism than to such extreme and exceptional seasonal dimorphism, for well-marked instances of the former relationship have been already adduced. It must also be remembered that the dimorphism of this

species includes a very great difference in size between the imagines of the two broods, as well as a most decided divergence in colour.

The dates of the various events of the life-history during the present year (1884) have been as follows:—The ova were laid April 14th and 15th; the larvæ hatched from May 2nd to the 11th; the first larvæ spun up June 1st, the others at various subsequent dates all through June and into July. I conducted experiments with artificially induced cold upon most of the pupæ, but the imagines emerged a few days after the withdrawal of the ice in all cases. A few pupæ were not exposed to cold, and these had pupated towards the beginning of July, emerging in about twelve days. The eggs of the next brood were laid on July 4th, and a few days afterwards, by a moth which had been exposed to ice in the pupal state for thirteen days. (The male which fertilised the eggs had been similarly exposed for nine days). The tendency of this cold would, of course, be towards diminishing the number of broods in the year, and, as it did not have this effect, it may be left out of consideration, except as keeping back all subsequent events by a period about equal to that passed in the cold. The eggs hatched in the middle of July, and the larvæ spun up from the 20th of August to the middle of September. One, however, only spun up on October 29th. The perfect insects emerged in from two to three weeks, but a considerable proportion have not emerged and constitute the winter brood. Eggs for a third brood were laid September 15th and the following days, turning brown in two or three days, as on previous occasions. The larvæ began to hatch on October 4th. These larvæ are not adult at the present date (December 18th). They have been partially kept back by the difficulty of obtaining food at this time of the year, but there is great doubt as to whether they could have lived at all in the open air, unless, indeed, these larvæ hibernate. Thus there have been three broods of larvæ this year, and some individuals of the first brood showed tendencies towards a winter pupation (but died as larvæ); many individuals of the second brood are passing the winter as pupæ, and it seems likely that the third brood will hibernate as larvæ.

Summary.—There are a few especially interesting features in this ontogeny. The two first stages are

extremely unlike the remaining three in ground colour, markings, and shape. The two former are very dark, almost black, with white bands at intervals round the central part of the body, while the larva is cylindrical. The three last stages are very similar to one another, but much more complicated than the first two, and the break very sudden. The chief traces of continuity are seen in the permanence of the anterior white band in a modified form, and in the changes that take place towards the end of the second stage. These latter, however, are probably due in a great measure to the actual existence of the third stage beneath the tightening skin of the second. The last three stages bring out the importance of attitude in a very interesting way. With a similar colouring and structure the appearance of a larva in the third stage at rest is extremely different from one in the fourth or fifth stage, and the difference is correlated with a position upon leaves or branches respectively. It is very likely that some such difference will be found in the ontogeny of all *Geometer* larvæ which are protected in the advanced stages by resembling twigs. The rhythmical lateral movements are very hard to explain. The habit seems to be extremely ancient, as it is so widespread and so frequently manifested. At present I can only suggest a possible use in the unvarying and mechanical characters of the movements which are certainly very unlike those generally seen in organic forms.

14. THE UTILISATION OF THE CHANGES IN COLOUR BEFORE PUPATION FOR PROTECTIVE PURPOSES. — In a paper read before this Society last year (November 7th, 1883), I suggested that the darkening of certain larvæ before pupation is probably of protective value. I was not then aware that this suggestion had been previously made by Mr. Meldola (see his paper in *Proc. Zool. Soc.*, 1873, p. 155, and the Appendix to his translation of Weismann's book quoted above, p. 525). Mr. Meldola instances the darkening of *Sphinx ligustri*, and this was the very larva which prompted me to make an identical suggestion, quite independently, although many years afterwards. In my last paper I gave instances of green larvæ protected by their resemblance to leaves, which became brown when they wandered over the bare ground before burying, and other larvæ which darkened less, still retaining green as their predominating colour, and

which found suitable places for pupation in damper and greener situations. I did not then know any instance of protection by a change of colour in the reverse direction. I am now able to supply such an instance. During the present summer (1884) I bred a number of the larvæ of *Ennomos angularia*. The adult larva is dark brown in colour, and in this respect, as well as by its attitude, is extremely well protected by resemblance to the dark twigs of its food-plant (elm). The pupal period is very short, and passed in the hottest part of summer, and the cocoon is very loosely constructed of leaves, between which the larva and subsequently the pupa are generally visible. In this case the brown colour of the larva is discharged before pupation, and it becomes green (see fig. 19, natural size, Plate VII.), and is therefore well protected in its new surroundings. The pupa is also green, but is dimorphic, one form being light bluish green covered with white dots, and the other dark brownish green sprinkled with black dots (see figs. 20 and 21, natural size, Plate VII.). Both forms are well protected in the cocoon, and it is probable that the dimorphism is of *direct* value (see my paper quoted above for other instances of the direct value of dimorphism). In *S. illunaria* the larva only becomes green over a small part of its surface, and the pupa is of the ordinary shining reddish brown colour, but the cocoon is fairly complete, so that the contents are hidden. I may also add to the instances adduced last year the case of *M. stellatarum* feeding on *Galium verum* in dry situations exposed to the sun, which darkens very completely all over before pupation, and which wanders over the earth before making a slight cocoon, within which it may be sometimes visible. Again, there is the unusual darkening of the larva of *D. vinula*, which makes its cocoon on the bark; while other larvæ (*S. populi* and *ocellatus*), with the same food, darken very slightly, but pupate in the earth, which is covered with green vegetation beneath such trees (growing in moist places). Of course there will remain a great many larvæ which do not gain protection in this way, for example, all those which form complete cocoons at once or bury without wandering and exposing themselves in new surroundings with which their colours do not harmonise. I only urge that certain larvæ gain protection by making use (through natural selection) of the

changes of colour before pupation, and this theory is, I think, much supported by the unusual change of colour in the larva of *E. angularia*.

15. ON A CURIOUS HABIT OBSERVED IN SOME LARVÆ BEFORE PUPATION.—This summer (1884) I have been told by my sister of a curious habit that she has noticed in the full-fed larvæ of *M. stellatarum*. When these have ceased to feed, but before the colour has darkened, they cover themselves all over with a brown fluid from their mouths. My sister describes the process as occupying considerable time, being conducted with the greatest care. The mouth is even brought into contact with the dorsal surface of the 1st thoracic segment, so that this is moistened together with all other parts of the larva. The same observer considers that several layers of fluid are poured out over the larva, and she believes that the changes of colour before pupation are produced in this way, stating that the moistened part of the surface is quite different in colour from that which has been hitherto untouched. This interesting observation seemed to render intelligible a fact which must have been noticed by every breeder of caterpillars, *i. e.*, that adult larvæ which are thoroughly wet all over the body are often seen in the breeding-cages. I had also noticed that such larvæ had ceased to feed before this took place, and that soon afterwards they changed colour and wandered about to find a spot suitable for pupation. With this interpretation I watched carefully, and in a few days I saw the adult larva of *S. populi* carefully and very systematically covering itself with fluid. I then recognised the moistened surface as quite similar to that which I had often seen before, when I did not know of the method by which the moisture was applied. Since then I have seen the same thing in *M. stellatarum*, although in this case the fluid (if any) seemed to dry at once, and was hardly ever visible. The movements of the head are exactly those indicated by the term "licking." It seems likely that this habit is really very common, perhaps universal, among larvæ, but I do not feel any certainty as to its use. I do not see how it can affect the change of colour, for this must be due to comparatively deep-seated processes, whereas the fluid is superficial. Further, the larva of *S. populi* does not change in colour to any extent, and only on the back,

while the fluid was applied to the ventral surface as well as to all other parts. At the same time it is very likely that the moistened part may, while wet, appear different in colour from the dry part. The change of skin at pupation does not essentially differ from an ordinary ecdysis, and it is therefore difficult to understand why the skin should receive such elaborate preparation for the former event only. It is to be hoped that further observation may decide upon the frequency of the occurrence and lead to some suggestion as to its use.

16. AN ANATOMICAL REASON FOR THE SPECIAL PROTECTION OF LARVÆ.—Larvæ differ from most other organisms in their liability to death from slight injuries. The reason for this is to be chiefly found in the anatomical construction of a larva, which may be described as a soft-walled cylindrical tube which owes its firmness, and, indeed, the maintenance of its shape, to the fact that it contains fluid under considerable pressure. The pressure is exerted by the muscular parieties of the body. The advantage of this construction is as obvious as its danger: the larva possesses a motive force which can be applied to any movable part of the surface through the medium of the fluid. Indeed, it does not seem possible that the emission of a process of the body-wall could be effected with any great power under any other system of construction, at any rate, in soft-bodied animals. And it is necessary that larvæ should thrust out various projections with great force. Thus the claspers must retain the larva (often of considerable weight) upon the food-plant during high winds; and the force with which they hold is seen in the fact that larvæ may be often injured by roughly and rapidly detaching them. Again, many larvæ possess flagella or shorter projections, which must be swiftly emitted for the purpose of driving away ichneumon flies, &c. Then there are fluid secretions, which must be ejected with considerable force, and glands producing a disagreeable odour, which are bodily everted at a moment's notice (larvæ of certain phytophagous Hymenoptera). This motive force is also known in very different organisms: the eye-bearing "tentacles" of the snail are thrust out by such means. The retraction of all processes which are emitted in this way must be by invagination, and this is most readily performed by means of an axial muscle attached to the

interior surface of the apex. The retractor muscle of the snail's tentacle is well known to have this arrangement, and I have found striated muscle fibres similarly attached to the eversible glands of hymenopterous larvæ. The most striking of all the instances of this kind of protrusion is, I think, afforded by the well-known flagella of the larva of *D. vinula*. The pink flagella are very long and narrow, and are protruded with great rapidity. At the base of each flagellum there is a small transparent area extending round the whole circumference, and through this, as through a window, the processes of invagination and evagination can be readily watched. When the invaginating flagellum has shortened to half its length, the tip has, of course, been drawn inwards as far as the transparent base, and a pink line is seen in the axis of the latter, rapidly lengthening inwards until the whole axis is pink. As invagination becomes complete the pink axis disappears inwards as the transparent part is itself invaginated. The same phenomena are also seen in evagination in the reverse order. The protrusion and withdrawal of claspers seems to be essentially due to the same process. The whole shape of the larva also depends on the fact that it contains fluid under considerable pressure, as can be readily seen in a dying larva, in which the muscles have lost their tone. Under these circumstances the larva entirely collapses, and the only traces of movement are seen in its thoracic legs, which depend upon their own muscles, and are not moved by the fluid (although the elevations upon which they are placed owe their firmness to this cause).

It is hardly necessary to point out that this construction is extremely dangerous, for a very slight wound entails great loss of blood, while a moderate injury must prove fatal. The larvæ of *S. ocellatus* (and many others) nibble off each other's horns, and the wounded larvæ (although they do not seem to be aware of the injury) lose a great deal of blood, and, although they may recover, are generally stunted; and often, I am sure, the loss of blood proves fatal. If the wound be at all extensive the fat-body and viscera protrude, owing to the pressure on the side distal to the wound (that on the proximal side having been relieved by escape of blood). It is, I believe, in consequence of these facts that the various means of protection in larvæ

are almost always of a passive kind. When active (flagella) they seem to be directed against the attacks of ichneumons, which produce fatal results in quite another way. Nearly all the means of defence against other enemies are such as tend to prevent the larva from being seen or touched, rarely such as to be of any avail when actually attacked. There may be various changes in the mode of defence, but the object is always the same,—to leave the larva untouched, a touch being practically fatal. If the disguise of a twig-like Geometer be seen through, in some cases the larva may drop to the ground; but, if followed, there is no further defence. The larva of *C. elpenor* is protected by resemblance to the brown or green (according to its colour) parts of its food-plant. When it is discovered and attacked it assumes the terrifying attitude, but, if this fail to terrify, it possesses no other means of protection. So also the unpleasant taste or smell are powerless for those foes which attack the larvæ notwithstanding such protection, and the “warning colours” of distasteful larvæ have been acquired to prevent experimental or inadvertent “tasting” on the part of enemies (which would, of course, be fatal owing to the larval construction). And of all the various modes of protection, by far the commonest is that of resemblance to surrounding objects, a means for rendering the larva practically invisible. It seems probable that the extremely perfect and very various means of defence are related to the unusual delicacy which results from larval organisation.

EXPLANATION OF PLATE VII.

FIG. 1, $\times 4$ diam.—The larva of *Sphinx ligustri* just after hatching, extended in walking. There are no markings, the colour is yellowish, the head greenish. There are two rows of hairs on the back, two hairs in each row upon most of the segments. There is another row of hairs upon each side slightly above the spiracles (with the same arrangement of hairs). The hairs are scattered thinly and irregularly upon the head and posterior to the 7th abdominal segment. The caudal horn is seen to be immensely long, and distinctly bifid at the tip. Its colour is black, but the upper half is greenish, because the black surface is rather trans-

parent, and allows the green fluid within to shine through. The termination consists of two tubercles, from each of which a single bristle projects.

FIG. 2, $\times 3$ diam.—A larva of *S. ligustri* at the close of the first stage, extended in walking. The horn is somewhat longer in this individual, and is now held straight, sometimes at the angle shown, and sometimes parallel with the back. The larva is now bright green, and shows the (white) markings of the stage,—a subdorsal and the system of oblique stripes. These markings are formed by the linear arrangement of minute white shagreen dots that cover the body (not shown), and of larger dots at the bases of some of the long hairs. The two kinds of dots are essentially similar, for the smaller ones also terminate in minute hairs (seen with a lens). Before these markings were established there was a stage when the dots at the bases of the larger hairs became conspicuous, especially in the case of the dorsal rows, so that most of the segments showed four large white spots when looked at from above. On the thoracic segments there were only two such spots. These spots can still be seen in the figure, some of them taking part in the stripes, while some are outside the latter. The subdorsal is more distinct than the stripes, and is entirely made up of the smaller dots. A very faint and small "8th stripe" is seen upon the 1st abdominal segment above the subdorsal. There is a horizontal line upon the thoracic segments parallel with and above the subdorsal. It is chiefly formed by the single pair of large dots upon each segment, and on a superficial examination it looks like the anterior continuation of the 8th stripe. This, however, is not really the case, as the latter is prolonged slightly below its posterior termination.

FIG. 3, $\times 2$ diam.—A larva of *S. ligustri* at the close of the second stage, comfortably extended at rest. The larva much resembles that shown in fig. 2. The movable horn is brownish red, covered with black tubercles (shagreen dots), which are absent at the sides of the base, and thus cause the appearance of a reddish patch where the 7th stripe enters the base of the horn. The tip is still bifid, but less markedly so. The fork is due to two pronounced tubercles with the hairs upon them. The origin of the larval markings from the arrangement of shagreen dots is very obvious. The dots terminate in minute hairs at this time and in future stages. The long hairs have now disappeared, and so also have the large spots, except those that enter into the "8th stripe" and the line above the subdorsal. The latter is now less distinct, except anteriorly, while the oblique stripes are very clear. There is a pink tinge upon the thoracic legs, elaspers, and spiracles. The shagreened head is surrounded by a marginal white line.

FIG. 4, $\times 2$ diam.—A larva of the same species at the close of the third stage, comfortably extended at rest. The markings are very similar to the last. The subdorsal is now indistinct anteriorly and absent elsewhere. The large white spots are still present upon the anterior segments, and contribute to their markings. There is still a trace of the bifid termination of the horn in some individuals, but this feature requires higher magnification for its detection than has been employed in this figure. The side of the head is now often darkened by a black cloud, which spreads from above downwards, behind the (yellow) marginal line. There is great variability in this character, and it is often absent, as in the individual figured. The spiracles are faintly ochreous, the thoracic legs red, and the claspers dark purplish. The ground colour is often dark green below, which extends upwards as a border to the lower third of the white stripes in the darker individuals. During growth in this stage the shagreen dots of the oblique stripes become enlarged, fuse, and form continuous lines. The annulation of the segments keeps the dots separate for some time (as each dot in a stripe is on a separate annulus, and there is a deep furrow between adjacent annuli). In the 8th abdominal segment there is no annulation, and here therefore the dots coalesce much earlier than elsewhere, and the stripe is more distinct than the others. The anal flap is bordered with white. The purple borders to the oblique stripes appear in this stage. They are never present at the beginning, and there is extreme irregularity in the time at which they appear and the extent to which they are developed. Sometimes they are not present at all in this stage. The borders are linear, and they are first seen in front of the middle of the 1st and last stripe, afterwards upon the intermediate ones. The shagreen dots are absent from the purple borders, or, if present, are very small, the borders being modified from the ground colour. At this stage the *Sphinx* attitude is often assumed during rest; in previous stages it was also seen, but far less commonly. In the present stage, and in the second, there is the greatest resemblance between this larva and that of *Smerinthus ocellatus*. The purple borders of the individual figured are rather more developed than usual.

FIG. 5.—Slightly over the natural size. Larva of *S. ligustri* at the close of the fourth stage, at rest in the *Sphinx* attitude, which is more marked in this stage than in any other. The larva at first exactly resembles the appearance in the last stage, but the purple borders are broader. The remnant of the subdorsal and line above it, with the large dots, are at first present, but disappear later. The "8th stripe" remains. The stripes are white where they are bordered with purple, yellowish above this, while the purple is replaced superiorly by dark green. The ground colour

round the oblique stripes is much yellower and brighter than elsewhere. The larva is shagreened all over, but the stripes become continuous at an earlier period than in the third stage. The purple borders are darker anteriorly and inferiorly, becoming black in the darker individuals (there is great variability).

FIG. 6, natural size.—Larva of the same species at the beginning of the fifth (and last) stage immediately after ecdysis. The larva in this stage is well known. For a few hours after ecdysis the horn and sides of the head are greenish, gradually becoming black. The shagreen dots (terminating in hairs) are also present, but very minute, and the "8th stripe" is visible. Very soon these characters cease to be recognisable, although the scattered white points which form the anterior inferior extremities of the stripes remain to the end, and are true shagreen dots, for each of them has a minute hair upon it. There are also very small but distinct dots on the ventral aspect of the body. Traces of shagreening can even be detected at first upon the caudal horn, which later becomes very smooth and polished.

FIG. 7, A and B, natural size.—Two abdominal segments from the central part of the body of a full-grown larva of *S. ligustri*, viewed from the left side, showing phytophagic differences. The larva from which (A) was drawn had been fed upon lilac for its whole life, while (B) had been fed upon privet. Both are dark varieties, but it is seen that (A) has a darker duller ground colour, and the purple border is not bright, as in (B). It is very difficult to bring out the differences between the larvæ in a figure. Too many annuli are represented on the segments: there should be eight upon each.

FIG. 8, $\times 3$ diam.—The head and anterior segments of the larva of *S. ligustri* at the close of the second stage, viewed from above. The figure shows the subdorsal, distinct in front, faint behind, between the 1st and 2nd oblique stripes. These markings are formed of yellow shagreen dots. The "8th stripe" and line above the subdorsal are formed of white dots, among which the larger spots are conspicuous. The annulation of the segments is shown, and it is seen that the dots composing the markings are separated by the furrows between the annuli.

FIG. 9, $\times 4$ diam.—The 1st and 2nd abdominal segments of the larva of *S. ligustri*, rather strongly contracted, just after the third ecdysis (fourth stage). The segments are looked at from above. At this early period in the stage the arrangement of the shagreening is well seen, and the relation of the dots covering the body generally to those forming the markings. It is seen that there is a ring of dots upon every annulus in the segment, and that a single dot in each ring becomes much enlarged and very white

when the level of the oblique stripe is reached. By this enlargement of a single dot at the appropriate level in each annulus the oblique stripes and other white markings arise. The 8th stripes are seen together as a V, and their constitution is shown to be similar to that of the other stripes. The purple borders are very small at the beginning of the stage, but the figure shows that this marking has nothing to do with the dots (which are absent from it), but arises as a darkening of the ground colour. The annulation of the segments is very distinct.

FIG. 10, $\times 50$ diam.—The extremity of a well-formed horn of a larva of *S. ligustri* in the third stage, viewed from above. The horn is covered with black tubercles (shagreen dots) terminated by minute hairs, which are always directed upwards. The bifid tip is formed of two rather larger tubercles with longer hairs. This feature is, of course, much more pronounced in earlier stages.

FIG. 11, $\times 188$ diam.—A single tubercle (dot), seen in optical section, from the side of the horn of the larva of *Smerinthus ocellatus* at the end of the third stage. The hair upon the apex is forked. The great majority are of this kind, but sometimes three or even four prongs are found in this species; and some hairs terminate simply. The penetration of the base of the hair into the apex of the tubercle can be just made out, as shown in the figure. The hairs are transparent and colourless.

FIG. 12, $\times 3$ diam.—The head of the larva of *S. ocellatus* in the third stage, as seen from the front. The larva was an extremely yellow variety, even at this period. (It was a larva found upon *Salix rubra* in the summer of 1884). The head is covered with yellow shagreen dots (with hairs). These are arranged round the margin as a yellow line in which they have coalesced, but are still recognisable. The two dots at the apex of the head and the summit of the marginal lines are bright red in colour, and greatly enlarged (although they still retain the hairs). At this time they form a very conspicuous feature.

FIG. 13, $\times 2$ diam. — The head of a whitish-green larva of *S. ocellatus* at the beginning of the fifth stage, viewed from the front. The red tubercles, which were so distinct in the last figure (12), were also prominent in the second stage, and continued into the fourth. At the close of this latter stage, however, the colour becomes yellowish or orange. In this figure (13) it is shown that the tubercles still retain the red colour upon their rounded summits, but their relative size is much less, and their shape is not conspicuous.

FIG. 14, $\times 2$ diam. — The head of a yellowish-green larva of *S. ocellatus*, advanced in fifth stage (about 50 mm. long) when looked at from the front. In this figure the red has entirely

disappeared from the tubercles, which are now only distinguished from the others by their greater size. In these three figures there is traced the gradual disappearance of a structure which must have been very conspicuous, from its colour and position, when it reached its culmination in the fifth stage. Its present significance appears to be historic. This seems to support the argument that the *Smerinthus* larva was brightly coloured, but has undergone alterations for protective purposes. The brightly-coloured spots that often appear on the body of *Smerinthus* larvæ are explained as due to reversion by this theory.

FIG. 15, $\times 6$ diam.—The larva of *Selenia illunaria* just after emergence from the egg, seen from the left side. The figure represents the habitual attitude of rest at this stage. The body is almost black, thinly covered with hairs (not shown), and encircled by four white interrupted bands.

FIG. 16, $\times 2$ diam.—The larva of *S. illunaria* towards the beginning of the second stage, seen from above. The ground colour is not so dark, the anterior band is distinct, the others much less so; the posterior band has become broad, and has spread backwards over the 5th abdominal segment as a light greyish cloud. The ground colour is still dark brown, becoming dull black posteriorly, but there is much variability. The protection at this stage is due to a resemblance to the excrement of birds, which is much assisted by the irregular (sometimes) asymmetrical attitude.

FIG. 17, natural size.—The larva of *S. illunaria* in the third stage, seen from the right side, at rest in the protective attitude. The appearance is now much altered. The anterior band is visible as two transverse pale yellow marks on the dorsal surface of the anterior part of the 2nd abdominal segment. The last band is also present as a light cloud upon the sides of the 4th and 5th abdominal segments, which are swollen, and each of them has two tubercles on the back. The ground colour consists of various shades of brown, or sometimes of dull yellow. The last pair of thoracic legs are placed on a prominent transverse ridge projecting from the ventral surface of the 3rd thoracic segment. By holding the ridge and the legs, as shown in the figure, the bend in the 3rd thoracic segment is made to appear exceedingly angular. The head is very flattened, and continues the line of the two anterior thoracic segments, and, like them, it is lighter on the under surface. The 1st and 2nd pairs of thoracic legs are bent upwards, and are thus inconspicuous. There are also other bends in the body of the larva, as shown in the figure. The very irregular attitude is assumed upon the surface of the leaves of the food-plant, for the larva does not at this time retire to rest upon the twigs. Hence

the protection is not by resemblance to a twig, but to an irregular fragment upon a leaf, such as the excrement of a bird or a brown piece of leaf.

FIG. 18, natural size.—The full-grown larva of *S. illunaria*, seen from the left side, at rest upon a twig. There is no essential difference between the colouring of this stage (fifth) and that of the third (fig. 17), and the intervening fourth stage is, of course, similar. Nevertheless, the appearance is very different, and this is entirely due to the attitude. The bend in the 3rd thoracic segment is still very prominent, but it is not so great as in the third stage. The effect is still to prolong the line of the body into the ridge on the ventral aspect of the 3rd thoracic segment and the 3rd pair of thoracic legs. The rest of the body is held straight, and the resemblance is to a lateral twig of the branch upon which the larva is resting. The effect of the anterior bend is very peculiar and unlarva-like. The white marks upon the 2nd abdominal segment are nearly always present. The thread which supports the larva in the protective attitude often passes between the 3rd pair of thoracic legs (see figure). The attitude and appearance in the fourth stage is similar to that just described and shown in fig. 18. The ground colour is very variable.

FIG. 19, natural size.—The larva of *Ennomos angularia* before pupation, seen from the right side. The colours have undergone change, and the larva was taken out of its cocoon to be figured. The adult larva was dark coloured and twig-like, but the colours have entirely changed to greenish tints. Thus the larva is inconspicuous against the surrounding leaves, which are fastened together to form its cocoon. This is important, for the loose construction of the latter renders the larva easily visible.

FIG. 20, natural size.—The pupa of *E. angularia*, seen from the left side. The pupa was nearly ready for the emergence of the imago, for the darkened eyes can be seen through the covering. In this form the pupa is bluish green, covered with white points.

FIG. 21, natural size.—The pupa of *E. angularia*, seen from above. The figure shows the other form of this dimorphic pupa. It is of a brownish-green colour, sprinkled with black dots. Both these forms are well protected in the cocoon, and it is probable that the species is directly benefitted by the dimorphism.

III. *On a new genus of Histeridæ.* By GEORGE
LEWIS, F.L.S.

[Read February 4th, 1885.]

PLATE VIII.

I FOUND a genus of Coleoptera in Japan whose members deviate so far from the *Histeridæ* in their general structure that, after a careful examination of their characters, I excluded it from a paper on this family in the 'Annals and Magazine of Natural History,' February, 1884, and merely alluded to it on page 137 as probably belonging to the *Synteliidæ*. A more perfect scrutiny of the insects convinces me, however, that they are true Histerids, although their location in the family is not easy to determine. There is much that is abnormal in their structure. If the elytral striæ and general surface sculpture is considered important, they may be placed near the cylindrical species of *Platysoma*; but there is no lip or chin to the prosternum, and, if this is thought to be an essential character, the genus must be put near *Tryponæus*. I am inclined myself to set them in the catalogue after *Platysoma*, because they are allied to the latter genus in their habit of life and mode of seeking their prey, rather than to *Teretrius* or *Tryponæus*.

The genus rests even now on four well-marked species, and two of these have a large range over Japan and occur in localities whose extreme limits lie 700 miles apart; we may rest therefore on the assurance that a genus so widely distributed is not confined to Japan alone, for although it is true the beetles from having a definite habitat are inclined to be local, they also belong to a class likely to be conveyed long distances in floating timber. In August, 1880, I saw large oak-trees on the beach at Horobetsu,—strewed there by a gale in the Pacific,—and trunks of such size doubtless landed large numbers of insects on the sea-border of Southern Yezo. But there are more weighty reasons for the supposition of a wide distribution. Lately

Dr. Sharp, while writing a memoir on the Japanese and Ceylonese *Colydiidæ*, found twelve of the genera were represented in both collections; and five species are found in Ceylon as well as Japan. And another insect found as yet in Japan alone—*Sympanotus pictus*, Sharp,—is closely allied to *Coxelus guttulatus*, Leconte, and in coloration agrees with it spot for spot. Thus small entomophagous Coleoptera living under bark or in rotten timber, as *Colydiidæ* do, are exposed to conditions which are in a great part the same all the world over; and we find them agreeing *inter se* more than those kinds that in the imago-state lead an active, and therefore a more diversified, life, rather than one in which concealment is continually courted.

My captures were made in moist forest-lands where such insects as *Cucujus*, *Hololepta*, and many *Nitidulidæ* were abundant, but the number of specimens I obtained was small—not above forty altogether. Like *Tereetrius* and *Tryponæus*, *Niponius* is entomophagous, and essentially diurnal; but instead of following the *Platypi*, which bore diametrically into the timber, it seeks out *Scolyti* and *Tomici*, which reside either in the bark or not far from the cambium. In fine weather in June, at Kashiwagi, I have taken *Niponius*, in company with *Cyphagogus*, crawling over the bark of oaks in search of fresh burrows.

There are other Coleoptera which have something in common with *Niponius*. *Osorius* and *Nemosoma*, for instance, have the armature of the head formed on a similar plan, and there is a certain correspondence in their habits. These usually live in old trees, and, when seeking food, force themselves through galleries partially obstructed by frass or fragments of wood, or burrow for their pabulum in the wood-mould created by decay under the bark; but in *Osorius* there are stercoraceous as well as arboreous species both in Japan and Ceylon, and it is only the latter which have the epistoma cornute. These facts taken together are evidence that habit, or the mode of life of an insect, precedes structure, and in these genera is the primary cause of the arrangement of the organic elements which build up the frontal formation we see in the species named. But, when stating that habit is sufficient to account for the manner of their construction, we must not forget that when a structure is once set up, modification of habit and modification of

structure advance together, and act reciprocally one on the other.

NIPONIUS,* n. g.

Corpus elongatum, cylindricum, nitidum. Caput magnum non retractile, epistomo cornuto; mandibulis validibus reflexis, bidentatis. Antennis elongatis, ante oculis insertis, clava ovali 4-articulata, 8^o obsolete. Pronotum parallelum, punctatum caput longium utrinque marginatum, scutellum minutissimum. Prosternum angustatum marginatum, lobo antico nullo. Elytris tenuis striatis. Pygidium foveolatum. Meso- et metasternum canaliculatis. Pedes sat elongatis, tibiis extus basali dente armatis.

Niponius impressicollis, n. s. (Pl. VIII., figs. 1—11).

Cylindricus, sat elongatus, robustus, niger, punctatus. Antennis pedibusque, nigro-piceis, clava tarsisque rufis; epistomo cornuto, piceo, transversim bicarinato, thorace grosse punctato, utrinque profunde impresso. Elytris striis 1^o validis et cæteris punctiformibus vel obsolete. Propygidio quadri foveolato. Pygidio profunde bisulcato. Long. 5—5½ mm.

This species is the largest and most robust of the series, and is distinguished from the others by the depth of the impressions in the thorax. I obtained eighteen specimens; gathered in pairs or single examples, from localities ranging from Yuyama in Higo to Junsai in Yezo.

Niponius osorioceps, n. s. (Pl. VIII., figs. 12—14).

Cylindricus, elongatus, niger, punctatus, pedibus nigro-brunneis, epistomo piceo transversim tricarinato, thorace grosse punctato utrinque obsolete impresso, elytris striis *N. impressicollis* similis. Propygidio pygidioque profunde bifoveolatis. Long. 4½ mm.

This insect is less robust than the last; the chief specific differences lie in the sculpture of the propygidium. Only two examples were captured, both in Higo, one at Yuyama and the other at Konose.

Niponius furcatus, n. s. (Pl. VIII., figs. 15—19).

Cylindricus, angustatus, niger, punctatus, antennis, pedibusque piceis, thorace grosse punctato, sine fovea, propygidio quadrisulcato pygidio biimpresso. Long. 4¼ mm.

* The name of this genus is derived from the word Nipon, of which Japan is a corruption. .

The narrow form of this species, the divergent direction of the projections on the epistoma, and the different form of the abdominal sulci separate it from the others.

There are five specimens in my cabinet from Yuyama.

Niponius obtusiceps, n. s. (Pl. VIII., figs. 20—23).

Cylindricus, elongatus, brunneus, punctatus. Antennis pedibusque rufis, epistomo obtuso subfurcato, thorace grosse necnon minute punctato. Elytris fasciis transversis medio nigris. Propygidio punctato, pygidio bisulcato. Long. 4 mm.

The colour separates this from all the others, and it is also remarkable in having the propygidium without fovæ or sulci. The large thoracic punctures also are interspersed with some of a fine grade which is peculiar to it. The elytral striæ are almost alike in all the species, and are not consequently of use as discriminating characters.

One example was taken at Oyayama near Kumamoto in Higo, and eight others have come to me through a collector I sent to the Ishikari River in Yezo in 1883.

EXPLANATION OF PLATE VIII.

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- FIG. 1. *Niponius impressicollis*.
 2. " under side.
 3. " mandible.
 4. " labrum and lingua.
 5. " mentum.
 6. " maxilla.
 7. " clypeus and labrum detached.
 8. " antenna.
 9. " profile.
 10. " fore leg.
 11. " hind leg.
 12. *Niponius osorioceps*.
 13. " profile.
 14. " face.
 15. *Niponius furcatus*.
 16. " profile.
 17. " face.
 18. " middle leg.
 19. " hind leg.
 20. *Niponius obtusiceps*.
 21. " profile.
 22. " face.
 23. " fore leg.

Figs. 2—7 are from dissections and drawings kindly provided by the Rev. A. Matthews. The under side of the thorax in fig. 2 is drawn as if pushed back from the abdomen.

IV. *List of Lepidoptera collected in Southern Afghanistan.*
By Lieut.-Col. C. SWINHOE, F.L.S., F.Z.S.

[Read October 1st, 1884.]

PLATE IX.

THIS list represents the Lepidoptera collected by me personally during the year I spent in field-service between Sibi and Kandahar during 1880—81. I took up a trained native collector with me, who collected every day, and, so long as he lived, my collection increased rapidly; but unfortunately the man was murdered one morning by a Ghazi, who got into my quarters in Kandahar a few months after my arrival there; and my very severe duties as administrative head of the whole of the Commissariat in Southern Afghanistan left me very little time to collect insects. To my own list I have added the few species from Afghanistan described up to the present, and I believe the subjoined list, meagre as it is, represents all the Lepidoptera from that country of which we have as yet any knowledge.

RHOPALOCERA.

NYMPHALIDÆ.

EUPLŒINÆ.

1. *Limnas chrysippus*.

Papilio chrysippus, Linn., Mus. Lud. Ulr., p. 263 (1764).

Specimens from Koondalane taken in March, Mach in August, Chaman in May, Quetta in September, and Kandahar in October; it was nowhere common, but one or two were to be seen occasionally wherever we stayed throughout the year, when the weather was not too cold. This insect appears to have no particular season for appearing. In Kurrachee I have taken examples of it in every month of the year, the specimens captured during the winter months being, as they also were in

Afghanistan, of a much smaller size than those taken in the warmer months.

SATYRINÆ.

2. *Amecera menava*.

Lasiommata menava, Moore, P.Z.S., 1865, p. 499, pl. xxx., f. 3.

Kwas Valley, Beloochistan, 8000 ft. elevation (*Lang*).

3. *Epinephele darendra*, Moore (var. *roxane*).

Epinephele roxane, Felder, Reise Nov. Lep. iii., p. 491, pl. 69, figs. 12, 13 (1867).

Chaman and the Kojak, May and June; Ispingil, June; Mach, in the Bolan Pass, July; Kandahar, May and June (*H. Roberts*). Fairly common; it is uniformly paler than *E. roxane*, but I have a pair that can hardly be distinguished from that species.

4. *Epinephele interposita*.

Epinephele interposita, Erschoff, Lep. Turk., p. 22, pl. ii., f. 16 (1874).

Chaman, May; Kandahar, May (*H. Roberts*).

5. *Epinephele narica*.

Papilio narica, Hübner, Eur. Schmett., i. f. 704—707 (1825).

Chaman, May.

6. *Hipparchia pimpla*.

Satyryx pimpla, Felder, Reise Nov. Lep., iii., p. 494, pl. 69, f. 10, 11 (1867).

Kwas Valley, Beloochistan, 8500 ft. elevation (*Lang*).

7. *Hipparchia parisatis*.

Satyryx parisatis, Kollar, Denkschr. Akad. Wien, Math. Nat. Cl., i., p. 52, n. 7 (1850).

Bolan Pass (Mach), July; Chaman, May; Balgoi, May; Kandahar, May and June (*H. Roberts*). Very common.

8. *Hipparchia anthe*.

Papilio anthe, Ochs., Schmett. Eur., i., p. 169, n. 2 (1807).

Chaman, May.

9. *Hipparchia thelephassa*.

Eumenis thelephassa, Hübner, Samml. Exot. Schmett., ii., pl. 85 (1816—24).

Chaman, May; Quetta, May and September; Gwal, May; Kandahar, May (*H. Roberts*). Fairly common.

10. *Ypthima bolanica*.

Ypthima bolanica, G. F. L. Marshall, P.Z.S., 1882, p. 759.

Mach, Bolan Pass; September.

NYMPHALINÆ.

11. *Melitæa robertsii*.

Melitæa robertsii, Butler, P. Z. S., 1880, p. 406, pl. xxxix., f. 2.

Chaman, April and May; Kandahar, May and June (*H. Roberts*). Fairly common.

12. *Pyrameis cardui*.

Papilio cardui, Linn., Faun. Suec., p. 276, n. 1054 (1761).

A few taken at Kandahar in October and November, 1880; very plentiful in March and April following. The gardens about Kandahar were alive with regular swarms of this butterfly in the last month; but I did not observe it at Quetta or anywhere else on our lines of communication between Sibi and Kandahar; Quetta, May, 1882.

13. *Junonia orithya*.

Papilio orithya, Linn., Mus. Lud. Ulr., p. 278 (1764).

Quetta, September. Not observed anywhere else.

LYCÆNIDÆ.

14. *Chrysophanus phlæas*.

Papilio phlæas, Linn., Faun. Suec., p. 285, n. 1078 (1761).

P. timæus, Cramer, Pap. Exot., ii., t. 186, E, F (1779).

Chrysophanus stygianus, Butler, P. Z. S., 1880, p. 408, pl. xxxix., f. 5.

Quetta, September; Kandahar, October to January. Very common. With a long series such as I have, containing the typical forms of all the three above named, it is absolutely impossible to separate them.

15. *Lycæna persica*.

Lycæna icarus, var. *persica*, Bien., Lep. Ergeb., p. 29 (1870).

Quetta, April to June; Kandahar, April to June (*Roberts*); also October and November. Very common. Also a very large variety taken at Quetta in August and September; and at Kasian and the Lora Valley in June; fairly common.

16. *Lycæna bracteata*.

Lycæna bracteata, Butler, P. Z. S., 1880, p. 407, pl. xxxix., f. 4.

Kandahar, May and June (*H. Roberts*).

17. *Lycæna chamanica*.

Lycæna chamanica, Moore, Journ. Asiat. Soc. Bengal (1884), vol. 53, part ii., No. 1, p. 8.

Kandahar, November; Quetta, August and September.

18. *Lycæna bilucha*.

Lycæna bilucha, Moore, Journ. Asiat. Soc. Bengal (1884), vol. 53, part ii., No. 1, p. 9.

Chaman, May.

19. *Lycæna fugitiva*.

Lycæna fugitiva, Butler, P. Z. S., 1881, p. 606.

Chaman, May; Gwal, May; Sheerog, June; Quetta, March to May. Very common.

20. *Polyommatus beticus*.

Papilio beticus, Linn., Syst. Nat., i. (2), p. 789 (1766).

Quetta, May, June, and September; Ispingil, June; Kasian, June; Lora Valley, June; Kandahar, April to June.

21. *Catochrysops contracta*.

Lampides contracta, Butler, P. Z. S., 1880, p. 406, pl. xxxiv., f. 3.

Kandahar, May and June. Very common (*Roberts*).

22. *Catochrysops* sp.

Near *C. amyntas*, Fab., of Europe, and nearer still to the American form, *C. comyntas*, Godart; but, as I got only one female example (Quetta, September), it is necessary to wait for further specimens before it can be properly identified.

23. *Zizera karsandra*.

Polyommatus karsandra, Moore, P. Z. S., 1865, p. 505, pl. xxxi., f. 7.

Metazai, May.

24. *Zizera kandura*.

Polyommatus kandura, Moore, P. Z. S., 1865, p. 772, pl. xli., f. 7.

Quetta, September.

The under side of the only example taken is much paler than the type, but it is otherwise identical.

25. *Zizera trochilus*.

Lycæna trochilus, Freyer, Neuere Beitr., v., pl. 440, f. 1 (1844).

Quetta.

26. *Scolitantides cashmirensis*.

Scolitantides cashmirensis, Moore, P. Z. S., 1874, p. 272. Kandahar, May and June. Very common (*Roberts*).

27. *Thecla mirabilis*.

Thecla mirabilis, Ersch., Lep. Turk., p. 7, pl. i., f. 4
(1874).

Chaman, May.

Among the three taken one is a very perfect example identical with Erschoff's figure.

28. *Aphnæus acamas*.

Lycaena acamas, Klug, Symb. Phys., pl. 40, figs. 7, 9
(1834).

Common at Chaman in May.

One very large female, taken at Chaman, measuring 1·6 in.; also a large var. received from Karain, June, 1882, measuring 1·5½ in.

PAPILIONIDÆ.

PIERINÆ.

29. *Pieris mesentina*.

Papilio mesentina, Cram., Pap. Exot., iii., pl. 270,
f. A, B (1782).

Chaman, March; Quetta, March to May and September; Ispingil, June; Karain, June; Kandahar, April, June, October, and November. Very common.

30. *Aporia belucha*.

Aporia belucha, G. F. L. Marshall, P. Z. S., 1882,
p. 760.

Ziarut Pass, Kwass Valley, June; 8000 ft. elevation
(Lang).

31. *Synchlōë daplidice*.

Papilio daplidice, Linn., Syst. Nat. (1), ii., p. 760
(1761).

Quetta, February to April, August and September; Goolistan, April; Chaman, May and August; Balgai and Kasian, June; Kandahar, February, April, August, and October. Common everywhere above the Bolan.

32. *Synchlōë iranica*.

Papilio iranica, Bienert, Lep. Ergebn., p. 27 (1870).

Kandahar, June; common (*Roberts*).

33. *Ganoris rapæ*.

Papilio rapæ, Linn., Faun. Suec., p. 270, n. 1036 (1761).

Pontia Mannii, Mayer, Stett. ent. Zeit., 1851, p. 151.

Quetta, March to May; Goolistan, May; Lora Valley, June; Chaman, May; Kandahar, January, March, April, October, and November. Very common everywhere.

Out of the many hundred examples I have examined some are referable to *G. rapæ*, and some to the true type of *G. Mannii*, but there are so many intermediate that it is impossible to separate the two forms.

34. *Ganoris brassicæ*, Linn., var. *nepalensis*.

Pieris brassicæ, var. *nepalensis*, Gray, Lep. Ins. Nep., pl. vi., f. 1, 3 (1846).

Kasian, June. One male example only.

35. *Catopsilia crocale*.

Papilio crocale, Cramer, Pap. Exot., i., pl. 55, c, D (1779).

The perfect wings of a female sent me from Quetta by Capt. Yerbury, but without date of capture.

36. *Colias helichtha*.

Colias helichtha, Lederer, Verh. zool.-bot. Ges. Wien, ii., p. 33 (1853).

Quetta, August and September; Kandahar, April to June (*Roberts*), and October.

It was scarce at Kandahar, but fairly plentiful at Quetta; this appears to me to be one of the most distinct species in the genus. If it ever was a hybrid between *C. erate* and *C. edusa*, as suggested by Dr. Staudinger, it is now so constant that it is impossible to mistake it for anything but what it is; then again Capt. Elwes says *C. erate* is only a variety of *C. hyale*,

and as regards *C. edusa*, from 1879 up to the present neither Howland Roberts nor Lang succeeded in getting it. My collectors hunted every day for ten months, and out of the many collections I have received from Quetta since I left Afghanistan, I have not obtained a single example of *C. edusa*.

37. *Colias erate*.

Papilio erate, Esper., Eur. Schmett., i. (2), pl. 119, f. 3 (1806).

Quetta, August to October; Kandahar, August to October. Very common.

All the females obtained by me are yellow, but many of them have regular leprous patches of white on the wings below.

38. *Colias pallida*.

Colias pallida, Staud., Cat. Lep. Eur., p. 3, n. 54 (1861).

Quetta, September; Chaman, April; Kandahar, October to April.

Some of the females are yellow and some white; it is very probably only a variety of the above, but can easily be distinguished, because all the males are more or less streaked with yellow in the black border of the fore wings, and the basal and central area of the hind wings below in all fresh specimens, yellow and white of both sexes, is dark greenish, leaving a broad marginal band of the lighter colour.

39. *Colias sareptensis*.

Colias sareptensis, Staud., Cat. Lep. Eur., p. 5, n. 64 (1871).

Quetta, May and September; Kandahar, February to October. Very common.

All the females obtained by me are white. Capt. Elwes, in his paper in Trans. Ent. Soc. Lond., 1884, part I., April, states his belief that the three last-named species, as well as *C. nilagiriensis* of Felder, are merely varieties of *C. hyale*. This is very probably true, insomuch that they very likely had some such common ancestor; but it is an indisputable fact that they are all

common in countries where *C. hyale* is not now found; where, in fact, if *C. hyale* ever did occur, it is now extinct, and is replaced by these varieties or new species, both terms, where the normal form is pushed out by a new and constant type, being synonymous; and I do not quite understand why he blames naturalists for giving these new forms new specific names, because a synonym is absolutely necessary to enable one clearly to record the habitat of the variety or new species. I could not, for instance, record *C. erate*, *C. pallida*, and *C. sareptensis* as Afghan varieties of *C. hyale*, because forms of exactly the same kind are found in many other countries, and therefore I must be thankful that I can enter them as *C. erate*, *C. pallida*, and *C. sareptensis*, because, though they may all have descended from *C. hyale*, and though the latter may still have occasional varieties like all three, still the three in many countries where *C. hyale* does not now exist are very plentiful, very constant, and very unlike typical *C. hyale*, and have, in point of fact, become new species.

40. *Teracolus fausta*.

Papilio fausta, Oliv., Voy. dans l'Emp. Ottom. Atlas, pl. 33, f. 4, a, b (1801).

Quetta, September; Kandahar, October and November.
Common.

Major Howland Roberts also took a few at Kandahar in June and July. It is the common form of this genus in Persia, Afghanistan, Beloochistan, and Sind.

HESPERIIDÆ.

41. *Pamphila karsana*.

Hesperia karsana, Moore, P. Z. S., 1874, p. 576, pl. lxxvii., fig. 6.

Quetta, September; Kandahar, October and November.
Not common; four pairs taken in all.

42. *Erynnis marrubii*.

Hesperia malvarum, var. *marrubii*, Rambur, Herr.-Schäff., Schmett. Eur. I. Hesp., f. 14, 15 (1845).

Quetta, May and September; Kandahar, April, October, and November. Very plentiful.

43. *Erynnis dravira*.

Pyrgus dravira, Moore, P. Z. S., 1874, p. 576, pl. lxxvii.,
fig. 5.

Kandahar, October. Common.

HETEROCERA.

SPHINGIDÆ.

1. *Deilephila robertsi*.

Deilephila robertsii, Butler, P. Z. S., 1880, p. 412,
pl. xxxix., figs. 9, 10.

Kandahar, July. Common.

2. *Deilephila livornica*.

Sphinx livornica, Hübn., Eur. Schmett., SpHING.,
p. 96, n. 5, pl. 12, f. 65.

One taken at Quetta in July.

3. *Eusmerinthus kindermanni*.

Smerinthus kindermannii, Lederer, Verh., zool.-bot.
Ges. Wien, ii., p. 92 (1853).

Kandahar, June, July, and August.

4. *Chærocampa cretica*.

Deilephila cretica, ♀, Boisd., Ann. Soc. Linn. Paris,
1827, p. 118, pl. 6.

Kandahar, June. Common in the vineyards.

5. *Chærocampa stipularis*, n. s. (Pl. IX., fig. 1).

Fore wings, antennæ, head, thorax, and abdomen dull fawn-colour, with a reddish tinge; antennæ thicker than usual, and deeply crenulated; fore wings with all the veins dark and plainly visible, a large cream-coloured transverse spot covering the whole space at the end of the discoidal cell, continued in a pale shade to the inner margin, forming a sort of pale band across the wing; inner margin covered with brown hairs, which deepen outwardly, and partly extend along the outer border. Hind wings brickdust-colour, becoming pale towards the costa and abdominal border; outer border darker, with a dark-coloured submarginal stripe of

six square spots; fringe cream-colour. Abdomen with segmental stripes of reddish brown, fringed with cream-colour. Below pale dull pinkish; legs and body pinkish cream-colour. Expanse of wings, $2\frac{9}{10}$ in.

Chaman, May.

6. *Macroglossa stellatarum*.

Sphinx stellatarum, Linn., Syst. Nat., i. (2), p. 803, n. 27.

Quetta, September; Kandahar, January, February, November, and December. Very common.

LITHOSIIDÆ.

7. *Deiopeia thyter*.

Deiopeia thyter, Butler, Trans. Ent. Soc. Lond., 1877, p. 361.

Quetta, May and September; very common. Kandahar, November; one taken.

All true *thyter* of Mr. Butler's type.

8. *Deiopeia pulchella*.

Tinea pulchella, Linn., Syst. Nat., i. (2), p. 884, n. 349. Kandahar, June.

NOCTUÆ.

LEUCANIIDÆ.

9. *Leucania loreyi*.

Noctua loreyi, Duponchel, Hist. Nat. Lep. Fr., vii., i., p. 81, pl. 105, f. 7 (1827).

Quetta, May.

XYLOPHASIDÆ.

10. *Spodoptera cilium*.

Spodoptera cilium, Guenée, Noct., i., p. 156 (1852).

Quetta, September; Dubrai, October.

HELIOTHIDÆ.

11. *Heliothis armigera*.

Noctua armigera, Hübner, Noct., pl. 79, f. 370.

Quetta, September; Kandahar, April. Very common.

12. *Heliothis rubrescens*.

Thalpophila rubrescens, Walker, Cat. Lep. Het. B. M., xv., p. 1681.

Quetta, September.

13. *Heliothis peltigera*.

Noctua peltigera, Wien. Verz., p. 89, n. 2.

Quetta, September. Common.

APAMIIDÆ.

14. *Caradrina belucha*, n. s. (Pl. IX., fig. 2).

Allied to *C. insignata*, Walk., but quite distinct. Head and fore joint of palpi white; thorax and fore wings yellowish cinereous, irrorated with brown, and with brown markings; costa with largish spots; reniform and orbicular quite distinct, the former 8-shaped, the latter round; basal, ante-medial, and post-medial broken zigzag lines, and outer series of brown longitudinal streaks almost forming a band and black marginal lunules; fringe yellowish and brown interlined; abdomen pale cinereous; hind wings silvery white, cinereous near the margin, with a marginal brown line; fringe white. Expanse of wings, $1\frac{1}{10}$ in.

Quetta, September.

15. *Laphygma exigua*.

Noctua exigua, Hübner, Eur. Schmett., Noct., f. 362.

Quetta, September.

NOCTUIDÆ.

16. *Spælotis undulans*.

Spælotis undulans, Moore, Sci. Res. Yark. Miss., Lep., p. 10, pl. i., f. 10 (1879).

Killa Abdoolla, May; Sagee, May; Dubrai, October.

17. *Spælotis coruscantis*, n. s. (Pl. IX., fig. 3).

Thorax and fore wings sericeous brownish grey; abdomen pale grey; fore wings irrorated with brownish atoms; orbicular spot very large, elliptical; reniform spot small, nearly round, both indicated by dark brown lines; costa with brown marks, and many

spots of the same colour all over the wing; outer border brown, with the line running into the veins, and with white dots on the under side; fringe grey, very deep; hind wing with the basal half silver-grey, gradually darkening into the darker brownish colour on the outer half; fringe white; the whole surface of both wings with a bright glittering sheen on it. Expanse of wings, $1\frac{3}{10}$ in.

Chaman, May.

18. *Agrotis suffusa*.

Noctua suffusa, Hübn., Eur. Schmett., Noct., fig. 134.
Quetta, September.

19. *Agrotis segetum*.

Noctua segetum, Wien. Verz., p. 81, pl. 1 a, figs. 3 a,
1 b, fig. 3 b.
Quetta, September; Dubrai, October.

20. *Agrotis aversa*.

Agrotis aversa, Walker, Cat. Lep. Het. B. M., x.,
p. 345.
Kandahar, April.

21. *Agrotis cespitis*, n. s. (Pl. IX., fig. 4).

Very pale fawn-colour; thorax with a slender brown band in front; abdomen whitish; tarsi with black bands; fore wings with pale brown marks on the costa, mostly in pairs, a dark brown sinuous marginal line; orbicular spot long, large, and club-shaped, with brown border; claviform long and narrow; reniform large, with incomplete brown borders; an interior and exterior brown irregular undulating line; fringe pale cinereous, with a brownish line running through the centre of it; hind wings white, tinted with fawn-colour towards the costa. Expanse of wings, $1\frac{1}{10}$ — $1\frac{4}{10}$ in.

Quetta, August and September.

22. *Agrotis conformis*, n. s. (Pl. IX., fig. 5).

Very pale fawn-colour; last joint of the palpi white, the remainder brown; abdomen fawn-colour, rather paler than the thorax; fore wings uniform pale fawn-colour, with a reddish tinge; orbicular and reniform spots large, round, very faint, the former

the larger, with a double ring round each, with the space between the rings slightly paler than the ground colour; fringe white; hind wings white; unmarked. Expanse of wings, $1\frac{1}{2}$ in.

Quetta, September.

ORTHOSIIDÆ.

23. *Orthosia uniformis*, n. s. (Pl. IX., fig. 6).

Pale fawn-colour; head whitish; thorax, abdomen, and fore wings uniform pale fawn-colour; unmarked; orbicular and reniform spots large, round, very faintly indicated by whitish lines round them; hind wings white; the entire surface of both wings covered with a silvery sheen. Expanse of wings, 1 in. $2\frac{1}{2}$ -10ths.

Quetta, September.

ANTHOPHILIDÆ.

24. *Anthophila ligaminosa*.

Amphipyra ligaminosa, Eversm., Bull. Soc. Imp. Nat. Mosc., 1851, xxiv., No. 2, p. 630.

Kandahar, April.

25. *Agrophila sulphuralis*.

Phalæna (Pyralis) sulphuralis, Linn., Syst. Nat. i. (2), p. 881.

Quetta, September and June; common. Kandahar, November; a few only taken, one example being almost pure bronze-colour, with nearly all the usual black markings absent.

26. *Leptosia quinaria*.

Leptosia quinaria, Moore, P. Z. S., 1881, p. 371.

Quetta, September.

PLUSIIDÆ.

27. *Plusia aurifera*.

Noctua aurifera, Hübner, Eur. Schmett., Noct., pl. 98, f. 463.

Quetta, September.

28. *Plusia circumflexa*.

Phalæna (Noctua) circumflexa, Linn., Syst. Nat., p. 844, n. 128.

Kandahar, October.

29. *Plusia extrahens*.

Plusia extrahens, Walker, Cat. Lep. Het. B. M., xii.,
p. 929.

Quetta, September.

AMPHIPYRIDÆ.

30. *Axiopœna fluviatilis*, n. s. (Pl. IX., fig. 7).

Allied to *A. maura*, Eichw., *A. karelini*, Ménétr., En. Corp. An. Mus. Imp., Lep., part iii., p. 160, pl. xvii., f. 5 (1863). Wings more falcate; colour of wings soot-brown; red of the hind wings covering less than the basal half; submarginal red markings wanting; anal portion and the entire under side of hind wings differs widely in having the red almost obliterated, the colour only being visible in the anal margin, and in a couple of basal streaks. Expanse of wings, $4\frac{4}{10}$ in.

Quetta; sent me by Capt. Yerbury. Date of capture not recorded. Found on the water-courses. Captain Yerbury states he has on several occasions found their wings on the banks in the early morning.

The only other example of this curious genus as yet discovered was referred by Ménétrics to the family *Arctiidae*, with which it certainly has no real connection, it being a *Noctua* and not a *Bombyx*. It is nearest allied to the *Amphipyridæ*, but is also closely allied to the *Bendidæ*, and will hereafter most probably, on the discovery of more species, find a place in a new family yet to be founded.

TOXOCAMPIDÆ.

31. *Spintherops spectrum*.

Noctua spectrum, Esp., Schmett., iv., 131, pl. 100,
f. 3, 4.

Quetta, June. Common.

32. *Apopestes phantasma*.

Spintherops phantasma, Eversmann, Bull. Mosc., 1843,
p. 546.

Kandahar, May.

CATOCALIDÆ.

33. *Catocala afghana*, n. s. (Pl. IX., fig. 8).

Fore wings exactly resembling *E. elocata*, Esp., of Europe, but the hind wings are of a different colour, and have the central black band stopping short of the abdominal margin, and formed exactly as in *C. arizona* of Grote.

Gwal, June; Quetta (no recorded date).

OPHIUSIDÆ.

34. *Grammodes stolida*.

*Noctua stolid*a, Fabr., Sp. Ins., ii., 218, 54.

Moostaff, at the mouth of the Bolan Pass; March.

35. *Thria inepta*.

Thria (?) *inepta*, Butler, P. Z. S., 1881, p. 620.

Chaman, April and May.

GEOMETRITES.

ACIDALIIDÆ.

36. *Acidalia ornata*.

Phalæna ornata, Scopoli, Ent. Carn., 219, 545.

Quetta, July; one taken. Kandahar, October; two taken. November and December, very common.

37. *Idæa negataria*.

Idæa negataria, Walk., Cat. Lep. Het. B. M., xxii., p. 751.

Kandahar, October.

FIDONIIDÆ.

38. *Sterrha sacraria*.

Phalæna sacraria, Linn., Syst. Nat., i (2), p. 863 (1767).

Quetta, September; very common. Kandahar, October; common. November, two or three taken.

39. *Tephrina ossca*, n. s. (Pl. IX., fig. 9).

Allied to *T. falsaria*, Walk. Dirty bone-colour; antennæ blackish in the male, and deeply pectinated throughout, simple, and of the general colour in the female; a blackish spot at the end of the cell in each wing; costa of fore wings and a deep faint marginal border rather darker than the rest of the wings; otherwise the wings are unmarked. Expanse of wings, ♂ 1 in. $\frac{1}{2}$ -10th, ♀ 1 in. 2-10ths.

Quetta, March, May, and September.

HERMINIIDÆ.

40. *Aginna turpatalis*.

Bocana turpatalis, Walker, Lep. Het., xvi., p. 174.

Male, Quetta, in September. Female taken in Bombay in September.

PYRALIDÆ.

41. *Pyralis farinalis*.

Phalæna (Pyralis) farinalis, Linn., Syst. Nat., i. (2), p. 88, n. 327.

One taken at Kandahar in April.

42. *Aglossa pinguinis*.

Phalæna (Pyralis) pinguinis, Linn., Syst. Nat., i. (2), p. 882, n. 336.

Quetta, May and September; Kandahar, April and October.

HERCYNIDÆ.

43. *Pyrausta ostrinalis*.

Pyralis ostrinalis, Hübner, Pyral., pl. 17, f. 113.

One taken at Kandahar in November.

44. *Eschremon disparalis*.

Eschremon disparalis, Herr.-Schäff., Schmett. Eur., vi., p. 140, f. 134, 135.

One taken at Kandahar in November.

45. *Aporodes meleagrisalis*.

Herbula meleagrisalis, Walker, Cat. Lep. Het. B. M., xvii., p. 324.

Quetta, March and May; Metazai, May; Kandahar, November.

BOTIDIDÆ.

46. *Spilodes sticticalis*.

Phalœna (Pyralis) sticticalis, Linn., Syst. Nat., i., (2), p. 883, n. 340.

One taken at Quetta in September.

47. *Scopula ferrugalis*.

Pyralis ferrugalis, Hübner, Pyral., p. 27, n. 13, pl. 9, f. 54; pl. 23, f. 150.

One taken at Kandahar in November.

SCOPARIIDÆ.

48. *Stenopteryx hybridalis*.

Pyralis hybridalis, Hübner, Pyral., pl. 17, fig. 114.

Quetta, March and September; Metazai, May; Kandahar, February, October, and November. Very common.

CRAMBIDÆ.

49. *Eromene bella*.

Tinea bella, Hübner, Tin., fig. 60.

Two taken at Chaman in May.

PHYCIDÆ.

50. *Acrobasis imbella*.

Acrobasis (?) imbella, Walker, Cat. Lep. Het. B. M., xxx., p. 955.

Kandahar, May.

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V. *Life-history of three species of Western Pacific Rhopalocera.* By GERVASE F. MATHEW, R.N., F.L.S., &c.

[Read February 4th, 1885.]

PLATE X.

Papilio Schmeltzi, Herr.-Schäff.

This fine butterfly, which I believe is the largest* species inhabiting the Fijian Islands, was not uncommon at Suva and Levuka in May, June, and August, 1882-3-4, and I also met with it at Mango and Vanua Balavu, and it probably occurs upon all the other islands of the group.

From notes I have been able to make of its habits I am inclined to believe that there is a succession of broods throughout the year, although they are doubtless more plentiful during certain months. They are difficult to obtain in perfect condition, for they frequent thick forest undergrowth, where they soon lose their tails and get their wings torn. They fly in an irregular jerky manner, and, when frightened, go off at a rapid pace.

On June 6th, 1884, while collecting in the forest near Suva, I saw a female fluttering about a small shrub in a shady spot beneath some thick-foliaged trees. I had long hunted in vain for the larva among a variety of what I had imagined were likely food-plants, and now at last the secret was about to be disclosed. Keeping perfectly still, I watched, as the butterfly flitted from twig to twig, and presently saw her alight upon a leaf, and, with vibrating wings, thrust her abdomen beneath

* I have a large female *Ornithoptera* (I believe an undescribed species) which was given to me by a friend, who assured me that he had received it from Fiji; but I have spoken to many people at Suva and Levuka, and they are all confident that they have never seen or heard of such a large butterfly, nor do the natives know of it. However, it is not impossible that such a species may exist in the less explored portions of the islands, particularly in Vanua Levu, the large northern island.

it, and in a moment the egg was deposited! She then flew up and wheeled several times round the bush, but, as she showed no disposition to lay another egg, I netted her, as she was a remarkably fine and perfect specimen. Upon examining the shrub I found the egg fixed to the under side of the leaf, not far from the tip, and, after thus discovering the food-plant, I had not much difficulty in finding a supply of ova, larvæ, and a few pupæ.

The shrub upon which the larvæ feed is a species of *Aralia* (probably a small variety of *Aralia ritiensis* of A. Gray), and at a little distance reminds one of our English spindle-tree. It grows to a height of from eight to ten feet, bears broadly lanceolate dark glossy green leaves, and clusters of small white sweetly-smelling flowers, with a perfume something like that of privet. Its berries are at first green, but turn to bright scarlet when ripe. They germinate freely, but do not seem to grow quickly, for the ground in the neighbourhood of an old bush is often thickly covered with little plants about a foot high, with a single stem nearly as thick as one's little finger. It was upon these small plants, growing in shady places, that the larvæ, &c., were chiefly to be found. Sometimes as many as three or four ova were to be seen upon a single leaf, but they were probably deposited by different females, as they were generally of different age. As a rule the same female only lays one egg upon the same leaf, though she may deposit several upon the same plant. These ova were terribly subject to the attacks of a minute hymenopterous parasite. Only about one in a dozen produced a larva, the remainder giving birth to three or four ichneumons, so small that they were barely visible to the naked eye.

The egg is perfectly globular above and flattened at the base. When newly laid it is of a pale straw-yellow, but changes to orange in about twenty-four hours, and a couple of days before the larva emerges to a mottled grey, the black head of the young caterpillar showing plainly through the upper part of the shell.

The egg laid on morning of June 6th hatched on the afternoon of June 11th. After resting for a little while the young larva turned round and carefully devoured the empty shell. It was then a quaint-looking little creature; its head black and shining; 2nd segment surmounted by a pair of white-branched spines, seated upon ear-like

protuberances pointing forward over the head on each side, and forming a kind of hood; dorsal surface greyish white, with a black bar across the 4th and 5th segments; subspiracular and ventral region black, subdorsal white; branched spines upon each segment, those on the anal segment being the longest, and pointing backwards.

After the first moult the markings of the larvæ remain much the same, but the ear-like protuberances are not so conspicuous, and assume a spiny appearance, and the white spines have become reduced to small, fleshy, wart-like tubercles of a reddish-brown colour upon all the segments but the 6th, 7th, 12th, and 13th, where they are white.

After the second moult there is a marked difference in the appearance of the larva; its whole surface is of a glistening reddish-brown colour, and the 3rd, 4th, and 5th segments have become much thickened; the spines upon the 2nd segment, projecting over the head, are of a creamy white, and a nuchal Y-shaped tentacle is emitted between them when the larva is irritated; there is an oblique whitish stripe on 8th and 9th segments, and an irregular whitish subdorsal spot on the 11th and 12th segments, and a narrow shining white subspiracular line. At this stage of its existence the larva has a peculiar slimy appearance, its skin looking as if it was too tight for it.

After the third moult the larva somewhat loses this shining peculiarity, and more nearly approaches its final dress, the reddish brown giving way to mottled greens, greenish yellows, browns, and reds.

The full-grown larva is from 50 mm. to 55 mm. long, rather stout and plump in proportion to its length, and with the 3rd, 4th, and 5th segments considerably thickened; there are two small pointed tubercles upon the crown of the 2nd segment, just behind the head, and from between these, when the larva is annoyed, it protrudes its peculiar Y-shaped nuchal tentacle, which is of a bright carmine colour; there are also three or four small blunt tubercles on each side of the dorsal line on the 3rd, 4th, and 5th segments, and faint indications of tubercles on each side of the dorsal line on the remaining segments, those on the anal segment being conspicuous and pointing backwards. The whole colour of the upper surface, as far as the spiracular stripe, a beautiful apple-green, mottled and marbled

with oblique and transverse markings of darker, paler, and golden green; upon the 3rd, 4th, and 5th segments the golden green predominates, and towards the spiracular stripe, upon the 3rd segment, there is a blotch of greenish blue; a broad glistening white stripe, very narrowly bordered by black above, above the spiracles, and extending from anterior of 5th segment and terminating in anal flap just above the claspers; a triangular brownish-red patch running from mouth obliquely upwards to dorsal line, and having its base on posterior of 5th segment; a broad oblique stripe on 8th segment springs from the spiracular stripe, and runs backwards a little into the 9th segment nearly to dorsal line, blackish red above and mottled with white and grey below, its lower part forming a triangular blotch; a similar but smaller stripe on 10th segment; head and legs reddish brown; ventral and anal claspers pale slate-colour; under surface whitish, mottled with grey; spines golden green.

The above is a description of what appears to be the typical larva, but they vary a good deal, some having scarcely any oblique or transverse markings, while others are beautifully marbled with madder-brown or golden olive.

When full-fed the larva remains in one position for about twenty-four hours, during which period it voids the contents of its intestinal canal. It then proceeds to spin the usual pad of silk for the insertion of the anal hooks of the chrysalis, and, having completed this and its silken girdle, it remains quiescent for another twenty-four hours, or generally less, and then changes to a chrysalis.

None of the larvæ I reared showed any disposition to wander when they were full-grown, but attached themselves to the twig where they last fed, and took no pains whatever to conceal themselves; and those I found at large were equally exposed.

Neither the larvæ nor chrysalids, as far as I could see, appear to be subject to the attacks of ichneumons, for all those I found produced butterflies, and the numerous empty chrysalids I saw showed no signs of having given birth to anything else than their lawful occupants. But once I happened to come across a chrysalis which had only just turned, and while it was in a soft and helpless state was being attacked by a number of very small red

ants, who had managed to bore their way into it, and its violent writhing attracted my attention. When I passed that way again a few hours after there was nothing left but a little piece of shell attached to the anal hooks. If this chrysalis had had time to harden I do not believe the ants could have harmed it.

The chrysalis is from 30 mm. to 35 mm. long, angulated; head strongly bifid; back considerably humped; sheath of haustellum prominent; body much pinched in at centre, where the suspending silken girdle supports it; ridged subdorsally, and with two small tubercles each side of lower part of abdomen; all the upper parts of a beautiful deep bluish green; costal portion of wing-sheath streaked with silvery white; a spiracular silvery white abdominal streak; a short ventral silvery stripe near the anal point; central portion of the abdomen bright golden green, forming a conspicuous triangular mark; sheath of haustellum and other parts slightly tinged with golden green. Shortly before the butterfly emerges the chrysalis changes to a deep leaden green colour, and then to black, and the butterflies generally appeared between seven and eight in the morning.

Papilio Godeffroyi, Semp.

This is, I believe, the only species of *Papilio* (and the largest butterfly) occurring in the Samoan islands. It was common near Apia, on the island of Opolu, and at Pango-Pango, on the island of Tutuila, in June, 1884, and is probably to be found upon all the islands of the group. I was fortunate enough to take it in all its stages. Its habits are almost similar to those of *Papilio Schmeltzi*. The perfect insect flies rapidly among the forest trees, and often ascends to a considerable height, being attracted by the flowers on the topmost branches. I only succeeded in capturing one, although I had several other chances. They fly in a wild irregular manner, and are difficult to net. The larvæ were not uncommon, and I took them of all sizes. They fed perfectly exposed upon young stunted plants of *Aralia* growing in shady and sheltered places. This *Aralia* differed slightly from the Fijian, the leaves being larger and the shrub altogether more robust; but it was evidently merely a climatic variety.

The ova were attached to the under sides of the leaves

in the same manner as those of *Papilio Schmeltzi*, and were similar in every particular. They were also terribly attacked by the same kind of parasite. Here, however, the similarity ceases, for the larvæ, chrysalids, and perfect insects are quite different.

The young larva is black, with a white V-shaped mark on the back, running through the 5th and 6th segments. Spines black, those upon the anterior segments being the longest, and curved backwards at their tips; head black and shining.

After the first moult there is very little change, the white V-shaped mark is slightly larger, and the general colour smoky black.

At the third stage the head is black and shining; general colour dusky black; a greyish-white oblique stripe runs up from spiracular line from 5th segment to apex of 6th segment, and joins over the back, and appears, when the larva is viewed from above, like a broad V-shaped mark; a shining white line just above each of the ventral claspers; subdorsal conspicuous, curved pointed spines upon 2nd to 13th segments, those on the 2nd segment the longest, and pointing outwards, and slightly curved backwards at the tip, and with an additional small spine at their base; and there is also an additional spine upon the 3rd and 4th segments, between the subdorsal row and spiracles; the spines on 6th to 8th segments are very small; ventral and anal claspers slaty gray.

The fourth stage is similar to the third stage, with the following exceptions: the whole larva has become very shining, and looks as if its skin was too tight for it; the V-shaped mark is much smaller; the spines are smaller, and of a golden-brown colour, tipped with black; the spines on 6th to 8th segments have disappeared; the white stripe above the ventral claspers to anal segment is much broader; the ventral claspers shining whitish grey.

The full-grown larva is from 50 mm. to 55 mm. long, rather plump, tapering slightly towards the anal extremity, and with the 4th, 5th, and 6th segments considerably thickened; whole colour a beautiful golden green; oblique darker green stripes pointing backwards; a darker narrow dorsal line widening out to a diamond-shaped longitudinal spot at the segmental divisions; a double stripe between this and the oblique stripes; from

the 2nd segment, in a line with the mouth, a somewhat triangular blotch of a deep velvety madder-brown runs obliquely upwards through 3rd and 4th to base of 5th segment, and connects over the back with a similar marking on the other side; this stripe is continued through the 6th segment, where it meets the broad shining white stripe, which runs above claspers to vent; the triangular blotch is bordered above by a pale golden-green line; on 8th and 10th segments a somewhat triangular madder-purple blotch, bordered above by a narrow white stripe; head shining brownish green, with a narrow white line down centre of face, and a V-shaped mark over mouth; legs pale reddish brown; ventral and anal claspers smoky black; two bluntish orange-coloured spines upon the 2nd segment, just behind the head, and at the base of each of these a minute orange tubercle, between which, and a little to the rear of the spines, is the nuchal valve, through which, when the larva is irritated, the usual tentacles are emitted: the tentacles are of a deep carmine, and give off the accustomed pungent odour; on 3rd and 4th segments a pair of subdorsal blunt spines; on 5th, and from 9th to 13th segments, a single subdorsal spine on each side; all the spines orange, faintly tipped with black.

These larvæ varied a good deal; in some the oblique stripes and triangular blotches were entirely absent, the whole surface, above the white spiracular stripe, being of a beautiful green, more or less marbled or streaked with darker and golden greens; while one or two larvæ I took had the markings upon one side only! a circumstance I do not remember to have met with before.

The chrysalis is from 30 mm. to 35 mm. long, angulated; head very strongly bifid, the extreme points tipped with black; back gradually arched; sheath of haustellum prominent; costal edge of wing-case ridged; body pinched in at centre; whole surface a beautiful golden apple-green; spiracles well marked, darker; segmental divisions clearly defined, pale yellowish brown.

The chrysalis is invariably attached to the midrib of a leaf, while those of *Papilio Schmeltzi* are just as invariably attached to a stem.

There was a peculiarity about these larvæ which I have not seen mentioned as having been noticed in the larvæ of any other species of *Papilio*. On the crown of the 2nd segment, just behind the head, there is a horny

plate, with a transverse slit or valve in it, through which the nuchal tentacle is emitted; and when this tentacle is thrust out to its fullest extent the larvæ have the additional power of shooting out a fine, colourless, thread-like filament from the tip of each branch of the tentacle, the larva tossing its head backwards, or moving it rapidly from side to side all the time. As soon as the cause of irritation is over these little filaments are first withdrawn before the tentacle itself disappears through the valve-like aperture. All the time the tentacle is exposed an unpleasant pungent odour, as of rotten oranges, is distinctly perceptible; but this is, I believe, common to most larvæ of the *Papilionidæ*. In confinement I noticed that the larvæ fed only by day, remaining perfectly quiescent during the night; and the larvæ of *P. Schmeltzi* have the same habits.

Rearing larvæ on board ship is, of course, attended with much difficulty, as it is nearly impossible to obtain a constant supply of fresh food for them. However, in the case of the larvæ just described I found it easy to dig up small plants—about a foot high—of *Aralia* (taking care to see that there was as much earth as possible attached to the roots). These I placed in empty biscuit-tins, with more earth, and kept well watered, and found that they remained fresh for weeks. Indeed, as I write this (August 21st), the plants are still alive, and throwing out a new crop of leaves. Another thing in my favour was that during the two months the larvæ were feeding we were cruising among the Fijian, Samoan, and Tonga Islands, where plenty of the food could be got, and, as we were seldom at sea for more than a few days at a time, I was able to gather fresh food pretty frequently, and only allowed the larvæ to eat the growing plants when we were actually at sea and their other food had shrivelled.

The tins were secured upon a table in my cabin, and on the wall behind these were some pictures framed in maroon-coloured velvet. One morning I noticed that a larva of *Papilio Godeffroyi* had attached itself to a leaf which was almost touching one of these frames, and when I looked at it the next morning I was surprised to see that it had changed to a chrysalis of a beautiful deep rose-colour. After this I thought I would try some experiments, so I pinned some twigs, to which were attached larvæ that were on the point of changing, to

pieces of cork, to which I had gummed scarlet, blue, black, yellow, and white papers. Those placed on scarlet and white changed to rosy-pink chrysalids, those on blue and yellow to green, and those on black to very dark green. The chrysalids of *Papilio Godeffroyi* have a thinner shell, and are more delicate than those of *Papilio Schmeltzi*, and in consequence they were probably more susceptible to rays of light, for the former were more influenced by the colour of the background than the latter. The newly-changed chrysalids of both species were pale green, and it was not until several hours had elapsed that they assumed the colour of their surroundings. They are also very soft, and are covered with a thin coating of some viscid substance, which may have the power of absorbing refracted rays of colour-light as they dry and harden.

The *Aralia* grew more abundantly upon the Tongan islands than at Samoa or Fiji, but I saw no signs whatever of either of these butterflies at Tongatàbu, Vavua, or Lefuka (the three islands of the group which we visited), at which I was rather surprised, for these groups are not very far apart.

Xois Sesara, Hew.

This beautiful little butterfly, which appears to be confined entirely to the Fijian Islands, is usually to be seen by the sides of paths in the bush, or in moderately open spots in the forest where the ground is overgrown with a thin carpeting of a species of couch-grass, upon which its larvæ feed. It flies in a weak uncertain manner, and frequently alights upon a blade of grass or upon a flower. I watched the females time after time in the hope of seeing them deposit their eggs, but never detected them doing so; so I came to the conclusion that they are dropped as the butterflies fly over the grass. Of course I was very anxious to find the larvæ, and had many a long and unavailing hunt for them; and it was not until the afternoon of August 2nd, 1884, that my labours were crowned with success. In a certain pathway through the bush, near Suva, there was a small open spot where the grass grew in patches, and here *X. Sesara* were flying in considerably numbers, and many of them looked as if they were dropping their eggs; so, thinking this was a likely place, I went down on my hands and knees and tore the grass up by the roots, and

shook it over a clear piece of ground, which I had previously prepared for the purpose, as I thought it very possible that the larvæ might be night-feeders, concealing themselves among the roots during the day. At the very first shake, to my infinite delight, out dropped an unmistakable Satyrid larva, which, of course, could be no other than that of *X. Sesara*, for the only other Satyrid occurring near Suva is the ubiquitous *Melanitis Leda*, whose larva I was very well acquainted with. This larva appeared to be about full-grown, and, having found it so easily, I thought there would not be much difficulty in getting a plentiful supply of them; but a couple of hours' hard work under a broiling sun only produced two more of them, one the same size as the first, and the other about half-grown. A few days after I found three more small larvæ near the same place. One or two pieces of the food-plant dug up by the roots, with earth attached, and placed in a small wide-mouthed bottle, kept alive and fresh and continued to throw up young shoots in my cabin for several weeks; and upon these the half-dozen larvæ were successfully reared, and produced butterflies at Sydney during September.

The larvæ in confinement were rather sluggish in their habits, and when not feeding rested upon a dead or withered blade of grass, well down towards the roots, and their colour so harmonised with the dried stems that they were difficult to see. When annoyed they generally curled themselves into a ring and fell to the ground, though sometimes they remained on the blade of grass and raised their anterior segments *Sphinx*-like.

The full-grown larva is from 18 mm. to 20 mm. long, cylindrical, tapering towards each extremity, and with the anal segment produced into two points; head smooth, subcordate, slightly porrected, and manifestly larger than the 2nd segment; whole colour a light pinkish brown, or pinkish putty-colour; dorsal stripe darker and bordered on each side by a line of a still deeper shade; subdorsal line darker than the general ground colour, and bordered below by another line of a paler hue, and below this there are several longitudinal lines; just above the spiracles there is a pale waved line, and below them a conspicuous pale stripe; spiracles very small and black; ventral surface slightly darker than the upper; head same colour as the body, with a

small V-shaped mark above the mouth, a line down the centre, and three wavy lines on each side of face; ocelli deep brown. The whole larva is covered with very minute raised dots, which give it rather a roughened appearance, and there are also a few fine hairs, which, however, are scarcely visible to the naked eye; segmental divisions clearly defined.

One of the small larvæ, when I first took it, was pale green, with pinkish dorsal and lateral lines, but became drab or putty-colour when it was about half-grown.

When ready to pupate the larva attaches itself by its anal hooks to a pad of silk spun on the under side of a grass-stem, and generally well down towards the roots of the plant.

The chrysalis is 9 mm. long, short and stumpy, with the margins of the wing-sheaths strongly ridged; a ridge across the back from just beyond the anal angle of wing-sheath, and two conspicuous curved ridges on back of abdomen, and one smaller one; several small dorsal tubercles. Whole surface a warm putty-colour, reticulated and dotted with reddish brown; keel of ridges rather darker. One chrysalis out of six was of a beautiful pale golden green, with the margins of the wing-sheaths pink, and a few scattered pink dots and lines.

This butterfly was very abundant near Suva, on the island of Viti Levu, and at Levuka on Ovalau; but I did not meet with it at Mago or Vanua Balavu, two other islands of the Fijian group. It occurs throughout the year.

EXPLANATION OF PLATE X.

- FIG. 1. Larva of *Papilio Schmeltzi*.
2. Pupa of " "
3. Larva of *P. Godeffroyi*.
4. Pupa of " "
5, 6. Larva of *Xoïs Scsara*.
7. Pupa of " "
8. " " " (green var).
-
9. *Triscolia patricialis*, Burm.
10. *Scolionima insignis*, Butl.
11. *Mygymia aviculus*, Sauss.
12. *Coloborhombus fasciutipennis*, C. O. Waterh.

VI. *On two remarkable cases of mimicry from Elopura, British North Borneo.* By H. J. S. PRYER.

[Read December 3rd, 1884.]

PLATE X.

SINCE the appearance of my friend Mr. George Lewis' valuable paper on the mechanical action of solar rays I have sought evidence for and against the views expressed therein, more particularly as affecting the questions of protective coloration and mimicry. Having obtained lately, while in Borneo, two most striking cases of mimicry which I think will throw some light on both points, I venture to lay the following remarks before the Society.

The first case is a large coleopteron mimicking an equally large hymenopteron:—

Description.—The beetle: Size, $1\frac{3}{8}$ in. long; expanse of wings, $2\frac{1}{2}$ in. The elytra are only $\frac{3}{8}$ in. long, leaving the greater portion of the body exposed, after the manner of the *Staphylinidæ*. Antennæ, 1 in.; legs long, hind pair $1\frac{3}{8}$ in. Colour: Antennæ, head, thorax, elytra, body, and legs, jet-black; wings also black, but having a large conspicuous white patch occupying the apical third of the wing; tip of the wing black.*

The wasp: Size, $1\frac{3}{8}$ in. long; expanse of wings, $2\frac{1}{2}$ in. Antennæ, $\frac{3}{8}$ in.; legs long, hind pair $1\frac{3}{8}$ in. Colour:

* *Coloborhombus fasciatipennis*, n. s.

Niger velutinus; alis nigro-fuscis, fascia lata ante apicali alba. Long. 16 lin.

Velvety black, with scarcely any violet tint above; distinctly tinted with violet-blue below. The wings nearly black on the costa, shading into dark fuscous posteriorly, with slight bluish tints here and there. Near the apex of the wing there is a broad semi-transparent white band. Abdomen with a whitish silky spot on the side of the basal segment beneath.

Hab. Borneo.

This species differs from *C. hemipterus*, Fabr., from Java, chiefly in having a white band across the wings. The thorax is, however a little more transverse.—C. O. WATERHOUSE.

Antennæ, head, thorax, and body, jet-black; wings also black, but having a large conspicuous white patch occupying the apical third of the wing; tip of the wing black.*

It will be seen that they agree in shape and colour, and the only difference is an unimportant one, in the length of the antennæ; the shape of the beetle agrees as nearly as it is possible to imagine insects so widely separated as a wasp and beetle could be.

It is singular that there is also a second species of wasp very closely resembling the one described, also common in North Borneo; it is, however, rather larger, and with yellow antennæ instead of black.

The second case is a large lepidopterous insect, a *Sesia*, mimicking a very large hymenopterous *Scolia*:—

Description.—The moth is a male, and therefore presumably somewhat smaller than the female. Size, $1\frac{1}{4}$ in. long; expanse of wings, 2 in. Antennæ, $\frac{1}{2}$ in.; hind legs nearly as long as the body, very hairy. Colour: Antennæ black; palpi yellow; head black; upper part of thorax black, lower part yellow; body black, with a conspicuous yellow band in the middle, and a little yellow on the 1st segment; legs black; wings of a uniform metallic blue-black, only excepting a clear space on the anal angle of the hind wing.†

* *Mygnumia aviculus*, Sauss. (Described from Java).—W. F. KIRBY.

† SCOLIOMIMA, n. g.

Allied to the African genus *Toosa* (= *Ninia*); primaries elongated, rather narrow, the costal margin nearly straight, slightly arched towards the apex, which is moderately acute; outer margin very oblique; inner margin nearly straight; costal vein lying very close to the margin, terminating a little beyond the middle of the costa; subcostal five-branched, the first two branches emitted before the end of the cell; the third and fourth emitted from the anterior angle of the cell, the fifth forking from the fourth half-way between the cell and the outer margin; disco-cellulars forming an oblique zigzag line; upper radial emitted above the middle of the disco-cellular; lower radial and third median branch emitted close together, and widely diverging from the first and second branches, which are also emitted close together; the whole (owing to the narrowness of the wing) being somewhat crowded together at the inferior extremity of the cell; submedian following the inner margin in its slight deviation from a straight line; secondaries elongated, with nearly straight costal margin; outer margin very gradually arched to abdominal margin, which is short and straight; costal vein running close to edge of costa; subcostal branches running parallel to about the basal third, where they unite

The bee: Size, $1\frac{3}{8}$ in. long; expanse of wings, $2\frac{3}{4}$ in. Antennæ, $\frac{5}{8}$ in.; hind legs nearly as long as the body and hairy. Colour: Antennæ black; head yellow; upper part of thorax black, lower part yellow, extending to the 1st segment of the body; rest of the body black, with a conspicuous yellow band in the middle; wings of a uniform metallic blue-black; the anal angle of the hind wing projected. The colours of both bee and moth were identical when alive, but since their capture the yellow on the bee has changed to a brownish tint, and

abruptly; disco-cellular veinlet obsolete; median branches widely separated; submedian and internal veins widely divergent; head large, broad, with prominent eyes; palpi large, recurved, densely scaled, with acute terminal joint; antennæ long, very thick, smooth, coarsely pectinated in front (not bipectinated); tapering, and with a small terminal pencil of hair at the distal extremity; collar broad; thorax very robust and convex; abdomen long, coarsely scaled, especially towards the anal extremity, which has an almost woolly appearance owing to the numerous long projecting scales which clothe the last three segments; anterior legs rather short and thick, the tibiæ broad and coarsely scaled; posterior legs densely clothed with coarse hair-scales, as in *Melittia*.

Scoliomima insignis, n. s.

An admirable mimic of *Triscolia patricialis*; the primaries metallic sap-green, with the apical border from fourth subcostal branch to third median bronze-brown (forming an almost triangular patch of this colour); secondaries bronze-brown, but nearly the whole basal half occupied by a broad patch of metallic sap-green; a transparent white spot at base of interno-median area; nearly the whole of the area enclosed between the submedian and internal veins also hyaline white; head black-brown, antennæ blue-black; palpi chrome-yellow, with black terminal joint; collar brilliant golden yellow; thorax black-brown, with two patches of yellow scales at the back; abdomen blue-black, with a golden-yellow belt on the basal segment and another on the 4th segment; under surface of body black, extremity of femora of posterior legs with a few white hairs; tarsi fringed with white hairs; expanse of wings, 56 mm.

The scales on the collar of this species are bent, in order to catch the light, and thus render the resemblance which this yellow band bears to that on the back of the head of the *Triscolia* more striking; the hairy legs no doubt help to make up the deficiency in the width of the abdomen needed to complete the similarity of the moth to the wasp.

The genus *Scoliomima* agrees best with *Toosa*, Walk., in form of wings, with *Melittia* in the clothing of its legs; but in its antennæ it comes nearer to *Tarsa*, though very distinct, owing to the unipectinate character of these organs. It should stand between *Toosa* and *Melittia*.—ARTHUR G. BUTLER.

the yellow on the body of the moth is now almost obliterated by grease.*

The habits of these insects, as far as my observations go, are that the wasp, bee, and beetle fly about under the shade of the forest; the wasp and beetle frequently settle on the ground; the bee flies very heavily, making a loud buzzing noise; the moth, when first seen, was flying rapidly about a bush in the open, and was captured while at rest on a leaf in the full blaze of the sun.

The wasp (or beetle) is abundant, but difficult to capture; when flying or on the ground at a distance of six feet it is quite impossible to distinguish the wasp from the beetle, and I cannot therefore say which is most common, as I only succeeded in securing a single specimen of each. The bee is very common, but I only saw one of the *Sesia*, which was taken on Pulo Balhalla, an island just outside Sandakan Bay, and about two miles from Elopura.

I have unsuccessfully endeavoured to apply Mr. Lewis' theory to account for the remarkable resemblance shown in coloration, as having been effected by the mechanical action of light only, but in both instances we have an equally remarkable resemblance in form, which I think shows in a marked manner, more particularly in the case of the wasp and beetle, a wonderful intentional resemblance, indicating clearly the handiwork of an Almighty designer, effected doubtless by the agency of natural selection; in contradistinction to an objectless blind mechanical action of the laws of light, which cannot fortuitously have also altered or adapted the shape and size simultaneously in both cases to heighten the protection undoubtedly obtained by the resemblance in colour.

Granting for the sake of argument that the habits of the wasp and beetle are alike, and that both are subjected to the same solar influences, still in the case of the bee and moth the habits are very different. The moth when first seen was flying rapidly, and afterwards settled in the sun, this being in accordance with the usual habits of a *Sesia*, the bee, on the contrary, spending most of its time in the shade. The question of solar influence is also further complicated by the presence

* *Triscolia patricialis*. Burm. (Described from Sumatra).—
W. F. KIRBY.

of a second species of wasp marked in nearly the same manner as the first.

From the view that the three insects (two wasps and a beetle) owe their similar coloration, irrespective of solar influence, to natural selection, the case at once becomes easy of comprehension. In the forests of Borneo the greatest destroyers of insect-life on the ground are lizards and birds such as the Pittas; the wasp and beetle, which frequently run on the ground, are conspicuously marked with a white spot, and exhibit this as a flag of danger to any would-be destroyer; no living creature would knowingly twice attack such a formidable insect as this wasp. I have seen a small *Sphex* attack and paralyse the largest of the tropical spiders. It is easy to understand how the beetle, having the same habits as the wasp, has ultimately assumed the same garb as the wasp through the influence of natural selection. It is also very probable that the resemblance in colour, shape, and habits indicates an even closer intimacy between the wasp and beetle, as the latter may be a parasite on the wasp, when the resemblance would be beneficial in a twofold measure. All three are very restless, sometimes running or flying in the shade, and at others in the sun, but always recognisable from a distance by the white spot.

It is also easy to understand how the moth became so much like the bee, by the action of natural selection; all the *Sesiæ* resemble bees and wasps to a certain extent, although their habits are widely different from the Hymenoptera. The *Sesiæ* spend a great deal of their existence either sunning themselves on a trunk or leaf, or flying with so great rapidity as to be nearly invisible. This particularly large *Sesia* has come to resemble in coloration a large bee, owing to the survival of those most closely approaching the bee, until the resemblance has become perfected in the manner we now see it, these having a manifest advantage when propagating their species.

EXPLANATION OF PLATE X.

- FIG. 9. *Triscolia patricialis*, Burm.
10. *Scolionima insignis*, Butl.
11. *Mygymia aviculus*, Sauss.
12. *Coloborhombus fasciatipennis*, C. O. Waterh.

- VII. *On the discovery of a species of the Neuropterous family Nemopteridæ in South America, with general considerations regarding the Family.* By ROBERT M'LACHLAN, F.R.S., Pres. Ent. Soc. Lond.

[Read March 4th, 1885.]

THE insects forming the family *Nemopteridæ* (or—as some no doubt prefer to read it—*Nematopteridæ*) have remained until now probably the only important group of Neuroptera that was unknown either in North or South America, and, notwithstanding their marvellous form, they appear to have excited so little interest in America that in the last (8th) edition of Dr. Packard's 'Guide' the family is dismissed with half-a-dozen lines of mention, including the statement that "the species are found in Western Asia and in Northern Africa."* The form of these insects is so essentially peculiar that I had almost despaired of the possibility of the family occurring in America; still there was always the hope that it might be found in Chili (that land of marvels in insect-productions), and in Chili it has been found. Mr. J. J. Walker, R.N., late of H.M.S. 'Kingfisher,' recently gave me a single example of a species observed by him not uncommonly on a sandy spit at Coquimbo, North Chili, at the end of January and beginning of February. Mr. Walker was (perhaps unfortunately) perfectly familiar with the striking black and yellow species of the sandy shores of South-eastern Europe: he was not aware that the family had not been noticed from America, and, moreover, he paid but little attention to Neuroptera generally; therefore he brought home only this single specimen, which was exhibited by me at the meeting of this Society held on October 1st, 1884.

The family stands much in need of generic subdivision, but unfortunately, with the exception of the European forms, the species are so limited in amount of available

* Dr. Packard here overlooks the fact that the typical species are essentially South European, and that the family has long been known to extend into India, Australia, and all over Africa.

materials as to render this a work of difficulty. In 1842,* however, Rambur, in his *Hist. Nat. Névroptères*, p. 332, essayed a division into three genera, viz:—(1) *Nemoptera* (restricted), for the black and yellow “European” forms, with the mouth strongly produced into a beak; (2) *Halter*, for mostly transparent forms, with the long narrow hind wings more or less dilated towards the tips, and the mouth also produced into a beak; (3) *Brachystoma*, for a single hyaline species, in which the mouth (or front) is short. *Nemoptera* (as restricted) is very natural; *Halter* is somewhat heterogeneous; *Brachystoma* remains practically unknown to me save from the figures in Savigny’s *Descript. de l’Égypte*. Certain species described by Klug (whose work was apparently not known to Rambur), Westwood, &c., such as *N. capillaris*, *jilipennis*, &c., with almost hair-like hind wings, form an especially distinct group or genus.

In considering the new Chilian insect, Rambur’s *Brachystoma* † comes prominently forward, for the front is more decidedly shorter ‡ than is indicated in Savigny’s figure. Unfortunately the palpi, &c., are not in good condition. The insect might be placed provisionally in *Brachystoma*; but that term had previously been used by more than one author (and even in *Insecta*), so I propose for it the generic term *Stenotænia*, and leave it for future decision as to whether Rambur’s *Brachystoma* be absolutely congeneric with it, or otherwise.

STENOTÆNIA, n. g.

(= *Brachystoma*, Ramb.?, *nom. præoc.*).

Antennæ rather short, setaceous, but stout, the joints strongly distinct, except towards the apex. Head above narrowly transverse; front very short; cheeks strongly developed, with a very deep fovea on each, in part impinging upon the cheeks, in part on

* But one year previously Westwood (*Proc. Zoological Soc. Lond.* 1841) had essayed a division into sections, &c., without names.

† F. Walker, *Cat. Brit. Mus. Neuroptera*, pt. ii., placed under *Brachystoma* many species to which his divisional character “*Os vix elongatum*” by no means applies, and which should be transferred to *Halter*, &c.

‡ The ordinarily rostrate front in *Nemopteridæ* usually results from all the parts (front proper, clypeus, and labrum) being greatly elongated (the labrum especially so), and this is exaggerated owing to the labium usually extending beyond the apex of the labrum.

the sides of the true front.* Clypeus and labrum scarcely distinct, very short and transverse (labium and palpi uncertain). Pronotum short and transverse. Abdomen short and slender. Legs slender; first tarsal joint equalling all the others united, 5th as long as the 2nd to 4th united. Anterior wings transparent (of the form usual in the Old World species with transparent wings), network rather close. Posterior wings very long, narrowly tape-like, not dilated towards the end (but twisted, as is usual), not conspicuously ciliated.

Stenotænia Walkeri, n. s.†

Antennæ about 43-jointed, black, the basal two joints yellowish beneath. Head deeply bisinuate posteriorly above; yellow, a broad transverse blackish brown band above, behind the antennæ, a very broad band of same colour in which the antennæ are inserted (leaving only a narrow yellow line between it and the band on the vertex); front yellow; orbits yellow; the posterior portion of the top of the head brownish in the situations. Pronotum yellow; at about one-third of its length the posterior portion is strongly separated from the anterior by an elevated ridge, leaving a depressed transverse collar, slightly clouded with brownish; the posterior portion with a large median, and two smaller lateral, brownish black spots, and the deflexed sides are also broadly of the same colour; there are also numerous small brown dots, whence arise short black hairs. Meso- and meta-nota blackish, with short black hairs, but the inner sides of the lateral lobes of the mesonotum and the scutellum of the metanotum (excepting in its centre) are yellow. Breast and sides of thorax yellow, varied with brown. Abdomen (♂) yellow, above with a narrow black longitudinal median line, and a broad lateral black band (leaving only narrow subdorsal yellow lines); beneath it is wholly yellow, excepting a narrow lateral blackish line below the lateral sutures, and there are numerous small semituberculate black dots, whence spring black hairs: terminal dorsal segment blackish in the middle, clothed with long black hairs, triangularly excised in its posterior margin; appendages stout, cylindrical, very obtuse, somewhat conical if viewed laterally, slightly incurved, yellow, with a blackish spot externally, furnished with long black hairs: terminal ventral segment large, yellow, furnished and fringed with long black hairs, its apical margin rounded; it is deeply concave if viewed from

* Savigny's figure indicates precisely analogous foveæ as existing in the Egyptian species on which Rambur founded "*Brachystoma*," and an approach towards a similar structure, but much less pronounced, occurs in others.

† In honour of Mr. J. J. Walker, R.N.

above, and with an appearance as of a large raised tubercle in the middle of the cavity. Legs yellow, with numerous short, but strong, black hairs; coxæ internally, femora internally at the base, and externally at apex, tibiæ externally at apex, tarsal joints at apex, marked with brown; claws piceous, yellowish at base.

Anterior wings long-oval, very obtuse, costal edge straight; vitreous and very shining, but the costal margin to below the radius is broadly smoky grey; pterostigma scarcely indicated; neuration black, set with rather long divaricate black hairs; subcosta and radius conspicuously yellow; costal nervules simple; cellules mostly quadrangular. Posterior wings very narrow, not dilated near the tips, greyish, but the inner margin transparent; subcosta and radius yellow;* only very faint indications of the usual darker fasciations; marginal veins blackish; the veins and the margins with short black hairs.

Length of body (♂), 11 mm. Expanse of anterior wings, 56 mm. Length of an anterior wing, 26 mm.; greatest breadth of same, 9½ mm. Length of a posterior wing, 58 mm.; breadth of same, 1½ mm.

Hab. Coquimbo (*J. J. Walker*).

In *facies* this insect quite agrees with several Old World forms, in which the wings are transparent but have the costal margin tinted.

CROCE, n. g.

I propose this generic term for a group of species, usually of small size, characterised by the front being very strongly produced into a slender beak, by short antennæ (which are usually somewhat thickened towards the apex), by transparent anterior wings with very open neuration and usually with a strongly-defined pterostigmatic mark, and especially by long *setaceous* posterior wings, strongly ciliated, in which even the rudiments of neuration are scarcely to be traced.

Taking *N. filipennis*, Westwood, as the type of this genus, I think the following should also be placed

* I do not remember to have seen any description of the neuration of the hind wings of *Nemopteridae*, other than a vague statement that there are two longitudinal veins. In reality there are *three* such veins, *viz.*, the subcosta and radius, which become confluent a little before the apex, as in the anterior, and a third vein equivalent to one of the cubiti. The marginal veinlets are simple (straight or oblique), but in those species in which these wings are very strongly dilated before the apex, such as "*N. dilatata*," "*N. Huttii*," &c., they are complex in the dilated portion.

therein, viz.:—*N. alba*, Oliv., *N. aristata*, Klug, *N. capillaris*, Klug, *N. setacea*, Klug, and *N. pusilla*, Taschenberg.*

This group of excessively delicate species appears to be especially partial to the desert regions of Africa and Asia.

Of *Nemoptera* as restricted to the four characteristic species that find a place in the "European Fauna," viz., *N. Coa*, L., *N. lusitanica*, Leach, *N. ægyptiaca*, † Rambur (*hebraica*, Westwood), and *N. sinuata*, Oliv., nothing further need be said.

But there remain many species which for the present may find a place in *Halter*, Rambur, species with transparent wings, and the front prolonged into a beak. *Halter*, as defined by Rambur, should have the posterior wings "plus ou moins dilatées" before the apex. If taken literally, several of these remaining species could not in this case rest in this genus. But the form and amount of dilatation varies greatly in different species (and also slightly according to sex). I think it will be found that tarsal characters of some importance exist in several of these species, but my materials are too few. ‡

These insects (excepting the well-known European forms) are very difficult to obtain, and I only possess about sixteen species of the family as a whole, which, however, contrasts favourably with other collections I have seen. Less than thirty species are known, and it is very probable that the names by which some of these are represented are really only synonyms.

* According to this association of species, *Croce* is practically identical with Westwood's group (Proc. Zool. Soc. Lond. 1841, p. 13), characterised by the words "alæ posticæ setacæ, haud fasciatæ."

† Rambur's *ægyptiaca* was characterised from Savigny's excellent figure. Hagen (Stett. ent. Zeit., 1866, p. 451) identifies it with *sinuata*, Oliv., but erroneously. It is more allied to *lusitanica*, Westwood's *hebraica* (Thes. Ent. Oxon.) was from Syria, whence I also possess the insect, which is undoubtedly that figured by Savigny.

‡ Westwood, in 1841, separated these species into two groups, according to the dilatation, or otherwise, of the posterior wings; but a more radical subdivision, based upon other characters, may become necessary.

VIII. *New species of Languriidæ.* By Rev.
W. W. FOWLER, M.A., F.L.S.

[Read March 4th, 1885.]

THE following new species of *Languriidæ* are from Guinea, with the exception of one fine species of *Callilanguria* from the Philippine Islands; they are more particularly interesting, as comparatively few species have hitherto been described from Africa. One new genus, which appears to be distinct, has been formed, and it is probable that two or three of the other species have a claim to generic value: the more, however, that the *Languriidæ* are studied the more evident it becomes that an entire revision of the family is necessary, and that the genus *Languria*, at all events, is composed of a number of heterogeneous groups that will ultimately have to be separated. There is one character that hitherto has been much neglected, but which seems likely to prove very useful, and that is the formation of the parts of the head and the position of the antennæ. In the *Languriidæ* the antennæ are inserted in sockets, which vary very much in size, shape, and depth; these stretch obliquely from the eyes to the clypeus, and are therefore larger or smaller, accordingly as the eye approaches the clypeus or is removed farther from it. In some genera (e. g., *Fatua*, *Callilanguria*, *Langurites*, and *Goniolanguria*), there is a clear corneous space between the eye and the commencement of the socket; in others, as in *Teretilanguria*, there is no intervening space, and the eye appears to open straight upon the socket. If we examine the various species of the genus *Languria* we shall find that many of them have a clear space between the eye and the antennal socket (as, for instance, *L. lata*, *L. discoidea*, *L. atriceps*, and the species, as a rule, that have the prothorax red), whereas other species (e. g., *L. ingens*, *L. geniculata*, *L. Lewisii*, &c.), have the eye opening immediately, or almost immediately, on the socket, as in *Teretilanguria*, to

which genus these particular species bear a closer external resemblance than they do to the majority of the ordinary species of *Languria*.

Another very important point is the relation of the clypeus to the labrum. These parts seem to a certain extent to be correlative; if the clypeus is small the labrum is proportionately large; if, however, the clypeus is large the labrum is proportionately small, and in some cases the corneous portion forms a mere strip, or the labrum is entirely membranous and partially concealed behind the clypeus. A few instances may perhaps be mentioned. In *Callilanguria* the clypeus is very short (this is especially noticeable in *C. eximia*, n. s.); the labrum, however, is actually longer than the clypeus, and is very distinct; in *Pachylanguria* the clypeus is long and the labrum short; in *Teretlanguria* the clypeus is very large and distinct, rather convex, with the suture plain and well-marked, and the apparent labrum is reduced to a narrow strip; in *Doubledaya*, again, the clypeus is very narrow and emarginate, while the labrum is rather large and membranous; in *Goniolanguria* the clypeus is very peculiar, being large, with a strong λ -shaped emargination; in *Langurites* it is large and distinct, and the labrum is also well-marked. The clypeal suture usually runs straight across between the base of the antennæ, but it is rather variable as to position and distinctness, and is often distinctly curved; when it is strong the head is usually depressed just before it: however, whatever may be the size of the clypeus, the socket for the reception of the antennæ appears to be continued to meet it. The nearer, then, that the clypeal suture approaches to the mouth the larger the sockets become; this is very apparent in several of the genera mentioned, and more especially in genera akin to *Cladoxena*; in the latter genus the head is large and the clypeus is very small and situated at the extremity; the antennal socket accordingly runs along the whole side of the front part of the head as far as the mouth; a clypeal suture in some specimens appears to be indicated between the antennæ, and may prove deceptive, but there is no real division, and the length of the antennal socket indicates its true position.

In the division of the *Languriidæ* great stress has been laid upon the number of joints in the club of the antennæ, and yet the genus *Languria*, as at present

constituted, contains many species that vary considerably in this point; the formation of the apex of the elytra is also a strong point, and yet now there are *Languriæ* with rounded, truncate, and produced apices; the mouth-parts and the skeleton of the under side will also probably be found useful.

The species described below are all from the collection of Mr. Gorham, who has kindly put into my hands his whole collection of the group, and has given me many valuable hints and notes concerning them.

Mr. Gorham intends shortly to give an account of the species of *Languria* of the Dutch Royal Expedition to Sumatra, in the Notes from the Leyden Museum.

I have received a small number of Assam *Languriæ* from Mr. G. Lewis, which appear to comprise two or three new species, and also a new species from my brother in Assam. These I hope to describe in a future paper.

I ought to add, in conclusion, that all the species described have been carefully compared by Mr. Gorham with Mr. Crotch's type-specimens from Africa, and that they are all quite distinct from his species.

CALLILANGURIA, *Crotch*, Cist. Ent., xiii., 1876, p. 5.

Callilanguria eximia, n. s.

Elongata, postice acuminata, prothorace eum epipleuris viridicæneo, elytris cupreis, antennis pedibusque nigris; capite magno, lateribus fortiter dilatatis, parum punctato, fronte leviter impressa; antennis modicis, clava 5-articulata; prothorace elongato, vix rotundato, et postmedium leviter contracto, basi marginata bisinuata, lævissimo, puncturis paucis majoribus irregulariter dispositis; elytris longis, angustis, lævibus, apicem versus acuminatis, haud striatis, puncturis subtilioribus seriatim dispositis, interstitiis subtilissime punctatis; tarsis dilatatis. Long. 27·5 mm.

Elongate, narrowed towards apex; prothorax greenish bronze; elytra cupreous; antennæ and legs black; femora with a bronze reflection. Head large, with the sides very strongly dilated to receive the large mandibles; eyes situated on the top of the head, rather prominent, finely granulate; clypeus very narrow; labrum large and distinct, furnished with long hairs; prothorax nearly twice as long as broad, very smooth, with sides slightly rounded, almost parallel; base bisinuate, margined, marginal fold strongly punctured; on the disc and sides there are a few scattered and rather large punctures; elytra very long, gradually narrowed to apex, with regular rows of fine punctures, which are almost

obsolete towards base and apex; apices truncate, with a slight blunt tooth near suture.

Hab. Philippine Islands.

This fine species appears to be the largest of the *Languriidæ*, in point of length, that has yet been described.

LANGURIA, *Latr.*, *Hist. Nat. Crust. et Ins.*, iii., 1802, p. 209.

Languria Nyassæ, n. s.

Oblonga, parallela, tota ferruginea, antennis pedibusque unicoloribus; capite modico, leviter impresso, punctato; antennis brevibus, clava male distinguenda, triarticulata; prothorace subquadrato, confertim fortiter punctato, lateribus fere parallelis, ad basim sensim contractis, his et basi marginatis; scutello sat magno, punctato; elytris oblongis, parallelis, striato-punctatis, interstitiis subtiliter punctatis, apicibus rotundatis; corpore subferrugineo, profunde punctato, metasterno fortiter-canaliculado. Long. 9—9.75 mm.

Oblong and rather broad, entirely of a ferruginous colour; head moderate, inserted into the thorax as far as the eyes, which are large, black, and not very prominent; antennæ rather short, with a badly-defined 3-jointed club; prothorax almost quadrate, coarsely punctured, with sides and base margined, the latter very slightly sinuate, almost straight, the former almost parallel, very slightly contracted towards base; base with a small round impression and a very indistinct short stria on either side; elytra oblong, with sides almost parallel, about twice as long as prothorax, with plainly punctured striæ, and rows of small punctures on each interstice; in a cross light the elytra are plainly rugose transversely; legs rather stout, tarsi somewhat dilated, femora strongly punctured; under side ferruginous, deeply punctured; extreme posterior margins of abdominal segments piceous.

Hab. Lake Nyassa.

This species appears to form a type of a distinct section of the genus. I should propose to give it generic value under the name of *Promecolanguria*; there are, however, other species that come near it, and which require examination before the genus can be formed finally.

Languria Calabarensis, n. s.

Tota nigro-cyanea, corpore subtus rufo, antennis pedibusque (femoribus præter genua exceptis) nigris; capite sat magno, oculis prominentibus; antennis modicis, clava latiori 4-articulata; prothorace leviter convexo, apicem versus rotundato, diffusius et fortius punctato, utrinque stria profunda basim attingente instructo; scutello magno postice acuminato; elytris basi prothoracis latioribus, humeris prominentibus, ordinibus punctorum seriatim dispositis, apicibus rotundatis; pedibus robustis, femoribus late rufis, tarsis fortiter dilatatis. Long. 10 mm.

Nigro-cyaneous, with antennæ and legs black, except the base of the femora, which is broadly red; under side entirely red; prothorax subquadrate, slightly convex, rounded in front, very slightly contracted towards base, broadest a little before middle, with a strong basal stria on each side; scutellum large, pointed, with two large deep circular punctures; elytra rather broad, considerably wider at base than base of prothorax, set with very regular rows of round punctures; interstices very slightly coriaceous, almost smooth; legs rather stout; tarsi considerably dilated.

Hab. Old Calabar.

Languria dubia, n. s.

Elongata, nigro- vel viridi-ænea, corpore subtus fusco-piceo, antennis et pedibus (basi femorum ad extremum excepta) nigris; capite prothorace angustiori, oculis hand prominentibus, antennis modicis, clava lata 4-articulata; prothorace subquadrato, subdepresso, lateribus vix rotundatis, fere parallelis, marginatis, diffusius punctato; scutello semicirculari; elytris sat longis apicem versus sensim acuminatis, tarsis dilatatis. Long. 10 mm.

Rather elongate, nigro-cyaneous, shiny, under side pitchy; head rather large, eyes not prominent; head with a strong depression before clypeus; clypeus large and much more strongly punctured than disc of head; antennæ of moderate length, with a broad flat 4-jointed club, of which the 1st joint is the smallest, the 2nd and 3rd large and broad, and the 4th narrower than the two preceding; prothorax black, subquadrate, with the sides very slightly rounded, almost parallel, without basal striæ; scutellum semicircular; elytra with prominent shoulders, slightly acuminate towards apex, with regular rows of moderate-sized punctures, interstices slightly coriaceous; legs black, except the extreme base of the femora, which is rufous.

Hab. Guinea; Cameroon Mountains.

This species comes rather near the preceding, and I thought at first that it might be the other sex; the absence, however, of the striæ at the base of thorax, the round scutellum, and the different sculpture of the elytra, seem to show that it is a distinct species.

Languria Murrayi, n. s.

Tota læte cyanea, antennis pedibusque cyaneis vel nigro-cyaneis; capite sat magno, oculis prominentibus; antennis robustis, sat longis, clava lata 4-articulata; prothorace convexo, fere subgloboso, lateribus fortiter rotundatis, marginatis, ad basim valde depresso, latitudinem longitudine fere æquante, diffusius punctato; scutello magno, fortiter depresso; elytris ad basim depresso, inde subdepresso, ad apicem sensim contractis, apicibus latis subrotundatis, punctis seriatim dispositis instructis; corpore subtus cyaneo; pedibus nigro-cyaneis; coxis rufis. Long. 8 mm.

Of a deep bright blue colour, with antennæ and legs black or slightly cyaneous; head rather large, with prominent eyes; prothorax about as broad as long, very convex, with sides strongly rounded and gradually contracted behind; base of prothorax very strongly depressed, forming a horizontal fold before posterior margin; disc and sides with rather large shallow punctures; scutellum large, much depressed, circular, but fixed in a triangular cavity; elytra rather broad, becoming gradually narrower towards apex, convex at base, and from thence rather depressed to apex; apices rounded, truncate just at their extremity, with even rows of moderate-sized round punctures; interstices almost smooth; legs robust; tarsi somewhat dilated.

Hab. Old Calabar.

Languria femoralis, n. s.

Tota nigro-ænea vel picea; capite triangulari, oculis magnis prominentibus, antennis robustis, clava 4-articulata; prothorace magno, latitudine longiori, convexo, subgloboso, lateribus fortiter rotundatis, leviter marginatis, hoc et capite diffusius et fortius punctatis; elytris prothoracis medio angustioribus, ad apicem sensim contractis, ordinibus punctorum seriatim dispositis, utroque producto subacuminato; pedibus robustis, nigris, femoribus ad basim late rufis; corpore subtus piceo. Long. 6.75 mm.

Nigro-æneous or piceous; under side piceous; head large, triangular, rather strongly punctured, with large prominent eyes; antennæ somewhat robust, with a 4-jointed club, black except the base, which is pithy; prothorax convex, with sides strongly

rounded, diffusely and strongly punctured; elytra narrow compared with prothorax, with regular rows of punctures; shoulders not prominent; each elytron is depressed towards suture near apex, and the apex is produced into a blunt point; legs rather stout, black; base of femora broadly rufous.

Hab. Guinea; Cameroon Mountains.

Languria monticola, n. s.

Elongata, cyanea, capite prothoraceque rufo, antennis, basi excepta, nigris, pedibus versicoloribus, corpore subtus rufo, apice abdominis fusco; capite triangulari, oculis prominentibus; antennis modicis, clava 4-articulata; prothorace latitudine longiori, lateribus leviter antice rotundatis, postice sensim contractis, ad basim depresso, et stria basali utrinque evidentiter instructis; scutello sat magno, rufo; elytris cæruleo-cyaneis, ordinibus punctorum seriatim dispositis; femoribus nigris, ad basim rufis, tibiis plus minusve piceis, tarsis testaceis, unguibus piceis. Long. 5.75—6 mm.

Elongate, cyaneous, with head and prothorax red; antennæ with 4-jointed club; head triangular, with prominent eyes, rather strongly and deeply punctured; prothorax longer than broad, slightly cordate, rather diffusely punctured, with a well-marked depression at base, terminated at each end by a plain longitudinal stria; scutellum rather large, red; elytra bluish, with shoulders distinctly raised, with regular rows of moderate-sized round punctures; femora black, with base red; tibiæ pitchy or reddish; tarsi testaceous; claws pitchy.

Hab. Guinea; Cameroon Mountains.

STENOLANGURIA, n. g.

Elongata, angustata, capite lato prothoracis latitudinem æquante vel superante; clypeo magno, convexo; oculis magnis prominentibus, antennis basim prothoracis haud attingentibus, clava biarticulata; prothorace latitudine multo longiori, basi bisinuata, angulis posticis fortiter acuminatis; elytris apicem versus sensim angustatis, humeris prominentibus, apicibus ad extremum plus minusve divaricatis, utroque producto et acuminato, pedibus longis teretioribus.

This genus appears to present a distant affinity to *Oxylanguria* on the one side, and rather a strong connection with *Langurites* on the other; the chief marks of distinction are the divaricate apices of the elytra, which are more or less strongly pointed, and are

furnished with a more or less evident blunt tooth before their extremity, the large and rather prominent clypeus, and the elongate form, subcylindrical thorax, and comparatively slender legs; the whole surface of the body is more or less asperate or finely wrinkled between the punctures; this asperation is also visible on the femora.

Stenolanguria tricolor, n. s.

Angusta, capite nigro, antennis piceo-flavescentibus, pedibus basi femorum excepta piceis; prothorace rufo, subcylindrico, obsolete punctato, lateribus leviter marginatis; elytris cyaneis, seriatim punctatis, intra puncturas rugose asperatis; apicibus sensim divaricatis, fortiter acuminatis; pedibus longis, piceis; basi femorum, capite subtus, prosterno et metasterno testaceis. Long. 7·25 mm.

Elongate, narrow; head black, impressed, diffusely punctured; prothorax red, elongate, with rather large, diffuse, and shallow punctures; elytra cyaneous, rugosely asperate, with rows of large shallow punctures, divaricate at apex, and each produced into a strong point, and furnished with a blunt tooth a little before the extremity.

Hab. Old Calabar.

Stenolanguria Gorhami, n. s.

Perangusta, tota viridi-ænea, antennis piceis, pedibus nigris vel nigro-piceis; prothorace elongato, subcylindrico, leviter marginato, obsolete punctato; elytris seriatim punctatis, interstitiis leviter asperatis, apicibus ad extremum divaricatis, acuminatis; pedibus longis teretibus. Long. 6·2 mm.

Very narrow, entirely of a dull greenish colour; antennæ and legs black; head large and broad; eyes very large; head with eyes broader than prothorax; prothorax narrow, elongate, with sides slightly rounded, gradually contracted towards base, diffusely punctured with rather large obsolete punctures; elytra with rows of rather large, shallow, almost square, punctures; interstices very narrow, finely asperate; apices slightly divergent, each produced into a plain, though rather blunt, point; legs long and slender.

Hab. Cameroon Mountains.

IX. *The life-history of Atypus piceus*, Sulz.

By FREDC. ENOCK.

[Read May 6th and June 3rd, 1885.]

DURING the year 1875 I read that most charming book by the late T. Moggridge, entitled 'Harvesting Ants and Trap-door Spiders,' in which is just mentioned the fact that "there is but one British or North European representative of the *Territelariæ*." I determined to search for this, but the information given in Blackwall's 'Spiders of Great Britain' was so small that I scarcely knew how or where to begin my search; however, I obtained the 'Supplement to Harvesting Ants and Trap-door Spiders,' and therein I read Mr. Brown's account of his discovery of this grand spider at Hastings, in which he states:—"My attention was first arrested by the sight of something hanging down which looked like the cocoon of some moth." With this clue I started early in 1876 to search the banks at the sides of such lanes as remained around the North of London,—at Tottenham, Edmonton, working round towards Hendon, then to Hampstead,—which seemed to be the most likely place where I might see the "something hanging down which looked like the cocoon of some moth"; but after many long and weary back-aching searches I began to think I should not be successful; and on March 26th, 1876, I had but a small part of the Heath left unworked, this composed of steepish banks, with stunted gorse and broom bushes scattered about. I searched the ground most carefully, and much to the amusement of the keepers and policemen, who seemed to doubt my sanity, my constant reply to their questions being "I am looking for *spiders*"; and I found that my movements were watched, particularly when I was searching at night. They had heard of "butterfly catching," but never before of anyone wanting *spiders*: however, I managed to allay their doubts and fears,

going on with my nose and eyes almost close to the ground, looking under tufts of grass at the base of various bushes, until at last my attention was suddenly arrested, for there was "the something hanging down which looked like the cocoon of some moth." But now a fresh difficulty arose; Hampstead Heath was "preserved," and I thought that possibly I might get myself into a "pickle" by "disturbing the soil." So I went to the superintendent, and told him I had found the spiders, and wanted to dig them up, and, as I was by this time pretty well known to him, he soon gave me permission to dig up my precious find. This I did after repeated failures, the tubes being so delicate; and I was repeatedly interrupted in my work by the usual Hampstead rambblers, who are, to say the least, inquisitive. After many trials I managed to box seven tubes, each containing a female *Atypus*.

Some of these I forwarded to Rev. O. P. Cambridge for identification: he replied "that he was not able to identify them positively unless he saw the mature male," but thought it might prove to be *Atypus Beckii*, as the late Richard Beck used to work Hampstead for spiders.

I now had my work cut out, for my only directions were:—"You might find them (the males) from October to spring, I think, so far as I know; they are never found in a tube, but are wanderers, taking shelter by day in any holes or corners, and among stones, *débris*, &c." I must confess I did not see why the male should not form a tube as well as the female, for, until it reached maturity, it certainly would require a home of its own.

In going over the ground at Hampstead I soon found that the colony of *Atypus* was much larger than I at first imagined; but, like all so-called "rarities," they only wanted looking for. I found the nests in the most awkward places to get at—numbers just at the foot of an old gorse bush, which I might not pull up to enable me to get at them; others concealed by stunted bushes of wild sage, the tube going down between the roots, and often just when I had reached to within an inch of the end, my digger would catch an unlucky bit of root, causing the tube to break short off, the spider escaping by retiring by the back door, a habit they are particularly fond of.

I searched high and low for the male among dead leaves and grass, under stones, both by day and by night, even going so far as to fancy I might possibly trap them by placing long glass phials in the ground (the mouths just level with the surface), close to the tubes of the females; but only a "devil's coach-horse" beetle, *Ocytus olens*, was stupid enough to fall in. I made many unsuccessful journeys in search of the mature male, but at the same time I added very much to my knowledge in several points connected with *Atypus*.

On October 20th, 1877, I made my twenty-ninth visit to the colony, examining a great many tubes, noting any change in their outward appearance, &c. I had almost reached my last tube when I came upon one near a stunted sage plant, having an opening at the end *with the edges turned in*, showing that something had entered. I felt sure that I was now on the right scent, and, going down on my knees in a moment, with my knife I cut away every bit of dry stalk of sage and grass; then quietly scraped away the sand from around the top, keeping hold of the aerial part of the tube, with the bent file working round it, gently raising small quantities of sand, each time going deeper, until I had uncovered about seven inches of the tube. After another ten minutes' digging the bottom of the tube was reached; my digger placed under, and the whole nest heaved out. I then noticed something moving up inside; this was the female, which soon forced its way out at the open end. I then observed at the other end something which looked like an old skin. I touched it, when it immediately spread its legs, betraying itself to be the long-sought-for *mature male*. I cannot describe my feelings or my movements at that moment. I only know I was highly excited, and immediately ran to the Highgate Post Office, and sent a post-card to the Rev. O. P. Cambridge, apprising him of my success. On the 22nd I sent this male on to him, receiving a reply which somewhat disappointed me, *viz.*, that the male was not *A. Beckii*, but *piccus*.

However, having now settled the identity of the Hampstead *Atypus*, I determined to follow up my observations, until I had completed its life-history; and I venture to think that the following facts will prove

that this representative of the marvellous trap-door spiders is well worthy of the relationship.

In Blackwall's 'Spiders of Great Britain and Ireland,' p. 15, I find it stated that the female *Atypus* deposits between thirty and forty eggs, &c., but, so far as my experience goes, this is considerably under the number, for whenever I have dug a tube containing young I always made a point of carefully counting them. My first capture was made October 29th, 1876, at night; I dug up a large tube containing a female and 129 young. February 31st, 1877, female and 157 young; this tube was nearly eleven inches long. September 25th, 1877, a female and 143 young; besides a great many other family tubes, in every one of which there were over 100 young.

On August 1st, 1877, I dug up a tube, ten inches long (example), from half to five-eighths of an inch in diameter for about six inches and a half down then widening out into a sort of pouch, containing something hard, which I at first imagined was a male. I carefully cut a slit across the tube, enabling me to see that it was the cocoon of eggs suspended in a beautiful hammock of silk, one inch long, the flat ends of which were about three-sixteenths wide, attached to the top and bottom of the pouch. I also found another tube the same date, containing an unfinished cocoon of eggs. Sept. 1st, 1879, another, which I carefully replaced.

Sept. 25th, 1879, a short tube containing female and young; these latter were quite white, evidently only just hatched, many of them being very feeble and scarcely awake. I dug another tube, in which the young seemed to be a few days older.

The following are a few of the dates when I found tubes with female and young:—Sept. 13th, 1881; Sept. 25th, 1877; Sept. 26th, 1879; Oct. 3rd, 1884; Oct. 6th, 1879; Oct. 6th, 1883; Oct. 29th, 1876; Nov. 1st, 1877; March 31st, 1877; and April 5th, 1879. I consider the last two rather late, but I find that we had wet weather in March, 1877, and a heavy fall of snow March 25th, 1879; no doubt keeping the young back.

April 2nd, 1876, I found a number of young *Atypi* wandering about on some wild sage, their silken threads crossing and recrossing from twig to twig. They were passing along these threads; all seemed inclined to get

as high as possible. I boxed a few, which I examined under my microscope, when I noticed a peculiar movement apparently in or under the eyes, but could not arrive at any satisfactory conclusion as to the cause, and the spiders soon died.

On Sept. 13th, 1881, I dug up a tube containing a female and young, a number of which had only just gone through their *first* moult, the cast-skins in the tube testifying to this fact.

Finding the young *Atypi* wandering about on the wild sage, on April 2nd, 1876, somewhat puzzled me; so I wrote to Rev. O. P. Cambridge, informing him of the fact. He replied:—"This, if a usual mode of putting their families out, would be, so far as I know, quite a new fact in their history; and, if usual, you would be sure to find them again so placed." I have carefully searched for them, but only once have I found one (April 20th, 1877), almost at the exact spot where I found the others.

I was much puzzled as to the length of time which elapses, from the entry of the male into the nest of the female, to when the young made their appearance. My idea was that eighteen months would prove to be about the time, and, though I searched year after year for proof, I did not ascertain until the present year (1885); but now I am able to place it beyond a doubt.

On Oct. 15th, 1883, I dug up at Woking (where I have found four very large colonies) five tubes, each containing a male and female. I removed the males and reset the five tubes (containing the impregnated females) in a bank at the bottom of my garden; this bank I made of turves from the Common, arranging it with great care, so that it should resemble their natural habitat as much as possible, facing S.W. To each of these five tubes I placed a good-sized wooden peg, with the number painted on, so that there should not be any chance of it washing out. These five and many others have been under almost daily notice ever since, being a constant source of interest during the spring and summer of 1884.

On March 28th, 1885, the sun was very hot, shining full upon my bank. I noticed the tubes (about thirty), which during the winter had been nearly flat to the bank, were showing signs of "spring cleaning," and the

following day, in each of the five tubes containing the impregnated females put into this bank October 15th, 1883, I observed a small round hole, one-sixteenth inch diameter, just at the apex of the aërial portion (example). I had waited so long that now, when I saw what I believed would prove a realisation of my idea, I could not rest long away from my bank; but nothing appeared that day. The following morning (March 30th) was warm and muggy, or what the country-folks call "a blight." Whilst watching these tubes, at 10 a.m., I observed a young *Atypus* emerge from the small hole in No. 5; it was shortly followed by others, until ten had left the home of their birth, *never more to return*. A few emerged from the tubes Nos. 1 and 3. The following are my notes taken on the spot:—The first young *Atypus* emerged at 10 a.m. from the hole in No. 5, walked a short distance to the foot of a grass-stem, up which it crawled, leaving its silken thread as it went along; when this one had climbed about an inch high, another young one came out, taking hold of the silken cord, followed on adding his cord to it, and so on each one following the leader, which had, by the time the tenth one emerged, mounted up several inches, and, climbing up a small twig, it would descend again to the main stem, up which it climbed, bridging over the space from twig to twig with the never-ending silken cord, along which each one followed, strengthening it as they passed, until it became quite visible, glistening in the sun.

The young *Atypi* still went on mounting higher and higher: "Excelsior" was evidently their motto. I had previously stuck some pea-sticks on the top of the bank just above these tubes, and the first spider was not such a great while in reaching one, up which it crawled, followed by the others. The first arrived at the top (some 3 ft. 6 in. from the ground), walked round and round, the others soon joined it, and not one of the ten seemed inclined to descend by the same way they came up; the rising wind gently swayed the sticks about, until some of the spiders were blown off into mid-air, still keeping a hold upon their endless silken cords, until they became attached to other sticks; these they mounted as the first, were again blown off on to the grass, at 5 p.m., where they hid themselves, no doubt

taking lodgings therein for the night, during which we had a sharp frost of six degrees.

The next morning *all* the small outlets in the tubes were carefully spun up, and, judging from the "mesh" of the web, I should say the female had, with a mother's care, closed the opening so securely that the remaining members of her family could not make their *début* until more favourable weather.

Another tube with female and young, taken Oct. 15th, 1883, I put into a large flower-pot of sand, which I placed in a conservatory. March 16th, 1884, an exceedingly hot day, I found the young *Atypus* crawling all about some geraniums, over and around which they had made a regular sort of silken trellis by their crossing and recrossing. Nearly all had disappeared by next morning. I was called away, and prevented from securing any of them, but noticed that two had found their way into a large bell-glass nearly filled with sand, already containing two tubes with females.

On October 4th, 1884, I dug up a tube containing a female and young, which I immediately reset in a large flower-pot with sand up to within an inch and a half of the top. This I placed in a warm room, where I could examine it at any time. On the 7th the aerial part was much inflated; the 9th, the female evidently enlarging her premises, the heap of sand lying at the end, giving me good evidence that she had added about one inch in depth to her tube. No doubt the warmth of the room brought on the young somewhat earlier than usual, for on January 30th, 1885, I noticed a small round hole at the top of the tube. The next day (Jan. 31st) I observed seven young ones crawling round and round the inside edge of the pot under the glass cover; Feb. 1st, fifteen; the 2nd, thirty-one; and the 3rd, fifty-four. These continued their peregrinations during the whole of the day, forming a perfect tunnel of silk, attached to the cover and edge of the pot. I noticed that they could easily force their way through the silken walls when pressed too hard by their followers.

Feb. 4th was a very fine day; I placed the pot out in the sun. I was called away from home that day, and the spiders were left out all the night, which was a very wet one, followed by a sharp frost. On looking for them next day not one was to be seen; but, on closer examin-

ation, I found they had descended from their aërial tunnel to the angle formed by the sand and side of the pot, where they had formed several horizontal tunnels, covered over with sand; but how this was done had long been a mystery to me, and to endeavour to solve it I thought that possibly the tube was at first viscid, the female forcing the excavated sand out at the top, which, falling down, adhered to the silk, for I could hardly believe that the spider came out and covered the outside with sand, &c.; but to prove this, I reset a large female in a pot, leaving the end of the tube just level with the ground; I covered this with the lid of a small pill-box the same size as the tube, then I covered the surrounding sand with a layer of bright red brick-dust, and carefully removed the lid, leaving the tube quite clean. During the next night the female lengthened her tube three-quarters of an inch; and this was covered with *black* sand, proving that it was done from the *inside*. But yet this did not satisfy me as to *how* the sand was affixed: however, the accident of leaving the pot containing the young out all night was the means of clearing up the mystery to my entire satisfaction, besides enabling me to watch the young *Atypus* commence life on its own account, by laying the foundations of its future home.

Shortly after I had brought the pot back to my room the warmth caused all the *Atypi* to come out of their sandy tunnel, and ascend to their aërial one. I then took the pot out again into the cold, which had the desired effect upon them, for they quickly descended to the sand, evidently determined to select suitable sites for their dwellings; most of them entered the various tunnels in the sand from which they had escaped but an hour or two before, the rest walking round and round, carefully examining any irregularity or small depression in the sand. Two of them were much interested in a minute piece of sandstone standing up at the side of the pot, and one, after coming into contact with it three or four times, appeared to finally settle that this bit of sandstone would form a very good support for the end of its tube, for it commenced moving its spinners from it to the inside of the pot, and towards the tiny corner formed by this sandstone. After weaving a silken carpet of about a quarter of an inch long by one-eighth of an

inch wide, it commenced twisting its abdomen up and over from side to side, each time fixing the ends of the silk to the sandstone and floor, gradually moving up towards the side of the pot, to which it fixed some silken cords, but not so thickly as at the lower end; it continued this twisting movement until it had roofed itself in, thus forming an upright tube a quarter of an inch long and fully one-sixteenth wide. The end fixed to the pot was turned up very slightly, the other to the sandstone and level of sand-line. The time occupied was just one hour. I could see through the silk distinctly, and, as the level of the sand was only one inch and a half from the top of the pot, I was enabled to fix my magnifier at the right focus for observing every movement of the spider, which next walked to the lower end and commenced biting the sand, taking one—two—ten mouthfuls; then, turning round, it proceeded to the other end, when I saw it had a load of sand between its falces, each grain of which it most deftly guided (I might almost say *handled*) with its fangs, literally pushing the grains through the sides of the tube, the silk of which was evidently adhesive, or else some viscid fluid was ejected on to the sand. After exhausting its supply it reversed its position, returned to the bottom, repeated the action of biting the sand, turned round again with its load, and distributed each grain in the most methodical manner. Occasionally, after unloading, it would put its fangs through the side and *take hold* of some grain of sand on the outside, placing it in the desired position; then, withdrawing them, reversed its position, bringing its spinners into action, strengthening the walls with another layer of silk. I watched it for just one hour and a half, at the end of which time it had completely covered the silken tube with sand, every grain of which it brought up between its falces from the surface of the ground. I continued to watch, but could only see the sand pushed through, and occasionally one fang, or both, adjusting the grains.

The next morning a small quantity of sand had been forced out at the top end, showing that the industrious little inmate had continued its labour during the night by excavating into the sand, and this it continued to do during the greater part of the day. The following night it had lengthened the aërial portion of the tube, covering

it with sand. While this one was engaged making its tube some of the others were still walking about, and, coming close to the tube, the builder immediately stopped work, and the loafers their walk for a moment; then they quietly shelved off in another direction, but *never* once crossed the tube, for, though they are peaceable enough when roaming about together, directly they have made anything like a tube for themselves they appear to lose their family affection, and, I regret to say, show fight if molested.

During the following night all the young spiders had disappeared, and in the course of a few days I noticed a large number of tiny tubes around the angle of the pot, while others had attached theirs to some bits of loose moss.

Since the above observations were made I have read, in 'Annals and Magazine of Natural History' for 1876 (vol. viii., p. 241), an account, by Rev. O. P. Cambridge, of an *Atypus* which he watched making a new nest. The only thing I did not observe which he mentions was that, after the spider had placed the earth against the sides, it *patted* it all over with its feet. No doubt the young one's feet were too small and tender.

Considering that there are in each family tube from 100 to 150 individuals, we might reasonably expect to meet with this grand spider in far greater abundance; but I do not hesitate in saying that as they emerge from the tubes on a bright sunny day great numbers of them are destroyed by the ants which swarm about the various colonies.

On March 30th, whilst watching the young *Atypi* emerge from the five tubes, I noticed an ant with a spider *in its jaws*; "to keep the balance true," on the other side of the tube was an impudent-looking crab-spider, *Xysticus thomisus*, with an *ant* in its jaws.

We must now suppose an interval of three or four years, and probably *more*, elapses between the last and the next act which I am able to go on with, for I cannot give any proof as to the time *Atypus* takes to reach *maturity*; I believe it is at least four years. I hope I shall not be considered ungallant by describing the habits (so far as I am able) of the male first; but, as the female is certainly the most interesting (though not the handsomest) of the two, I shall endeavour to let her have the last word.

As previously stated, I captured my first male October 20th, 1877, in the nest of the female. I searched a great many times during 1878 for the immature male, which I firmly believed lived in a tube just the same as the female.

On Oct. 19th, 1878, I examined nearly one hundred tubes, digging up suspicious-looking ones, resetting them if not wanted. One protruding from the bank an inch and a half caught my eye, as looking more delicately made than the others, besides having an opening at the top, with the edges *turned outwards*, showing something had escaped. I dug it up with great difficulty, as it was a very delicate one, though not more than four inches long (example). It was, as I expected, empty. I boxed it very carefully, together with the loose *débris* at the bottom of the tube: this I most carefully examined under my microscope, and at last found two immature palpi (example), proving that the tube had been occupied by an immature male. On Oct. 23rd I dug up two tubes, similar to the above, the edges of the hole turned outwards, and in each tube I found a pair of immature palpi. I find in my note-book the following:—"I think this proves that the male does either make or *steal* a tube, wherein to come of age. Try digging small tubes." Subsequent experience leads me to think the idea of an immature male turning a female out *quite impossible*.

My next advance was made Sept. 13th, 1881, when I found four males at the bottom of the tubes of the female, and one male *alone*. This I boxed, together with the tube and *débris*, among which I found the two immature palpi. This certainly strengthened my case, but it was not until July 6th, 1883, at Woking, that I dug eighteen small tubes, about four inches long (examples), from a bank covered three or four inches deep with pine-needles. I examined each occupant under my microscope; one of them was of a much lighter colour than the others, and when I did manage to get the palpi into the field, at last I saw the immature male before me. After thoroughly satisfying myself I directed his footsteps towards the open end of the tube, which I had stretched wide: he soon disappeared. I reset this one in a flower-pot, examined it from day to day until July 17th, when I perceived an unpleasant

smell from the tube, dug it up, and found the spider dead, its abdomen putrid.

July 7th, 1884, just a year after, I dug up two tubes (example), which I felt sure, from their resemblance to the others, were males; and so they proved to be, each containing an immature male. These I reset in a small bell-glass, making the holes close to the side, to enable me to watch their movements. Both soon made themselves at home by carrying their tubes up an inch from the surface, attaching the end to the glass. A short time after one died; the other lived happy and contented for some time.

On Oct. 8th I examined the tube, at 10 p.m.; all quiet. The following morning, at 9 a.m., there was the *mature* male walking about, having emerged during the *night*. I noticed that this spider, as it walked round and round, left a silken thread behind; but others, which had been living for some time in the tube with the female, and then escaped, did not in their wandering leave any such thread.

Although I have searched in every nook and corner, among dead grass, &c., in close proximity to the tubes of the females, I have never yet been so fortunate as to capture a *wandering* male, though I have since my first capture, Oct. 20th, 1877, obtained twenty-five mature males, *all* of which I found in the tubes of the females. I therefore conclude that it is the habit of the male to emerge from its tube *at night*.

Beside the above number I found seven mature males in their *own* tubes, and from these I obtained the following facts:—

On Oct. 9th, in the evening, I placed a male in a large flower-pot filled with sand to within one inch and a half of the rim: in the centre was a large tube containing a female, placed there the previous day. Next morning (Oct. 10th), on removing the cover, the male was not to be seen, but a newly-mended rent at one side of the tube showed where he had gone.

Oct. 15th, 1883, in the morning, I found a male in its own tube (example), and, among the *débris*, almost a perfect skin and part of another. I also dug several tubes containing females, which I disturbed as little as possible. In the afternoon I reset one of them in a 12 in. bell-glass, the aerial portion of the tube lying flat

on the surface of the sand, the end just reaching to the side. I then turned out the male at the opposite side, and he, spreading his legs, walked rapidly away, keeping close to the side, until he set his foot upon the collapsed tube of the female, when he stopped suddenly; the next moment he commenced making an opening in the tube, using his fangs for the purpose of tearing an opening. After each effort he paused to tap with his palpi; after doing this seven or eight times he made a rent right through both sides, and, walking through, he came out at the other side, evidently much to his surprise. I then, with my pliers, picked the end of the tube up, and, as the male came round again, hung it in his pathway, with the result that, coming into contact with it, he stopped as before, commenced to serenade with his palpi, followed by an attempt to force an entrance, more tapping in the short intervals, until at last he tore an opening in the tube, and immediately thrust his palpi and faeces through, another tap, and I suppose he concluded he was accepted, for he quickly disappeared down the tube and out of sight. Next morning the rent was neatly repaired. I did not see anything more of the male until July 16th, 1884, when I noticed the skin lying at the end of the tube, pretty good evidence that, after living happily for nine months, he had fallen a victim to the appetite of his partner.

On October 3rd, 1884, I placed a male in a pot of sand; then, taking a tube containing a female, I dangled it over the pot, so that the aerial end just touched the sand at one side. The male was then at the opposite side: I gently roused him to activity, and he fairly ran round the pot until he touched the suspended tube, and there he stopped, as if paralysed; but only for a moment, as if to collect his thoughts. He then tapped, and evidently this has some great charm in it for the female. I have tried the same with my finger, but with quite a different result, in the shape of a very sharp reminder that I had better go away. The tapping was followed by attempts to tear an opening. I then interfered, driving him off, which he resented by making most ferocious bites at my pliers. I then set the tube in another pot, and turned the male in. On examining, at 10.15 p.m., I caught the male serenading, so watched him, and in less than five minutes he had torn an

opening and disappeared: the rent all closed up by next morning. This male managed to escape with his life Dec. 24th, 1884.

On July 7th, 1884, I dug up three immense tubes containing females, one a forked tube; this I examined in the evening, and was surprised to find a magnificent male in, too; no doubt they had been living together since October, 1883. I reset this tube, but have not seen anything of the male since, so conclude his old skin was too valuable to part with.

The male reared Oct. 9th, 1884, I placed in a large pot, nearly filled with sand, over which I spread some loose moss. From the thickness and width of the silken carpet I should imagine the spider had been walking round and round all night. It had made a very flimsy horizontal tube, about an inch and a half long, among the moss (examples), in which it hid during the daytime, coming out at dusk to resume its journey round the pot. I generally found it had constructed a very frail covering, I suppose at the approach of daylight. It came out nearly every night until January 17th, 1885, when I found it dead.

Another of the males found in its own tube lived in good health for two months, when one morning, at 9 a.m., I found it almost dead, its abdomen dry and shrivelled up. I gave him a good shower-bath from a fine rose water-pot, and at 2 p.m. the abdomen was fully distended, and the spider as active and as savage as ever he had been—at 9 p.m. going his rounds—and lived some time after.

Although I offered flies to these wandering males, not one would accept my hospitality; a cold shower-bath seemed to do them more good than anything else. From the ease with which the males can climb I believe that most of them find their way to the tubes of the females the same night as they emerge from their tubes, as they are always in close proximity to those of the females; some marvellous power leading them to the tubes of mature females.

I have tried putting males in pots which contain impregnated females, with the result that, instead of the sudden stop on coming into contact with the tube, they immediately run away as fast as possible.

I think I have gone through all my notes respecting

the male, and must now leave the female and the most interesting part of their history, *viz.*, that of their food,—what it is, and how they obtain it,—to our next meeting, when I hope to finish the life-history.

We now come to the problem, which is the most important to the welfare of humanity, whether in times of peace or war, and no doubt at the present time,—the question of the food-supply,—is troubling some of the highest as well as the lowest, and I venture to think that, in some respects, the humble *Atypi* are the best off. They certainly are a most contented family, always adapting themselves to circumstances.

Before giving my own observations respecting the food of this spider, I will refer to what has already been recorded. First, I find, in 'The Zoologist,' Mr. Newman gives an account of the first capture of *Atypus* in England by Mr. Brown, in which is the following:—"On drawing out *one* of the sacs I observed a *worm* at the lower end, partially within the sac and partially outside, and that the spider had evidently been eating a considerable portion of its anterior extremity. It is not unlikely that this kind of food may frequently fall to the lot of the spider."* Mr. Brown adds, "I never saw any flies or fragments of insects in the nests."

From this I should imagine the nests were broken, for at the bottom of all tubes I have dug is a trodden floor of earth, upon which, and mixed with bits of roots, I find the *débris* of all sorts of insects. Mr. Meade, in answer to Mr. Newman, says:—"I cannot help thinking it was a fortuitous circumstance, that an earth-worm was found in the retreat of the *Atypus*, though it is quite possible the spider would feed upon the earth-worm when it came in its way. I believe these spiders are erratic in their habits, and none of them bring home prey to their retreats."

Mons. E. Simon † (of Paris) considers that the food of this spider consists almost *entirely* of earth-worms. Possibly the French representative may, for there is no accounting for tastes; and such food is certainly in

* See 'Zoologist,' vol. xiv., 1856, p. 5021, "Notes on *Atypus*," by E. Newman.

† Ann. Soc. Ent. de France, 5e ser., tom. iii., 1873, p. 109.

keeping with the slugs and snails, &c., which our neighbours are so fond of. The dimensions of the tube of this spider, as given by Mons. Simon, being totally different to our representative,—and also the fact mentioned that the tubes are found “concealed by stones or in moss, which one must remove carefully, and in large masses, in order to detect them,”—lead me to think that one or the other is wrongly named *piceus*. I should much like to know in what way Mons. Simon “frequently surprised *Atypus* in the act of holding earth-worms in their falces.” I presume the nest must first have been dug up, and, if so, I cannot understand how the spider would retain its hold after the tube has been torn open, which must have been done before the spider could be *seen*.

My own humble opinion concerning worms as the food of *Atypus* entirely agrees with that of Mr. Meade,—that if a worm in its boring pushes against the lower wall of the chamber, where the lining is very thin, the spider seizes it by its head and holds on tight; the worm, finding it cannot go back again, withdraws its body from its burrow, and, falling to the bottom of the nest, it twists and twirls about, a liberty the spider resents by making rapid bites at it, soon reducing it to mince-meat.

April 9th, 1879, I dug up a large tube, which had a small opening at the *top*, the earth rammed hard on the floor or lower end of the tube. On tearing the tube open I found a worm three inches long, nearly bitten in two at half an inch from its head. It had also two minute punctured wounds at an eighth of an inch from the tip, plainly showing that the spider had pinned it as soon as it touched the aerial portion.

On February 4th, 1884, one of my garden colony had ejected a piece of an earth-worm.

These are the *only* instances respecting worms which have come under my own observation.

From the numerous examinations I have made of the *débris* taken from the bottom and around the end of various tubes, I long ago came to the conclusion that *insects* form the staple food of *Atypus*. During April and May I have observed the ejected *débris* to consist of several species of *Andrena* and *Nomada*, with a few *Cicindela*; then, later on, various *Muscidæ*; finishing

up, in August and September, with earwigs, flavoured with a few woodlice.

Having mentioned a few of the delicacies which form the food of the spider, the next important question, and one which hitherto has not been answered, is—How does the spider obtain its food?

The Rev. O. P. Cambridge, in his ‘Spiders of Dorset,’* writes:—“The young of *Atypus piceus* live with their mother in their tubular abode for a considerable time after they are hatched, coming out at times for air and exercise, and fed by insects brought into the tube by their parent. At least so I conclude, from having found the *débris* of beetles and earwigs in the tube along with the young brood of spiders.”

I venture to *entirely* disagree with this. I do not think the young *ever* return to the maternal abode after making their exit in April; neither do I think it possible for the female spider to leave and return to the tube loaded with food for its young. We have but to look at the form of its body and legs to see at once how unadapted they are for walking even on a level surface, much less up a steep bank. My opinion is that the female *never* quits its tube; certainly not in search of food; but if a large stone or other hard substance should prevent its downward boring, it might, possibly, under such circumstances, leave its nest.† I have tried running a stick in a diagonal direction towards the end of the tube, and so compelling the occupant to quit, which it did, forcing the aërial end open, always falling headlong down the bank, seemingly unable to

* ‘Spiders of Dorset,’ by Rev. O. P. Cambridge. See p. xxxiii of Introduction.

† But even under such circumstances the spider shows very great reluctance to leave the original tube. On October 15th, 1883, I found one, three inches long, containing a mature female, in a bank having but a shallow depth of soil below it the hard yellow sandstone, into which the spider had bored. I had to cut a solid piece off to enable me to lift the tube out of the hole. (*Example.*)—Whenever I have compelled a female to quit her tube, she has always left her siken threads behind; and I think that if she was in the habit of leaving her tube to go marketing (as some conclude she does), she certainly would not venture out in the dark without leaving her cord behind. But though I have examined numbers of tubes, the first thing in the morning before the dew is off either the grass or *other* spider’s webs, I have never met with any such unmistakeable proof in connection with *Atypus*.

obtain a hold, it afterwards formed a tunnel along the bottom of the bank, excavating the following night. When examining the aerial portion of the tubes I noticed a number of small patches, which appeared to be newly-mended holes or rents, exactly the same as those made by the male, and repaired by the female. I also noticed punctured holes, about the size of a pin; these were generally of one size in a large tube. I compared these with the "gape" of a female spider, and found they agreed pretty nearly. I have often put a large female *Atypus* in a shallow lid of a tin box, then teased her, until she threw back her falcies, opening them wide, and literally erecting her long fangs (example), then closing them instantaneously, at the same time making a slight forward movement. I tried this experiment, *once* with my finger, into which she drove her long fangs with such force, followed up with a terrific clenching movement, that, on withdrawing, the blood flowed freely from each puncture. This experiment led me to think that these long fangs were used in penetrating the aerial portion, and aiding in obtaining its food, the spider lying in ambush, either in or close to the aerial portion of the tube. With this idea I determined to watch my captives.

On January 6th, 1879, at 10 p.m., with the aid of a dark lantern, I examined three tubes, dug up and reset in separate pots of sand:—

No. 1 had constructed a beautiful aerial part, attaching the end to the inside of the pot.

No. 2. The aerial part was an inch long, lying horizontally on the surface of the sand.

No. 3, had brought her tube just above the level of the sand.

On teasing No. 2 with a small dry twig, the spider came up (at least so I imagined from a slight movement noticed), and on repeating the gentle scratching the tube was suddenly drawn down a quarter of an inch. The spider had evidently pulled the sides in, leaving about three-sixteenths of an inch space on each side. I made a note, as follows:—"Does the spider pull the tube in, so making a sort of pit-fall at each side, into which beetles, &c., might fall, and in their endeavour to escape attract the attention of the spider, which might then inflate the tube, and so hold the insect?"

I afterwards teased No. 3 (with the short tube). The fangs were immediately thrust through, bent over, followed by a sudden pull,—just the movement given to my finger; then were quickly drawn in again. I longed for a fly, to see if I could tempt the spider to give me proof of the method of feeding; and, as fortune would have it, I found a *Trypeta* in one of my breeding-boxes. Holding it by the wings with my pliers, I let it just scratch the end of the tube of No. 3, when almost immediately it was pierced through by the cruel fangs of the spider within. Wishing to see if it was held, I gave the fly a gentle pull, and so did the spider; and I saw the fly pulled right through the roof or side of the aerial portion of the tube down to the lower regions. I left them at 11.15 p.m., and the next morning the rent was neatly repaired.

April 25th, 1879, I tried teasing No. 1, and the instant I touched the tube the end of the twig was seized, and so suddenly that I drew it back as quickly, and with it the huge female *Atypus*, which had driven its fangs into the twig. I managed to get it down its tube again, and an hour after the rent was mended. I broke it open again, hoping to catch her mending, but she was not near. I found the rent again repaired in less than an hour.

From the above experiments, I felt tolerably certain as to how the food is obtained by these spiders. From some cause or other my captives did not do at all well, though I tried all sorts of places to make them comfortable, and for the next two years I did not make much progress.

On removing to Woking in June, 1882, I commenced working the country lanes and commons, expecting to find *Atypus*, and on April 12th, 1883, I discovered a very large colony on the banks at each side of a road, from which I removed a number of tubes to my garden-bank, where they soon settled down, making the aerial part about $1\frac{1}{2}$ to 2 inches long.

On July 16th, 1883, I held a large blow-fly by its wings, letting it crawl up the bank until it walked upon one of the tubes. The spider evidently came up a short distance, and went back. I then took a firmer hold of the fly, and *rubbed* its head against the tube. I soon saw signs of something coming up. I continued the rubbing,

the tube quietly and almost imperceptibly becoming distended, the spider evidently making some sort of move which I could not then make out; and there was no time for reflection, for after a moment's pause the fangs were thrust right through the fly, followed by a crunching sound as the spider closed and almost crossed the tip of the fangs around its prey. I let go with my pliers and watched; the left-hand fang was withdrawn *just* into the tube, which was immediately torn, the fang refixed into the fly; the right fang was then withdrawn, and quickly seized the fly through the opening made; then the spider commenced to give several tugs, until it had pulled the fly right through, backing down the tube with it fast in its falces, leaving a rent a quarter of an inch long by three-sixteenths of an inch wide. After an interval of three minutes I saw the tube move, and up came the spider, moving *very* cautiously towards the rent, on reaching which she opened her falces and literally *taking hold* of the rough edges, drew them towards each other in the most marvellous manner until almost close together; she then backed a little, and turned right round, bringing her spinners to the edge at one side; she seemed to be able to use these spinners with as much ease as we do our fingers; taking hold of one edge she pulled it almost close to the other, then making some seven or eight zigzag movements with the spinners she completely closed the rent, leaving it most neatly repaired. The spider then returned to feast upon the blow-fly, which she had no doubt hung up in her delightfully cool larder at the bottom of her tube.

The next morning the rent was covered with sand so carefully that I could scarcely detect where it had been.

Since this experiment I have frequently teased the tube with the tip of my finger, and had very narrow escapes of being translixed. At other times the tube would be drawn in, in such a determined manner that I quite understood the movement to mean, "I don't want anything more." I have known a spider to retain her hold upon the tube in this manner for several hours.

July 23rd, 1883.—I repeated the trial upon the same tube with a blow-fly, and with exactly the same results. I also tried another large tube, the spider striking so quickly that it clipped off the head of the fly in the neatest manner possible, besides scratching my finger.

It soon pulled the head through and down the tube. I then immediately placed the trunk of the fly at the rent; the spider coming up to mend at once seized and dragged it down.

Immediately after this I caught a large *Sarcophaga*; holding it to the open rent, it was seized at once, and, being a strong and lively fly, it gave the spider a great deal of trouble; but after pulling, pushing, and jerking for twenty minutes, she managed to pull it through. Before she had time to return I had another fly ready at the opening, towards which she drew near, and, taking in the situation at a glance, she immediately pulled the tube in with the unmistakable "I don't want any more" movement.

On March 19th, 1884, the warm sun shining full on to my garden-bank, I took my stand just where I had some dozen tubes in my field of vision, watching them in the hope of seeing some *voluntary* attempt to obtain food. After watching for over an hour, suddenly I saw a pair of fangs dart through one of the tubes and then as quickly withdrawn. I immediately got my magnifier to bear upon this one, and not a moment too soon, for once more the fangs darted through, paused for a moment, then back again, leaving four tiny punctures in the somewhat hard winter covering of the tube. I looked for the cause of this movement, and discovered just at one side of the tube a small hard-coated beetle on its back, which, in its endeavours to right itself, had kicked against the spider's tube. I observed, too, that when the fangs were darted through, the *tips* were pointing *upwards*. I immediately caught a fly, holding it head *downwards* in such a position that I could see the fangs; it was seized in a moment, and pulled through and down in a most business-like manner; the rent mended in less than five minutes, and I did not see the fangs as I desired.

At 12.25 of the same date (March 19th, 1884) I caught a large male *Anthophora*, and, holding it by its wings, allowed it to touch a tube hanging *down* the bank; the bee buzzed a little, and the spider immediately pulled the tube in and held it for some time. I then held the bee to a tube, the occupant of which had but a short time before taken a large fly. The bee was seized in a moment, but from *behind*. I released my hold, and it struggled and buzzed loudly, but all to no purpose—the

spider held on. In a quarter of an hour it had turned the bee completely round, now holding it by its *head*. After ten minutes' hard tugging, the spider pulled it through and down, a very large rent $\frac{2}{3}$ in. by $\frac{1}{4}$ in. having been made in the tube. In five minutes the spider returned, and commenced pulling the torn edges together until they almost touched; it then retired for twenty minutes. At 1.25 it returned, reversed its position, spun a few threads across the rent, and then once more retired, this time for close upon an hour, when it came up and finished mending the rent, leaving it perfectly joined—just two hours after the *Anthophora* was seized.

I caught another *Anthophora*, and held it to a tube which had not been opened since October, 1883, a very hard and dry one, protruding about two inches from the bank. The moment the bee set foot upon it, it was seized from behind and underneath. A quarter of an hour the spider was trying to reverse the bee, for it seemed to know it could not draw the bee down *tail* first. I was called away for twenty-five minutes, but on my return I found the bee had disappeared and the rent had been repaired. Six days after, I noticed the spider had ejected the dry and mutilated remains of the *Anthophora*. One large *Atypus* seized and dragged down two large blow-flies in ten minutes.

July 13th, 1884.—At 10 a.m. I offered a *Stomoxys* to the immature male *Atypus*, whose tube was attached to the side of a bell-glass for about $1\frac{1}{2}$ in. high. I placed the glass so that the sun shone on to the tube, then taking the *Stomoxys* by the wings I allowed it to touch the tube, and, having previously arranged my magnifier, I could see through the aërial part of the tube. Directly the fly moved, up came the spider with a rapid but stealthy step, until it was exactly under the fly, then throwing its head back it opened its falcæ as wide as possible, the fangs being almost at right angles to the *upright* tube; a moment's pause, just like a cat about to spring upon a bird, then a lightning-like thrust, driving the fangs through and just *over* the thorax of the fly, closing them with a crunch; then backing, it pulled the fly through and down, but did not repair the rent until the following *night*.

I then tried one with a worm, which was seized, the worm struggling so hard that it pulled itself in two, the

head end crawling down at the side of the tube; the tail end held for some time, until I gave it a gentle pull, when it was released immediately. I held another worm a dozen times each at various tubes; one spider came up, and, just when I expected it to strike, it backed and pulled the tube in deep. Another struck four times and quickly relaxed its hold, refusing to take it in. The other did the same—not *one* would retain their hold after apparently tasting the worm. I made a hole in one tube and forced the worm to crawl down; a few days after the mutilated remains were lying outside.

On September 1st, 1884, a blow-fly which I put to a tube was seized by its ovipositor and one leg, and before any attempt was made to pull it in the spider *reversed* it.

On September 7th I offered drone and blow-flies, *all* of which were seized from behind, and in *every* case reversed before being dragged down the tube.

On September 25th I teased a large tube in No. 2 colony; it moved a little. I then placed my finger just above the subterranean part, then, continuing to tease the end with a piece of twig, it was seized; down went my finger, imprisoning the spider in the aërial part, which I tore open, and was amazed to find an immense mature male. After boxing him I drew up the tube, finding the female at the bottom. This is the *only* time I have ever found the male nearest the *top* of the tube. In every other instance he has invariably been at the extreme lower end, the female above.

I had noticed that all the flies offered to *hanging* tubes had been seized from behind; this I could not quite understand, but on thinking over the subject I fancied the spider might be in the *habit* of striking underneath. I immediately obtained a supply of flies; taking one I held it in the same way as before, by its wings, the head up, and allowing it to walk up the bank until it stepped upon a tube *hanging down*, with the result that the fangs were driven in from behind. I then carefully examined and found the tips were pointing up and towards the commencement of the aërial portion, showing that the spider was then head downwards, *on its back!*

I repeated this experiment upon every tube *hanging down*, and in *every* case with the same result. I then tried upon the tubes in the upright or normal position, having the end attached to grass-stems, &c. Holding

the fly in the same position, by the wings, I allowed it to crawl up and touch the tube; here the spider struck from *above* and *down*, and as there was no need for reversing the fly it was pulled in and down in much less time.

I next tried upon a *horizontal* tube; the spider moved along until it was evidently under the fly, when from the movement it turned over on its back exactly like a shark, not suddenly, but a stealthy screwing movement, until it was just beyond the fly; then striking like lightning, it buried its fangs in the fly.

Although I did not require further proof, I tried another experiment upon a horizontal tube by enticing the spider almost to the extreme end, then placing the fly nearer the subterranean part. By the movement of the tube I saw that the spider had turned back. I kept the fly moving until it was suddenly seized, the fangs now pointing *up* and towards the end, away from the subterranean part. Although the fly was half between the spider and its quiet resting-place, it was quite equal to the apparent dilemma, for after a good deal of holding on by one fang at last it turned *itself* round, and quickly pulled the fly down.

There can be no doubt as to which is the normal position of the aerial portion of the tube. If, when a spider is put into a pot of sand, it will, after making a sort of horizontal tunnel or tube, always carry the tube up the side of the pot, and no doubt it does the same thing on the banks, attaching the ends to grass or other stems *above* it; but this frail support is soon swept down by the falling earth, the wonderful spider adapting itself to its changed position. A careful examination of the spider shows how marvellously it is formed for obtaining its food without ever leaving its tube.

I have repeatedly tried to induce *Atypus* to feed from November to the end of February, but could not succeed unless the weather was very warm; and I believe that the moisture of the bank in winter is quite sufficient to sustain life until the spiders are able to obtain their natural food (*insects*) in plenty.

When digging tubes up in search of the male, I have found various insects—in one a blow-fly, in another a woodlouse, in a third a large fly, and in one a larva of *Agrotis segetum*; all of these were apparently *fixed* to the side, a short distance from the bottom.

On the sand in the bell-glasses containing a tube of a female I had put several pupæ of *Cerura vinula*, and in the other a number of *Pygæra bucephala*. On June 21st, 1884, several *bucephala* emerged, one of which must have crawled over the spider's tube, for I found it newly mended, with a large number of scales attached, and one of the *bucephala* missing. I dug the tube up, April 20th, 1885, to look for the young, which I expected out when the small hole was made for them, and there at the bottom of the tube I found the rudimentary wings and the cornea of the eye of the missing *bucephala*! On June 26th, in the other glass, the spider had seized and killed a freshly-emerged female *vinula*, but it was too large to pull down.

I think I have now said sufficient concerning the food of *Atypus*, what it is, and how obtained. My garden colony has been an endless source of pleasure to my friends, who have been highly delighted at seeing these spiders feed.

When I commenced writing these notes, I thought I should finish the account of the habits of the female in a more pleasant manner, but my last observations prevent me doing so. The truth must be told, which is, that under certain circumstances she is a cannibal, *eating her own offspring*. When the female, by making an outlet in her tube, plainly intimates to her brood that it is time and her desire for them to go out into the world on their own account, and, if the weather should not be warm or fine enough, she closes the entrance again and massacres the lot or any remaining. As previously stated, the tubes of the five impregnated females had, on March 28th, 1885, a small round hole at the apex, and a few young emerged on March 30th; and during the following night a sharp frost occurred, causing the females to fasten up the holes, and though we had very warm weather on April 17th and after that date, the holes were not reopened in any of the five tubes.

On April 20th I dug up three tubes, and found the female the sole occupant; not a young one to be seen, but a number of empty skins, which, from their *colour*, could not, I think, have belonged to the young when *first* they moulted. Two other impregnated females made holes in their tubes, but no young escaped from these; I dug them up and found nothing but the female; these had been set in bell-glasses placed in the shade.

One of the questions asked by Mr. Moggridge is the following:—"What is the precise structure of the nest of *Atypus*, and are they always uniform in character at all seasons of the year?"*

You will see by the specimens upon the table that the nest consists of a silken tube from seven to twelve inches long, of which an inch and a half to two inches forms the aerial portion; this in the normal condition is attached to the surrounding grass-stems or any projecting stone, and generally it simply follows the slant of the bank; but it is more often found hanging *down*, its frail attachment being easily broken by any rolling stones. The use of this aerial portion is that it really forms the *snare* of the spider, the delicate silken lining being set in motion the instant an insect sets foot upon it, the spider frequently lying in ambush just at the top of the subterranean part.

This aerial part of the tube is not always uniform in character at all seasons of the year. From April to October it presents much the same appearance, nearly always distended, except in wet weather, when it becomes flattened to the bank. Some writers have said it regains its shape by *inflation*, but I am inclined to doubt the power of the spider to raise sufficient wind to distend a tube when flattened.

After October the aerial portion is not distended, but seems to shrink and become somewhat wrinkled; and after a heavy fall of snow or rain it is often flattened so hard to the bank that it is most difficult to see. Dry, frosty weather hardens the tube, so much so that when warm weather sets in at the end of March the spider has been unable to draw a fly through.

During the past winter all the tubes in my garden-colony have been dry and hard. The very heavy fall of snow flattened every one of those in an exposed position. No attempt was made by the spiders to "inilate" them; instead of this, as soon as the warm weather set in they started making a new aerial tube, and this leads me to speak about the *branched tubes*, several of which I sent to the Rev. O. P. Cambridge some years ago; and in an article in the 'Annals and Magazine'† for 1878 he

* 'Harvesting Ants and Trap-door Spiders' (Supplement), p. 187.

† O. P. Cambridge in Ann. & Mag. N. H., Feb., 1878, pp. 106 and 107.

writes, "I am unable to conjecture what the significance of these branched tubes may be." My own opinion is that when the aërial portion of the tube becomes flattened and fixed to the earth, the spider, being unable to "inflate" it at the return of the warm weather, immediately sets about constructing another, thus forming a forked tube. Another explanation is this:—At Hampstead the ground above and about the colony is constantly being disturbed in several ways, and frequently the aërial portion is covered or partially so, perhaps only half of it; then the spider starts a new one and often carries it up, making it longer than the buried part of the aërial.

At Woking the plan of repairing some of the roads is characteristic of the "natives" in more ways than one. In the roads where no footpath exists, with high banks at each side, the plan is to allow the sand and stones to roll down into the road until they become inconvenient, then a wise man is sent from somewhere, and armed with a shovel he proceeds to shovel the rubbish up; but not into a *cart*—that would be progressing at too great a rate; he just shovels it up and "slaps" it on to the bank again, but how long it remains there in *some* of the roads depends upon how soon after "a lover of spiders" passes that way. This method of road-mending does not improve or add to the comfort of the *Atypi* which may be in the banks, many of whose tubes are completely "slapped" over, in some cases too deep for the imprisoned spiders to dig themselves out, though I have often found that they have done so. I exhibit one which I dug out of a "cake," under which I came upon the *original* aërial portion; this had been flattened, the spider boring straight through until it reached the surface again. I reset this, and after a few days' rest the spider took to the *original* aërial portion, and never once entered (so far as I can judge) the second one, forming the *branch*. In another tube I found the aërial portion rammed full of sand (example), until at last the spider, finding it could not break an opening, started another branch.

On May 7th, 1884, I noticed a most extraordinary tube in a turf bank (example). It had no less than *five* branches protruding from the bank; the owner (a huge female) was at the bottom. This bank was at the side of a road which faced south-west, and I think it most

probable that each branch had become flattened and attached to the bank during the winters, the spider adding a new one each spring-time.

Some time ago I placed a flat piece of slate on the aerial portion of a tube, leaving a very small part visible. In a day or two the spider commenced to eject the sand, and form a new aerial portion.

In one of the examples of branched tubes you will observe the branch is at the subterranean end. I think this has been formed in consequence of some disturbance of the soil, which at Woking is exceedingly light, and it is possible that a severe blow from the shovel of the road-repairer might have driven a stone down on to the tube an inch or so from the end, flattening it in; and when the spider desired to deepen, it had no alternative but to start a branch.

Before leaving the subject of the form of the tubes, I will endeavour to answer another of the questions suggested by Mr. Moggridge,* *viz.*, "Do the young, like their relatives in the south, construct nests like those of their parents in miniature?" To this I reply that they certainly do follow the example of their parents in every way, and to quote the words of Mr. Moggridge, when referring to the nest of the *true* trap-door spiders, "I believe that the nests are, as a rule, the result of many successive enlargements, and that the nest of the infant, the tube of which is no bigger than a crow-quill, is not abandoned, but becomes that of a full-grown spider. This must require time, but how long, whether months or years, we have yet to learn."

I am afraid it *will* be many years before I am able to give much proof as to the age to which these spiders attain. As I said before, the ground at Hampstead is constantly changing from various causes, and I have had great difficulty in obtaining proof positive of the age of any one female. Though I marked some of the tubes which were in the most concealed places, yet these pegs and the tubes were constantly destroyed by the swarms of holiday-folk, who wear all the grass and everything else off the face of the earth.

I paid a visit to my old Hampstead colony on April

* 'Harvesting Ants and Trap-door Spiders' (Supplement), p. 187.

† 'Harvesting Ants and Trap-door Spiders,' p. 123.

1st, 1885, and found very few of the nests left, some of their favourite hillocks having been levelled by "The Board."

On March 12th, 1879, Mr. Cochrane, the obliging Superintendent of Finsbury Park, who had become much interested in my diggings, very kindly brought his pony-trap round to the colony, and with the help of two or three of his men cut off a prominent piece of the bank about eighteen inches square, containing several tubes of females, which I should judge were at *least* three years old. This huge lump was safely placed in a large tea-chest, and landed in my garden at Holloway, where for about a year the three or four spiders seemed to do pretty well; but, what with cats and smoke, they did not flourish as I had hoped.

On June 1st, 1882, I turned the contents out of the tea-chest, and in demolishing the earth I found one of the nests all right, the female well and savage. But in the confusion of removing to Woking she was damaged, and died in a few days. I think I shall be within limits in putting the age of *this* spider at *six* years!

Many of the tubes from the Woking colony transferred to my garden-bank April 12th, 1883, were very large ones, and evidently of good age, some of the tubes quite green with moss; all the spiders are at the present time in good health and spirits, and I have become so attached to them that I shall feel leaving them as much as anything. I hope to move them, though I fear that after living so long and drawing their supplies from my garden-bank they will not care to settle in a flower-pot.

I should imagine *Atypus* was about four years in reaching maturity, then eighteen months is taken up before the young are turned out, and how long the *female* lives after that time I have yet to learn. I have one still alive and savage which turned her family out March 16th, 1884, and, judging from the vigour with which she grasps a fly or my finger when teased, I can safely say her teeth are not failing.

I imagine many females live and *die* "old maids," though not before reaching a good age; and, comparing their nests with those of younger ones, I fancy not far short of *ten* years!

There is one point mentioned in Mr. Brown's* account

* Notes on *Atypus Sulzeri*, 'Zoologist,' vol. xiv. (1856), p. 5021.

of his captures which I should like to refer to ; it is the supposed power possessed by *Atypus* to "inflate" its tube. No doubt, had Mr. Brown examined *more* tubes, in all probability he would have arrived at some other conclusion, for you will observe in his account he says, "In *one* case, on opening the box in which the nest was placed, he perceived a movement throughout the tube, as if it were being inflated ; this soon subsided, but the following morning he was surprised to see the whole tube inflated, especially at the end which had lain upon the bank," &c. I have watched many times for this "inflation," but all the movement I have noticed resulted from the spider creeping along from end to end ; and I believe during the night they gave a few twirls with their spinners, strengthening the tube so that it would bear its own weight, and the aërial portion, being the *strongest*, would present the most inflated appearance. But to enable me to arrive at a more satisfactory conclusion than mere supposition, I made the following experiments with some large tubes and *powerful* females:—

No. 1.—8 in. long. I laid straight out.

No. 2.—7 in. long. I laid in a bent position, at right angles.

No. 3.—10 in. long. I tied up with cotton four inches from the aërial top end, but only just tight enough to prevent the female passing from the subterranean end.

No. 4.—10 in. long. Four inches of the subterranean end was tied, the spider at the other.

No. 5.—8½ in. long. Two inches from end, the spider in the middle part.

No. 6.—8 in. long. I laid a flat piece of glass along and half-way over the edge of the tube for four inches down, so that the spider could not pass.

I flattened every part of each tube, leaving the spiders at the ends, their heads towards the contracted part of the tube. Next morning I examined each one most carefully:—

No. 1.—The spider had walked from end to end, distending the tube the whole distance.

No. 2.—Was empty, an opening at the aërial end showing the spider escaped there after traversing the length, the tube still retaining the "inflated" appearance.

- No. 3.—A *very* large tube, in which I found a male as well as a female next morning; the female had been left in the lower part of the tube from which I had not removed the ball of earth usually found at the end, and no doubt the male was just above this when I laid the tube in the box; however, the pair of them could not get up sufficient wind to “inflate” the aërial portion, though both of them were found close to the contraction, leaving the part traversed during the night well distended.
- No. 4.—Another huge female, left in the aërial part, through which she walked before dark, gently distending it as she passed along; but not any alteration in the subterranean part, which was as flat as when I left it.
- No. 5.—Where the spider was confined in about four inches of the middle part, which was distended next morning, the two ends to which she could not obtain entrance were perfectly *flat*.
- No. 6.—The spider had traversed and distended the free portion up to where the end of the piece of glass was laid on, but beyond this there were no signs of any “inflation” having taken place.

The sum total of the above experiments was, that wherever the spider had a free passage, either at the aërial, or subterranean end, or in the middle of the tube, it distended it by simply passing along; but the parts of the tubes contracted were not altered in any way whatever, *all* being perfectly flat, just as I kept them on the previous day, and I think satisfactory *proof* that the spider does not distend any part of her tube by “inflating.”

Should the day after rain has fallen be warm and bright, the aërial part nearly always presents a very much distended appearance. I attribute this to nothing else than the power given to the spider enabling it (though only a *spider*) to know when to put its snare (the aërial portion) in such a condition that the flies will alight upon it in ignorance of what it may be, and suffer accordingly.

There is just one more fact which I noticed, and then I have exhausted my notes and, I am afraid, your

patience too. On December 27th, 1884, I examined a large female *Atypus* under my microscope with a power of about 40 diameters, and just in the folds of the joint of the legs where the covering is very thin I could see most distinctly the circulation of the vital fluid, and counted twelve to thirteen beats per minute; this I observed from twenty to thirty times, my nephew confirming my observation a dozen times.

To enable me to form a correct idea of the progress made by a spider in a given time, I have filled a deep bell-glass with layers one inch deep of black, white, and yellow sand. In this will be placed some young *Atypi*, which will commence their tubes on black sand. As soon as white sand is thrown out I shall know the spider has gone down one inch in a certain time, and so on, carefully noting down date as each successive colour is reached; and in course of some years I hope to solve the only facts about which I am in doubt, *viz.*, how long it is before the male and female reach maturity, and how long the female lives.

Since putting my notes into order I have made one other observation upon the young which emerged on February 3rd, 1885. Many of them have now formed very delicate tubes, attaching the aerial portion to the sides of the pot. On April 24th I caught a small *Phalangium* (? sp.), and holding it by its legs I touched one of the tubes with it, but without any notice being taken. I tried another *upright* one; the tiny spider came up directly, striking in the same manner and with as much precision as its mother, the fangs penetrating the body of the *Phalangium*, which was drawn through and down out of sight in less than five minutes. This is the *first* meal taken by any of the brood. Next day the spider was very busy excavating, throwing out quite a quantity of sand.

In bringing my notes to a conclusion, I think I cannot do better than just recall one fact in the history of this interesting spider—that when the *first* young one emerges from the tube it takes an upward course, leaving behind it a silken cord, which is taken hold of and added to by each one as they emerge and follow on. Cannot we follow their example by adding our small amount of knowledge, and so make the pathway stronger and easier for our fellow-students who may come after us?

X. *On the classification of the Australian Pyralidina.*

By E. MEYRICK, B.A.

[Read August 5th, 1885.]

THIS paper includes the remaining families of the *Pyralidina*, viz., *Pterophoridae*, *Alucitidae*, *Hydrocampidae*, and *Oxychirotidae*, together with such additional species of the previous families as have been obtained since their publication; and therefore completes for the present the results of my investigations on the Australian species of this group.

The thirteen families into which I have divided the group (including throughout the world at present some 2500 described species, a number which will probably be at least quadrupled), appear to me to be mainly collateral branches descended from a group of extinct forms. I think that the *Phycididae* may be regarded as a development of the *Galleriadae*, the *Botydidae* of the *Scopariadae*, and the *Hydrocampidae* and *Musotimidae* of the *Pyralididae*. With these exceptions it does not appear to me that any of the families can be regarded as immediately derivable from any other known existing forms. The *Pyralididae* and *Epipaschiadae* are referable to a common ancestor very little removed; and the same may be said of the *Scopariadae* and *Crambidae*; whilst the *Galleriadae* come from somewhere between these two presumptive ancestors. The *Tineodidae*, *Oxychirotidae*, *Pterophoridae*, and *Alucitidae* are relics of a once more extensive section of the group, now reduced to a fragmentary condition, and approaching most nearly to the *Crambidae* and *Scopariadae*. Of course no linear order can express these affinities fully, but I think the following arrangement the most convenient:—*Epipaschiadae*, *Pyralididae*, *Musotimidae*, *Hydrocampidae*, *Botydidae*, *Scopariadae*, *Crambidae*, *Galleriadae*, *Phycididae*, *Tineodidae*, *Oxychirotidae*, *Pterophoridae*, *Alucitidae*.

The original type-form of the *Pyralidina* may be

considered to have had in the fore wings vein 1 basally furcate (the furcation soon being lost), and veins 8 and 9 stalked; in the hind wings 1 *a*, 1 *b*, and 1 *c* all present, 6 only approximated towards 7 at base (soon becoming stalked with 7), and 8 free, but approximated to 7 in middle, and soon constantly anastomosing with 7.

The family *Tincodidæ*, referred to above, is formed for the reception of the peculiar genus *Tincodes*, of which the generic characters have been given. The family diagnosis will be as follows:—Maxillary palpi triangularly dilated; fore wings with 8 and 9 stalked, 7 separate; hind wings with 5 and 6 from transverse vein, rather nearer together than to 4 or 7, 8 anastomosing at a point with 7, lower median naked.

PTEROPHORIDÆ.

The characters of this and the following family, and of the genera included in them, are given in the paper read with this, which will be published early in next year's volume, and need not be repeated here.

COSMOCLOSTIS, *Meyr.*

Cosmoclostis aglaodesma, *Meyr.*

Sydney, New South Wales.

TRICHOPTILUS, *Wlsm.*

Trichoptilus scythrodes, *Meyr.*

Sydney, New South Wales; Port Lincoln, South Australia.

Trichoptilus ccrarnodes, *Meyr.*

Sydney, New South Wales; Port Lincoln, South Australia.

Trichoptilus xerodes, *Meyr.*

Toowoomba, Queensland; Bathurst, New South Wales; Adelaide, Wirrabara, and Port Lincoln, South Australia.

PLATYPTILIA, *Hb.*

Platyptilia falcatalis, *Walk.*

Platyptilus falcatalis, *Walk.*, 931; *Meyr.*, *Trans. N. Z. Inst.*, 1884, 128; *P. reptetalis*, *Walk.*, 931.

Christchurch to Invercargill, New Zealand.

Platyptilia emissalis, Walk.*Platyptilus emissalis*, Walk., 930.

♂, ♀, 17—22 mm. Head, thorax, and abdomen fuscous or dark fuscous, mixed with whitish, face usually suffused with reddish ochreous; frontal tuft short, conical. Palpi light ochreous, irrorated with reddish ochreous. Antennæ fuscous. Legs fuscous, tarsal joints broadly whitish towards base. Fore wings cleft from two-thirds, segments rather broad, 1st segment slightly dilated, hind margin subconcave, oblique, 2nd segment rather strongly dilated, hind margin gently rounded, oblique; ochreous-brown, sometimes suffused with fuscous, and more or less mixed with whitish scales, sometimes forming oblique striæ; a small dark fuscous spot on submedian fold at one-fourth, and another beneath costa before middle, both sometimes obsolete; a triangular dark fuscous blotch on costa at two-thirds, apex resting on base of cleft, anterior side suffused, posterior side tolerably defined; a rather broad dark fuscous fascia (sometimes not much darker than ground colour) crossing both segments above base, posteriorly bounded by a straight whitish line; hind margin suffusedly darker; costal cilia dark fuscous, between blotches and before apex white; rest of cilia whitish, on hind margin with a sharp black basal line, on inner margin with a small spot of black scales at two-thirds. Hind wings cleft firstly from middle, secondly from near base, 1st segment gradually dilated throughout, apex equilateral-triangular, 2nd segment moderately dilated, hind margin straight, very oblique, 3rd segment linear; fuscous; cilia light greyish, with a short black line at base on apex of 1st segment, 3rd segment with some small short black scales scattered along inner margin, especially towards base, and three or four inconspicuous fine black hair-scales at two-thirds.

Southern specimens are more deeply coloured and somewhat larger than northern.

Toowoomba, Queensland; Sydney, Bathurst, Glen Innes, and Mount Kosciusko (up to 6000 feet), New South Wales; Mount Wellington, Tasmania. Common from September to January.

Platyptilia Haasti, Feld.

Platyptilus Haasti, Feld., Reis. Nov., pl. cxl., 58;
Meyr., Trans. N. Z. Inst., 1884, 128.

Distributed throughout New Zealand.

Platyptilia heliastis, Meyr.

Platyptilia heliastis, Meyr., Trans. N. Z. Inst., 1884,
129.

Castle Hill, New Zealand.

ACIPTILIA, Hb.

Aciptilia innotatalis, Walk.

Pterophorus innotatalis, Walk., 945; Meyr., Trans.
N. Z. Inst., 1884, 124.

This species is easily separated from the larger but very similar *A. tetradactyla* by the absence of dark stripes on the legs.

Masterton to Invercargill, New Zealand.

Aciptilia furcatalis, Walk.

Aciptilus furcatalis, Walk., 950; Feld., Reis. Nov., pl.
exl., 52; Meyr., Trans. N. Z. Inst., 1884, 123.

Cambridge to Otira River, New Zealand.

Aciptilia lycosema, Meyr.

Aciptilia lycosema, Meyr., Trans. N. Z. Inst., 1884, 124.

Wellington to Dunedin, New Zealand.

Aciptilia monospilalis, Walk.

Aciptilus monospilalis, Walk., 950; Meyr., Trans.
N. Z. Inst., 1884, 124; *A. patruelis*, Feld., Reis.
Nov., pl. exl., 56.

Distributed throughout New Zealand.

Aciptilia aptalis, Walk.

Aciptilus aptalis, Walk., 950.

♂, ♀, 16—20 mm. Head, palpi, antennæ, thorax, abdomen, and legs yellowish white. Fore wings cleft from middle, segments rather narrow, gradually finely attenuated; very pale whitish yellowish, becoming white towards base of costa; some fine irregularly scattered blackish speckles, sometimes nearly obsolete, but usually forming a transverse mark at base of cleft, two dots on

costa before and after middle of 1st segment, a dot on inner margin of 1st segment towards apex, three dots on inner margin of 2nd segment, a dot at apex of each segment, and sometimes one or two others; cilia whitish. Hind wings cleft firstly from before middle, secondly from near base, segments linear; white; cilia white; vein 1*b* strongly pectinated towards base.

Nearest allied to *A. monospilalis*; probably also related to *A. malacensis*, Z.

Larva pale green (undescribed); feeds on *Astrotriche floccosa* (*Araliaceae*), eating the leaf into holes from beneath. Pupa exposed, appressed to lower surface of leaf; rather thinly clothed with curved bristly whitish hairs; pale green, with dorsal and subdorsal rows of black dots.

Brisbane, Queensland; Sydney, New South Wales; George's Bay, Tasmania; from September to April, common amongst its food-plant; also occurs in the New Hebrides, Fiji, and Tonga.

Note.—In *A. innotatalis* veins 2 and 11 of the fore wings are both absent, as in *A. tetradactyla*, *A. spilo-dactyla*, and *A. pentadactyla*; in *A. furcatalis*, *A. lycosema*, *A. monospilalis*, and *A. aptalis* vein 11 is absent, but 2 is present; the oldest type of the genus, in which veins 2 and 11 are both present, as in *A. galactodactyla*, is not represented in this region. It may therefore be inferred that the genus did not originate here (but probably in Europe); but that its introduction into New Zealand dates back to a remote period: the single species found in Australia must be regarded as a straggler which has recently found its way thither from the Pacific Islands.

DOXOSTERES, *Meyr.*

Doxosteres canalis, Walk.

Pterophorus canalis, Walk., 948.

♂, ♀, 17—19 mm. Head and thorax brownish ochreous, suffusedly irrorated with white. Palpi ochreous, apex of 2nd joint white. Antennæ whitish grey. Abdomen ochreous, base and apex mixed with white. Legs white, anterior tibiæ striped with ochreous. Fore wings cleft from before two-thirds, 1st segment moderate, parallel-sided, hind margin subconcave, extremely oblique, 2nd segment somewhat narrower, slightly dilated, hind

margin slightly rounded, very oblique; light brownish ochreous, with irregularly scattered black and white scales, tending to form streaks along basal half of costa and submedian fold; an indistinct darker spot at base of cleft; cilia white, on inner and hind margins pale greyish ochreous except towards base, with two blackish basal dots on hind margin of each segment. Hind wings cleft firstly from two-fifths, secondly from near base, 1st segment tolerably narrow, spatulate, 2nd segment moderate, caudate, 3rd segment linear; fuscous; cilia pale greyish ochreous.

Duaranga and Brisbane, Queensland; Sydney and Blackheath (3500 feet), New South Wales; Mount Graham and Wirrabara, South Australia; from September to November, and in February; rather common.

MIMESCOPTILUS, Wallgr.

Mimesoptilus orites, Meyr.

Mimesoptilus orites, Meyr., Trans. N. Z. Inst., 1884, 126.

Clinton, New Zealand.

Mimesoptilus lithoxestus, Meyr.

Mimesoptilus lithoxestus, Meyr., Trans. N. Z. Inst., 1884, 127.

Arthur's Pass, New Zealand.

Mimesoptilus charadrias, Meyr.

Mimesoptilus charadrias, Meyr., Trans. N. Z. Inst., 1884, 126.

Arthur's Pass, New Zealand.

Mimesoptilus celidotus, Meyr.

Lioptilus celidotus, Meyr., Trans. N. Z. Inst., 1884, 125.

Sydney and Mount Kosciusko (5000 feet), New South Wales; Christchurch and Lake Wakatipu, New Zealand; in December, January, and April.

Mimesoptilus phæonephes, Meyr.

Mount Wellington, Tasmania.

Mimeseoptilus leuconephes, Meyr.

Mount Kosciusko (4700 feet), New South Wales.

CENOLOBA, Wlsm.

Cenoloba obliteralis, Walk.

Pterophorus obliteralis, Walk., 945; Wlsm., Ent. Mo. Mag., 1885, 176.

This species, said to be Australian, is unknown to me.

Oxyptilus cinctipedalis, Walk., 935; *Pterophorus diffusalis*, ib., 945; and *P. deprivalis*, ib., 946. These species I have not yet succeeded in identifying; nor can I speak with certainty of *P. tinctidactylus*, Newm.

ALUCITIDÆ.

ALUCITA, Z.

Alucita phricodes, Meyr.

Duaringa, Queensland; Sydney, New South Wales.

HYDROCAMPIDÆ.

Uncus in ♂ well-developed, complex. Fore wings with 10 often out of 8, rarely also 7. Hind wings with lower median not pectinated, 7 out of 6, 8 anastomosing with 7 beyond cell.

- 1 a. Vein 10 of fore wings rising out of 8 *Paraponyx*.
- 1 b. " " " " separate.
- 2 a. Labial palpi very long, straight *Schœnobius*.
- 2 b. " " moderate, generally arched.
- 3 a. Terminal joint of labial palpi acute *Anydraula*.
- 3 b. " " " " obtuse.
- 4 a. Veins 4 and 5 of hind wings stalked *Hydreuretis*.
- 4 b. " " " " separate *Scirpophaga*.

ANYDRAULA, n. g.

Forehead vertical; ocelli present; tongue slender, developed. Antennæ two-thirds, in male moderately ciliated (1), above with angularly projecting scales at joints. Maxillary palpi moderate, loosely scaled. Labial palpi moderate, curved, obliquely ascending, 2nd joint beneath rough-haired or with a loose rough projecting tuft of scales towards apex, terminal joint shorter than 2nd, slender, pointed. Abdomen in male with valves strong, exerted, scaled;

uncus long, slender, curved, with a straight slender process from base beneath not reaching apex; claspers indicated by a slender spine. Posterior tibiæ with outer spurs half inner; anterior tarsi sometimes dilated with rough hairs. Fore wings with veins 8 and 9 stalked, 11 short. Hind wings with vein 7 absent (coincident with 8), 8 anastomosing shortly with 6 beyond cell.

Nearly allied to *Cataclysta*, which it resembles in appearance, but well distinguished by the presence of ocelli, the separation of vein 10 of the fore wings from 8, and the rough-haired 2nd joint of palpi.

Anydraula glycerialis, Walk.

Cataclysta glycerialis, Walk., 450.

♂, ♀, 15—18 mm. Head and thorax ochreous mixed with dark fuscous, sides of face, collar, and patagia except shoulders silvery white. Palpi dark fuscous mixed with yellowish, base and terminal joint white, 2nd joint beneath with loose apical tuft. Antennæ dark fuscous. Abdomen whitish ochreous, posteriorly paler. Legs ochreous whitish, anterior tibiæ and apex of tarsal joints suffusedly dark fuscous. Fore wings elongate-triangular, costa straight, posteriorly slightly arched, apex round-pointed, hind margin sinuate, oblique; silvery white; markings pale yellow-ochreous, strongly margined with dark grey; a streak along costa from base to three-fifths; a rather narrow fascia from middle of costa to one-fourth of inner margin; a moderate fascia from two-thirds of costa to middle of inner margin, much narrowed at extremities, posterior edge angularly projecting at one-third and three-fourths from costa; a rather narrow fascia from five-sixths of costa, bent inwards beneath costa, almost touching hind marginal fascia below middle, thence sending a sharp truncate angle inwards to near middle of second fascia, terminating in anal angle; a narrow fascia along hind margin; cilia white, tips grey. Hind wings silvery white; markings light yellow-ochreous, strongly margined with dark grey; a transverse dark grey mark in disc before middle; an irregular direct central fascia not reaching margins; a spot on inner margin below middle; a dark grey line near and parallel to anterior edge of hind marginal band; a moderate hind marginal band, attenuated above apex and to anal angle, containing a row of five confluent irregular deep black spots with bright brassy-metallic centres; cilia white, tips grey.

Sydney and Blackheath (3500 feet), New South Wales; Sale, Victoria; locally common, frequenting damp

ground in February and March, but not near water; the larva cannot therefore be aquatic.

Anydraula drusialis, Walk.

Cataclysta drusiensis, Walk., 450.

♂, 14 mm. Head, palpi, antennæ, thorax, and abdomen whitish ochreous; 2nd joint of palpi dark fuscous except towards apex. Legs whitish, anterior tarsi with three basal joints very broadly dilated with blackish scales; two small black tufts between posterior coxæ. Fore wings rather elongate-triangular, narrow at base, costa posteriorly slightly arched, apex rounded, hind margin somewhat bowed, oblique; silvery white, with ochreous-yellow markings, obscurely margined with dark fuscous; a small basal patch, bounded by a thick dark fuscous streak from one-fifth of costa to one-fifth of inner margin; a moderate fascia from two-fifths of costa to two-fifths of inner margin, anteriorly not dark-margined, produced along costa to join a second somewhat broader fascia from two-thirds of costa to anal angle, of which the anterior edge projects obscurely in middle; space between first and second fascia mixed with black scales, tending to form four irregular lines; a third narrower fascia from costa near apex, and a fourth hind marginal, both confluent with second towards anal angle, where they form a blotch, containing an elongate light shining grey spot; cilia pale grey, tips white. Hind wings silvery white; a fuscous spot on inner margin towards base; a moderate irregular ochreous-yellow fascia from below two-fifths of costa to anal angle, posteriorly dark-margined; two blackish lines at two-thirds parallel to hind margin, beneath bent downwards to anal angle, the second terminating in a golden metallic spot; space between these lines and anterior fascia mixed with black scales, tending to form lines on veins; an ochreous-yellow hind marginal fascia, preceded by a narrow band of thickly-strewn blackish scales, and containing four large subquadrate deep black spots, each including an irregular bluish-metallic spot; cilia with basal half grey, terminal half white.

Described from Fijian specimens, but I believe they do not differ from Australian.

Townsville, Queensland; also occurs in Borneo and Fiji.

PARAPONYX, *Hb.*

Forehead vertical; ocelli present; tongue developed. Antennæ two-thirds, in male shortly ciliated ($\frac{3}{8}$ — $\frac{3}{4}$), with angularly projecting scales at joints, at least towards apex. Maxillary palpi short, dilated with loose scales. Labial palpi moderate, curved, more or less ascending, 2nd joint loosely scaled or rough-haired beneath, terminal joint variable, obtuse or tolerably pointed. Abdomen in male with valves strong, exerted, scaled; uncus moderately long, slender, curved, with a somewhat upwards-curved nearly equally long but remote process from base beneath. Posterior tibiæ with outer spurs half inner. Fore wings with veins 9 and 10 out of 8, 11 moderate. Hind wings with veins 4 and 5 closely approximated or from a point, 7 out of 6 near origin, anastomosing with 8 from or near origin to $\frac{1}{2}$ — $\frac{3}{4}$.

A nearly cosmopolitan genus, of which the larvæ are probably all aquatic. Besides the species given below I have probably two others from Queensland, but the specimens are not in a condition to describe.

- 1 a. Hind wings with an annular discal spot *marmorea*.
 1 b. ,, without annular discal spot.
 2 a. Hind wings with a median line furcate above.
 3 a. Median line of hind wings thick *polydectalis*.
 3 b. ,, ,, ,, ,, slender *dicentra*.
 2 b. Hind wings without furcate median line.
 4 a. Hind wings with two parallel lines becoming
 blackish beneath *myina*.
 4 b. Hind wings without blackish lines.
 5 a. Fore wings clear white *decussalis*.
 5 b. Fore wings mostly suffused with light greyish
 fuscous *nitens*.

Paraponyx polydectalis, Walk.*Cataclysta polydectalis*, Walk., 451.

♂, ♀, 15—18 mm. Head white. Palpi with 2nd joint densely scaled, terminal joint two-thirds of 2nd, pointed; white, 2nd joint externally fuscous except towards apex. Antennæ ochreous-whitish. Thorax white, slightly mixed with ochreous, with a small blackish spot on middle of patagia, and two others more indistinct behind. Abdomen white, base of segments ochreous-tinged. Legs white, anterior tibiæ and apex of tarsal joints dark fuscous above. Fore wings elongate-triangular, costa almost straight, apex rounded, hind margin gently rounded, rather oblique;

snow-white, with light ochreous-yellow blackish-margined markings; base and costa to two-thirds tinged with pale ochreous, costal edge to two-thirds blackish; a small black spot in middle of base, and another midway between base and first line; first line narrow, curved, from before one-fourth of costa to one-fourth of inner margin, marked with a small black spot in middle; a small blackish longitudinal mark above middle beyond first line; an obliquely-placed oval white strongly black-margined spot in disc beyond middle; second line narrow, rather wider beneath, running from two-thirds of costa obliquely outwards to below middle, thence acutely curved inwards through lower edge of discal spot to middle of wing, and again rectangularly bent to inner margin, somewhat sinuate near costa and inner margin; a narrow hind marginal fascia, connecting with an elongate blotch on posterior third of inner margin; an irregular fascia near before this, broadest above middle, extremely attenuated opposite angle of second line; cilia grey-whitish, with a dark fuscous line. Hind wings snow-white, markings light ochreous-yellow, blackish-margined; a blackish transverse line near base, not reaching inner margin; a narrow blackish median fascia, separating above middle into two costal branches, the second curved outwards; a moderate fascia near before hind marginal fascia, touching it at both extremities; a narrow hind marginal fascia; cilia white, with a dark fuscous line, base marked with three small quadrate deep black spots above middle of hind margin.

♀. Fore wings mostly suffused with light ochreous, all markings indistinct, blackish markings obsolete except indistinct discal spot and the small spot on first line; hind wings as in male.

Distinguished from all others by the blackish furcate median fascia of hind wings, and the three black spots in cilia of hind margin.

Sydney, New South Wales; flying commonly over pools, from February to April; also from Fiji.

Paraponyx dicentra, n. s.

♂, ♀, 15—21 mm. Head, thorax, abdomen, and legs white. Antennæ whitish ochreous. Palpi with 2nd joint densely scaled, somewhat rough beneath, terminal joint about half 2nd, tolerably pointed; white, 2nd joint externally suffused with fuscous except towards apex. Fore wings very elongate-triangular, costa posteriorly slightly arched, apex rounded, hind margin obliquely rounded; snow-white, with light ochreous-yellow markings, irregularly and obscurely margined with dark fuscous, in female very

pale and indistinct; some scattered dark fuscous scales towards costa and base, sometimes forming a small spot near base in middle; an indistinct narrow transverse streak about one-third, parallel to hind margin, not reaching costa, containing a small irregular black spot in middle; an irregular fascia from costa at three-fourths, upper half slender, moderately curved outwards, thence tolerably straight to inner margin at two-thirds, lower half moderately broad; two small transversely placed blackish discal spots above angle of this, partially connected anteriorly so as to form a crescentic mark; a moderate irregular fascia at five-sixths, rather suddenly contracted at one-third and two-thirds; a blackish subterminal line near and parallel to hind margin, separated from a narrow hind marginal light ochreous-yellow unmarginated fascia by a white line; cilia whitish, with a blackish line interrupted into spots. Hind wings white; an indistinct blackish line near base; a fine blackish median line from middle of inner margin, above middle furcate and sending two branches to costa, second beyond middle, curved; a moderate irregular light ochreous-yellow fascia about three-fourths, irregularly blackish-margined, contracted towards costa, emitting a projection posteriorly above middle; subterminal line, hind marginal fascia, and cilia as in fore wings.

Readily known by the white ground colour, ochreous-yellow markings, double blackish discal spot of fore wings, and fine furcate median line of hind wings.

Duaringa, Queensland; sent down commonly by Mr. G. Barnard.

Paraponyx myina, n. s.

♂, 15—21 mm. Head, palpi, antennæ, thorax, and abdomen light greyish ochreous, irrorated with dark fuscous; palpi with 2nd joint broadly scaled, somewhat rough beneath, terminal joint about two-thirds of 2nd, thick, tolerably obtuse. Legs ochreous-whitish, anterior pair suffused above with dark fuscous. Fore wings very elongate-triangular, costa almost straight, apex rounded, hind margin obliquely rounded; pale greyish ochreous, irrorated with fuscous, with cloudy dark fuscous markings; a small spot in disc at one-fourth, connected with inner margin by a faint line; a small transverse blackish discal spot beyond middle; an indistinct line from two-thirds of costa to three-fifths of inner margin, projecting outwards in an irregular curve above middle, forming a small spot on costa, sometimes with an obscure yellowish spot below middle; a very ill-defined line at five-sixths; on these two lines are sometimes yellowish spots above middle; a fine slightly waved subterminal line; cilia pale greyish ochreous, with two partially

interrupted dark fuscous lines. Hind wings pale greyish ochreous, irrorated with fuscous, sometimes] whitish towards base; two parallel well-defined dark fuscous lines, second indistinct on upper half, from beyond middle of costa to middle of inner margin, with an irregularly rectangular angulation at one-third from costa subterminal line and cilia as in fore wings.

Very similar in general appearance to *P. hebraicalis*, Snell., which I have not seen; but, if the description and figure are accurate, *P. myina* is easily recognised by the characteristic median parallel lines of hind wings.

Duaringa, Queensland; six specimens sent by Mr. G. Barnard.

Paraponyx decussalis, Walk.

Zebronia decussalis, Walk., 481; *Z. medusalis*, ib., 486.

♂, ♀, 14—16 mm. Head, antennæ, thorax, abdomen, and legs white; anterior tibiæ and tarsi suffused interiorly with fuscous. Palpi with 2nd joint densely scaled, terminal joint nearly as long as 2nd, roughened with scales anteriorly, pointed; white, 2nd joint externally fuscous except towards apex. Fore wings elongate-triangular, costa almost straight, apex rounded, hind margin gently rounded, rather oblique; snow-white; costa somewhat sprinkled with ochreous towards base; two small round blackish spots placed transversely in disc at one-third, the upper posterior; a somewhat 8-shaped black discal spot beyond middle; a slender irregular light ochreous fascia from two-thirds of costa to two-thirds of inner margin, mixed with blackish on costa, from below costa to middle semicircularly curved outwards; a very irregular light ochreous fascia midway between this and hind margin, tolerably thick on upper half, very slender on lower; a waved dark fuscous line near and parallel to hind margin, connected with it by irregular fuscous scales on veins; cilia white. Hind wings white; a central light ochreous discal spot, hardly perceptibly connected with a short irregular line from middle of inner margin; a narrow irregular partially interrupted light ochreous fascia at three-fourths, tolerably parallel to hind margin; a waved dark fuscous line near hind margin; cilia white.

Shorter-winged and more neatly marked than the other Australian species.

Duaringa, Queensland; several specimens sent by Mr. G. Barnard; also occurs in Ceylon.

Paraponyx marmorca, n. s.

♀, 17—19 mm. Head, thorax, and abdomen fuscous, irrorated with whitish. Palpi with 2nd joint with long rough projecting hairs beneath, terminal joint short, pointed, partly concealed; dark fuscous mixed with whitish. Antennæ pale greyish ochreous. Legs whitish ochreous, anterior pair suffusedly spotted with dark fuscous on joints. Fore wings very elongate-triangular, costa posteriorly gently arched, apex rounded, hind margin obliquely rounded; ochreous, more or less entirely suffused with fuscous; a narrow curved whitish fascia before one-fourth; an obscure whitish dark-bordered line before middle, irregularly sinuate in disc; an indistinct whitish line from three-fourths of costa to beyond middle of inner margin, obscurely double in disc above middle, upper half strongly sinuate inwards, in middle rectangularly bent inwards to middle of disc, thence again rectangularly bent to inner margin; the narrow median space between this and preceding line more or less obscurely whitish, only distinctly white on a costal spot beyond first line, a subquadrate spot in angle of second line more yellow-ochreous; an irregular ill-defined white subterminal fascia, sinuate inwards at one-third and two-thirds; cilia grey-whitish, with two fuscous lines and a subbasal blackish line. Hind wings whitish, with fuscous markings; a small spot on inner margin near base; a larger subtriangular spot on middle of inner margin, posterior edge closely followed by a parallel line; an irregular roundish ochreous dark-margined discal spot; second line white, dark-margined, from two-thirds of costa to touch first line on inner margin, forming a rounded-angular projection outwards above middle; beyond second line ground colour fuscous, with an irregular whitish subterminal fascia, projecting inwards in middle to touch angle of second line; cilia as in fore wings.

Distinguished from all other species by the ochreous dark-margined discal spot of hind wings.

Duaringa, Queensland; Sydney, New South Wales; six specimens in February.

Paraponyx nitens, Butl.

Paraponyx nitens, Butl., Cist. Ent., ii., 556; *Hygraula nitens*, Meyr., Trans. N. Z. Inst., 1884, 122.

The genus *Hygraula* cannot be maintained; I failed at first to discover ocelli in this species, but afterwards proved their existence; they are usually concealed in the male, but tolerably distinct in the female.

Sydney, New South Wales; Melbourne, Victoria; Lake Alexandrina, South Australia; Hamilton to Lake Wakatipu, New Zealand; from November to March, rather common.

HYDREURETIS, n. g.

Forehead vertical; ocelli present; tongue short. Antennæ three-fourths, in male shortly ciliated ($\frac{1}{3}$), with projecting scales at apex of joints. Maxillary palpi moderate, loosely scaled. Labial palpi moderate, somewhat arched, somewhat ascending, 2nd joint roughly scaled, terminal joint moderate, cylindrical, obtuse, or pointed. Abdomen in male with uncus moderately long, strong, curved, with an upwards-curved shorter remote process from base beneath; valves strong, exerted, scaled. Posterior tibiæ with outer spurs somewhat more than half inner. Fore wings with veins 4 and 5 from a point or stalked, 8 and 9 stalked, 10 closely approximated to 9 towards base, 11 moderate. Hind wings with veins 4 and 5 stalked, 7 out of 6 near origin, 8 anastomosing with 7 from origin to two-thirds.

This genus is almost exactly intermediate between *Paraponyx* and *Schœnobius*, and doubtless forms the developmental connection between them. The larvæ are, I believe, aquatic and case-bearing.

Hydreuretis euryscia, n. s.

♂, 23 mm. Head, thorax, and abdomen white. Palpi with terminal joint as long as 2nd, rather slender, pointed; whitish, 2nd joint grey. Antennæ grey. Legs whitish, anterior and middle pair suffused with grey. Fore wings very elongate-triangular, costa almost straight, faintly sinuate, apex rounded, hind margin tolerably straight, rather oblique; white; veins indistinctly indicated with pale fuscous; costal edge slenderly fuscous; upper and lower medians and submedian fold marked by strong cloudy dark fuscous streaks from base to middle of disc; a suffused dark fuscous fascia at one-fourth, extending from upper median to inner margin; a narrow transverse dark fuscous discal spot; a dark fuscous fascia from five-sixths of costa to middle of inner margin, two-thirds somewhat curved outwards, slender and subdentate on upper half, moderately broad on lower half; a narrow dark fuscous fascia from costa before apex to inner margin at three-fourths, gradually dilated beneath, confluent at both extremities with a narrow hind marginal fascia; cilia whitish. Hind wings white; a cloudy fuscous spot towards middle of disc; an indistinct fuscous

streak from apex rather near hind margin, becoming obsolete below middle; an indistinct fuscous line near and parallel to hind margin; cilia white.

Readily distinguished from the following species by the white head and thorax, pointed palpi, and nearly obsolete markings of hind wings.

Sale, Victoria; one specimen taken by Dr. Lucas.

Hydreuretis tullialis, Walk.

Hydrocampa tullialis, Walk., 462.

♂, 17—21 mm.; ♀, 25—26 mm. Head, palpi, and thorax ochreous-brown, sometimes irrorated with dark fuscous. Antennæ fuscous. Abdomen varying from whitish to ochreous. Legs white, anterior pair internally suffused with fuscous. Fore wings very elongate-triangular, in female extremely elongate, costa very slightly arched, apex obtuse, hind margin tolerably straight, rather oblique; ochreous-brown or fuscous, sometimes irrorated or suffused with dark fuscous; an indistinct white suffusion in male forming bands before and beyond middle, not reaching margins, in female absent; a slender, sometimes almost obliterated, white dark-margined line from five-sixths of costa to three-fourths of inner margin, forming a small spot on inner margin, irregularly sinuate inwards on lower half; a similar nearly straight line near hind margin; cilia pale fuscous, base white spotted with blackish. Hind wings white; a cloudy irregular fuscous streak from two-thirds of costa to middle of inner margin, in male more or less obsolete, in female suffused towards base beneath; a more defined fuscous or dark fuscous streak at three-fourths, parallel to hind margin; a narrow pale ochreous hind marginal fascia, finely dark-margined; cilia white, with basal dark fuscous dots on veins.

Variable in depth of colouring.

Sydney, New South Wales; in March and April, at lamps and over pools.

SCHENOBIUS, Dup.

Forehead with conically projecting scales; ocelli present; tongue very short or obsolete. Antennæ in male two-thirds, in female less than one-half, in male tolerably stout, moderately ciliated. Maxillary palpi moderate, triangularly dilated with scales. Labial palpi very long, straight, porrected, clothed with dense loosely dilated scales, broadest in middle, terminal joint not distinct.

Abdomen in male with valves moderate, scaled, exerted; uncus moderately long, curved, beneath with an upwards-curved remotely-divergent process from base meeting it again at apex. Posterior tibiæ with outer spurs four-fifths of inner. Fore wings with veins 8 and 9 stalked, 10 approximated to 9 towards base, 11 moderate. Hind wings with vein 7 out of 6 near origin, anastomosing with 8 to one-third.

Schænobius imparellus, Meyr.

Schænobius imparellus, Meyr., Proc. Linn. Soc. N. S. W., 1878, 176.

Gayndah, Queensland; Sydney, New South Wales; locally common in March.

SCIRPOPHAGA, Tr.

Forehead vertical. Maxillary palpi moderate, loosely dilated with scales. Labial palpi moderate or rather short, porrected or somewhat ascending, loosely scaled, terminal joint short, partly concealed. Other characters quite as in *Schænobius*.

Scirpophaga patulella, Walk.

Tipanæa patulella, Walk., Tin., 522; *Scirpophaga exsanguis*, Meyr., Proc. Linn. Soc. N. S. W., 1882, 161.

Brisbane, Queensland; Glen Innes (3000 feet) and Sydney, New South Wales; Fernshaw, Victoria; Deloraine and Hobart, Tasmania; Mount Graham, South Australia; very common.

Scirpophaga ochroleuca, Meyr.

Scirpophaga ochroleuca, Meyr., Proc. Linn. Soc. N. S. W., 1882, 162.

Duaringa, Queensland.

OXYCHIROTIDÆ.

Wings linear. Fore wings with veins 7 and 10 both rising from stalk of 8 and 9. Hind wings with vein 7 out of 6, anastomosing with 8, lower median not pectinated. Maxillary palpi triangularly scaled.

OXYCHIROTA, n. g.

Forehead with short cone of scales; ocelli absent; tongue well-developed, slender. Antennae almost as long as fore wings, with angularly projecting scales at joints. Maxillary palpi moderate, porrected, triangularly scaled. Labial palpi moderately long, straight, porrected, roughly haired above and beneath, gradually attenuated. Middle and posterior tibiae with all outer spurs obsolete. Fore wings linear-lanceolate, inner margin with small scale-teeth, cilia $2\frac{1}{2}$; veins 2, 3, 4 very short, 5 from near 4, 6 from middle of short transverse vein, 7 out of stalk of 8 and 9, 8 and 9 long-stalked, 10 out of stalk of 8 and 9 beyond 7, 11 moderate, from near angle, 12 free. Hind wings linear, acute, inner margin with small scale-teeth, cilia 5; veins 2, 3, 4 apparently very short but indistinct, 5 from point with 4, short, transverse vein imperceptible, 7 out of 6, anastomosing with 8 to beyond middle of wing.

This extraordinary genus has exactly the form of wing of a *Gracilaria*, yet its true position admits of no doubt. In repose the wings are extended and appressed to the surface on which the insect is resting, in the attitude of *Eupithecia*. Owing to the small size of the species, and excessive narrowness of the wings, the neurulation of the hind wings especially is extremely cramped and hard to make out from the single specimen, but I believe the details given above are correct. Probably in the male the genital uncus will be found to be developed.

Oxychirota paradoxa, n. s.

♀, 11 mm. Head, palpi, thorax, abdomen, and legs ochreous, mixed with whitish. Antennae whitish, annulated with grey. Fore wings linear, slightly dilated beyond middle and attenuated again to apex, acute, about nine times as long as broad; brownish ochreous, with scattered black scales; markings cloudy, obscure, formed by the coalescence of pearly-whitish scales; these form indefinite longitudinal streaks on veins towards base, a broad fascia before middle, a narrow one at two-thirds, and two or three cloudy posterior spots; cilia pale ochreous-greyish, on inner margin with three or four very small teeth of black scales. Hind wings linear, acute; brownish ochreous, mixed with black scales, and with indefinite irregular pearly-white transverse markings; cilia pale ochreous-greyish, with five or six very small teeth of black scales on inner margin.

Sydney, New South Wales; one specimen at rest on a fence in June.

APPENDIX.

The following are additional species and notes since the publication of other families:—

EPIPASCHIADÆ.

CATAMOLA, *Meyr.**Catamola capnopsis*, n. s.

♂, ♀, 17—22 mm. Head, palpi, and antennæ blackish; antennæ of male filiform, ciliations one-half, process rather short, erect. Thorax blackish grey. Abdomen dark grey, segmental margins whitish. Legs blackish, apex of joints whitish. Fore wings triangular, costa gently arched, apex rounded, hind margin obliquely rounded; dark grey, coarsely mixed with black and whitish scales; first line thick, cloudy, blackish, rather irregular, from one-third of costa to beyond one-third of inner margin; a small blackish discal spot before middle; second line thick, cloudy, blackish, followed by a pale line, subdentate, from beyond middle of costa to two-thirds of inner margin, upper half tolerably regularly curved outwards; cilia grey, with a blackish line. Hind wings rather dark grey; in male a faintly indicated paler post-median line towards costa; cilia grey, with a darker line.

Nearest to *C. classota*, with which it agrees in the shorter erect antennal process, which in all the other species is longer and thrown back; but easily separated by the quite different form of the second line, besides the larger size and more blackish colouring.

Mount Kosciusko, New South Wales; five specimens taken in January, at from 4300 to 4700 feet.

CACOZELIA, *Grote.**Cacozelia costigeralis*, Walk.

Pyralis costigeralis, Walk., Trans. Ent. Soc. Lond., 1. (3rd ser.), 121.

♂, 22—23 mm. Head, palpi, antennæ, and thorax blackish; tuft of maxillary palpi ochreous-whitish. Abdomen dark fuscous mixed with ochreous-whitish. Legs black, irrorated with whitish, apex of joints white, posterior tarsi whitish ochreous beneath. Fore wings triangular, costa gently arched, at two-fifths with a hard glandular swelling forming a rounded protuberance, apex

rounded, hind margin rounded, rather oblique; veins 4 and 5 stalked; lower surface with a membranous scaled ridge above vein 6 extending from one-third of length to near two-thirds; fuscous, densely irrorated with black, and with a few fine scattered whitish scales; a very indistinct row of whitish dots in disc at three-fourths parallel to hind margin, and a hind marginal row of whitish dots; cilia grey, towards base dark grey. Hind wings grey-whitish, posteriorly more or less broadly suffused with grey, hind marginal edge dark grey; cilia grey-whitish, becoming dark grey towards base; veins 4 and 5 from a point, 7 and 8 sometimes joined at a point.

Immediately distinguished from the other species of the genus by the structural differences. In this species veins 7 and 8 of the hind wings occur either free or united at a point, a rare form of variability. In view of this inconstancy, I think *Cacozelia* may be held to include all the species of the family which possess the long maxillary pencil of hairs in the male. The glandular costal swelling of this species (similar to that found in some species of *Balanotis*) and membranous discal ridge are probably restricted to the male.

Mount Kosciusko (4000 feet), New South Wales; Hobart, Tasmania; three specimens in January and February.

PYRALIDIDÆ.

BALANOTIS, *Meyr.*

Balanotis carinentalis, Walk.

Having obtained specimens for examination, I find that the species has well-developed maxillary palpi and ocelli, both of which are erroneously stated by Lederer to be absent; the genus *Cardamyla*, founded on this species and supposed by Lederer (Walker's characters being useless) to be distinguished by this deficiency, must therefore cease to have any existence. In this species the antennæ of male are very shortly ciliated (one-fifth); veins 4 and 5 are separate in fore wings and hind wings; vein 6 of fore wings rises from a point with stalk of 8 and 9; the costa of fore wings has no glandular swelling; all other characters quite as in *Balanotis*.

PERSICOPTERA, *Meyr.*

The antennæ of male are strongly ciliated with fascicles of cilia ($2\frac{1}{2}$).

DRYMIARCHA, n. g.

Forehead with hairs projecting in a rough cone; ocelli present; tongue well developed. Antennæ in male moderately bipectinated. Maxillary palpi obsolete. Labial palpi rather long, straight, porrected, densely scaled, obtuse, above with a dense expansible tuft of scales. Thorax hairy beneath. Abdomen in male with valves moderate, exerted, clothed with long scales; uncus moderate, curved. Fore wings with vein 1 moderately furcate at base, 4 and 5 from very near together, 7 out of stalk of 8 and 9, 8 to below apex, 10 sinuate. Hind wings with veins 4 and 5 almost from a point, 6 and 7 stalked, 8 free, closely approximated to 7 beyond origin.

A very distinct genus, most allied to *Edematophaga*.

Drymiarcha exanthes, n. s.

♂, 29 mm. Head light purple-reddish, mixed with grey-whitish. Palpi dull fuscous-purplish, tuft mixed with grey-whitish, base white. Antennæ grey-whitish. Thorax purple-reddish, on posterior half with a central grey-whitish streak. Abdomen pale ochreous, posteriorly mixed with grey. Legs whitish, anterior tibiæ mixed with grey above. Fore wings triangular, narrow at base, costa nearly straight, somewhat sinuate, apex obtuse, hind margin strongly bowed, rather oblique; pale grey-reddish, lightest towards anal angle; basal third rather dark reddish fuscous, bounded by a slender whitish grey-margined line from one-third of costa to two-fifths of inner margin, angularly bent outwards in middle and less prominently inwards near inner margin; a white dot in disc above middle; a slender white grey-margined line from two-thirds of costa to two-thirds of inner margin, upper portion perpendicular to costa, tolerably straight, below middle acutely angulated inwards to beneath discal spot, thence slightly curved outwards; costa between first and second lines suffused with white; a large ochreous-reddish costal patch beyond second line, margins suffused with fuscous; cilia light fuscous-purplish, basal half grey. Hind wings rather light ochreous-yellow; a moderately broad dark grey hind marginal band, below middle suddenly ceasing, but sending from lower corner a short narrow suffusion inwards towards

base; cilia pale yellow, opposite band with tips and a median line dark grey.

A conspicuous and striking insect.

Sydney, New South Wales; one specimen in August, beaten from *Banksia serrata*.

BOTYDIDÆ.

LEPYRODES, *Gn.*

Forehead flat, oblique; ocelli present; tongue well-developed. Antennæ as long as fore wings, filiform, in male shortly ciliated ($\frac{1}{3}$). Labial palpi short, porrected, with dense projecting scales above and beneath, anteriorly truncate, terminal joint short, filiform. Maxillary palpi short, filiform. Anterior tarsi in male with broad dense tuft of hairs on basal joint beneath; posterior tibiæ with outer spurs nearly equal inner. Abdomen elongate, in male with short slender anal tuft, valves retracted. Fore wings with vein 11 very long, oblique. Hind wings somewhat broader than fore wings; veins 4 and 5 tolerably approximated, 7 out of 6 near origin, anastomosing with 8 to near middle.

The characters of this genus given by Lederer (copying Guenée) are in part erroneous.

LONCHODES, *Gn.*

Forehead rounded, vertical; ocelli present; tongue well-developed. Antennæ five-sixths of fore wings, in male filiform, minutely ciliated ($\frac{1}{4}$). Labial palpi rather short, curved, ascending, 2nd joint with appressed scales, somewhat rough beneath, terminal joint very short, cylindrical. Maxillary palpi absent. Posterior tibiæ with outer spurs half inner. Abdomen very long, anal segment extremely elongate, valves retracted. Fore wings with vein 10 rising out of the stalk of 8 and 9, 11 very oblique. Hind wings as broad as fore wings; veins 4 and 5 approximated at base 7 out of 6 near origin, anastomosing with 8 to near middle.

This genus I believe to be undoubtedly identical with Guenée's *Lonchodes*, founded on two South American species; I have certainly one other species from the South Pacific Islands. Lederer was unacquainted with the genus; the size of the eyes, which he quotes from Guenée, affords no definite character. This genus and the following *Hydriris* are characterised by the maxillary palpi being really absent; they appear to form a

specialised development of the group of *Notarcha* and *Molybdantha*.

Lonchodes mannalis, Walk.

Botys mannusalis, Walk., 726.

I saw the types of this species in the British Museum; I did not examine them, but the species appeared to belong to this genus, and to be distinct from the following.

Lonchodes ceramochra, n. s.

♂, 24—25 mm. Head, palpi, antennæ, thorax, abdomen, and legs pale ochreous; palpi suffused with fuscous. Fore wings elongate-triangular, narrow towards base, costa moderately arched on posterior half, apex rounded, hind margin rounded, rather strongly oblique; rather light ochreous, slightly irrorated with fuscous; extreme costal edge fuscous, costa suffused with fuscous towards base; a cloudy dark fuscous dot beneath costa at one-fifth, and another at one-third; a small quadrate spot unevenly outlined with dark fuscous in disc above and slightly before middle; a slender sharply dentate dark fuscous line from two-thirds of costa to beyond middle of inner margin, irregularly curved outwards, below middle sending a sharp tooth inwards to below discal spot; an irregular dark fuscous hind marginal line; cilia grey-whitish, with a dark fuscous line near base. Hind wings with ground colour, discal spot, posterior and hind marginal lines, and cilia, as in fore wings.

Duaringa, Queensland; two specimens received from Mr. G. Barnard.

HYDRIRIS, n. g.

Forehead tolerably flat, oblique; ocelli present; tongue well-developed. Antennæ five-sixths of fore wings, in male shortly ciliated ($\frac{1}{3}$), with angularly projecting scales at joints. Labial palpi moderate, arched, ascending, 2nd joint with dense broadly projecting scales beneath, terminal joint short, triangularly dilated with scales, obliquely truncate. Maxillary palpi absent. Posterior tibiæ with outer spurs half inner. Abdomen elongate, in male with moderate anal tuft, valves retracted. Fore wings with vein 10 closely approximated to 9 towards base, 11 oblique. Hind wings as broad as fore wings; veins 3, 4, 5 approximated at base, 7 out of 6 near origin, anastomosing with 8 to middle.

Hydriris chalybitis, n. s.

♂, ♀, 16—17 mm. Head, thorax, and abdomen pale ochreous, somewhat mixed with dark fuscous. Palpi dark fuscous, towards base whitish. Antennæ pale ochreous. Legs whitish ochreous, anterior pair suffused with fuscous. Fore wings elongate-triangular, narrow towards base, costa moderately arched on posterior half, apex obtuse, hind margin rounded, rather strongly oblique; light ochreous, irregularly irrorated with fuscous and dark fuscous, between first and second lines clearer and more whitish ochreous except towards costa; base mixed with black and leaden-metallic scales; first line from one-fourth of costa to one-fourth of inner margin, indistinct, dark fuscous, irregularly curved outwards; these discal spots and second line leaden metallic, dark-margined; first spot round, beneath costa before middle; second similar, on submedian fold obliquely before first; third 8-shaped, beyond middle; second line from two-thirds of costa to two-thirds of inner margin, slightly irregular, moderately curved outwards; an oblique apical streak and apical portion of costa and hind margin suffused with rather dark fuscous; cilia pale ochreous, base fuscous. Hind wings pale ochreous, somewhat mixed with fuscous, becoming clearer and more whitish ochreous towards base; a rather thick blackish transverse line very near base, not reaching costa; a dark fuscous dot below costa at one-third, and a blackish sometimes metallic-centred median dot; second line as in fore wings, but indistinct; cilia as in fore wings.

Duaringa, Queensland; several specimens received from Mr. G. Barnard; also occurs in Tonga and the New Hebrides.

GODARA, *Walk.*

My specimens are all females, and I cannot therefore yet give the full characters of this genus; but if separable from *Orobena*, Gn. (which I doubt), it must be by the costal tuft and hairs of the middle legs in the male, since the stalking of veins 4 and 5 in the hind wings is not constant, some specimens having them separate, and others stalked, with intermediate gradations.

Godara comalis, Gn.

Pionea incomalis, Gn., 369, is, I have no doubt, only the female of this species; it varies considerably, the varieties which I have (all from the same place) covering

all the differences of marking given, and the structural differences being sexual characteristics.

SEMIOCEROS, *Meyr.*

Semioceros chrysoryeta, *Meyr.*

I have taken this species also in Ceylon.

HYALOBATHRA, n. g.

Forehead, flat, oblique; ocelli present; tongue well-developed. Antennæ two-thirds of fore wings, in male filiform, moderately ciliated (1). Labial palpi moderate, straight, porrected, with broad rough projecting scales above and beneath, attenuated to apex. Maxillary palpi short, filiform, apex somewhat penicillate. Abdomen in male with valves retracted. Posterior tibiæ with outer spurs half inner. Fore wings with vein 10 very closely approximated to 9, 11 oblique. Hind wings as broad as fore wings; cell very short, veins 3, 4, 5 approximated, 7 out of 6 near origin, anastomosing with 8 to near middle; a small oval perfectly transparent bladder in cell at base (probably in male only).

Allied to *Botys*, but immediately distinguished by the transparent bladder at the base of the hind wings.

Hyalobathra archeleuca, n. s.

♂, 20—21 mm. Head, palpi, antennæ, and thorax light brownish ochreous. Abdomen whitish ochreous, becoming white on sides and beneath. Legs white, above irregularly suffused with fuscous. Fore wings triangular, moderately broad, costa on posterior half moderately arched, apex rectangular, hind margin somewhat bowed, rather oblique; light fuscous, slightly reddish-tinged, along costa more ochreous-tinged; lines slender, blackish, rather indistinct and tending to be interrupted, waved; first from one-fourth of costa to two-fifths of inner margin, curved outwards; second from two-thirds of costa to two-thirds of inner margin, forming a small spot on costa, whence it runs obliquely outwards, in middle rather abruptly curved, and sinuate inwards above inner margin; a small cloudy dark fuscous discal spot in middle; faint indications of a subterminal line; cilia whitish ochreous, with a sharply marked dark ferruginous basal line. Hind wings pale fuscous, slightly reddish-tinged; costa broadly and inner margin more narrowly suffused with pure white; a tolerably distinct waved dark fuscous line at three-fourths, parallel to hind margin,

with an abrupt triangular indentation below middle; cilia as in fore wings.

Sydney, New South Wales, in September and October; three specimens.

MYRIOTIS, n. g.

Forehead tolerably flat, rather oblique; ocelli present; tongue well-developed. Antennæ three-fourths of fore wings, in male shortly bipectinated, pectinations rather thick, flattened, clothed terminally with rather long cilia. Labial palpi rather long, straight, porrected, clothed with dense projecting scales above and beneath, somewhat attenuated towards apex, terminal joint concealed. Maxillary palpi short, terminally dilated with dense scales. Thorax posteriorly hairy. Abdomen in male with moderate anal tuft, valves small, exerted, scaled. Posterior tibiæ with outer spurs half inner. Fore wings with vein 10 approximated to 9, 11 moderately oblique. Hind wings as broad as fore wings; veins 3, 4, 5 somewhat approximated, 7 out of 6 near origin, anastomosing with 8 to middle.

Near to the preceding, but specially characterised by the pectinated antennæ.

Myriotis ptoualis, Walk.

Botys ptoualis, Walk., 728; *Osiriaca inturbidalis*, ib., Suppl., 1493.

♂, 23 mm. Head, palpi, antennæ, and thorax whitish ochreous; sides of palpi and shoulders tinged with fuscous. Abdomen whitish ochreous, yellowish-tinged. Legs whitish, anterior femora dull carmine-reddish, anterior tibiæ and middle femora dark fuscous. Fore wings triangular, moderately broad, costa gently arched, apex round-pointed, hind margin somewhat bowed, oblique; pale brownish ochreous, costa suffused with yellowish ochreous; cilia grey, tips grey-whitish. Hind wings light ochreous-yellow; cilia yellow-whitish, base greyish. Under surface of both fore wings and hind wings with a strong dark fuscous transverse streak from costa towards apex, tolerably parallel to hind margin, reaching half across wing.

Having obtained this species for examination, I find that my conjectural reference to *Euryeron* was quite unwarranted.

Sydney, New South Wales, in September; two specimens.

MECYNA, Gn.

Mecyna rhodochrysa, n. s.

♂, 21 mm. Head and antennæ light greyish ochreous, ciliations one-third. Palpi dark fuscous, beneath white. Thorax grey. Abdomen ochreous-yellow. Legs white, anterior pair banded with dark grey; posterior tibiæ with outer spurs one-third of inner. Fore wings triangular, moderately broad, costa gently arched, apex obtuse, hind margin bowed, rather oblique; fuscous, with bluish reflections; apex and hind margin suffused with pale lilac, mixed with pale bluish metallic scales; a very large quadrate bright yellow blotch, extending on inner margin from before middle to near anal angle, upper edge rather near and tolerably parallel to costa, anterior and posterior sides rather broadly margined with dull crimson, tolerably straight, upper edge marked with two small fuscous spots, and lower edge with two cloudy crimson dots; a sinuate cloudy dark fuscous line from three-fourths of costa to middle of posterior edge of yellow blotch; a row of small dark fuscous spots on hind margin; cilia deep yellow, tips lighter. Hind wings and cilia unicolorous ochreous-yellow.

A beautiful and very distinct species; I think the bright colouring is adapted to the flowers of the *Loranthus*.

Larva 16-legged, cylindrical, tapering posteriorly; claret-coloured, spiracular area brighter; segmental divisions pale yellowish-rosy; spots fuscous; head pale reddish brown, reticulated with darker; 2nd segment with a pale reddish brown bisected dorsal plate; anal plate pale reddish brown, anterior half dark brown. Feeds between the cuticles of leaves of *Loranthus* (*Loranthaceæ*), usually towards the tip, which gradually curls back to form a kind of shelter; sometimes the tips of two leaves are drawn together; the refuse is accumulated in a mass above the withered part of the leaf. Pupa in an oval cocoon amongst this refuse. These larvæ were discovered by Mr. Gervase F. Mathew, R.N., from whose notes the above description is taken.

Sydney, New South Wales; three specimens bred in October from larvæ found full-fed early in the same month. The imago is probably very retired in habits.

MYRIOSTEPHES, *Meyr.**Myriostephes heliamma*, n. s.

♂, ♀, 16—17 mm. Head, palpi, antennæ, thorax, and abdomen deep yellow; a whitish line on margins of eyes; antennæ in male shortly ciliated, without projecting scales at joints; palpi white at base beneath. Legs ochreous-whitish, anterior pair yellowish above. Fore wings triangular, costa slightly sinuate, posteriorly gently arched, apex obtuse, hind margin somewhat bowed, rather oblique; deep yellow; marking rather light purplish fuscous, spots and second line darker; first line from one-third of costa to two-fifths of inner margin, slender, sinuate; a very small spot beneath costa at two-fifths, and a second beyond middle; second line from two-thirds of costa to two-thirds of inner margin, middle third tolerably evenly curved outwards, preceded by a moderately broad band becoming obsolete on costa and inner margin; a cloudy fascia immediately before hind margin, obsolete at extremities; a dark purplish fuscous hind marginal line; cilia deep yellow, becoming yellow-whitish towards tips. Hind wings yellow, somewhat mixed with grey; a cloudy suffused dark grey fascia from costa beyond middle to hind margin below middle, attenuated to a line beneath, on costa confluent with a suffused dark grey almost marginal fascia, attenuated beneath and reaching only to middle of hind margin; a dark grey hind marginal line; cilia yellowish, with a dark grey line becoming obsolete below middle of hind margin, tips paler.

Not closely allied specifically to *M. matura*, but structurally identical except in the absence of projecting scales on the antennæ of male.

Duaringa, Queensland; two specimens sent by Mr. G. Barnard.

STEREOCOPA, n. g.

Forehead rounded; ocelli present; tongue well-developed. Antennæ three-fourths, in male very shortly ciliated, joints very short, with angularly projecting scales, basal joint swollen. Labial palpi moderate, arched, ascending, 2nd joint appearing very broad through long dense projecting scales beneath, terminal joint almost as long as 2nd, slender, cylindrical, not pointed. Maxillary palpi very short, filiform. Abdomen in male with short anal tuft, valves retracted. Posterior tibiæ with outer spurs half inner. Fore wings with vein 10 approximated to 9 towards base, 11 oblique. Hind wings as broad as fore wings; veins 3, 4, 5 approximated at base,

7 out of 6 near origin, anastomosing with 8 to middle; lower median with a few long hairs towards base.

Allied to *Notarcha* and *Molybdantha*, but characterised by the peculiarly formed palpi, swollen basal joint of antennæ, and hairs of lower median vein.

Stereocopa scoparialis, Walk.

Gabrisa scoparialis, Walk., Suppl., 1266.

♂, ♀, 11—15 mm. Head, palpi, antennæ, thorax, and abdomen whitish ochreous, often mixed with dark fuscous. Legs ochreous-whitish, obscurely banded with fuscous. Fore wings elongate-triangular, costagently arched, apex rounded, hind margin obliquely rounded; whitish ochreous, often suffused with fuscous; lines dark fuscous, starting from small spots on costa; an indistinct line near base; first line before one-third, rather irregular, sometimes thick; a spot on middle of costa, connected with anterior margin of a curved subquadrate pale obscurely dark-margined discal spot; second line from three-fourths of costa to two-thirds of inner margin, indented beneath costa, below middle abruptly curved inwards to beneath discal spot, thence rectangularly bent to inner margin; cilia pale whitish ochreous, basal half chequered with quadrate fuscous spots. Hind wings pale whitish ochreous, more whitish towards base, sometimes mixed with greyish; a cloudy fuscous discal spot; second line fuscous, formed as in fore wings; a fuscous apical suffusion, and a smaller fuscous spot on hind margin below middle; cilia as in fore wings, but less distinctly spotted.

Sydney specimens are much lighter than the others which I possess.

Sydney, New South Wales; Hobart, Tasmania; Mount Lofty, South Australia; six specimens in October and December.

EURYCREON, *Ld.*

Eurycreon homophœa, n. s.

♂, ♀, 15—18 mm. Head, antennæ, thorax, and abdomen light greyish ochreous. Palpi dark fuscous, lower half white. Legs white, anterior pair suffused with dark grey. Fore wings triangular, narrow towards base, costa slightly sinuate, nearly straight, apex rounded, hind margin obliquely rounded; light greyish ochreous; costal edge suffusedly darker towards base; a small grey discal spot, sometimes obsolete; a slender white streak

along costa from beyond middle to near apex; second line blackish, slightly irregular, partially obsolete, proceeding from a small spot on costa at three-fourths towards anal angle, below middle rectangularly bent inwards to beneath discal spot, thence again rectangularly bent to inner margin at two-thirds; cilia ochreous-whitish, with two sharply-marked blackish lines. Hind wings grey, becoming whitish grey towards base; a small dark grey discal spot, sometimes obsolete; an irregularly curved dark grey line from two-thirds of costa to two-thirds of inner margin, rectangularly indented below middle; cilia as in fore wings, but second line less distinct.

Closely allied to *E. familiaris*, from which it is best separated by the hind wings; the fore wings also greyer and somewhat narrower, and characterised by the slender white posterior costal streak.

Bathurst, New South Wales (2300 feet); Deloraine, Tasmania; eight specimens in November. The Tasmanian specimen mentioned under *E. familiaris*, Meyr., belongs to this species, *E. familiaris* having only been found round Sydney.

Note.—To the characters of the genus *Eurycreon* should be added: Lower median vein of hind wings more or less distinctly pectinated towards base.

SCOPARIADÆ.

SCOPARIA, *Hw.*

Scoparia protorthra, n. s.

♂, ♀, 15—17 mm. Head, palpi, and thorax mixed with dark fuscous and white; palpi twice breadth of eyes. Antennæ dark fuscous, ciliations one-fourth. Abdomen whitish ochreous, base of segments greyish. Legs dark fuscous, banded with ochreous-whitish, posterior tibiæ ochreous-whitish. Fore wings elongate-triangular, costa slightly arched, apex rounded, hind margin faintly sinuate, obliquely rounded; pale greyish, mixed and suffused with white, and coarsely irrorated with black; a small black mark from base of costa; some irregular ochreous-yellow scales before first line; first line indistinct, slender, white, posteriorly obscurely black-margined, from one-third of costa to two-fifths of inner margin, indented in middle; orbicular and claviform both small, round, black, detached, claviform rather larger; reniform 8-shaped, white, obscurely blackish-margined; second line slender, white, blackish-margined, faintly waved, indented beneath

costa and above inner margin, preceded on upper two-thirds by a white suffusion extending to reniform; a small ochreous-yellow spot on inner margin immediately beyond second line; subterminal whitish, cloudy, partially obsolete, indented so as nearly to touch second line in middle; a hind marginal row of small cloudy blackish partially confluent spots; cilia whitish, with a black line, tips spotted with grey. Hind wings $1\frac{1}{2}$; very pale whitish grey-yellowish; an indistinct post-median line and hind marginal border obscurely greyer; cilia whitish yellowish, with a grey line.

Nearest to *S. eumeles*, Meyr.; the only allied species with distinctly yellowish cilia of the hind wings are *S. eumeles* and *S. exhibitilis*, of which the former is very distinct by the ochreous suffusion of the fore wings, and the latter by the clear white ground colour and black markings.

Sydney, New South Wales; three specimens on tree-trunks in October and November.

EROTOMANES, Meyr.

Forehead with a short conical projection. Ocelli present, Tongue well-developed. Antennæ somewhat over half fore wings, in male slender, filiform, with short scanty cilia at joints only. Labial palpi long, straight, porrected, with long rough projecting scales above and beneath, attenuated to apex, terminal joint concealed. Maxillary palpi moderate, triangularly dilated with loose scales. Abdomen in male with valves large, densely scaled, connivent; claspers also large, membranous, scaled, conically folded, appressed together inside valves; uncus moderate, curved. Posterior tibiæ with outer spurs two-thirds of inner. Fore wings with veins 8 and 9 stalked, 10 tolerably remote from 9, 11 moderate. Hind wings $1\frac{1}{4}$, lower median not pectinated, 1*a* and 1*c* loosely pectinated, disc without hairs; 3, 4, 5 closely approximated at base, 7 out of 6 near origin, anastomosing with 8 to one-third.

According to the above characters, which have not been before completely given, this peculiar genus must be placed in the *Scopariadæ*.

Erotomanes cuspilella, Walk.

Cauza cuspilella, Walk., Suppl., 1771; *Ancrastia mirabilella*, Meyr., Proc. Linn. Soc. N. S. Wales, 1878, 213; *ibid.*, 1879, 333.

Sydney, New South Wales.

CRAMBIDÆ.

THINASOTIA, *Hb.*

It would be possible to separate generically each of the first two additional species here given, on account of well-defined differences in the neuration, but at present I do not think it necessary to do so, regarding them merely as extreme forms of the genus.

Thinasotia termia, n. s.

♂, 22—24 mm. Head, palpi, antennæ, thorax, abdomen, and legs ochreous mixed with white; forehead with long conical projection; tongue extremely short; antennæ strongly bipectinated; legs somewhat irrorated with blackish. Abdominal valves moderate, exerted; uncus stout, terminal half abruptly curved down and attenuated; intromittent organ large, bent, lobed. Fore wings very elongate-triangular, costa gently arched, apex rounded, hind margin obliquely rounded; veins 4 and 5 stalked; ochreous-whitish, irregularly irrorated with ochreous, and with a few scattered black scales; sometimes a cloudy oblique blackish streak in disc at one-fourth; first line from two-fifths of costa to middle of inner margin, white, posteriorly edged by a deep yellow-ochreous line mixed with black, somewhat curved, indented above and below middle; a small clear white somewhat 8-shaped discal spot; second line near and tolerably parallel to hind margin, white, anteriorly edged by a yellow-ochreous line mixed with black, subdentate, indented beneath costa; hind marginal space light fuscous, except a cloudy white dentate marginal line, tending to be connected with second line on veins; a row of cloudy blackish hind marginal dots; cilia light fuscous, mixed with whitish. Hind wings with vein 5 absent (coincident with 4); light fuscous, becoming paler towards base; cilia whitish, with a cloudy fuscous line.

Not close to any other species, but allied to the group of *T. hoplitella*; distinguished from all other species of the genus by the stalking of veins 4 and 5 of the fore wings, and from all except *T. panteucha* by the disappearance of vein 5 of the hind wings.

Duaringa, Queensland; several specimens received from Mr. G. Barnard.

Thinasotia pedionoma, n. s.

♂, ♀, 17—24 mm. Head, palpi, and thorax ochreous; a white line above eyes; forehead with a short cone; palpi mixed with dark fuscous towards apex, white internally and at base beneath; patagia mixed with white. Antennæ grey, in male slender, strongly dentate, apex of teeth with moderate ciliations. Abdomen whitish ochreous. Legs fuscous, beneath whitish. Fore wings extremely elongate-triangular, narrow, costa gently arched, apex round-pointed, hind margin slightly rounded, rather strongly oblique; light fuscous; costal half suffused with ochreous towards base, and with whitish between first and second lines; first line indicated by two obscure blackish parallel lines from middle of costa parallel to hind margin, indented above middle, not passing submedian fold, above which both are bent inwards and coalesce to form a short black streak pointing towards base; a small roundish white blackish-margined discal spot; second line indicated by a short whitish streak from costa at five-sixths, preceded and followed by a darker suffusion on costa, and giving rise to an obscure row of blackish dots parallel to hind margin; a narrow white hind marginal fascia, leaving extreme hind marginal edge fuscous, and a marginal row of cloudy black dots; cilia whitish, a line and terminal third fuscous. Hind wings grey-whitish; cilia white, with a faint grey line.

Also a peculiar and distinct species, perhaps allied to the preceding and *T. longipalpella*, but with narrower fore wings than any other of the genus.

Bathurst, New South Wales (2100 feet); Mount Lofty, South Australia; in April, locally common in dry grassy places.

Thinasotia panteucha, n. s.

♂, 27 mm. Head and thorax whitish ochreous mixed with yellowish ochreous; forehead with a large acute conical projection. Antennæ dark fuscous, moderately bipectinated. Palpi ochreous mixed with dark fuscous towards apex, internally and at base beneath white. Abdomen and legs ochreous-whitish, anterior legs suffused with fuscous. Fore wings very elongate-triangular, costa moderately arched on posterior half, apex somewhat rectangular, hind margin nearly straight, oblique; rather light yellow-ochreous; costa and veins marked with ochreous-white streaks, posteriorly obsolete, strongest on margins of cell; a dark fuscous streak above submedian fold from near base to before middle, another beneath

upper margin of cell from one-fourth to transverse vein, re-appearing beyond this as a broader streak continued to costa before apex, an elongate dark fuscous spot beneath origin of vein 2, and interspaces of veins 2—5 dark fuscous on basal half; a clear white streak from apex near hind margin to anal angle, broadest above middle; five short dark fuscous linear streaks from lower part of hind margin between veins; cilia white, with a dark fuscous line, tips fuscous. Hind wings and cilia ochreous-whitish; vein 5 absent (coincident with 4).

Allied to the group of *T. opulentella*, from all of which it is immediately distinguished by the dark fuscous intervenal markings, as well as the pectinated antennæ and absence of vein 5 of the hind wings.

Mount Lofty, South Australia; one specimen received from Mr. E. Guest, who took it in April, together with a second.

Thinasotia megalarcha, n. s.

♂, 33—37 mm. Head, palpi, and thorax shining brownish ochreous; margins of eyes and a slender line on each side of back of thorax not reaching anterior margin white; forehead with a very short conical projection. Antennæ dark fuscous, dentate, moderately ciliated ($\frac{1}{2}$). Abdomen grey, anal tuft ochreous-whitish. Legs dark grey, posterior tibiæ grey-whitish. Fore wings very elongate-triangular, costa gently arched, apex round-pointed, hind margin sinuate, oblique; shining brownish ochreous; a slender white streak immediately beneath costal edge from near base to two-fifths; a straight narrow white streak from beneath extremity of this to apex; a moderate tolerably straight white median streak from base to middle of hind margin, margined with dark fuscous, lower edge somewhat toothed at origin of vein 4; two slender white streaks from near base, first to middle of inner margin, second to anal angle; veins 2—4 marked by obscure white lines; a fine fuscous hind marginal line; cilia light greyish ochreous, somewhat shining, with a white basal streak along upper part of hind margin. Hind wings with veins 4 and 5 short-stalked; grey; cilia light greyish ochreous.

The largest species of the genus; nearest to *T. panselenella*, but with grey hind wings, and without white hind marginal markings above median streak of fore wings.

Mount Kosciusko (5000—6000 feet), New South Wales; two specimens in January.

PHYCIDIDÆ.

LASIOCERA, Meyr.

Lasiocera antelia, n. s.

♂, 18 mm. Head, palpi, antennæ, and thorax dark fuscous; basal half of antennæ roughened with black scales above, but much less strongly than in *L. canilinea*. Abdomen ochreous-yellow. Legs dark fuscous, posterior tibiæ ochreous-yellow above. Fore wings elongate-triangular, narrow at base, costa slightly arched, apex tolerably obtuse, hind margin somewhat oblique, slightly rounded; dark fuscous, somewhat purplish-tinged, somewhat mixed with grey; both lines double, obscurely blacker, distinct but inconspicuous; first from about two-fifths of costa to middle of inner margin, slightly angulated in middle; second from four-fifths of costa to four-fifths of inner margin, sinuate on upper half; cilia dark greyish fuscous, with a darker line. Hind wings orange-yellow, apex of costa very narrowly infuscated; cilia ochreous-yellow, above apex purplish fuscous.

Immediately distinguished from *L. canilinea* and *Pempelia opimella* by the absence of the dark fuscous border of the hind wings.

Ardrossan, South Australia; one specimen.

EUCARPHIA, Hb.

I am now satisfied that *E. cnephælla*, Meyr., is merely an autumnal strongly-marked form of *E. tritalis*, Walk., of which it should therefore be quoted as a synonym.

ETIELLA, Z.

To this genus should be referred *Ampycophora apotomella*, Meyr., which is a true *Etiella*. In the specimen originally examined vein 5 of the fore wings was absent, and also vein 5 of the hind wings, and the palpi appear to have been accidentally injured; but having since obtained further specimens (from Brisbane and New Guinea), I find that in the fore wings vein 5 is normally present, rising from a point with 4, whilst in the hind wings veins 4 and 5 are both present and long-stalked; it is, I think, probable that the original specimen is rather an example of accidental deformity than of normal variation; the palpi are more ascending in

male, porrected in female, but formed as usual in *Etiella*. Under these circumstances the genus *Ampycophora*, Meyr., may be obliterated, as having no existence.

ADDENDUM.

In my second paper (Trans. Ent. Soc. Lond., 1884, 335), the localities for *Proteræca comastis*, Meyr., are accidentally omitted; it should be given as occurring at Castle Hill and Christchurch, New Zealand, on dry grassy hills in January.

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY OF LONDON

FOR THE YEAR 1885.

February 4, 1885.

R. M'LACHLAN, Esq., F.R.S., &c., President, in the chair.

Mr. M'Lachlan returned thanks to the members for his election to the office of President, and nominated Messrs. Dunning, Stevens and Weir as Vice-Presidents for the ensuing year.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

H. B. James, Esq. (Valparaiso) and Thomas Collett Sandars, Esq. (46, Cleveland Square, Hyde Park, W.), were balloted for and elected Members of the Society.

Exhibitions, &c.

Mr. J. W. Slater exhibited a specimen of *Polygonmatus chryseis*, Hüb., captured on Cultor Moor, Aberdeenshire, in July, 1878, by Mr. James Mutch. The occurrence had not been previously recorded, as the captor was not aware of the rarity of the species; two other specimens were seen in the same locality.

Capt. H. J. Elwes said the specimen greatly resembled the boreal form *P. Stieberi*, Gerh., which is uncommon in Lapland, and this fact tended to confirm the genuineness of the capture. Messrs. Stainton and Weir also made some remarks on the exhibit.

Rev. A. Fuller exhibited a collection of insects, particularly rich in Lepidoptera, captured along the line of the Canadian Pacific Railway during his visit to the Rocky Mountains after last year's meeting of the British Association at Montreal.

Mr. W. Cole exhibited a wasp's nest from Woodford Bridge, Essex, from which he had extracted specimens of *Vespa norvegica*, Fabr., and stated that Master Chapman, the finder of the nest, had captured specimens of *Vespa sylvestris*, Scop., issuing from the nest.

Mr. E. Saunders stated that he had examined the specimens, and the circumstance of the two species occurring in one nest was very curious; they both belonged to the same section, and were not structurally distinct, except in the genitalia of the males; still the species differed much in size, colour, and pubescence.

Mr. W. L. Distant exhibited, on behalf of Mr. L. de Nicéville, of Calcutta, a series of wings of butterflies, illustrative of seasonal variation in Indian Rhopalocera. Of fourteen species, as hitherto understood, this investigator admits seven only. All the specimens were collected in Calcutta; the species are all common ones, and exhibit the diverse forms found in the wet and dry seasons. Thus *Ypthima Howra*, Moore, appears to be the dry season form of *Y. Huebneri*, Kirb.; *Y. Marshallii*, Butl., the dry season form of *Y. Philomela*, Joh.; *Mycalasis Blasius*, Fabr., specifically sinks as the wet-season form of *M. Perseus*, Fabr.; *Mycalasis indistans*, Moore, thus shows as the dry-season form of *M. mineus*, Linn.; and *Mycalasis runeka*, Moore, bears the same relationship to *M. medus*, Fabr. It was quite consoling to find that *Melanitis Ismene*, Cram., is but the dry-season form of *M. Leda*, Linn., as the two species were always unsatisfactory; and in the Nymphaliniæ, *Junonia Almanax*, Linn., would seem to be the dry-season form of *J. Asterie*, Linn. Mr. Distant said he considered this one of the most interesting of recent observations made in the study of butterflies, though doubtless in some quarters it would meet at first with a cold reception. The point to be discovered is, as M. de Nicéville wrote to him, why "the ocellated forms should occur in the rains and the non-ocellated ones in the dry weather?" Mr. Distant had been asked to offer a suggestion, and now asked the Society to assist him in doing so.

Capt. Elwes made some extended remarks upon the subject of seasonal dimorphism and geographical forms, saying that Mr. Fuller's exhibits reminded him of one of the most interesting facts connected with geographical distribution, as many of the varieties in his collection made on the line of the Canadian Pacific occurred again over 500 miles south in the mountains of Colorado, and at no intermediate stations.

The President also remarked on the importance of M. de Nicéville's exhibition and discoveries of the temperature forms of various *Satyridae*, and hoped that this would serve as a warning to museum naturalists, as he firmly believed that a vast majority of the new species now being made on very slender characters would prove to be casual varieties or seasonal forms of one and the same species. In his younger days he well remembered

how two or three distinct forms of our common white butterflies (*Pieris*) were recognised as good, but are now exploded, species, and they were possessed of characters far more important than those now used to distinguish species by certain entomologists.

Mr. E. A. Butler exhibited the egg-sacs of three species of *Mantidea* from Molepolole, Bechuanaland. One species was indicated by egg-cases exactly resembling, though rather smaller than, those figured at Proc. Ent. Soc. Lond., 1883, p. xxxv, and his correspondent had sent them as without doubt belonging to a certain Mantis.

Mr. W. F. Kirby, on behalf of Herr Buchecker, who was present as a visitor, exhibited three volumes of drawings of Hymenoptera.

Mr. Stainton exhibited bred specimens of *Chauliodus insecurellus*, Sta., which he had received through Mons. A. Constant from Gascony. This insect had been first noticed in 1847, and ever since that time the great object had been to discover its food-plant. Till now every larva in the genus *Chauliodus* had been found solely on *Umbelliferae*, and hence every likely Umbellifer had been searched for the larva of *C. insecurellus*. Four years ago M. Constant had discovered the larva of *C. iniquellus* feeding on the seeds of *Peucedanum*, all the larvæ previously known feeding on the leaves of *Umbelliferae*. The larva of *C. insecurellus* had at last been found, not on one of the *Umbelliferae*, but on one of the *Santalaceae*, *Thesium divaricatum*. No doubt in this country the larva would be found on *T. humifusum*, a plant which, according to Brewer's 'Flora of Surrey,' occurred on Banstead Downs, the very locality where the specimens captured in 1847 were found. Unfortunately *Thesium humifusum* was a somewhat inconspicuous plant, with which few (if any) entomologists were at present acquainted. It would now be their mission to learn to recognise this plant, known in England as "bastard toad-flax," and to find the larva of *C. insecurellus* upon it.

Mr. T. R. Billups exhibited two females of *Ranatra linearis*, Linn., captured at Loughton, Essex, on January 16th last, in a locality where there was probably no water within a mile.

Mr. E. P. Collett did not think the *Ranatra* was so rare as was generally supposed; he had captured as many as sixty specimens in one day.

Mr. Billups also exhibited a box containing the following Ichneumonidæ, &c., and Hemiptera, which were all captured at Headley Lane on January 3rd, 1885:—*Colpognathus celerator*, Gr., *Dicælotus punitus*, Gr., *Ichneumon tempestivus*, Gr., *I. latrator*, Fabr., *I. sanguinator*, Rossi, *Pezomachus Neesii*, Först. (and varieties), *P. insolens*, Först., *P. instabilis*, Först., *P. anatis*, Först., *P. geocharis*, Först., *P. nigricornis*, Gr., species of *Megaspilus*, *Thoron*, *Spilomicrus*, and *Prosacantha*, *Micromelus pyrrogaster*, Noes; *Dasycoris hirticornis*, Fabr., *Podops inunctus*, Fabr., *Peritrochus geniculatus*, Hahn., and *Dryinus sylvaticus*, Fabr.

The Secretary read a letter from Mr. A. Lloyd, requesting the Society to give an opinion to assist him, as Hon. Sec. of the West Sussex Natural History Society, in recommending the best system of arrangement and nomenclature to adopt for British Lepidoptera.

Messrs. Distant, Kirby, M'Lachlan and Elwes made some remarks upon the communication, but it was generally thought that the Society was not in a position to offer any opinion upon the subject.

Papers read.

Mr. G. F. Mathew contributed the "Life-history of three species of Western Pacific Rhopalocera." *Papilio Schmeltzi*, H.-S., *P. Godeffroyi*, Semp., and *Xoïs Sesara*, Hew., were the species treated of.

Mr. George Lewis contributed a memoir, "On a new genus of *Histeridæ*." A very abnormal genus, previously referred to as probably belonging to the *Synteliidæ*, was described under the name *Niponius*, and four new species were described from Japan.

March 4, 1885.

R. M'LACHLAN, Esq., F.R.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

William E. Poole, Esq. (11, Chandos Street, Cavendish Square, W.), Richard South, Esq. (12, Abbey Gardens, St. John's Wood, N.W.), Robert Wylie Lloyd, Esq. (32, Grafton Square, Clapham Common), and Arthur Bliss, Esq. (Pennens, Allenby Road, Forest Hill), were balloted for and elected Members of the Society.

Exhibitions, &c.

Mr. G. H. Verrall alluded to the probable use that might be made of micro-photography in illustrating the neuration of transparent winged insects; he had lately been making experiments in this direction, and had succeeded admirably with but a small amount of practice; he found the most convenient way of obtaining the negative was by a ten minutes' exposure to gaslight. Mr. Verrall exhibited many prints and negatives illustrating the wings of *Scatopse*, *Tipula*, and other Diptera. Mr. Meldola made some remarks on the subject.

Mr. T. R. Billups exhibited specimens of *Ceraleptus lividus*, Stein., captured at Chobham on the 23rd February last.

Rev. W. W. Fowler exhibited the unique specimen of *Cerylon atratum* from Hungary, which had been lent to him by Herr Reitter; also specimens of an Indian *Cassida*, which had been soaked in a preparation to preserve the brightness of their colours.

Dr. Sharp said the last exhibit raised the curious question, On what does the colouring matter of the *Cassida* depend? He said that the application of glycerine under the wing-cases of certain Coleoptera maintained the bright colour for a short time, and he also thought that moisture had something to do with the colour, as he had often revived lost colours by soaking the specimen in water for a day or two. Mr. Fowler thought this last remark would only apply to fresh or recent specimens, not old ones.

Mr. Fowler also exhibited a microscopic movable stage of very ingenious construction and efficient application; it was made by Messrs. Smith and Beck.

Mr. W. F. Kirby exhibited, on behalf of Mr. Waterhouse, a beautiful variety of *Spilosoma lubricipeda*, Esp., which was recently captured by a policeman in the British Museum (Natural History), South Kensington.

The Secretary read the following:—

A few Observations touching Mr. De Nicéville's recent Suggestions on Seasonal Dimorphism in the Lepidoptera. By ARTHUR G. BUTLER, F.L.S., F.Z.S., &c.

I much regret that my absence from the recent meeting of the Entomological Society (when Mr. De Nicéville's cases of seasonal dimorphism were brought forward) prevented my offering the following remarks at the time: however, I will now test the correctness of his conjectures; for they can be nothing more, for reasons which I shall presently show.

1. *Y. howra* = *Y. hübneri*.

Ypthima howra is a form of *Y. hübneri*, linked to it by almost as many gradations as are found in our British varieties of *Satyrus hyperanthus*; it is represented by examples of *Y. hübneri*, in which the ocelli are reduced to points. If it be a seasonal form Mr. De Nicéville has yet to explain to which form, the dry or the wet, the intermediate grades belong.

2. *Y. marshallii* = *Y. philomela*.

Ypthima marshallii is a species discovered by Capt. Bingham in Tenasserim, and the only species, I believe, of which he was able to secure a series. On the other hand, *Y. philomela* is a species described by Johansson from an example taken in Java, the sole locality for this species; it is of about half the size of *Y. marshallii*, and the ocelli, as in that species, are mere dots. As it is obvious that an insect occurring only in Tenasserim

cannot be a seasonal form of an entirely dissimilar insect occurring only in Java, I need say nothing further on this point.

3. *M. blasius* = *M. perseus*.

In the Museum collection we have *M. (Calysisme) blasius* from Cachar, Ceylon, and the Philippine Islands; *M. perseus* from Kumaon, Bombay and Canara. It is possible that the two may occur in the same localities, indeed Mr. Moore has recorded both from Ceylon; he, however, has a note on *M. blasius* which rather militates against the idea of its being a seasonal form of anything, "Found at all times in the western and central provinces, plains, and up to 2000 feet, on grassy land." I may further observe that the two species associated by Mr. De Nicéville belong to different groups in the genus; perhaps he has incorrectly identified them.

4. *M. indistans* = *M. mineus*.

M. indistans not being in the collection of the British Museum, I will only remark concerning it that collectors must be very indolent at the time when it is flying, and equally industrious when *M. mineus* is about, since the former is very rare and the latter very common in collections.

5. *M. runeka* = *M. medus*.

M. (Orsotriæna) medus is a local race of *M. hesione*, occurring in Java and Borneo. *M. runeka* has five ill-defined ocelli, *M. medus* three well-defined. The two species are of nearly equal size, and, if they occurred in the same localities, they might prove to be mere varieties of one species. We have *M. runeka* from Assam, Kumaon and Burmah only.

6. *M. leda* = *M. ismene*.

Melanitis leda is an Amboinese species described by Linnæus so accurately that it can by no means be mistaken for the Indian species by anyone who takes the trouble to read the description, in spite of the vague locality, "in Asia," which is given. The diagnosis alone settles this point,—“*alis angulatis luridis: primoribus supra ocello geminato; posticis subtus ocellatis*,”—there being no *Melanitis* with “lurid” reddish wings in India. I have therefore suggested that the Indian species be called *M. determinata*; it is not a seasonal form of *M. ismene*, for not only have I constantly received both in the same collection made within a limited period, but Col. Swinhoe assures me that they fly together. In a recent paper “On the Lepidoptera of Bombay,” read before the Zoological Society in January of the present year, Col. Swinhoe has the following notes on these species:—“*M. leda*. Common in all moist places from July to October (in Bombay). *M. ismene*. Common in all moist places all the year round.”

7. *J. almana* = *J. asterie*.

These two butterflies also fly together, and Col. Swinhoe has a series of gradations completely linking the two extremes of these supposed species found in India, and which it is his intention to figure. Where every gradation exists one cannot speak with any satisfaction of a seasonal form, since it becomes impossible to show what you intend by the term.

In conclusion, I may note that most of De Nicéville's recent suggestions were not new to me, as he asked my opinion upon them (not as proved facts, but mere conjectures) when recently in London. Since then he has certainly not had time to convince himself by careful breeding of the accuracy of all these conjectures, and therefore he should have delayed publication until he had done his utmost in that direction. Nothing can be more beneficial to the study of Natural Science than the record of careful experiments, extending over many months, such as we obtain from Mr. W. H. Edwards, of North America; nothing can be more detrimental than the record of mere guesses, particularly where no care has been taken rightly to identify the species under consideration. Although Mr. Edwards has proved the identity (specifically) of many supposed species, no lepidopterist receives his *facts* without enthusiasm.

Mr. J. Jenner Weir thought it a great mistake to suppose that species closely linked together were cases of seasonal dimorphism. He also referred to *Pieris napi*, about which he was somewhat puzzled; the two seasonal forms were well defined in Britain, but not in those specimens he had received from Ireland.

Mr. R. Meldola thought that until Mr. De Nicéville had given further evidences of his supposed cases of seasonal dimorphism we should allow our judgment on the validity of the several species to remain in suspension; the evidence must remain incomplete until one form had been bred from the other.

Dr. D. Sharp alluded to the remarks in C. R. Soc. Ent. Belg. 1885, xxvi., upon the two different forms of spermatozoa in *Helops striatus*, Fourc., and *H. brevicollis*, Kryn., and expressed a hope that further details of the observations would be published. He had not at present detected *H. brevicollis* in this country.

Mr. Meldola said that Weismann instanced several species of *Daphniidae* in which very distinct varieties were found in their spermatozoa.

Papers read.

Rev. T. A. Marshall contributed Part I. of a "Monograph of British Braconidæ."

Rev. W. W. Fowler read "Descriptions of new species of *Languriidae*."

Mr. R. M'Lachlan read a note "On the discovery of a species of the Neuropterous family *Nemopteridæ* in South America, including general considerations regarding the family."

New Part of 'Transactions.'

Part V. of the 'Transactions' for 1885 was on the table.

April 1, 1885.

R. M'LACHLAN, Esq., F.R.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

Hastings Charles Dent, Esq., F.L.S., C.E., &c. (20, Thurloe Square, S.W.), and Ernest Sabel, Esq., F.R.G.S., F.Z.S., &c. (6, Grove Road, Clapham Park, S.W.), were balloted for and elected Members of the Society.

Exhibitions, &c.

Mr. T. R. Billups exhibited specimens of *Pezomachus immaturus*, Först., and *P. vulnerans*, Först., species new to Britain, captured at Headley Lane on January 3rd last.

Mr. E. A. Fitch exhibited a large moth, belonging to Mr. W. H. Harwood, which was captured by Dr. Wallace on the wall of his garden at Colchester, in October, 1883. It apparently was one of the *Chilonidæ*, and a new species coming nearest to *Erupa (?) titanalis*, Felder and Rogenhofer, Reise d. Nov., pl. cxxxvii, fig. 4.

Mr. R. M. Christy, who was present as a visitor, read the following note:—

"As requested by my friend Mr. Wm. Cole, I wish to bring under your notice what I think will be regarded as a remarkably obvious case of naturally protective colouring. I was in America in the autumn of 1883, and on the 26th August, near Carberry, Manitoba, I found a large larva feeding ravenously on the leaves of a small bush (*Fleagnus argentea*), which is common on many of the drier parts of the prairies of the Canadian North-West. A short search brought to light quite a number of others, all feeding on the leaves of the same bush. These I carefully kept, and in due time they entered upon the pupa stage, enclosing themselves in hard brown pear-shaped cocoons open at one end. Unfortunately, however, the mature insects emerged last spring (1884), while I was again away in America, with the result that I am now only able to exhibit two very dilapidated—

instead of two very handsome—specimens of that local form or subspecies of *Platysamia columbia* which is peculiar to the prairies of the Canadian North-West, and which has very recently been named *Platysamia columbia nokomis* by my friend Mr. Brodie, of Toronto, in accordance with the trinomial system of nomenclature so general across the Atlantic.

“I have brought up for exhibition specimens of *Eleagnus argentea*. It will be observed that the leaves are of a very peculiar pale silvery green colour, quite unlike that of the leaves of most other shrubs. I have also brought for exhibition a coloured drawing of the full-grown larva of the insect, made by my friend Mr. E. E. T. Seton, of Toronto. It is observable that the colour of the larva exactly corresponds during life with that of the leaves of the food-plant; and, as these themselves are of an unusual colour, I think it may be regarded as an obvious case of naturally protective colouring.”

“The total length of the larva is nearly three inches. The head is yellow, with a few small black spots; there are also four black spots on the first segment of the body. The first three segments bear yellow clasping legs; the next segment none; the next four bore slightly hairy legs of a light yellowish colour; the next segment none; and the last segment a pair of yellow legs. The body bore many small protuberances, of different kinds, covered with small black spikes. A row of spines ran down each side of the back. These rows were about one-fourth of an inch apart. Along each side of the body, and separated by the space of about one-fourth of an inch, ran two more rows of spines, the pair on the tail segment showing a brighter blue than the rest. Below this row again there were spines on the first five segments.”

Mr. Christy also exhibited a twig of *Betula glandulosa*, and made the following remarks thereon:—

“Among the many curious and interesting facts which have of late been brought to light in connection with the relationship between insects and flowers, those cases of error on the part of insects—as when a bee has been momentarily attracted by an artificial flower—which have occasionally been recorded certainly deserve some attention; and I desire therefore to bring under your notice an apparent instance of the kind which has come under my own notice.

“On the 7th August, 1883, as I was crossing a very extensive swamp, covered with trees of spruce and tamarac, lying on the banks of Pine Creek, Manitoba, I observed a butterfly, either belonging to, or closely allied to, *Papilio asterias*, fluttering over the bushes, evidently in search of flowers. As I watched it, it settled momentarily, and exactly as if it had mistaken it for a yellow flower, on a twig of *Betula glandulosa*, Mich., bearing withered leaves of a light yellow colour. This identical twig I now

exhibit. There were other similar twigs on the same bush. Of course I am perfectly well aware that it is impossible to say for certain that the insect mistook the leaves for a yellow flower; but it certainly settled upon them in such a manner as to leave little doubt on my own mind that they did so."

Mr. J. W. Dunning called attention to a "Note on a peculiar sense-organ in *Scutigera coleoptrata*," one of the Myriapoda, by Mr. F. G. Heathcote (Proc. Camb. Phil. Soc., v. 219). The organ is situated on the ventral surface of the head at a short distance from the mouth, near the base of the mandibles; and the author believes it to be homologous with the tympanic organ of insects, and to belong to the class of organs usually described as auditory.

May 6, 1885.

R. M^cLACHLAN, Esq., F.R.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Exhibitions, &c.

Mr. F. P. Pascoe exhibited a species of *Bruchidæ*, and its firm cocoon, which was constructed in the pod of the leguminous plant in which it fed, in South Brazil.

Mr. C. O. Waterhouse exhibited, on behalf of M. Alfred Wailly, two living larvæ of *Hemileuca maia*, Drury, which he believed to have been reared from the egg for the first time in Europe: these specimens had been fed upon whitethorn, but their natural food was oak or willow. The eggs were received from Illinois, U.S.A.

Mr. T. R. Billups exhibited numerous specimens of *Andricus radicis*, Fabr. (the gall-maker), *Synergus incrassatus*, Hart. (the inquiline), and *Calliome erucarum*, Schrank (the parasite), all reared from a single gall: of the latter there were fifty-four set specimens, and many additional living ones.

Mr. Billups also exhibited two living specimens of *Carabus auratus*, L., which had been captured, on April 30th, in the Borough Market out of a bunch of French radishes; the bunch also contained a specimen of *Dytiscus punctulatus*, Fabr.

Mr. J. W. Dunning called attention to the following, from the Parliamentary Intelligence of this morning's 'Times':—

"*Insects injurious to Crops.*—Mr. Rankin asked the Chancellor of the Duchy of Lancaster whether the Agricultural Department had any reports or treatises upon insects injurious to crops, and especially to hops, and, if so, whether they had been published in a form suitable to farmers and hop-

growers, and could be obtained by the public. Mr. Trevelyan: The Agricultural Department receive from time to time reports from the United States of America and elsewhere containing information on insects injurious to crops, but there are not any reports prepared by the Department itself dealing especially with the subject. I have given instructions that the reports I have mentioned should be looked carefully through, and if it appears that we can extract from them papers likely to be of use which could be laid in a small volume before Parliament, this shall be done."

Mr. E. P. Collett exhibited an oak-twig found last January at Hastings, on which were many hard gall-like swellings.

Mr. E. A. Fitch did not think the gall-like growths were due to insect-attack, but rather to what is popularly known as canker; possibly such growths might be caused by the presence of *Lachnus longipes* or *Stomaphis quercus*, which he had found on oak-twigs at Maldon in winter, but he had not noticed any growths, similar to those now exhibited, in the locality where the Aphides occurred.

Mr. H. Goss called attention to the important collection of fossil insects obtained during the past five years by M. Chas. Brongniart, of Paris, from the carboniferous strata of Commentry (Allier), France, and read a short analysis of several recent papers by M. Brongniart on the subject of these fossil insects, copies of which papers were presented to the Society from the author. Mr. Goss stated that at the date of his paper on "The Insecta of the Palæozoic Period," March, 1879, only 103 fossil insects from the carboniferous rocks of the whole world were known; whereas at the present time M. Chas. Brongniart has in his possession 1400 specimens from Commentry alone, including some 40 types. The Hemiptera are represented by forms allied to the genera *Fulgora*, *Lystra*, and *Membracis*; the Neuroptera by species approaching *Corydalis*, *Chauliodes*, and *Hemero-bius*; the Pseudo-Neuroptera by types related to *Ephemera* and *Perla*; and the Orthoptera by *Blattidæ* and *Phasmidæ*. The 1400 fossils also include a number of comprehensive forms combining characteristics of the Neuroptera and Orthoptera, representing a transitional type, connecting one order with another, which has been long extinct. The following is a list of the papers presented by M. Brongniart to the Society:—

1. Dec. 11, 1882.—Extract from the Comptes Rendus of the French Academy of Science, containing a description of *Titanophasma Fayoli*, a gigantic orthopteron allied to the *Phasmidæ*.

2. Dec. 18, 1882.—Bulletin de la Soc. Geologique de France, containing another description of *Titanophasma Fayoli*, and some general observations on the Insect Fauna of the Carboniferous Period.

3. Jan. 24, 1883.—Extract from the Bull. Ent. Soc. de France, in which two other extinct *Phasmidæ* are referred to, viz., *Protophasma Dumasii* and *P. Woodwardii*.

4. *March 31, 1884.*—Extract from the Comptes Rendus of the French Academy of Science, containing a description of *Dictyoneura Goldenbergi*, a gigantic species referred by M. Brongniart to an extinct order, for which he proposed the name of *Neurorthoptère*, but which order Goldenberg had already named *Palæodictyoptera*. Reference was also made in this paper to the species mentioned in the next paper (*D. Monyi*).

5. *Dec. 10, 1884.*—Extract from the Bull. Soc. Ent. of France. This paper contains a description of another gigantic species (*Dictyoneura Monyi*), belonging to the same order and genus as the last-named fossil (*Dictyoneura Goldenbergi*), and measuring, when the wings were expanded in flying, about 70 centimètres. The paper also contains general remarks on the Insecta of the Carboniferous Period, and reference is made to the discovery, by Prof. Linström, of a scorpion in the Silurian of the Isle of Gotland, in Sweden.

6. *Dec. 24, 1884.*—Extract from the Bull. Ent. Soc. France. In this paper attention is called to the discovery of the fossil wing of a cockroach in the Silurian Sandstone of Jurques, Calvados, France. The wing represented the most ancient-known insect, and was named *Palæoblattina Douvillei*.

7. *Dec. 29, 1884.*—Extract from the Comptes Rendus of the French Academy, containing another description of *Palæoblattina Douvillei*, the Silurian Cockroach.

8. *Jan. 14, 1885.*—Extract from the Bull. Ent. Soc. France. Attention is called to a neuropterous insect, believed by M. Brongniart to have been amphibious, like *Pteronarcys regalis*, but differing in neuration from this species, and approaching *Corydalids* and *Chauliodes*. M. Brongniart proposed to name this species *Corydaloides Scudderi*.

Mr. M'Lachlan and Mr. Waterhouse made some remarks thereon, especially referring to the relationship between the groups of Hemiptera, Neuroptera, and Orthoptera.

Paper read.

Mr. F. Enock read the first part of a "Life-history of *Atypus piceus*, Sulz."

New Part of 'Transactions.'

Part I. of the 'Transactions' for 1885 was on the table.

June 3, 1885.

R. M'LACHLAN, Esq., F.R.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

G. T. Baker, Esq. (The Bracken, Augustus Road, Edgbaston, Birmingham), and Robert Adkin, Esq. (Wellfield, Lingard Road, Lewisham), were balloted for and elected Members of the Society.

Exhibitions, &c.

Mr. F. P. Pascoe exhibited the aërial roots of an orchid (*Sarcanthus Parishii*) which greatly resembled caterpillars.

Mr. Pascoe also exhibited a new genus and species of *Colydiidæ*, remarkable in that its eyes were beset with broad erect scales arising between the facets, a character of rare occurrence among the Coleoptera. It is from North Borneo, and is described by Mr. Pascoe as follows:—

OPTIS, Pascoe.

Corpus peltiforme. Oculi prominuli, squamiferi. Antennæ 11-articulatæ; funiculus subfiliformis, clava rotundata, biarticulata; sulci antennarii obliqui. Tibiæ subfusiformes, spinis terminalibus nullis; tarsi articulis tribis primis æqualibus. Coxæ posticæ haud approximatæ. Abdomen segmentis longitudine æqualibus; processus intercoxalis triangularis.

Optis bicarinata, Pascoe.

O. lata, subparallela, indumento albo induta; caput transversum excavatum sed in medio paullo elevatum: prothorax brevis, versus apicem bituberculatus; scutellum nitide nigrum, transversum; elytra postice late rotundata, singulo juxta suturam carina elevata—antice excurvata, postice abrupte terminata-instructa; pedes rufo-testacei, tibiæ margine exteriori squamoso-fimbriatæ. Long. 4 mm.; lat. $2\frac{1}{2}$ mm.

The structural characters of *Optis*, except the eyes, are almost the same as those of *Endophlæus*, but the posterior coxæ are not approximate, and the last joint of the funicle is scarcely broader than the preceding one; this character is so far important that in *E. flexuosus*, Sol., it is so broad as to form the basal joint of the club, which thus becomes three-jointed. In Gay's 'Chili' the species is represented as being heteromerous (for this Lacordaire would refer it to *Bolitophagus*), but they are clearly four-jointed in my specimens. The type of *Optis* is broader and more convex than

Endophlæus spinulosus, the prothorax and elytra not denticulate, but, as well as the head, the margins fringed with close-set projecting scales, the surface closely covered with a white indumentum (or inflorescence, so to say) arranged on the elytra in transverse rows; the prothoracic tubers are crowned with erect scales, and others, in a somewhat fasciculate form, appear on the elytral carinæ.

Mr. G. T. Porritt exhibited living larvæ of *Phycis betula*, Göze, and of *Coleophora currucipennella*, Fisch., feeding on birch.

Mr. G. Coverdale exhibited two specimens of *Coleophora paludicola*, Staint., captured on the saltings near Shoeburyness in July, 1884.

Mr. R. M'Lachlan exhibited a specimen of *Deiopeia pulchella*, L., captured on board ship in the Atlantic, many miles from the nearest land.

Mr. J. W. Douglas communicated the following note:—

“For five years past a standard apple tree, some twenty-five years old, previously in good health and bearing fruit, has been annually attacked severely by *Schizoneura lanigera* and *Mytilaspis pomorum*, and has gradually pined away. Last year it was partly alive; now it is dead, and its trunk, six feet high, is entirely covered by the scales of the *Mytilaspis*; the piece of the bark sent herewith, on which they are as close as they can stick, is a fair sample of the entire surface. I do not say that all these Lilliputians were the sole cause of the death of the giant, for probably a radical disorder had previously undermined the constitution of the tree, but there can be no doubt that the insects by their pertinacity assisted materially in the destruction; they were in at the death, and have left their memorial.”

The President said it was difficult to believe that the *Mytilaspis* had caused the death of the tree, as they only appear to live on the extreme outer bark, and in a tree twenty-five years old the cambium would support growth, the outer bark being practically dead. Messrs. Weir and Fitch concurred in this opinion, pointing out that with the *Schizoneura* the case was different.

Paper read.

Mr. F. Enock read the completion of the “Life-history of *Atypus piceus*, Sulz.,” illustrating his remarks by the exhibition of numerous specimens and drawings.

July 1, 1885.

R. M'LACHLAN, Esq., F.R.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Members.

Thomas Edmonds, Esq. (Totnes, Devon), and Francis Maule Campbell, Esq., F.L.S., F.Z.S., &c. (Rose Hill, Hoddesden), were balloted for and elected Members of the Society.

Exhibitions, &c.

Mr. S. Stevens exhibited specimens of a *Coccus* which were proving very destructive to the leaves of an India-rubber plant.

Mr. J. W. Slater read the following note:—

The Influence of Magnetism upon Insect Development.

“Having seen that the eggs of fowls are not normally developed if subjected to magnetic currents during incubation, I thought it interesting to try the effect of magnetic action upon the development of caterpillars. Accordingly, having found last season six caterpillars of the common large cabbage white, all evidently of the same brood, I put three of them in a box, five inches in length, between the opposite poles of two bar-magnets. The other three were placed in a similar box at such a distance that they could not be affected by the magnets. Both lots were placed under exactly identical conditions as regards light, heat, and supply of food. Two of those between the magnets shrivelled up and died without passing into the pupa-state. Thinking they might have been attacked by some parasite, I removed them into another box and kept them for some time. As no ichneumons or other parasites made their appearance, I dissected the bodies carefully under the microscope, and found no traces of parasitic injury.

“The remaining caterpillar, and all the three which were not exposed to the magnets, became pupæ in due course, and came out in May. The non-magnetised lot were perfectly normal and healthy, and when released after examination flew away; but the survivor of the magnetised lot was a cripple. It had merely rudimentary stumps in place of antennæ, the wings on the left side were expanded, and the legs on the same side were smaller than those on the right side.

“To judge from this single experiment would be obviously premature; but I hope this season to make further trials on a more extended scale.”

August 5, 1885.

J. JENNER WEIR, Esq., F.L.S., F.Z.S., &c., Vice-President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of a Fellow.

Thomas William Hall, Esq. (3, New Inn, Strand, W.C.), was elected a Fellow of the Society.

Exhibitions, &c.

Mr. J. W. Dunning announced that the Society's application for a Royal Charter of Incorporation had been successful. He held in his hand the Charter which had been granted by Her Most Gracious Majesty, and begged leave to present it, and formally place it in the custody of the Society.

The document was then read by the Secretary, and was as follows:—

Victoria, by the Grace of God of the United Kingdom of Great Britain and Ireland, Queen, Defender of the Faith. TO ALL TO WHOM these presents shall come Greeting:

WHEREAS JOSEPH WILLIAM DUNNING, of Lincoln's Inn, in the County of Middlesex, Barrister-at-Law, Esquire, Master of Arts, formerly Fellow of Trinity College, Cambridge, Fellow of the Cambridge Philosophical Society and of the Linnean and Zoological Societies of London, has by his Petition humbly represented unto US, That in the year 1833 certain of our loyal subjects formed themselves into a Society for the Improvement and Diffusion of Entomological Science, and subscribed and expended considerable sums of money for such purposes, and have collected and become possessed of a valuable library and other property, and have been and continue to be actively employed in promoting the objects for which the said Society was founded, especially by the publication of Volumes of Transactions composed of Original Memoirs read before the Society. AND WHEREAS the said Petitioner, believing that the well-being and usefulness of the said Society would be most materially promoted by obtaining a Charter of Incorporation, hath therefore, on behalf of himself and the other Members of the said Society, most humbly prayed that WE would be pleased to grant a Royal Charter for incorporating into a Society the several persons who have already become Fellows, or who may at any time hereafter become Fellows thereof, subject to such Regulations and Restrictions as to US may seem good and expedient. NOW KNOW YE that WE, being desirous of encouraging a design so laudable, and of promoting the improvement and diffusion of Science in all its branches, have of Our especial Grace, certain Knowledge and mere Motion, given

and granted, and We do hereby give and grant, That the said JOSEPH WILLIAM DUNNING and such others of Our loving subjects as are now Fellows of the said Society, or who shall at any time hereafter become Fellows thereof in pursuance of the provisions of this Our Charter and according to such Bye-Laws as are hereinafter mentioned, shall be a Body Corporate by the name of "The Entomological Society of London," having perpetual succession and a common seal, with power to sue and be sued in their Corporate name, and to acquire and hold any goods and chattels whatsoever.

And our Will and Pleasure is, That JOHN OBADIAH WESTWOOD, Esq., Master of Arts, Hope Professor of Zoology in the University of Oxford, shall be Honorary President of the said Corporation during the term of his natural life. And that ROBERT MACLACHLAN, F.R.S., shall be the first President of the said Corporation and shall continue such until the Annual Meeting to be held in the month of January next.

And our Will and Pleasure is, And we do hereby declare, that there shall always be a Council to direct and manage the concerns of the said Corporation. And that the thirteen persons who were elected to form the Council of the said Society at the Annual Meeting held in the month of January last shall form the first Council of the said Corporation, and shall continue in Office until the Annual Meeting to be held in the month of January next.

And our Will and Pleasure is, And we further grant and declare, that the existing Bye-Laws of the said Society, as revised and amended at a General Meeting held on the 2nd day of May, 1883, shall be the Bye-Laws of the said Corporation, until the same shall be revoked or altered as hereinafter mentioned. And that it shall be lawful at General Meetings of the said Corporation to revoke or alter any former Bye-Laws, and to make such new Bye-Laws as shall be deemed useful and necessary for the regulation of the said Body Corporate.

Provided always: And we lastly declare it to be Our Royal Will and Pleasure, That no Bye-Law or Resolution shall, on any account or pretence whatsoever, be made by the said Corporation in opposition to the general scope, true intent, and meaning of this Our Charter or the Laws and Statutes of this Realm, and that if any such Bye-Law or Resolution shall be made, the same shall be absolutely null and void.

In Witness whereof We have caused these our Letters to be made Patent.

WITNESS Ourselves at Westminster the twentieth day of July, in the Forty-ninth year of Our Reign.

By Warrant under the Queen's Sign Manual.



Mr. Jenner Weir congratulated the Fellows, as he might now call them on the position which the Society had attained, and on the privileges which had been granted. He invited remarks.

Mr. Dunning said there was one thing in connection with the Charter of which he could not allow the Society to remain in ignorance. When, in 1883, it was decided to take action in the matter, he had invoked the assistance of our member, Mr. Frank Crisp, and left the conduct of the affair entirely in his hands. He thought the result which had been announced was a sufficient justification of the step. In truth Mr. Crisp had taken the burden upon himself, and relieved the speaker from all trouble. Now that the object had been obtained, Mr. Crisp had, with characteristic generosity, written to say that he has no charges whatever against the Society. He therefore moved that the hearty thanks of the Society be given to Mr. Crisp for his valuable and gratuitous services. This was seconded by Mr. Stainton, and carried unanimously. The Secretary was instructed to communicate the vote to Mr. Crisp, who was not present at the meeting.

Joukheer May, while gladly acknowledging Mr. Crisp's kindness, thought that it was only Mr. Dunning's modesty which induced him to take this means of diverting attention from his own share in obtaining the Charter. It was to Mr. Dunning also that the Society was indebted, and he moved that the hearty thanks of the Society were due, and should be given to him. Mr. Meldola seconded the motion, and it was carried unanimously.

Mr. Dunning, in acknowledging the vote, said that when temporarily occupying the chair, some six years ago, he had said, "Incorporation by Royal Charter is not beyond our hopes." It was only a passing thought, and he had little expectation that the hope would so soon be realised. To himself, it was an unmixed pleasure to have been instrumental in obtaining that which alone was wanting to complete the fabric of the Society, and give it that status to which its history of fifty years afforded a claim, the justice of which has now received such graceful recognition. Hitherto we have been only a fortuitous concurrence of atoms; now we have a legal existence, and are a body corporate, one and indivisible, and, as far as any human thing can be, perpetual. But if our privileges have increased, so also have our responsibilities; and those responsibilities can only be discharged by the united efforts of the individual members who in the aggregate form the Society. We have to take care that the future of the Society shall be worthy of its past, that by the constant introduction of new blood our body shall never grow old, but shall with ever-renewed vigour march with the times, welcoming and aiding in every advance of Science, and shall for many an age to come unite under one banner the Entomologists of the whole Realm over which the Granter of our Charter rules.

Mr. Dunning referred to the death of Henry Milne-Edwards, who had been an Honorary Member of the Society since 1843.

Mr. T. R. Billups exhibited a female specimen of *Inostemma Boscii*, Jur., taken on a sunflower-leaf at Peckham on August 3rd last. Also the egg-case of a *Mautis*, very slug-like in appearance, which was attached to a leaf of Virginian tobacco; and specimens of the following four species of *Chrysididæ*, which he had reared from the burrows of *Odynerus spinipes*, L., viz.:—*Chrysis ignita*, L., *C. fulgida*, L., *C. bidentata*, L., and the rare *C. neglecta*, Shuck.

Mr. E. A. Fitch called attention to the figure of the curious *I. Boscii* in Curtis' 'British Entomology' (pl. 309), and Vollenhoven's 'Pinacographia' (pl. 45).

Dr. E. Capron exhibited a specimen of *Phytodietus rufipictus*, Brischke, an Ichneumon new to Britain, which he had captured at Shere last month.

Mr. H. H. Winston, who was present as a visitor, exhibited a variety of *Arctia caja*, L., bred from a larva taken at Harrow.

Mr. A. C. Horner exhibited the following interesting British Coleoptera taken by him at Tonbridge during the present year:—

Throscus carinifrons, Bonv.—Forty specimens taken on one occasion by beating May-blossoms, and twenty others by evening sweeping at different times. The late Mr. Wollaston found a single specimen on palings in Tonbridge.

Abdera 4-fasciata, Curt.—Forty specimens taken at different times on the trunk of a single half-decayed horse-chestnut, whilst feeding on a small fungoid growth, or running up and down the trunk in search of it, in bright sunshine. It was accompanied by *Cis pygmaeus* at the same fungus.

Anthrribus albinus, L.—One by beating faggots. When tucking in its legs and antennæ and lying quiet it much resembled one of the loose buds from a birch faggot.

Epuræa diffusa, Bris. — Two under bark of a *Cossus*-infected oak, unaccompanied apparently by *E. decemguttata*. It seems to me quite a distinct species.

Colon Zebei, Kr.—Two males.

Thalycra sericea, Sturm.—Four by evening sweeping under trees. I fancy they drop to the ground if alarmed by noise, judging from their behaviour in the net.

Antherophagus pallens, Ol.—A remarkably dark variety.

Xyletinus ater, Pz.—One at rest on an old pollard willow.

Microglossa pulla, Gyll.—Twenty-two from carrion.

Aleochara lygæa, Kr.—Three. One named by M. Fauvel, and taken by sweeping; a second "in stercore"; and a third in carrion. They were all taken in the same wood during the last three years.

Oxypoda exoleta, Er.—One by sweeping.

Homalota splendens, Kr.—A single specimen taken by sweeping grass outside an osier-bed adjoining a hop-garden. Its bright colouring, narrow frame, wiry texture, and broadly-jointed antennæ, make it appear very unlike a *Homalota*.

Homalota humeralis, Kr.—Four in a small fungoid growth on the stump of a (fir?) tree, in company with *Cis boleti*, in a park near Winchester, last year. The 7th abdominal dorsal segment of the male has eight to ten rather feeble crenulations at its apical margin, the outer one on each side being rather more developed than the others; and its edge is rather rounded than hollowed out. The ventral plate of the same segment projects somewhat, and is much more pointed than in the female.

Mr. G. Coverdale exhibited stems of *Ouobrychis sativa*, showing the manner in which the larva of *Grapholitha cæcana*, Schl., feeds.

Papers read.

Mr. J. S. Baly communicated a memoir “On the Colombian species of *Diabrotica*.”

Mr. E. Meyrick communicated the completion of his paper “On the classification of the Australian Pyralidina”; also a paper “On the classification of the *Pterophoridae*.”

New Part of ‘Transactions.’

Part II. of the ‘Transactions’ for 1885 was on the table.

September 2, 1885.

R. M'LACHLAN, Esq., F.R.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

The President said :—

“Those of our Fellows now present who were not present at the last meeting (August 5th), will have learned from the Minutes of Proceedings at that meeting, just read and confirmed, that Her Majesty in Council has been pleased to grant a Royal Charter of Incorporation to this Society. The negotiations concerning the acquisition of a Charter had been long in progress; latterly the Council became aware that their efforts were likely to be crowned with success, but the time when any definite answer might be obtained from the Privy Council Office remained uncertain.

When the long-hoped-for reply arrived I was on the Continent, which will account for my not being present to personally congratulate you, as your President, on this auspicious event. I shall have occasion to refer to it a few months hence, and much as I regret my absence at the last meeting, I feel that I was most efficiently represented by our excellent Vice-President, Mr. Jenner Weir, who occupied the chair; and I have the additional satisfaction of knowing that the gratuitous exertions of Messrs. Dunning and Crisp, to whom we are so much indebted in connection with this matter, met with due acknowledgment.

“While I am speaking I ask you to allow me to allude to another subject. The day after my arrival on the Continent I had the pleasure of assisting at the celebration of the 40th anniversary of the foundation of the Entomological Society of the Netherlands, held at Amsterdam on the 18th July, a Society that has, as you know, done so much good work in furthering entomological science generally, and especially in the investigation of the insect-fauna of Holland and of its East Indian possessions. I met there our Honorary Member, my much respected friend Baron de Selys-Longchamps, who was specially delegated by the Belgian Entomological Society to represent it at the meeting. He has published an excellent account of what took place in the ‘Compte Rendu’ of his Society of the meeting on August 1st. It was natural that a country so intimately connected with Holland as is Belgium should have been officially represented. I was there simply in virtue of my much-prized position as an Honorary Member of the Society of the Netherlands, and the warmth of my reception, and the hospitality I experienced at the hands of our Dutch brethren in Entomology, could not have been greater had I been officially delegated by this Society; I ask you, as your President, and as unofficially representing British entomologists on the occasion, to allow this public expression of my thanks to appear in our ‘Proceedings.’ One word more. I found that almost without exception the members present were able to converse in English, and I found everywhere the warmest desire to still further enter into cordial relations with British entomologists.”

Exhibitions, &c.

Mr. C. O. Waterhouse exhibited living specimens of *Eubrychius velatus*, Beck., lately collected at Eastbourne swimming freely in water, using its legs after the manner of a *Dytiscus*. When resting on the *Myriophyllum* the middle pair of legs were kept in motion.

Messrs. Fowler and Champion said they had frequently taken other *Phytobii* with the water-net.

Mr. Waterhouse also exhibited the larva of *Gyrinus marinus*, Gyll., which was new to him, but was beautifully figured by Schiödte; also

specimens of an *Aleurodes*, which was very common on the leaves of a fuchsia in his dining-room.

Mr. T. R. Billups exhibited specimens of *Telenomus phalænarum*, Nees, with the eggs of *Pygæra bucephala*, from which they were bred; and a box of Hymenoptera, mostly aculeate, which were taken at Chobham the second week in last June.

Rev. W. W. Fowler exhibited a beautiful specimen of *Deilephila livornica*, Esp., taken two years ago at Laugharne, Caermarthenshire, but which was certainly indigenous.

Mr. J. Jenner Weir said he possessed four specimens taken at Lewes, and hoped very shortly to breed another from a pupa he found there under a stone amongst *Galium*.

Mr. T. H. Ralfe made some exhibits, and communicated notes as follows:—

SESIA ASILIFORMIS, Rt.

“Description of larva.—Length, when full-fed, from 12–14 lines; the body tapering at both extremities, of a pale yellowish colour, which is more decided from the 2nd to the 5th segment, and on the anal flap; dorsal line distinctly marked, spiracles brown; the head smooth, pointed, and brown, with darker markings on the face.

“The pupal change takes place in the first week of May.

“The males put in an appearance first, viz., June 7th to 12th; none after this date. The first female on June 12th; last, July 3rd.

“On April 18th an ichneumon was observed in the breeding-cage; this was followed up by single specimens on the 19th, 20th, and 22nd.

“The larva of this *Sesia*, in captivity, lives in the roots, trunks, branches, and stems of *Populus nigra*, forming long galleries or mines, and feeding upon the internal pith of the wood. The egg is deposited in crevices of the bark, and the young larva, when hatched, soon eats its way into the interior.

“Most authors describe the female, but figure the male; always described ‘with three yellow belts or rings.’ The male has four: one female has a fourth indistinctly marked.

“There are shown three larvæ, three male and five female pupa-cases, five male imagos, thirteen female imagos, and two ichneumons (*Ephialtes tuberculatus*?).”

CUCULLIA SCROPHULARIÆ, Esp.

“A local form or variety of *C. verbasci*. Exhibited as being remarkable for passing four years in pupa. The two imagos came out July 3rd and 5th. Living pupæ are shown going on for the fifth year. The larvæ were taken from off *S. nodosa*, growing near Chippendale, July, 1881.”

Also a male and two female specimens of an undetermined *Acidalia*, bred from a female taken near Weymouth at the beginning of August,

1883. The parent female was mistaken for *Cabera pusaria*, L., at the time of capture.

Mr. Robert Adkin exhibited a specimen of a *Lepisma*, which was found swarming on some account books which were constantly kept in an iron safe at High Street, Aldgate.

Mr. Jenner Weir exhibited specimens of *Batrachotriton bufo*, taken by Mr. G. A. Farini in the Kalahari Desert, South Africa. Although these grasshoppers strongly resembled toads, there was no reason to suppose the resemblance was mimetic, but that, on the contrary, as the toad and the orthopteron did not inhabit the same districts, such could not be the case. The resemblance in colour between the vertebrate and the insect might be termed synchronism, and was brought about by the need in each for a protective coloration in harmony with its geological environment. Mr. Jenner Weir was strengthened in this view of the case because Mr. Farini informed him the hue of the *Batrachotriton* varied as the colour of the soil which they inhabited. If these insects are preyed upon by some insectivorous bird, it must have a powerful beak, as the dermal covering was found to be hard enough to turn the point of a pin.

Mr. Jenner Weir also exhibited two specimens of Arachnids of the order Solpugidæ, apparently belonging to the genus *Galeodes*. These large Arthropods were about $2\frac{1}{2}$ in. in length, and their legs stretched a distance of over 6 in. As usual in the order, they possessed two eyes and very powerful didactyl mandibles, $\frac{4}{10}$ ths of an inch in length, each forming a hand with movable fingers, like that of the scorpions. On each hind leg there were five coriaceous pedunculated organs somewhat in the shape of a capital Y, about $\frac{1}{10}$ th of an inch in height and rather more in breadth. When first taken from the spirit, in which the specimen had been brought to England, these appendages were as white as ivory and opaque, but in drying they became brown and transparent; it was difficult to suggest their use. Although in drying these curious appendages had become flat, they were, when taken from the spirit, more in the shape of a mushroom, and the only idea that occurred to Mr. Weir's mind was that they might be suckers enabling the creature to obtain a firmer hold than the weakness of the claws on the six hinder legs would otherwise enable it to obtain. They were captured in the Kalahari Desert by Mr. G. A. Farini. Also a living rhyngophorous beetle belonging to the genus *Brachycerus*, which had survived the journey from the Kalahari Desert, from which it had been brought about two months ago by Mr. Farini. At present it seemed none the worse for the voyage. Also a large ant-lion (*Palpares immensus*, McLach.), and the cases of some insect which appeared to be made of agglutinated sand, in which were embedded small pebbly stones; the natives erroneously have a great dread of the inmates of these cases as being one of the most venomous creatures existing in their district.

Mr. M'Lachlan believed the cases to belong to the *Psychida*, although they much resembled those of a caddis.

Mr. M'Lachlan exhibited a box containing a large number of Neuroptera, which he had lately collected in the Schwarzwald.

October 7, 1885.

Prof. WESTWOOD, M.A., F.L.S., &c., Hon. President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Fellow.

Charles Donovan, jun., Esq. (Glandore, Leap, Cork), was balloted for and elected a Fellow of the Society.

Exhibitions, &c.

Mr. W. C. Boyd exhibited some specimens of a *Crambus* from Lowestoft, which he believed to be a new species allied to *C. contaminellus*, Hübn.

Mr. H. H. Druce exhibited varieties of *Argynnis Aglaia*, L., and *Epinephele Janira*, L., taken at St. Moritz, Switzerland.

Professor Westwood read a letter from Captain Anstruther Thomson, stating that when at Aldershot, on August 14th last, he had observed a specimen of *Gonepteryx rhamni* with orange spots on the fore wings, as in *G. Cleopatra*.

Mr. McLachlan thought it probable that there was a variety of *G. rhamni*, distinct from the true *G. Cleopatra*; and Mr. Weir stated that many years ago he had observed a specimen in the collection of the late Mr. Ingall, which was intermediate between *Rhamni* and *Cleopatra*, and which was stated to have been taken in this country.

Mr. Weir exhibited a portion of a nest of Termites from S. Africa, in which had been discovered specimens of the workers and soldiers. Also some specimens of an Entomostrakon, apparently belonging to the genus *Limnadia*, and another species from the Kalahari Desert, which were taken in pools which had been frequently dry for several years.

Prof. Westwood made some remarks on a statement of M. Ganeau that *Cis boleti*, Scop., had been found in great numbers at Port Elizabeth, in imported boots.

The Rev. F. B. D. Bickerstaffe sent specimens of *Tropicoris rufipes*, L., captured at Kensington.

M. Wailly exhibited a large box of Lepidoptera, principally from Madagascar and New Caledonia, and made some remarks on experiments he had been making in crossing various silk-moths.

Prof. Westwood directed attention to an extract from a recent Bulletin of the United States Fish Commission ('Nature,' Sept. 24th, 1885), giving an account of the destruction of young trout by mosquitoes. Some doubts were expressed as to the correctness of the statement, but Prof. Westwood said that it was believed to be a true account by the best naturalists in the States.

A letter received by the Secretary from Mr. C. O. Waterhouse stated that a specimen of *Sphinx convolvuli* had been taken in the grounds of the Inventions Exhibition, and another had been brought to the British Museum, taken in Yorkshire. Also a letter from Mrs. Buckmaster, stating that her children had taken five specimens of *S. convolvuli* and two of *Charocampa celerio* at Ramsgate.

Prof. Westwood made some remarks on an insect which he had been investigating, with a view to preparing a paper which he hoped to offer to the Society. It was *Macharota ensifera*, Burm., from Ceylon, an insect allied to the frog-hopper (*Aphrophora*), which, instead of being enclosed in a liquid (cuckoo-spittle), formed a case by the rapid hardening of the liquid secreted. He hoped to give a minute description very shortly.

Mr. R. McLachlan referred to the capture of three specimens of the striking neuropterous insect, *Drepanopteryx phalaenoides*, L., by Messrs. Morton and King in Lanarkshire, last September.

Mr. F. F. Freeman sent a communication recording the recent capture of a specimen of *Danais Archippus*, Fabr., at Plymouth.

New Part of 'Transactions.'

Part III. of the 'Transactions' for 1885 was on the table.

November 4, 1885.

R. M'LACHLAN, Esq., F.R.S., &c., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Fellows.

Dr. C. A. Dohrn, of Stettin, and Mynheer P. C. T. Snellen, of Rotterdam, were balloted for and elected Honorary Fellows of the Society.

Mynheer A. J. F. Fokker (Zierikzee, Holland), Mynheer J. R. H. Neerwort van der Poll (163, Keizersgracht, Amsterdam), and James Cosmo Melvill, Esq., M.A., F.L.S. (Kersal Cottage, Prestwich), were balloted for and elected Fellows of the Society.

Exhibitions, &c.

Mr. S. Stevens exhibited two specimens of *Chærocampa celerio*, L., captured at Brighton last October, one at rest on a window in the Hampden Road, and one on a doorstep in the Tubury Road, West Brighton.

Mr. J. Jenner Weir exhibited a singular variety of *Colias hyale*, L., which he had taken last September near Lewes; the specimen, in the extent of the apical black markings on the fore wings, more nearly resembled *Colias edusa helice*, Hübn.; the hind wings were even more marked with black than is usual in the latter species; there was a marginal series of six large black spots, four well-defined, and within a submarginal row of five black spots, four of which were well-defined. As Mr. A. G. Butler had told him that he had once seen *Colias hyale* (male) *in cop.* with *Colias edusa helice* (female), he thought this specimen might probably be a hybrid.

Mr. Gervase F. Mathew exhibited a number of specimens of *Hypolimnas Bolina*, Linn., from Fiji and other islands of the Western Pacific. They were interesting from the fact that many of them were bred from a single brood of larvæ found near Levuka. The males varied in no way whatever, but of the females, of which forty-eight were exhibited, scarcely two were alike, and the difference between the two extremes was very great. Mr. Mathew remarked that he only arrived in London the previous evening, and had but little time to work up the species; but, from a short examination of the types at the British Museum, he felt sure that several which had been described as new within the last few years were referable to this single species, for from this brood were bred individuals agreeing with varieties from the Gilbert, Ellice, and Marshall islands, the New Hebrides, New Guinea, Tonga, Samoa, &c. The larvæ were identical, fed upon the same food-plant, and were altogether similar in their habits. None of the females were found mimicking *Danaüs Erippus*. Mr. Mathew proposed that it might be advisable to collect these varieties together, and unite this oceanic race under one specific name. He further observed that, from his experience among the Pacific Islands, he had come to the conclusion that other species which appeared to be merely local varieties had been described as distinct, and quoted *Pieris teutonia*, Fabr., as an instance, and remarked that this butterfly varies slightly among the islands, and in consequence has been described as distinct from various places, whereas the difference between them is not nearly as great as between the spring and autumn broods of the same species to be met with at Sydney. Mr. Mathew hoped at some future occasion to be able to contribute further remarks upon the butterflies exhibited.

Mr. Arthur Bliss exhibited a collection of Lepidoptera from the Formosa River, W. Africa, collected by Mr. Frank Willecocks, his brother-in-law, who was present as a visitor.

The Rev. W. W. Fowler exhibited two specimens of *Pelophila borealis*, Curt., from Lowry's Lough, Ireland, in both of which the left-hand tarsus was much contracted; also a specimen of *Tachys parvulus*, Dej., taken by Mr. J. H. Smedley near Liverpool at the roots of *Parnassia palustris*. Mr. Fowler remarked that it appeared probable that many of these small *Tachys*, especially *T. Fockii* and *T. A-signatus*, were often imported with ballast.

Mr. Fowler also exhibited the specimens of *Cassida* which had been soaked in a colour-preserving solution last February (*cf.* p. v., *ante*), and were now but very slightly faded owing to their exposure to light.

Mr. C. O. Waterhouse exhibited both sexes of *Helopeltis Antonii*, Sign., a great pest in the Cinchona plantations in Java, described by Signoret in 1858 from Ceylon. He also remarked that *Helopeltis braconiformis*, Walk. (*Cat. Hem. B. M.* vi. 165, 1873), was synonymous with *Dulichius clavifer*, Walk. (*l. c.*, iv. 170, 1871), both from Dorey, New Guinea.

Mr. R. M'Lachlan exhibited the drawing of an exotic grasshopper, taken in a hot-house near Birmingham; he supposed it to be the same as the American species already exhibited to the Society by Messrs. Saunders and Weir, *viz.*, *Copiophora cornuta*.

Mr. E. A. Fitch exhibited several females of *Eriopeltis festuca*, Fonsc., a Coccid new to Britain, found at Plymouth last September by Mr. G. C. Bignell; these much resembled the white woolly cocoon of a Microgasterid.

Mr. C. O. Waterhouse remarked that he had twice seen similar Coccidæ to those now exhibited; once he found a large specimen on grass in the Warren at Folkestone, and Mr. F. Moore found a different species near Ilfracombe.

Mr. G. B. Buckton communicated the following:—

*Notes on experiments made with the winged form of Phylloxera
vastatrix radicecola.*

BY ALBERT C. F. MORGAN.

Phylloxera vastatrix, as is well known, exists in two forms, *viz.*, the *radicecola*, or root-feeder, found in Europe, and the *gallicola*, or leaf gall-making insect, found far more plentifully in America.

The following observations refer to the *radicecola* form found in Portugal, and identical, I believe, with that which is common in France and other parts of Europe.

It will be remembered that the *Phylloxera* is, like other Aphides, dimorphous, the one form being parthenogenetic and apterous throughout, shedding its skin three times; the other form developing wings after undergoing two further changes of skin. The eggs of the winged individual, according to Balbiani and Lichtenstein, produce the two sexual forms,

provided with reproductive organs, and not furnished, like the other stages, with the rostrum. The female lays one egg, the only fertilised egg of the chain.

The winged form is, I understand, uncommon, or at least difficult to procure in France; and in England, I apprehend, it is unknown. In Portugal it has seldom, if ever, been detected, although the insect in its earlier stages is abundant; and even in the nymph, or pupa stage, it is not unfrequently found, a circumstance which seems somewhat remarkable.

Perhaps the following notes may be of interest: first, as to the duration of time taken for the transformation from the pupa or nymph into the imago or winged form; secondly, as to the circumstances which apparently encourage the winged form:—

EXPERIMENT No. 1.—July 13th, 1885, 9 a.m.: Placed a nymph, bright yellow colour, tubercles pink, and clearly defined, in the bottom of a wine-glass on a vine-leaf. Glass covered with fine muslin. Idem, 2 p.m.: Insect could not be seen without moving the leaf, so left it undisturbed. Idem, 5 p.m.: Underneath the leaf was the perfect winged form. This transformation therefore took not more than *eight hours*.

EXPERIMENT No. 2.—July 14th, 1885, 6 p.m.: Placed a similar nymph on a vine-leaf, under similar circumstances. July 15th, 6 a.m.: Saw the insect on the point of changing. Wings visible. Head and thorax complete, but wings not yet free from exuvia. Idem, 1 p.m.: Wings still not free, but after a few minutes the wings of one side completely cleared themselves, but the exuvia remained obstinately clinging to the wings on the other side. After eight minutes' struggling the insect entirely freed itself; but the wings on the one side remained much crumpled, a circumstance I have noticed in another case, when they remained in this crumpled state for three days, *viz.*, during the insect's life. In the above-mentioned experiment the transformation occupied not more than *nineteen hours*.

EXPERIMENT No. 3.—Under similar circumstances the like metamorphosis occurred between August 29th, 6 p.m., and August 30th, 9.30 a.m.—that is, not more than *fifteen and a half hours*.

Average time from these three experiments about *fourteen hours*.

I will now state my experiences (which are, however, very limited) in breeding the winged form in bottles, with a view of suggesting that these experiences, as far as they go, point to a confirmation of what Mr. Buckton has suggested in his 'Monograph of British Aphides' as the probable cause of the development of the winged form, *viz.*, want of food, and a desire to emigrate.

My notes on this point will be confined to three bottles only, in which I had placed vine-roots plentifully inhabited with *Phylloxera*. Out of

two bottles I have taken about sixty winged individuals, and out of the third none.

It naturally occurred to me, when I found so many winged forms appearing in the bottles, and when I remembered that the members of the Anti-Phylloxera Commission informed me that the winged form had seldom, if ever, been found in Portugal, and that presuming their search for the winged form had been diligently made, though without success, then that the circumstances in which the insects found themselves in the bottles, though so contrary to natural circumstances, yet were apparently very much more favourable to the development of the winged form than were the natural conditions.

What, then, is the difference, or at least most marked obvious difference, between the natural and artificial conditions? I think it will be admitted that want of food is the characteristic of the artificial, and abundance of food that of the natural conditions. Perhaps it may be thought that the following experiments to some extent justify the conclusion to which I have referred:—

EXPERIMENT No. 4, Bottle A.—June 29th, 1885: Placed vine-roots, plentifully populated with *Phylloxera*, in a glass pickle-bottle, corked loosely, and half-filled with the dry argillaceous soil, in which the vines grew. July 9th (that is, eleven days afterwards), a winged form appeared, and every day, until about the 17th, three or four fresh winged forms appeared, crawling up the neck of the bottle. The roots were quite dead when the first winged form appeared, and were becoming mouldy. A few days after the first winged one appeared many young ones were crawling up the neck of the bottle, apparently searching for food, as they otherwise have a great objection to the light.

EXPERIMENT No. 5, Bottle B.—August 23rd, 1885; Circumstances similar, but less soil was included. On the 28th (that is, five days afterwards) two winged forms appeared, and every day since, up till about the 7th September, a duration of ten days, some three or four more winged forms appeared. Since then an occasional one or two appeared, the last being on September 20th. Altogether, out of Bottle A some twenty-five have been taken, and out of bottle B some thirty-six.

EXPERIMENT 6, Bottle C.—In order to make a different test, however, on August 23rd, same date as relates to bottle B, I placed phylloxerated vine-roots in a longer or higher bottle, and, instead of putting a little soil in it, I almost completely filled it with earth and roots; but up to this date (October 9th) no winged forms have appeared. I have twice taken the roots out of the bottle to examine them, and found numerous insects, as well as eggs, the former apparently quite healthy and active, but they appear to have left the small rootlets which they usually inhabit, but which are now quite dry, and have taken to the thicker or main roots, which in

this bottle are still alive, or at least supplied with sap. In the two former cases the roots had become mouldy, but in this case there is at present no appearance of fungus growth.

We see, then, that in the two bottles where the roots completely died and commenced to decompose as many as over sixty winged forms have appeared, whereas in the bottle in which the roots have kept alive not a single winged form has appeared.

I should add that bottles A and C were supplied with vine-roots from the same vineyard; but those in bottle B were taken from another vineyard some five-and-twenty miles distant.

The winged individuals that I have thus bred in confinement, have never lived more than three or four days. They have laid eggs whilst confined in a glass cell. In one instance two eggs were laid, and, on examining the insect under the microscope, a third was seen in the abdomen. I have also a specimen showing three eggs in the abdomen, another with two, and another with one; also another with what appears to be granular protoplasm in the abdomen. The maximum number of eggs laid appear therefore, from experiment, to be three, which I think is the number mentioned by M. Cornu.

I believe it is considered doubtful whether the produce of the winged form should be distinguished as an egg proper, or whether the alate form should not be considered viviparous, the apparent ovate body being perhaps nothing more than a pupa or chrysalis enclosed in a membranous investment.

But, if it is admitted that the apterous parthenogenetic larva is an egg-layer, then I think it should be conceded that the alate form is equally oviparous, because, after their exit from the body of the parent individual, it would be very difficult for an ordinary observer to distinguish one from the other; both are of an oval shape, of a bright yellow colour, easily to be seen by their glistening appearance, and of a sticky exterior.

Perhaps the remarks of Balbiani, as quoted by Mr. Buckton ('British Aphides,' iv. 73), will afford the best reason for describing these ovate bodies as eggs, for they entirely conform to his definition, *viz.*:—"Si l'on doit appeler des œufs de corps qui sont constitués essentiellement comme les œufs des autres insectes, qui se segmentent et dans lesquelles, les parties d'embryon se forment successivement et peu à peu: ces corps *sont des œufs et non des pupes* comme je l'ai toujours soutenu."

Whilst in the body of the parent individuals the eggs appear to be enclosed in a sort of envelope, but this does not appear to surround each egg, but encloses the whole of them, one, two, or three, as the case may be. The microscopic slides which accompany these remarks will show this.

When the eggs, however, are extruded, they no longer seem to possess this envelope, and, in fact, as they are only laid one at a time, it would be impossible. Therefore, I suppose the fact of their enclosure in the envelope

before their actual deposit could not be considered sufficient grounds for calling the egg-like bodies pupæ, or describing the winged form as pupiferous or viviparous.

The only winged forms with which I have had experience are those bred in bottles, under circumstances which I have already described, and from which I obtained altogether only nine eggs actually deposited by winged individuals, after being removed from the bottle and placed separately in confinement. Out of these nine eggs I can only report the result of three, the remainder having met with an accident of some form or another, with the exception of two, which I mounted.

On September 1st a winged form was removed from the bottle to a separate glass cell, and the next day had deposited an egg. This egg presented no change until the 12th of the month, when it seemed to have modified its shape, and had assumed a dark colour. On the 15th it had still further changed its form, a sort of knot or protuberance appearing at one end; and on the 19th the embryo had burst through its shell, which was adhering to the posterior end of the embryo. On the 22nd the eyes could be seen, and what appeared to me rudimentary legs; but it appeared still to be surrounded with a thin investment. I continued to observe it till October 2nd (one month), but it did not appear to make further progress. This individual, together with the egg-shell, is shown on slide No. 5, although, in the course of preparation, the shell slipped away from the body of the young insect to which it was before adhering.

Again, on the 4th September, I placed a winged individual in similar circumstances, at 9.30 a.m., and at 10 p.m. the same day I found an egg in the cell, and the winged insect apparently just recovering from having laid a second, as another was found under her wings, and she was struggling very much, as if in pain. The next day I found her dead, and, on examination under the microscope, observed another egg in her abdomen, which would have made three eggs laid by the same individual, if she had lived. These two eggs, laid on September 4th, I have still under observation. They have very much altered in appearance and shape, and I think are still progressing, but very slowly. They gradually became darker in colour, and swelled out at the sides, the polar ends becoming flattened. They now both show the form of the embryo, but no eyes at present; nor have I noticed yet any signs of bursting through the shell. Perhaps the very fact of this slow development precludes them from being considered as anything but actual eggs.

I have referred above to an individual apparently being in pain, after having laid an egg; and in another instance I noticed one (in an open glass cell) violently rearing up and down, using its cauda and posterior legs as fulera with which to raise itself up and down, after the manner of a horse rearing. After about ten minutes of these violent contortions it suddenly

fell backwards dead. Probably glass is not very suitable for the insect when depositing the egg, as not offering sufficient resistance. The downy hairs on the back of a vine-leaf would, of course, attach themselves to the sticky exterior of the egg, and, together with the rough surface of the leaf for the tarsi, much assist the insect in extruding the egg.

The appearance of the winged form does not appear to be dependent upon temperature, because with one or two (and these, I think, unauthenticated) exceptions it has never until now been found in Portugal, which may be considered, I suppose, especially in the parts where the greatest ravages have been committed, a warmer country than France. Of course, it may be that proper diligence has not been used in the search for the alate form, although, as there is a Commission with special officials placed in various parts on purpose to make observations, one can hardly suppose that the winged form, if it existed, would have escaped their notice. It has hitherto been said that no stage beyond the nymph stage had been found, and that in Portugal consequently only the subterranean stages existed. However, as I have already described the rearing of some sixty winged forms in bottles, I think we must be cautious in concluding that because the official observations in Portugal have not been successful in detecting them no winged forms exist in a natural state.

Castello, Villa Novada Gaya, Portugal.

Paper read.

Mr. E. Meyrick communicated "Descriptions of Lepidoptera from the South Pacific." 174 species of Geometrina and Micro-Lepidoptera, from the collections of Mr. G. F. Mathew, of H.M.S. 'Espiegle,' and Dr. Lucas, of Melbourne, were referred to.

December 2, 1885.

J. W. DUNNING, Esq., M.A., F.L.S., &c., Vice-President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Fellows.

Sidney Philip Smith, Esq. (Danes Inn, Strand, W.C.), and Col. L. Blathwayt, F.L.S. (Eagle House, Batheaston, Bath), were balloted for, and elected Fellows of the Society.

Exhibitions, &c.

Mr. F. Enock described experiments in mounting *Mymarida*, and exhibited photographs of the insects.

Mr. A. Eland Shaw exhibited the specimen of *Conicephalus* mentioned at the last meeting as having been taken at Birmingham. It had since been shown to M. de Saussure, who did not recognise the species, but believed it to be Australian; the captors, however, supposed it to be South American.

Mr. G. T. Porritt exhibited a melanic variety of *Agrotis obelisea*, Hübn., taken at Southport; also, on behalf of Mr. F. N. Dobrée, a melanic form of *Luperina testacea*, Hübn., from Sligo, and a very dark *Agrotis corticea*, Hübn.

Mr. Dunning read the following—

Note on the Election of Honorary Members.

At the first General Meeting of the Society, held on the 22nd May, 1833 (misprinted 1834, in the 'Journal of Proceedings,' p. i), the Rev. William Kirby was appointed Honorary President; and by the original Bye-Laws, adopted at the meeting held on the 4th November, 1833 ('Proceedings,' p. ii), it was declared that "the Society consists of British and Foreign Ordinary Members, the number of whom shall be unlimited, and of Foreign Honorary Members, whose number shall not exceed ten." It was also enacted that "No resident in Great Britain can be an Honorary Member, except the Honorary President, the Rev. Wm. Kirby, A.M., F.R.S., &c.;" but at the very meeting by which this Bye-Law was adopted William Spence, Esq., F.R.S., &c., was elected an Honorary English Member.

After the death of both Kirby and Spence it was proposed to repeal this enactment, so as to render residents in the United Kingdom eligible for Honorary Membership; but the proposal was rejected (Proc. Ent. Soc. 1863, p. 191).

The rule now stands that "No resident in the United Kingdom shall be an Honorary Member"; and that "the number of Honorary Members shall not exceed ten."

From time to time lists of the members for the time being of the Society have been printed; the earlier lists did not give the date of election of any of the members; since 1850 this has been supplied, in the case of Ordinary Members; but for some reason, or no reason, the hitherto-printed Lists have omitted to give the date of election of our Honorary Members. My attention was called to this matter by the mistake in Prof. Westwood's obituary notice of Milne-Edwards (Ent. Mo. Mag. xxii. 96), giving 1852 as the date of his election as Honorary Member, instead of 1843; and as the published 'Proceedings' of the Society do not supply the information, I have thought it worth while to prepare a complete List of our Honorary Members, with the dates of their election and death, showing the order of succession from the foundation of the Society to the present time.

Honorary English Members.

1. Rev. William KIRBY, elected 1833, died 1850.
2. William SPENCE, „ 1833, „ 1859.

Honorary Foreign Members.

	Elected.	Died.	Succeeded by
1. Alexandre Louis LEFEBVRE	1833	1867	Siebold, 1870.
2. Johann Christoph Friedrich KLUG	1833	1856	Schaum, 1860.
3. Johann Ludwig Carl GRAVENHORST*	1833	1857	Hagen, 1863.
4. Willem de HAAN	1833	1855	Pictet, 1855.
5. Christian Rudolph Wilhelm WIEDEMANN †	1833	1840	Zetterstedt, 1851.
6. Jean Victor AUDOUIN	1833	1841	Milne-Edwards, 1843.
7. Carl Eduard HAMMERSCHMIDT ‡	1833	1874	Leconte, 1863.
8. Carlo PASSERINI	1834	1857	Dufour, 1860.
9. Carl Johann SCHÖNHERR	1834	1848	Zeller, 1849.
10. Leonard GYLLENHAL	1834	1840	Kollar, 1843.
11. Vincenz KOLLAR	1843	1860	Lacordaire, 1863.
12. Henri MILNE-EDWARDS	1843	1885	Dohrn, 1885.
13. Philipp Christoph ZELLER	1849	1883	Osten-Sacken, 1884.
14. Johan Wilhelm ZETTERSTEDT	1851	1874	Burmeister, 1875.
15. François Jules PICTET	1855	1872	Saussure, 1872.
16. Léon DUFOUR	1860	1865	Guérin-Méneville, 1866.
17. Hermann Rudolph SCHAUM	1860	1865	Boheman, 1866.
18. Hermann August HAGEN	1863	—	—
19. Jean Théodore LACORDAIRE	1863	1870	Sel.-Longchamps, 1871.
20. John Lawrence LECONTE	1863	1883	Packard, 1884.
21. Karl H. BOHEMAN	1866	1868	Schiodte, 1870.
22. Félix Edouard GUÉRIN-MÉNEVILLE	1866	1874	Guenée, 1874.
23. Johan Georg SCHIÖDTE	1870	1884	Müller, 1884.
24. Carl Theodor Ernst von SIEBOLD	1870	1885	Snellen, 1885.
25. Michel Edmond de SELYS-LONGCHAMPS	1871	—	—
26. Henri Frédéric de SAUSSURE	1872	—	—
27. Achille GUENÉE	1874	1880	Signoret, 1881.
28. Hermann Carl Conrad BURMEISTER	1875	—	—
29. Victor SIGNORET	1881	—	—
30. Fritz MÜLLER	1884	—	—
31. Charles Robert OSTEN-SACKEN	1884	—	—
32. Alpheus Spring PACKARD	1884	—	—
33. Carl August DOHRN	1885	—	—
34. Pieter Cornelius Tobias SNELLEN	1885	—	—

* Gravenhorst was born at Brunswick in 1777; his entomological publications bear date from 1801 to 1848; and he died at Breslau in January, 1857. His name, however, appears in our printed List of Members down to October, 1861; and the vacancy was not filled up until 1863.

† Wiedemann was born at Brunswick in 1770; his latest entomological publication, 'Monographia generis Midarum,' appeared in 1831; and he died at Kiel in 1840. His name, however, appears in our printed List of Members on the 31st December, 1843; and the vacancy was not filled up until 1851, as it appears from the President's Address at the Anniversary Meeting on the 26th January, 1852, that Zetterstedt was elected "in the place of the late M. Wiedemann."

‡ No tidings of Hammerschmidt having reached the Society for many years, the Council treated him as dead, and resolved (in December, 1861) that his name should be expunged from the list of Honorary Members. His place was filled up in 1863. I cannot find that he published anything relating to Entomology after 1848. Subsequently to that date Dr. Hammerschmidt left Vienna, entered the service of the Sublime Porte, and was known at Constantinople as Abdullah Bey. Under that name he published papers on geological subjects at Paris, Vienna, and Florence; the latest of those mentioned in the Royal Society's Catalogue of Scientific Papers appeared in 1870; and he died in 1874.

Perhaps the following will be considered a more interesting method of exhibiting the succession :—

Lefebvre, 1833	Siebold, 1870	Snellen, 1885		
Klug, 1833	Schaum, 1860	Boheman, 1866	Schiödt, 1870	Müller, 1884.
Gravenhorst, 1833	Hagen, 1863			
de Haan, 1833	Pictet, 1855	Saussure, 1872		
Wiedemann, 1833	Zetterstedt, 1851	Burmeister, 1875		
Audouin, 1833	Milne-Edwards, 1843	Dohrn, 1885		
Hammerschmidt, 1833	Leconte, 1863	Packard, 1884		
Passerini, 1834	Dufour, 1860	Guérin, 1866	Guenée, 1874	Signoret, 1881.
Schönherr, 1834	Zeller, 1849	Osten-Sacken, 1884		
Gyllenhal, 1834	Kollar, 1843	Lacordaire, 1863	de Selys, 1871	

Classified according to the land of their birth, our thirty-four Foreign Honorary Members have included twelve Germans and Austrians, nine Frenchmen, five Scandinavians, two Dutchmen, two Swiss, two Americans, one Italian, and one Russian.

I would suggest that, in future, the date of election of our Honorary Fellows should be given in the printed Annual List: and the following will be the List for 1885 :—

Date of
Election.

Honorary Fellows.

1875. BURMEISTER, Hermann Carl Conrad, *Buenos Ayres.*
 1885. DOHRN, Carl August, *Stettin.*
 1863. HAGEN, Hermann August, *Cambridge, U.S.A.*
 1884. MÜLLER, Fritz, *Blumenau, Sta. Catarina, Brazil.*
 1884. OSTEN-SACKEN, Baron C. R., *Heidelberg.*
 1884. PACKARD, Alpheus Spring, *Providence, Rhode Island, U.S.A.*
 1872. SAUSSURE, Henri F. de, *Geneva.*
 1871. SELYS-LONGCHAMPS, Baron M. E. de, *Liège.*
 1881. SIGNORET, Victor, *Paris.*
 1885. SNELLEN, Pieter C. T., *Rotterdam.*

New Part of 'Transactions.'

Part IV. of the 'Transactions' for 1885 was on the table.

ANNUAL MEETING,

January 20, 1886.

R. M'LACHLAN, Esq., F.R.S., &c., President, in the chair.

An abstract of the Treasurer's accounts for 1885 was read by Mr. H. T. Stainton, one of the Auditors.

The Secretary read the following:—

REPORT OF THE COUNCIL FOR 1885.

In accordance with the Bye-Laws, the Council begs to present the following report:—

The grant of a Royal Charter of Incorporation, which bears date the 20th July, 1885, has supplied what was wanting to complete the legal and scientific status of the Society, and is a source of satisfaction to the Council, which will, it is confidently hoped, be shared by all the Fellows of the Society.

As the election of Annual Subscribers is for the future prohibited by the amended Bye-Laws, and the existing number of Subscribers is barely more than a score, the Council invites those gentlemen to qualify as Fellows, and thereby place all the members on an equality, so that, on the next revision of our Bye-Laws, reference to the class of Subscribers may be altogether omitted.

The vacancies in our list of Honorary Fellows occasioned by the deaths of von Siebold and Milne-Edwards have been filled by the election of Mr. Snellen, of Rotterdam, and Dr. Dohrn, of Stettin.

The Society now consists of ten Honorary Foreign Fellows, 40 Life Fellows, 186 Fellows, and the above-mentioned Annual Subscribers, the whole of whom it is hoped will soon be assimilated with and swell the number of our Ordinary Fellows.

The Transactions for the year, exclusive of the Proceedings, form a volume of 456 pages, containing ten Memoirs, contributed by as many Authors, and illustrated with ten plates, of which nine are coloured, and for the remaining one the Society is indebted to Mr. George Lewis.

The financial position may be shortly stated thus—

RECEIPTS.	PAYMENTS.
Balance in hand £2	Rent, Office, and Meeting } £118
Contributions of Fellows 259	Expenses }
Sale of Publications 64	Publications 272
Interest on Consols 9	Library 15
Donations 75	Balance in hand 4
£409	£409

Finally, the Council is well pleased with the progress made during 1885, and can assert with confidence that the year's work will bear comparison with that of any of its predecessors.

11, Chandos Street, Cavendish Square,
20th January, 1886.

The Secretaries not having received any notice proposing to substitute other names than those in the lists prepared by the Council, the following Fellows form the Council for 1886:—T. R. Billups, E. A. Fitch, W. W. Fowler, H. Goss, F. D. Godman, F. Grut, W. F. Kirby, R. M'Lachlan, E. B. Poulton, E. Saunders, H. T. Stainton, S. Stevens, and J. J. Weir.

The following are the officers elected:—*President*, R. M'Lachlan, F.R.S.; *Treasurer*, E. Saunders, F.L.S.; *Secretaries*, H. Goss, F.L.S., F.G.S., and W. W. Fowler, M.A., F.L.S.; *Librarian*, F. Grut, F.L.S.

The President then delivered an address, at the conclusion of which Mr. H. T. Stainton proposed a cordial vote of thanks to Mr. M'Lachlan for his services as President during the year, and requested that he would allow his address to be printed with the 'Proceedings.' The proposal was seconded by Mr. F. P. Pascoe, and carried unanimously. The President returned thanks.

Mr. Dunning proposed a vote of thanks to the Treasurer, Secretaries, and Librarian, which was seconded by Mr. W. L. Distant, and carried unanimously. Messrs. Saunders, Fitch, Kirby, and Grut made some remarks in acknowledgment.

ABSTRACT OF RECEIPTS AND PAYMENTS FOR 1885.

Receipts.		£ s. d.		Payments.		£ s. d.			
To Balance, 1 Jan. 1885	-	2	7	6	By Rent, Salary, Office Ex-}	117	16	4	
Subscriptions, 1885	-	191	2	0	penses, &c. - - }				
Entrance Fees	- -	33	12	0	Printing	-	173	17	6
Arrears	- - -	3	12	0	Plates, Colouring, &c.	-	98	10	0
Compositions	- - -	30	9	0	Books, Binding, &c.	-	14	19	6
Donations	- - -	75	6	3					
Transactions	- - -	63	12	5					
Interest on £313 4s. 8d.	}	9	2	1	Balance, 1 Jan. 1886	-	3	19	11
Consols									
		<u>£409</u>	<u>3</u>	<u>3</u>			<u>£409</u>	<u>3</u>	<u>3</u>

ASSETS.

	£	s.	d.
Subscriptions, considered good	-	-	10 10 0
Consols, £313 4s. 8d.	-	-	(cost) 293 4 0

Audited and found correct. {

H. T. STANTON.
J. JENNER WEIR.
W. F. KIRBY.
RICHARD SOUTH.
H. GOSS.

THE PRESIDENT'S ADDRESS.

GENTLEMEN,

In accordance with the terms of Chapter XX. of our Bye-Laws, I announce that the Officers and Council for the ensuing year will be as follows :—

President: R. M'Lachlan, F.R.S. Treasurer: E. Saunders, F.L.S. Secretaries: H. Goss, F.L.S., and W. W. Fowler, M.A., F.L.S. Librarian: F. Grat, F.L.S. And as other Members of Council: T. R. Billups, E. A. Fitch, F.L.S., F. Du Cane Godman, M.A., F.R.S., W. F. Kirby, E. B. Poulton, M.A., F.G.S., S. Stevens, F.L.S., H. T. Stainton, F.R.S., and J. J. Weir, F.L.S.

The exigencies of other engagements necessitate the retirement from Secretarial duties of both Messrs. Fitch and Kirby. A thorough change of Secretaries is always a matter of importance. The Secretaries (or the Acting Secretary) and the Treasurer are the most important Officers in every Society, for it is on their supervision, separately and combined, that the welfare of a Society mainly depends. Two of our Fellows have kindly volunteered to fill the vacancies, and from what we know of them and of their work, I have no doubt they will prove as efficient as their predecessors; and they are doubtless fully aware that they enter upon their duties at a time when the Society has acquired a new position and advantages, and also increased responsibility.

Our Treasurer has kindly supplied an unsolicited analysis of the financial condition of the Society for the last six years. It is not quite so satisfactory as I could have wished; but it shows a gradual increase in what may be termed current income, in all items save one; I allude to the receipts from the sale to the public of our Transactions, which last year show a notable diminution. This is an item at all times fluctuating and

capricious, and the universal depression in trade has no doubt affected it outside any other consideration. I believe I may say we have practically no liabilities. That we are in this position is mainly due, now as often, to the liberal donations we have received. I hope, very sincerely, that the time is not far distant when we may be placed outside the necessity of relying upon donations in order to equalise our balance-sheet. In connection with this I may remark that a new arrangement has lately been made with our printers, whereby there should be a considerable saving to the Society.

Our indefatigable Librarian, Mr. Grut, has so far completed in MS. the much-needed Catalogue of our Library, that its publication may be looked upon as likely to happen at no distant date.

Our current volume of Transactions if somewhat less varied in contents than has sometimes been the case, is none the less valuable. The publication of so large an instalment at one time of Mr. Marshall's Monograph of British *Braconidæ* crippled our resources. Of the value of that Monograph (which strikes me as one of the most important we have ever published) there cannot be two opinions, and I hope it may soon be completed; but the precise arrangements must be left to the advice and guidance of our Chancellor of the Exchequer. Certainly endeavours will be made to ensure its completion as soon as possible, without thereby being obliged to disappoint the authors of other memoirs.

On account of death five names that appeared in our last List have to be omitted in that which is in preparation. We have lost by death two Honorary Members, *viz.*:—Prof. CARL THEODOR VON SIEBOLD and Prof. HENRI MILNE-EDWARDS; and three Ordinary Members, *viz.*:—Major F. J. S. PARRY, Mr. E. C. RYE, and the Rev. D. J. FRENCH.

It is not my intention to give lengthy obituary notices in this Address. Such could amount to no more than a repetition of what has already appeared in various publications.

Carl Theodor von Siebold (born at Wurzburg, February 16th, 1804, died at Munich, April 6th, 1885) and Henri Milne-Edwards (born of English parents at Bruges, Oct. 23rd, 1800, died at Paris, June 29th, 1885) may well be coupled, for each was a power in his own country as a teacher, and each exercised

vast influence over zoological studies in Germany and France respectively, and in either case that influence was extended over the whole scientific world. Von Siebold's 'Lehrbuch der vergleichenden Anatomie der wirbellosen Thiere,' and Milne-Edwards' 'Cours élémentaire d'Histoire Naturelle,' are models of what text-books should be. So far as pure entomological work is concerned, the German *savant* published more than his French *confrère*, and his name will be ever remembered in connection with parthenogenesis, the observations on which were originally made from entomological subjects, but the existence of which was subsequently proved to extend far beyond the pale of Entomology. If Milne-Edwards published but little on purely entomological subjects, much of his work nevertheless concerned the Crustacea, a class always considered to lie within the scope of the Entomological Society of London. Both of these illustrious zoologists will be equally remembered in connection with Natural History journalism. Von Siebold was one of the founders of the 'Zeitschrift für wissenschaftliche Zoologie'; Milne-Edwards was long a leading editor of the not less celebrated 'Annales des Sciences Naturelles.'

Major Parry (born October 28th, 1810, died February 1st, 1885) was one of our oldest Members, having been elected so long back as 1840. At one time he was a frequent attendant at our meetings. His works on *Lucanidæ* are known to all of us, and he was in fact the leading authority on that family of Coleoptera. Possibly there never has been an entomologist whose scientific career, extending over so long a period, was so intimately connected with this Society, for, if I mistake not, the whole of his published papers appeared in our Transactions.

The premature decease, from that dire scourge smallpox, of Mr. E. C. Rye (born April 10th, 1832, died February 7th, 1885) is still fresh in our memories. That it should fall upon the President of a Society for the time being to find that in the annual roll-call there is no response in a few cases, is in all instances a painful experience. There are cases in which circumstances render this experience additionally painful; such, for instance, as personal friendship and intimate association over a lengthened period. In such a position I find myself at this moment. Five years my senior to a day, Mr. Rye and I commenced our respective careers in entomological science,

in different directions, almost at the same time, and for more than twenty years subsequently we were intimately associated in self-imposed editorial duties. In the early part of this friendship we had made many excursions together, even to the extent of sharing semi-starvation (in the early summer of 1865) in the Black-wood of Rannoch. It is sometimes said that friendships are the strongest where some ruling point in common draws together temperaments otherwise utterly different; and I may be allowed to think the case in point was an illustration. If we differed in much we had a bond in common of superior strength. I make no special allusion here to Mr. Rye's entomological labours (they are fresh in the minds of all) save that his name will always be remembered in connection with the study of British Coleoptera; and it will scarcely be less prominent as coupled with the 'Zoological Record' and the 'Entomologists' Monthly Magazine.' It may be said that indomitable power of work was his leading characteristic. It mattered not to him whether the work was done purely for the advancement of Entomology, or in fulfilling his engagements *pour vivre*; both conditions were the same to him: and his pastimes were pursued in precisely the same way. In the whole circle of my acquaintance I can recal no one to whom *work* appeared to be so absolute a necessity.

I have not been able to collect any information concerning the Rev. D. J. French, who joined us in 1869, and who died in India in the early part of last year.

Two British entomologists of note, not belonging to our Society, died in 1885. Joseph Sidebotham, of Manchester (died May 30th, aged 62), was known to many of us (and, if I mistake not, was for some years one of us). His scientific acquirements were very extensive, and he was a munificent supporter of Science in his district. Nicholas Cooke (born at Liverpool, Jan. 14th, 1818, who died suddenly near London, when on a visit, 19th May, 1885) was a well-known Lepidopterist.

The annual death-roll also includes the following:—L. R. Meyer-Dür, died at Zürich, March 2nd, aged 73, at that time the oldest Swiss entomologist, one of the founders of the Swiss Entomological Society, and a very prominent worker in several orders. C. Cornelius, of Elberfeld, died April 1st, aged 80, a prominent worker in the anatomy and life-histories of insects.

H. Weyenbergh (born at Haarlem, 6th Dec., 1842, died there July 25th, 1885), a pupil of Prof. Burmeister, and for many years Professor of Zoology at the University of Cordova (Argentine Republic). Antonio de Lacerda, of Bahia, a prominent coleopterist, died in August, aged 51. J. de Wankowicz, a prominent Polish entomologist, died at Minsk, Lithuania, 8th August, aged 50.

The event of the past year, so far as we are concerned, has been the grant to us of a Royal Charter of Incorporation. My immediate predecessor in this Chair—Mr. Dunning—in his Address delivered on January 21st, 1885, expressed his regret that a gracious response to our petition for a Charter had not up to then been received. That gracious response arrived in July last, and, as you all know, in the affirmative, and our coveted Charter is now in the possession of the Society. Accident of position caused me to be named therein as first President. Permit me to say, that while I feel proud of the honour, I most sincerely wish my immediate predecessor had received the distinction in my stead, for it is to his exertions and munificence we are enabled to style ourselves a Corporate Body. As a distinguished member of the legal profession, and as taking the warmest interest in this Society, no one amongst us could have seen more clearly than he, the disadvantageous position in which the Society had been placed during the more than fifty years of its existence,—an existence only in name.

After the public announcement of the grant of a Charter it occurred to several gentlemen, both of and outside our number, to question me as to the meaning and advantages of a Charter. Possibly I should have sought legal advice in framing my answers; possibly I should have sought it before endeavouring, on the present occasion, to place before you the remarks that follow: I am open to correction if my views be not strictly right.

In the first place, we have now a legal existence. As a body recognised by name we had existed for more than half a century, but we had no legal existence, and, although we possessed a magnificent property in our Library (and “something in the Funds”), we had, as a body, no real or direct control over this property. By the acquisition of a Charter we have, as a body, through our officers for the time being, an equal control over our

possessions to that which is accorded to a private individual or to a registered partnership. We have acquired the right to sue and be sued. The right to sue practically only concerns those of our Fellows who do not respond to our Treasurer's reminders as to unpaid subscriptions. This is a right possessed by every Chartered Society, and one, I am happy to say, very seldom required to be put in force. According to my experience, with regard to other societies, the right is only exercised when a contumacious Fellow, who there is every reason to believe can pay, will neither do so, nor acquire his right to resign by having satisfied his obligations. Let us hope the luxury of having acquired a right to be sued may never be indulged in.

There is another matter involved in the acquisition of a Charter. Possibly some benevolent individuals of our body, or outside our body, may desire to further the cause of entomological science as represented by this Society, by remembering us in their wills. In our former condition to have made a legacy of benefit to us, it must have been bequeathed to one or more individuals, and if the testator directed the amount to be invested, and the interest only to be applied to the immediate wants of the Society, or to any special purpose connected with the Society, a system of trusts must have been instituted, occasioning frequent changes, expense, and, to say the least, great inconvenience. As a Chartered Society these difficulties vanish.

Hitherto I have regarded the acquisition of a Charter from only the legal point of view. *Prestige* is perhaps scarcely an English word, and yet, somehow or other, it seems to be so generally acknowledged as to influence all by a process that may be termed "unconscious cerebration." During our more than fifty years of non-legal existence, I venture to believe we acquired a prestige not to be excelled by that of any kindred Society. To one and all I say, let that prestige not only be maintained, but be vastly extended.

I am not quite sure that our acquisition of a Charter is correctly appreciated by some of our continental *confrères*, and in at least one instance I almost wish we could look upon it somewhat in the same light as they appear to do. At the meeting of the Société Entomologique de France (a Society we may be proud to acknowledge our senior as a continuity), held on the

9th September, 1885, the President, our colleague M. Ragonot (whom, from his long residence in England, some of us are inclined to claim as a "British entomologist"), did us the honour to announce to his colleagues that we had become a Corporate Body; and it was stated that this distinction was analogous to the recognition as a "Société d'utilité publique" enjoyed by our French brethren. Of course we are a Society of public utility! But there is a slight difference. This official recognition on the part of the Government entitles the French Society to an annual subvention, which in 1885 was equal to £24. I am not aware that in this country any scientific society receives direct official recognition in a financial sense, with the exception of the Royal Society, and in this case the money grant does not benefit the Society as a body, but is distributed (under the supervision of a select committee) to individuals, the majority of whom are not Fellows of the Society.

Our Charter recognises the existing Bye-Laws; but it may be found necessary to call a Special General Meeting to authorise certain slight verbal alterations, due notice of which will be given.

In former Presidential Addresses delivered before this Society, it has been the custom to touch upon something beyond what may be termed home affairs. At one time it was not an uncommon practice to give a sketch of the principal results for the past year of the labours of entomologists, both British and foreign. I need scarcely say that the repetition of Addresses of this nature has become practically impossible, at any rate for one man; and even if it were possible, the result might run to the length of an average volume of our Transactions. It has also been a common practice to limit the Address to a consideration of one or more special subjects. Such a course I propose to adopt on the present occasion. Not unnaturally the choice of a subject has been before my mind some time, and the choice had provisionally fallen upon SYSTEMATIC ENTOMOLOGY in its various aspects. I had heard the students of Systematic Entomology called by hard names, and I had heard the subject itself styled the lowest form of entomological studies, and as applied partially I feel bound to confess there was truth in the remark. At the same time I felt there was more than gross injustice in the implied stigma, if cast upon systematists as a body.

The provisional idea thus formed has resulted in the remarks that follow; and it was an accident that caused the decision. In the 'Standard' newspaper for the last day of the old year was an anonymous sketch of the "Science of the Year." In unsigned articles one is sometimes at a loss how to draw a distinction between what may be written to suit the requirements of a particular journal, and what may reflect the writer's individual opinion. In the case in point some remarks attracted my attention, and the more so because on most subjects the writer and myself seem in accord.

The quotation is as follows:—"Naturalists of the new school are showing less interest in collecting than their predecessors. They half-despise the 'species-maker,' and are all for development, anatomy, and the philosophical bearings of the study. So far this is well. It raises Zoology and Botany out of the rut of mere museum work—preserving, labelling, cataloguing, and classifying. But it is mischievous in so far that it makes every acquisition simply subsidiary to Darwinism, without taking into account the fact that without the knowledge of species by which Darwin arrived at his first results any further advance is dangerous. The botanist who philosophises on distribution, or the zoologist on the connection between extinct and recent faunæ, is apt to blunder if he is not familiarly acquainted with modern species, which may be theoretically mobile, but which for all practical purposes are permanent. To compare fossil forms without knowing living ones is simply courting error. Yet, for the moment, this is the peril which the younger school are encountering in their haste to grow rich in sweeping conclusions. In this country biological science is in a state of transition. The old style is passing away; the new has not yet fully developed itself."

To me it appears that there is a singular amount of truth in several suggestions in this short quotation, and that, taken as a whole, no moderate man could possibly feel offended at the general tenor of the remarks. The remark as to the existing tendency to make every new discovery in natural science "subsidiary to Darwinism" struck me as *à propos*. I yield to no one in respect for the memory of our great philosopher. I yield to no one in warmth of adherence to the broad principles of Evolution. I take it that the broad principles of Evolution are

safe from any attacks that may be made upon them ; the days of ridicule are long past, and the opponents that remain admire while they doubt or dissent. But, for the sake of argument, supposing the principles to be vulnerable, the damage will be done not by opponents, but by too-enthusiastic admirers, who seek to make every acquisition subsidiary without having had Darwin's training. And I make bold to say that not the least important item in Darwin's early training was that of a systematist ; for, if done well, systematic work in Natural History requires an amount of diligence, of research, and, above all, of care, that, while it leaves room for the scientific use of the imagination, prevents everything being made subsidiary to the imagination. Just as Darwin, in the early part of his career, was a specialist and a systematist, so also have been most of our most celebrated philosophical naturalists, and so some of them continue. To my mind there is no subject so adapted to prove the capabilities of an aspirant in any department of Natural History as a monographic treatise on some special group, and to me there is nothing easier than to detect in works of this nature, on a subject with which I am acquainted, the amount of care taken by the writer—how much is original and how much second-hand, how much is solid and how much scamped : and, if my observations be correct, the lasting reputation of most naturalists will be gauged in direct proportion to the extent to which their systematic work stands the test of time. In systematic work not only do the animals themselves need careful and exhaustive examination, but, what is as much to the point, the whole literature relating to the subject must be carefully studied, and this alone must result in an amount of training for subsequent, and perhaps broader, studies that cannot fail to be beneficial. Therefore, I recommend to those younger Fellows of this Society with aspirations for future fame, to take up some special group, and work it out thoroughly, and publish the results. It may be said that the literature of every group has now become so appalling in extent as to be deterrent in comparison with that of years gone by. I do not share that opinion. In times gone by it was difficult to be able to consult the literature known to exist ; at present there is scarcely any work that is not to be found in one or many of our great Natural History libraries ; and, though the amount of current literature may be,

and no doubt is, enormous, the student, if possessed of sufficient acumen to avail himself of them, has so many aids in the way of what may pardonably be termed "keys" and "cribs," that any alarm on that score speedily dissipates on closer acquaintance.

But systematic work, if carried out too exclusively, can scarcely fail to have a narrowing influence, the one thing to be avoided of all others; and I earnestly recommend to *débutants* that while they seek to show their power of work by attacking some special subject, they should not lose sight of the surroundings.

ALL SYSTEMATIC (including descriptive) WORK SHOULD AIM AT BEING EDUCATIONAL; if it be not so I fail to see the necessity for it. And it should be so far educational as to be intelligible, in the majority of instances, to those who have not the identical materials before them; otherwise what can be the use of descriptions and figures? We might just as well, in museums and private collections, announce that we have a certain number of new genera or species, publish their names, label the specimens, and then invite workers in all parts of the world to come and see them if they wish to identify their own materials with them.

This latter remark brings me dangerously near the subject of "types." When writing, in 1880, the Preface to my work on European Trichoptera, the remark occurs that "the end and aim of every descriptive work in Zoology should be that of rendering references to types unnecessary in the majority of instances," that is "educational." But I am not of those who think it possible *always* to avoid the necessity or advisability of examination of types. To render it absolutely possible would, so it appears to me, render necessary not only a thorough knowledge of what is known to exist, but also a prevision of what does exist but is unknown; the former is possible, the latter more than verges on the impossible. Still I fear that a considerable proportion of descriptive work is of a nature that must necessitate an examination of types for its elucidation, and in many cases where more care could have produced other results. In such cases the descriptions had better not have been written. It is to be feared that so-called descriptions are often written for the sake of creating "types," and in some cases with the idea of thereby instituting a money

value, or, apart from this latter, the more sentimental idea of adding to the fame of a collection. There is also much popular misapprehension as to the meaning of the word "type." The purely systematic entomologist regards "type" or "types" as the specimen or specimens (for it is always desirable that a species be described from more than one example, even at the risk of confusing two species) from which a species was originally described. Now, permit me to put a case. An entomologist goes to a certain museum or collection, and asks to see a certain insect mentioned by name. It is shown to him, and he is informed that it is the "type," but, to the astonishment of the curator, or possessor of the collection, he flatly denies the truth of the assertion. There is simply a misunderstanding. The stay-at-home systematist sees in the term "type" only the specimen to which a certain name has been attached; the field-naturalist sees in it the dominant condition of the species according to his own observations. I opine that it might occur to me to side with the field-naturalist in such a case:—

" Wenn man so in sein Museum gebannt ist;
 Und sieht die Welt kaum einen Feiertag,
 Kaum durch ein Fernglas, nur von weiten,
 Wie soll man sie durch Ueberredung leiten?"

A misuse of the term "type" is made by collectors who, having spaced out their cabinets, and put in the labels, consider a type something, formerly wanting to them, that represents one of these names; it is a misuse, but is probably justifiable from their point of view, and needs no further mention. As bearing upon the question of "types," I call attention to one other matter, one that happens to affect my own special branch of entomological study very prominently. I allude to the mischievous practice of *publishing* names without descriptions. Such a course entails endless annoyance and confusion to subsequent writers; and another practice almost equally to be deprecated is that of naming undescribed species in collections (especially if the collections be important); such names often get inadvertently published, and thereby create confusion.

In earnestly recommending a course of systematic study to the younger Fellows of this Society, it may be well to call

attention to the fact that the insect-fauna of our own islands is yet by no means fully worked out. Much has never yet been touched in more than a preliminary manner, much yet needs revision. We have recently had an announcement of a hundred new British species of Diptera, and the writer of that article assured me that he believed he could, with a little more investigation, have raised the number to two hundred, from the materials in his own collection. But to work out any group of British insects properly, a knowledge is necessary of the insect-fauna of Europe as a whole, and even of that of the Palæartic region, so far as concerns the particular group. It has been said that already there are *five* "quarters" of the globe; I think our entomologists sometimes unwittingly acknowledge a *sixth* "quarter." I have on several occasions remarked, in our Transactions, and elsewhere, a distinction drawn between "British" and "European" insects. Such a distinction of course results from a casual *lapsus*, but its occurrence must occasion considerable amusement when viewed from across the Channel.

But do not for a moment imagine that I am disposed to look down upon that large class of our entomologists who from choice, or necessity, attend only to the productions of our own islands. Possibly there is no other portion of the globe of similar extent whose insect-fauna has been worked out in so exhaustive a manner; and I should say certainly there is no other portion in which so much has been done, and is being done, to work out the life-histories of the insect-productions, to the advantage of entomological science generally; though unfortunately this is too much restricted to the one order Lepidoptera.

I might have said, earlier, that it is almost necessary, in any case advantageous to an intending systematist, to have had a training in the entomology of his own country or district, and especially where that country or district possesses varied physical features. I will go so far as to say that it would have been an advantage to some amongst us who occupy themselves more particularly with exotic insects. They would have been better able to reason on the extent to which a species may vary, either locally or accidentally (I hope I may be pardoned for using the latter unscientific word). Many of our collectors of British Lepidoptera, finding difficulty in adding new native species to their collections, and having their own reasons for not wishing to enlarge their

acquaintance beyond the limits of these islands, have latterly taken to amassing varieties or local conditions; the result may be realised by an inspection of any one of our important British collections. Whatever vagaries of variation exist, we know the specimens belong to one and the same species. Let us take our common Tiger Moth (*Arctia caja*) as an instance, and let us suppose it is not a British, or even European, insect, and that (say) ten or fifteen of the most prominent varieties come home at various times, and from various localities, say in the Himalayas. It would very much surprise me if ten or fifteen so-called new species were not thereby manufactured, which might be avoided if the exotic systematist had received an efficient training as a British entomologist; or even if he did describe them, and give them names, it would occur to him to suggest that, from analogy, they might all be forms or varieties of one species. Very unfortunately the majority of British entomologists never seek to extend their knowledge further, and, on the other hand, those who attend to exotic insects have too often not paid sufficient attention to home productions.

In the foregoing remarks I have tried to show how, according to my own views, Systematic Entomology, if conscientiously pursued, should by no means be considered to consist in "species-making." Nor should "mere museum work" deserve an implied sneer. On the contrary, both can, and should, have an important bearing on philosophical Natural History.

It is not my intention on the present occasion to enlarge upon the connection of internal anatomy, embryology, and physiology with the systematic side of the subject. But it is most certainly desirable that a systematist should not be ignorant of the rudiments of these subjects, and in cases where the disputed position of isolated forms is concerned, something far more than the rudiments is required. Neither do I intend to touch upon Fossil Entomology, a subject that of late has acquired a vast importance from the recent discoveries of Silurian insects. Furthermore, I do not intend to give an analysis of the present position of Economic Entomology. On a future occasion I may possibly take up one or more of these subjects, for on one and all there is much to be said.

I conclude, Gentlemen, by thanking you heartily for the courtesy accorded to me during my first year of office as President.

Our meetings have been exceedingly well attended, far better so than was the case formerly, and I am sorry to say that on one or two occasions the attendance was out of proportion to the number and interest of the objects exhibited, or of the papers read. But each Fellow has it in his power to avoid the recurrence of what may be termed a blank evening, and I hope the power will be put in force at succeeding meetings.

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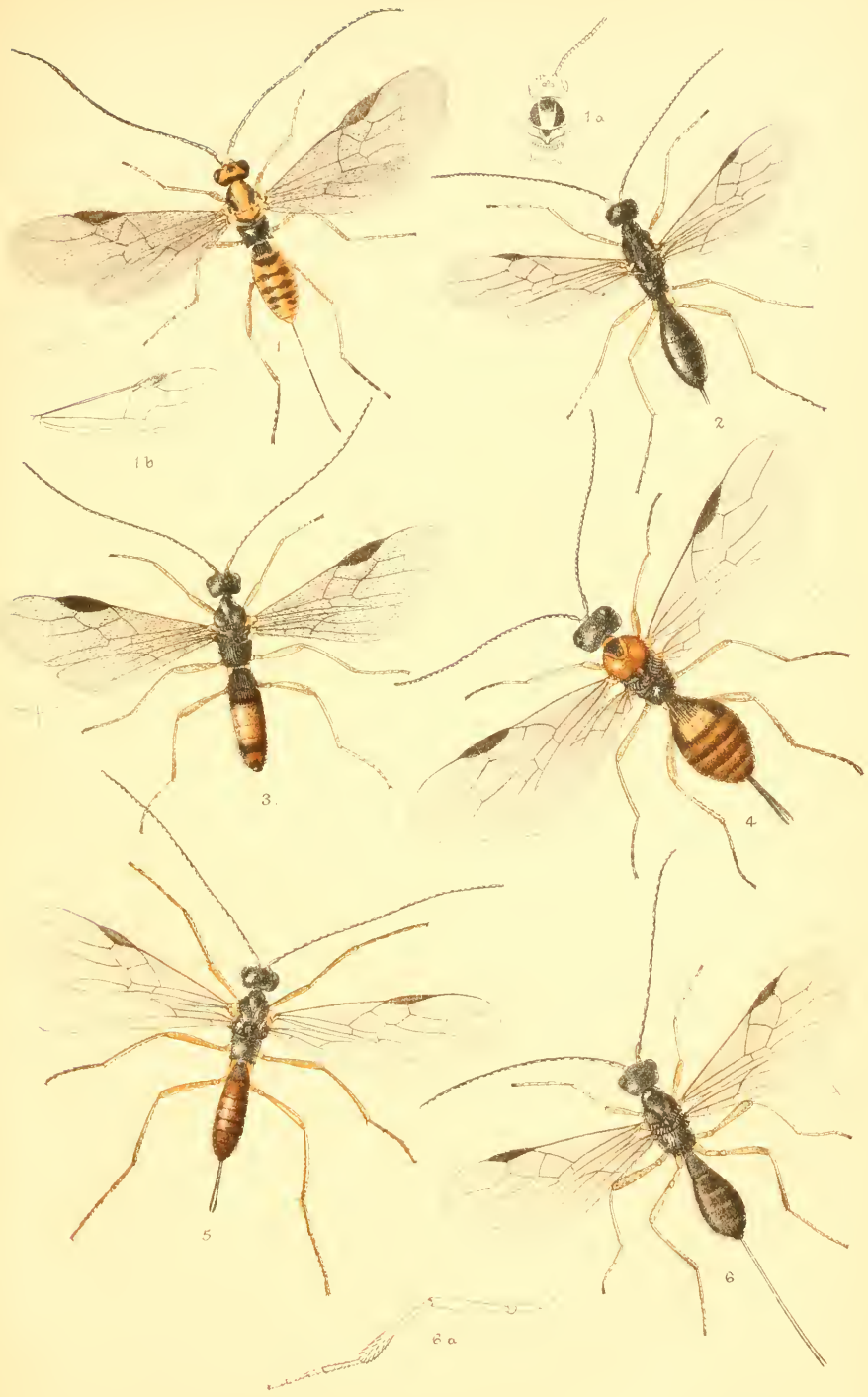
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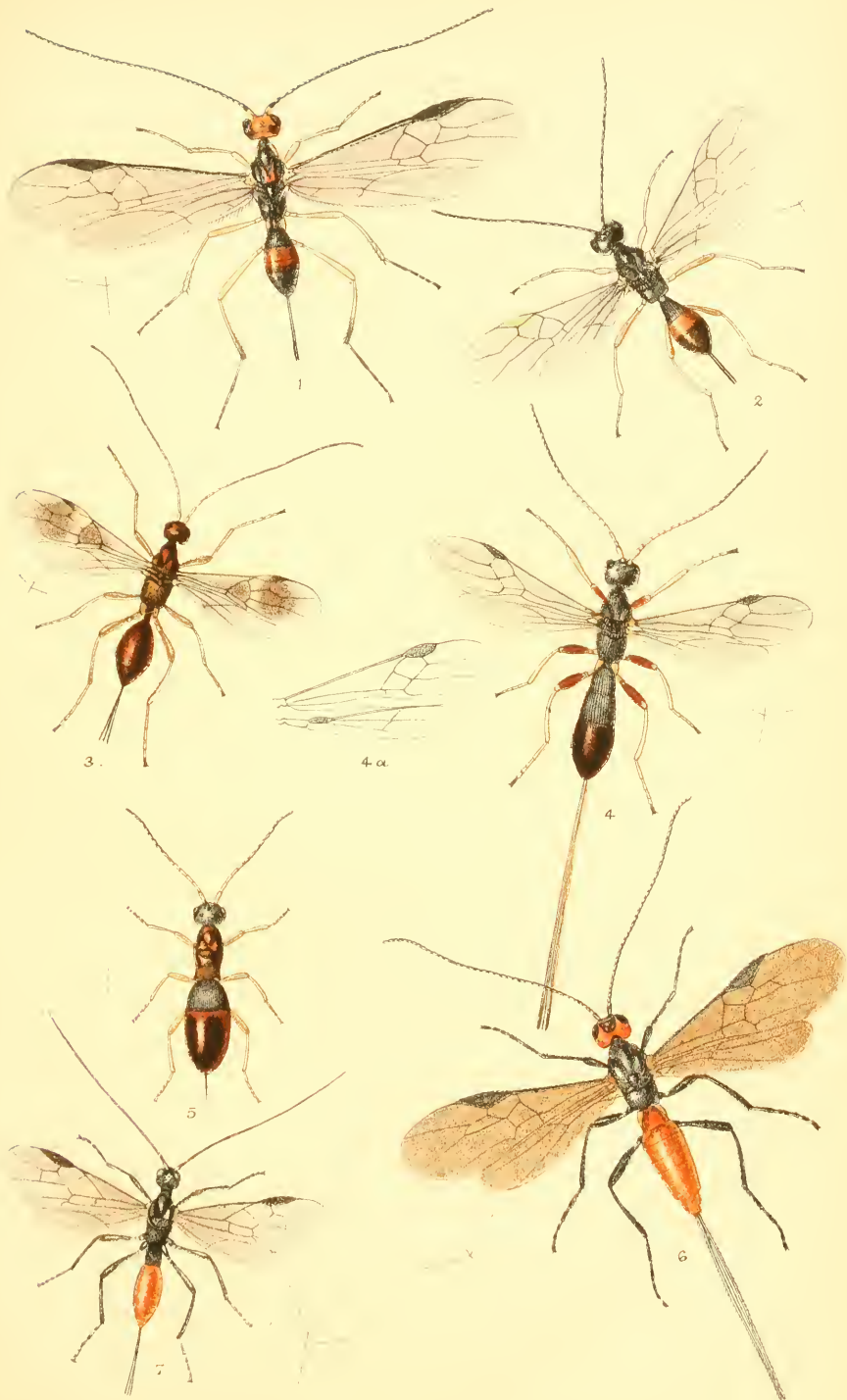
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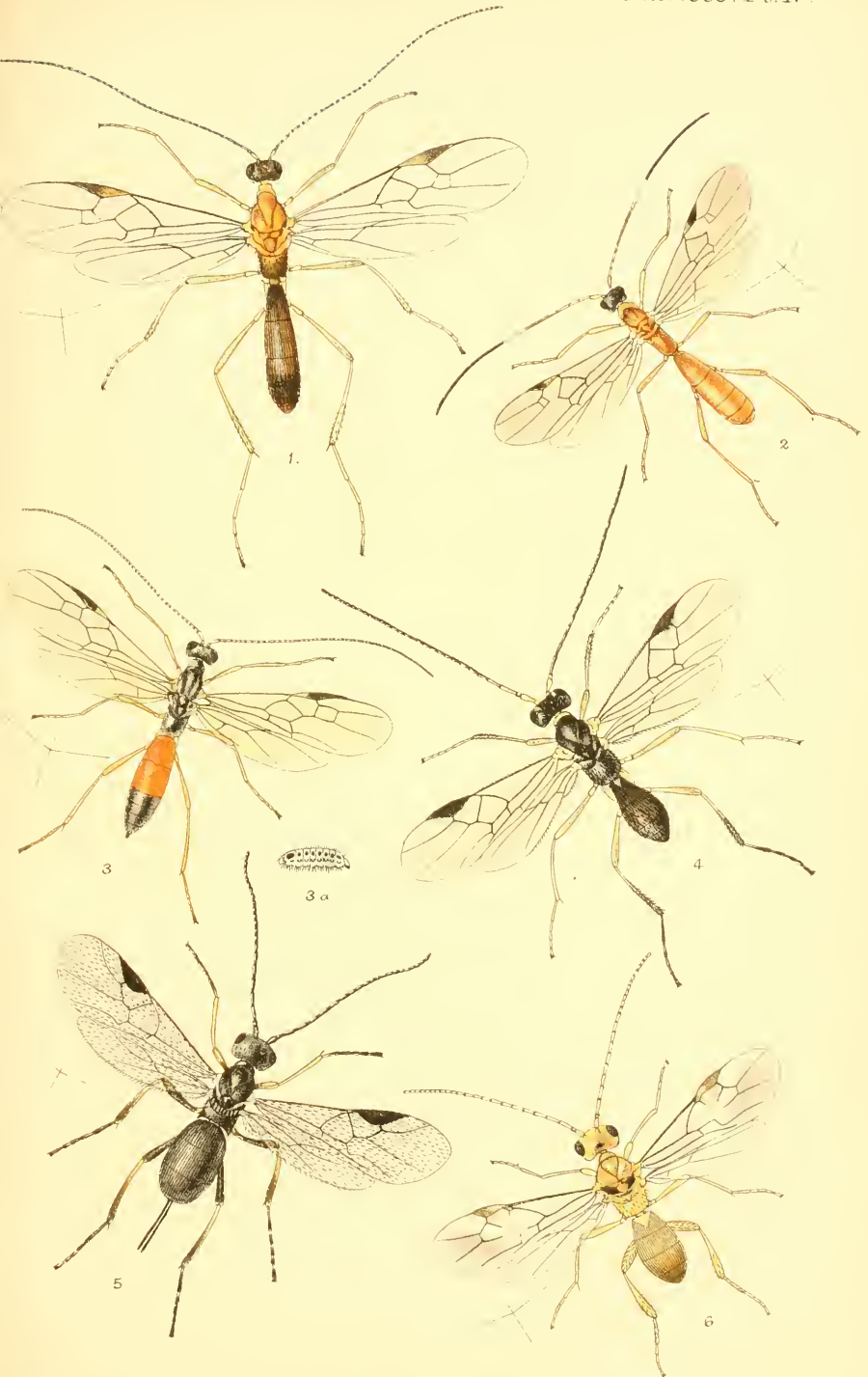


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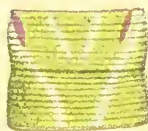
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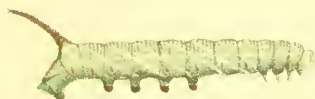
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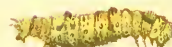
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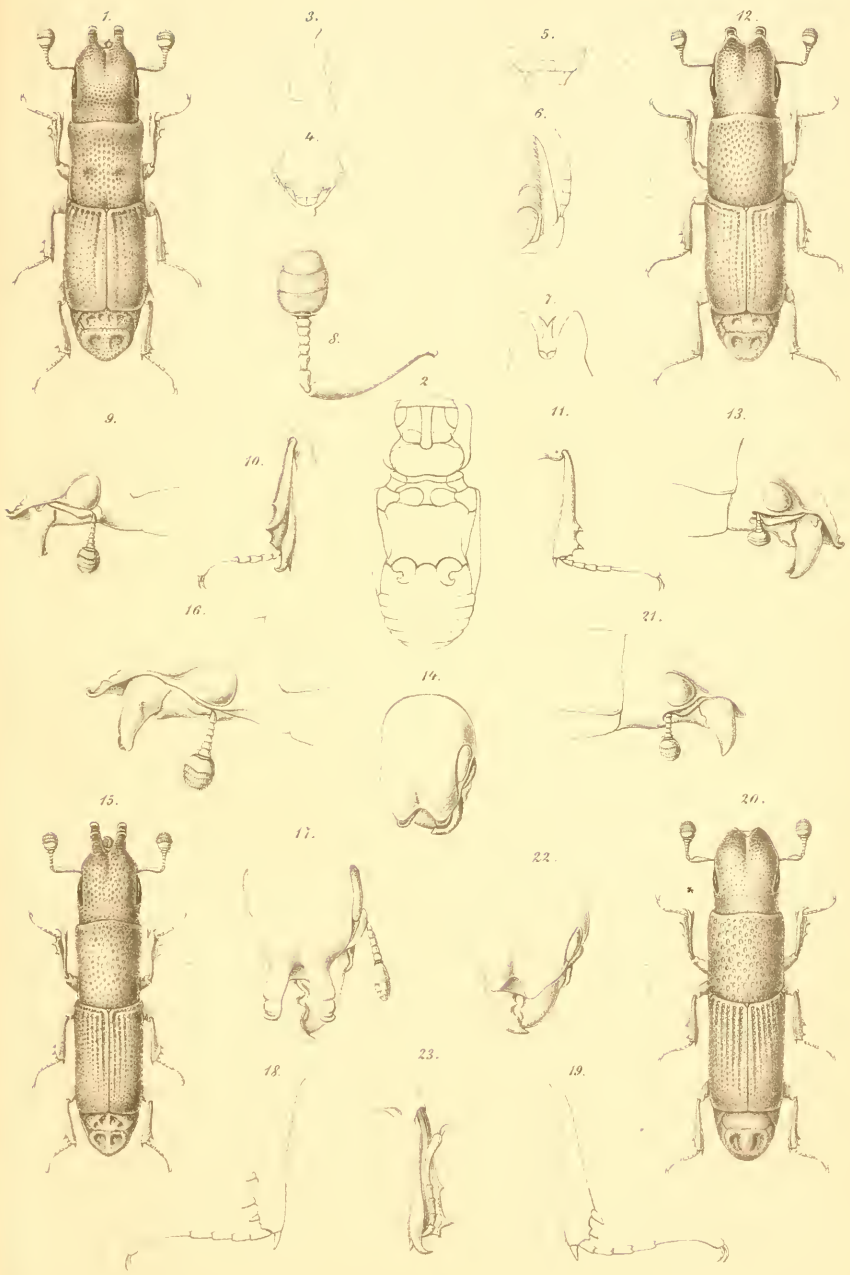
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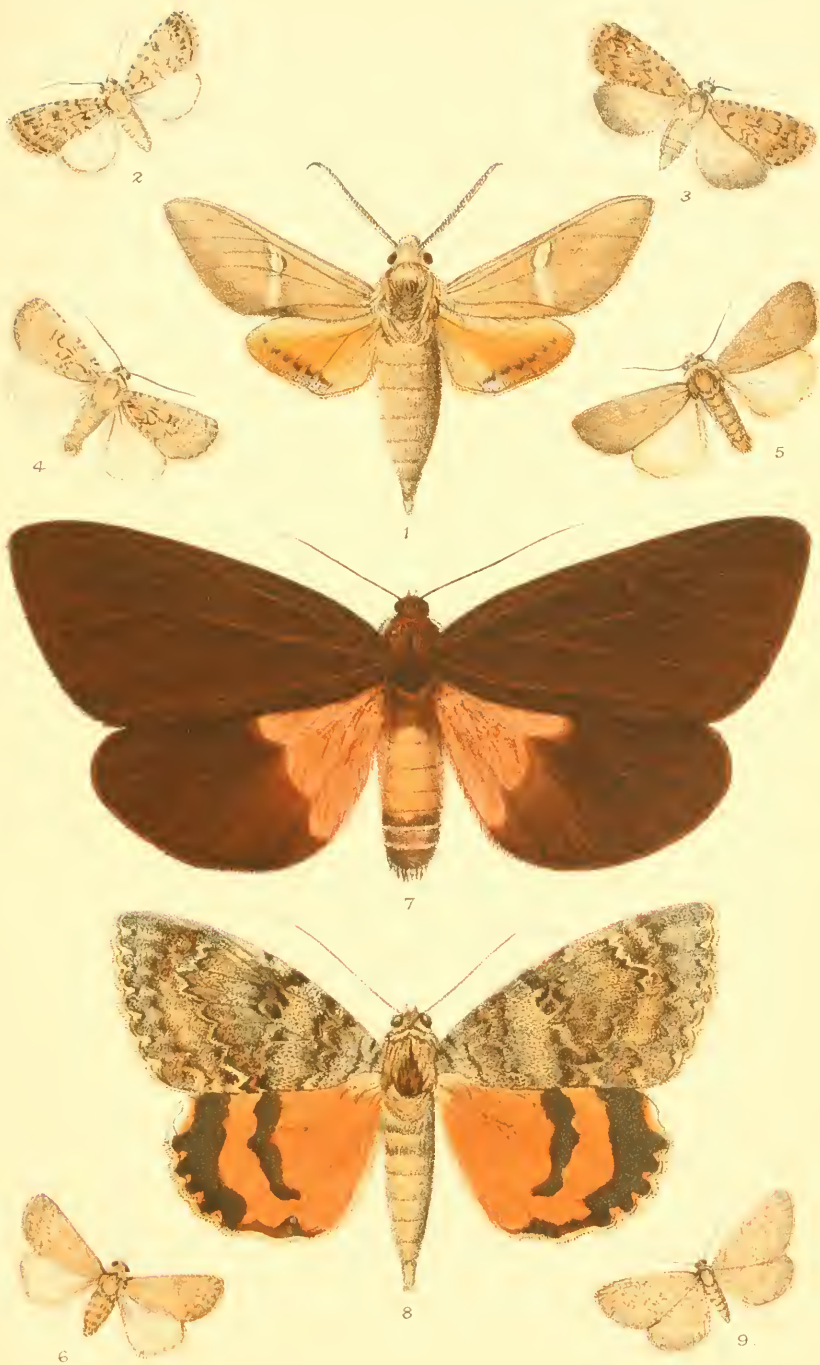


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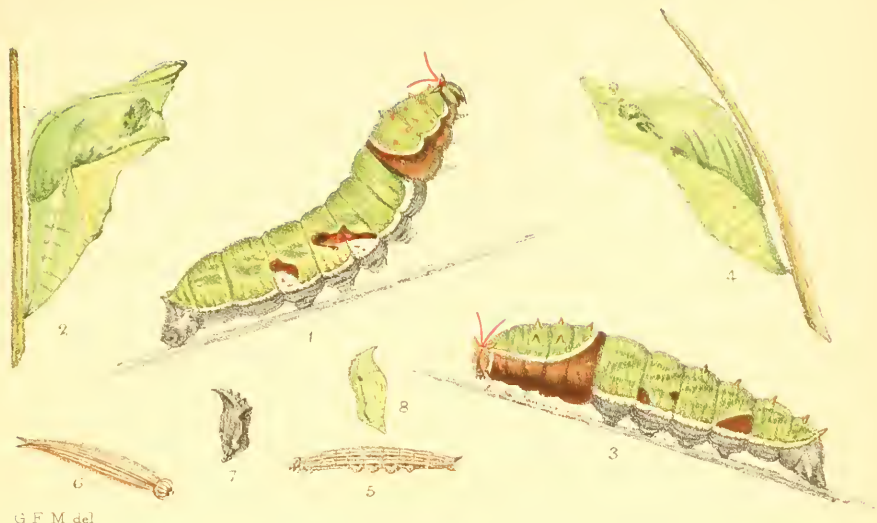
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