TRANSACTIONS and
PROCEEDINGS

OF THE

BOTANICAL SOCIETY of
EDINBURGH

VOLUME X.

EDINBURGH:
PRINTED FOR THE BOTANICAL SOCIETY.

MDCCCLXX

PRINTED BY NEILL AND COMPANY, EDINBURGH.

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LIST OF PLATES.

ERRATA.

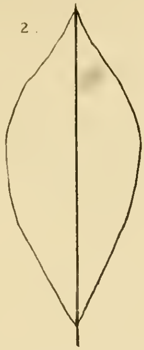
Page 28, line 27, *for* June 10 *read* March 11, p. 106.
,, 115, line 32, *for* xxv. *read* xxii.
,, 127, line 4, *for* Giardina *read* Giardini.
,, 127, line 7, *for* 180,000 *read* 60,000.
,, 130, line 34, *for* Custard apples *read* pomegranates.
,, 193, *Note*—Omit the words, "Dr Hooker, however, originally described it as a member of the *Cycadaceæ.*"

,, 335, to List of Plants *add*—
Bryum purpurascens?
Dicranum scoparium, var.
Hypnum Kneiffii, condensed form.
sarmentosum, var., with shorter leaves than usual.

FIG. 1.

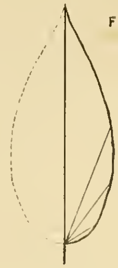
Rumex obtusifolius

FIG 2.



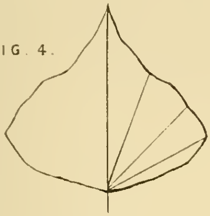
Symphytum officinale

FIG. 3.



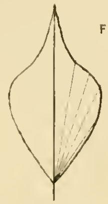
Laurustinus

FIG. 4.



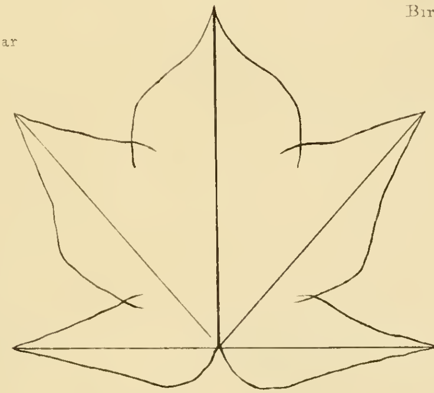
Lombardy Poplar

FIG. 5



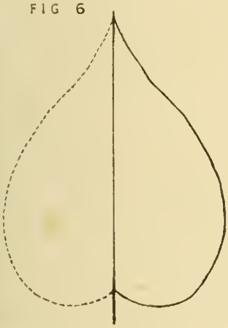
Birch

FIG. 9



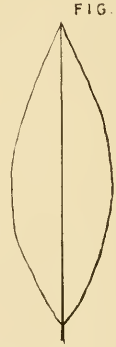
Pseudo-platanus

FIG 6



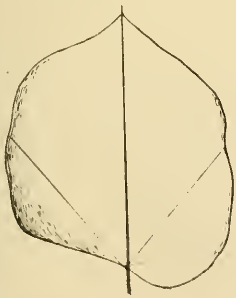
Syringa vulgaris

FIG. 7.



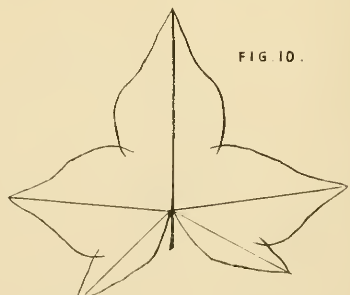
Ash tree, leaflet

FIG. 8.



Unequally sided Lime-tree leaf

FIG. 10.



Ivy

W H M^c Farlane, Lith^r Edin^r

Mr Mitchell on Equations for Leaves.

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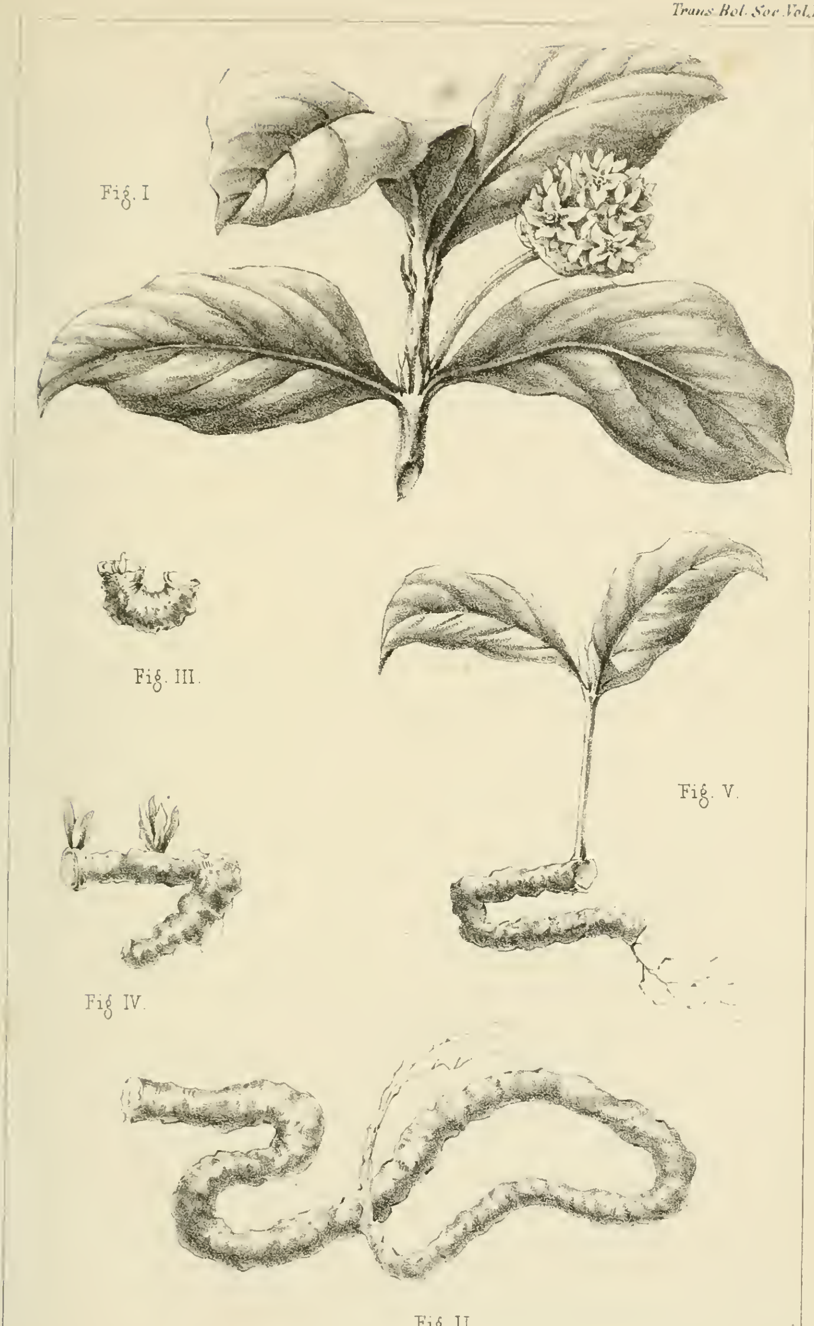

J. Mc N. delt

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Cephaelis Ipecacuanha, Rich.

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Taylor, R. H., M.D., 1 Percy St., Liverpool
Thomson, Prof. Allen, College, Glasgow
Thomson, Spencer, M.D., Ashton, Torquay
340 Thomson, Wyville, LL.D., Prof. of Geology Queen's College, Belfast
*Townsend, F., Shedfield Lodge, Fareham
*Traill, W., of Woodwick, M.D., St Andrews
Trevelyan, Sir Walter C., Bart., M.A., Wallington, by Morpeth
Tyacke, N., M.D., Westgate, Chichester
Vacy, Charles Kingford, M.D., Cornwall
Valentine, Colin S., M.D., Jeypore, Rajputana, India
Vanderbyl, Philip J., London
Veronge, Julius, M.D.
Vigor, A., Stonehouse, Cambridge
350 Waddell, Thomas, Cumbernauld
Walker, David, M.A., Colchester
Walker, V. E., Arno's Grove, Southgate, Middlesex
Wallich, George Charles, M.D., 17 Campden Hill Road, London
Ward, James, Richmond, Yorkshire
Watson, Hewett Cottrell, F.L.S., Thames-Ditton, Surrey
White, Alfred, F.L.S., West Drayton
*White, F. B. W., M.D., Perth
White, Frank Isa, M.D., F.L.S., Perth
Wight, R., M.D., F.L.S., Grazeby Lodge, Reading
360 Wilkinson, M. A. Eason, M.D., 21 Gore Street, Manchester
Wilks, G. A. F., M.D., Woodburn, Torquay
*Yellowlees, David, M.D., County Asylum, Bridgend, Glamorganshire
Young, Edward, Neath, South Wales
364 Young, Emanuel, North Shields

LADY ASSOCIATES.

Mrs Bain, Hillside, Montrose
The Most Hon. the Marchioness Cornwallis
Mrs Scrymsoure Fothringham, Fothringham House, Forfarshire
Miss Gage, Isle of Rathlin, Ballycastle
Miss Elizabeth Harvey
Lady Kane, 23 Lower Gloucester Street, Dublin
The Hon. Lousia Anne Neville, Audley End, Essex
Mrs Michael Percival
Miss Anna Maria Plowden
Mrs John Stewart, Nateby Hall, Lancashire

FOREIGN AND CORRESPONDING MEMBERS.

R. W. Arderne, Wynberg, Cape of Good Hope
John Erhart Areschoug, M.D., Professor of Botany, and Director of the Botanic Garden, Upsala
F. Marius Barneoud, Advocate, Toulon
F. Graf von Berchtold, Prague
H. A. Bolander, Botanist to the Geological Survey of California
Dietrich Brandis, Ph.D., Inspector-General of Forests, Calcutta
Alphonse de Brebisson, Vire (France)
Henry Hunter Calvert, British Vice-Consul, Alexandria, Egypt
Casimir De Candolle, Geneva
Robert Caspary, Professor of Botany, and Director of the Botanic Garden, Konigsberg
Baron de Castello de Paiva, M.D. (Paris), Professor of Botany, Lisbon
Dominique Clos, M.D., Prof. of Bot., Toulouse
F. S. Cordier, M.D., Paris
François Crépin, Professor of Botany, Ghent
Senhor Joachim Correa de Mello, San Paulo, Brazil
Hon. G. A. Cunningham, Mauritius
William Broughton Davies, M.D., Sierra Leone
Dr J. C. Grech Delicata, Malta
Frederick Adolphus Dietl, Vienna
George Dolliner, Idria
Senhor Adolph Ernst, President of the Natural History Society of Caracas
Antoine Laurent Apollinaire Fée, M.D., Professor of Natural History, Strasburg
Franz Xaver Fieber, Chrudim, Bohemia
A. Fischer, Wurtemburg
Geo. Ritter von Frauenfeld, Secretary of the Zoological and Botanical Society of Vienna
General von Gansauge, Berlin
F. Glocker, Brazil
Ch. H. Godet, Neufchatel, Switzerland
Dr Gottsche, Altona, Hamburg
M. Guthnick, Berne, Switzerland
Francis Seymour Haden, Grenoble, Isere, France
Joseph Haffner, M.D., Gratz, Styria
Oswald Heer, M.D., Professor of Botany, Zurich
Carl Friedrich Hellwig, Sommerfield, Berlin
Theodor Helm, M.D., Vienna
Ludwig Ritter von Heufler, Vienna
Archibald Hewan, M.D., 8 Minerva Street, Pimlico, London
Dr Hermann Hoffman, Giessen
Jas. Africanus Beale Horton, M.D., Sierra Leone
Louis von Houtte, Director of the Horticultural Garden, Ghent
Don Guilliermo Jameson, San Juan, formerly Professor of Botany, Quito
Edelstan Jardin, Cherbourg
H. Jewett, M.D., Drayton, Ohio, United States
Auguste le Jolis, Cherbourg
Mahomed Ali Katib, M.D., Egypt
Albert Kellogg, M.D., San Francisco, California
Albert Kölliker, M.D., Professor of Physiology, Würzburg
C. F. Kretschmar, Sonnewalde, Lusatia
Friedrich Traugott Kuetzing, M.D., Professor of Natural History, Nordhausen
François Lagger, M.D., Fribourg, Switzerland
Johannes Martin Lange, Professor and Director of the Botanic Garden, Copenhagen
C. B. Lehmann, Offenbach
Rev. Louis Leresche, St Cierge, sur Moudon, Switzerland
Wilhelm Ley, Military Apothecary, Juliers
Baron Justus von Liebig, Ph.D., Professor of Chemistry, Munich
Daniel Jerome Macgowan, M.D., Ningpo, China
C. F. Meissner, M.D., Ph.D., Prof. of Botany, Basle
Giuseppe Meneghini, M.D., Professor of Geology in the University, Pisa
Dr Molkemboer, Leyden
Mostapha Mostapha, M.D., Egypt
Ferdinand von Mueller, M.D. and Ph.D., Director of the Botanic Garden, Melbourne
Dr Müller, Emmerick-on-the-Rhine
Christian Munch, Basle, Switzerland
William Murray, San Francisco
C. Naudin, Member of the Institute of France, Paris
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M. René du Parquet, Paris
S. Louis Pisani, M.D., Malta
Chevalier J. C. Pittoni a Dannenfeldt, Gratz, Styria
J. E. Planchon, Sc.D., Director of the School of Pharmacy, and Professor in the Faculty of Science, Montpellier
Dr George August Pritzel, Custos of the Library, Berlin
L. Rabenhorst, Professor in Dresden
Dr L. Radlkofer, Professor of Botany, University of Munich
G. Reichenbach, jun., Professor of Botany, Hamburg
Rev. Alex. Robb, Old Calabar
Rudolph Benno de Roemer, Dresden
Dr Edouard Rostan, Vallée de Pérouse, Piedmont
Ferdinand Rugel, United States
Julius Sachs, Ph.D., Professor of Botany, Freiburg
J. L. Schaller, Fribourg, Switzerland
Antonio Schembri, M.D., Malta
Joseph J. Schiffer, Apothecary, Gratz, Styria
C. R. Schumann of Golzen, Apothecary, Lower Lusatia, Prussia
C. Sinz, M.D., Naples
Otto Wilhelm Sonder, Ph.D., Hamburg
Mahomed Ali Soubki, M.D., Egypt
Rev. W. C. Thomson, Old Calabar
G. H. K. Thwaites, Ph.D., F.R.S., Director of the Royal Botanic Garden, Peradenia, Ceylon
Edward Tuckermann, LL.B., Amherst, U.S.
Robert de Visiani, Professor of Botany, Padua
Friedrich Welwitsch, M.D., London
William Wilson, Paddington, Warrington
Ph. Wirtgen, Coblentz

ASSOCIATES.

Wm. Bell, Herbarium, Royal Botanic Garden
Robert Boyle, Australia
F. Y. Brocas, 4 Mill St. Conduit St. London (W.)
John Brown, West Princes Street Gardens
Alexander Croall, Museum, Derby
James Boyd Davies, Museum of Science and Art
Chas. Dunn, 2 Hanover Place, Clifton, Bristol
Peter Gray, Caithness
Charles Howie, Eden Cottage, Largo
Andrew Kerr, Montrose
John Laing, Nurseryman, Foresthill, London
William Graham M'Ivor, Ootacamund
T. M'Nab, Canada
Adam Matheson, Jedburgh
William Mitchell, 15 Upper Grove Place
George Morris, Chester
William Mudd, A.L.S., Cambridge Bot. Garden
Robertson Munro, Portobello
William Pamplin, A.L.S., Llanderfel, Corwen
Charles William Peach, A.L.S., 30 Haddington Place
James F. Robinson, Frodsham, Cheshire
John Sadler, F.R.P.S., Royal Botanic Garden
John Scott, Darjeeling, India
William Shaw, Gunsgreen, Eyemouth
John Sim, 9 Commercial Street, Perth
Neil Stewart, 11 West Richmond Street
John Thompson, Newcastle, Northumberland
Adam White, Tower Street, Portobello

Societies and Universities to which the Society's Transactions are sent.

Alloa, Society of Natural Science and Archæologia

Bonn, Natural History Society
Boston (U.S.), Society of Natural History

Cambridge, University
Caracas, Natural History Society
Cherbourg, Natural History Society
Christiania, University
Copenhagen, Botanical Society

Dublin, Natural History Society
Dublin, Trinity College

Edinburgh, Advocates' Library
Edinburgh, Geological Society
Edinburgh, Royal Society
Edinburgh, Royal Medical Society
Edinburgh, Royal Physical Society
Edinburgh, Royal Scottish Society of Arts
Edinburgh, University

Florence, Nuovo Giornale Botanico Italiana, (Editors)

Glasgow, Natural History Society
Glasgow, Philosophical Society

Königsberg, Physico-Economical Society

Lisbon, Academy of Natural Sciences
Liverpool, Literary and Philosophical Institute
London, British Museum
London, Linnean Society
London, Pharmaceutical Society of Great Britain
London, Quekett Microscopical Club
London, Royal Horticultural Society
Lund, University

Manchester, Literary and Philosophical Society
Montreal, Natural History Society

Newcastle, Tyneside Naturalists' Field Club
New York, Lyceum of Natural History

Oxford, University

Paris, Botanical Society of France
Perth, Perthshire Society of Natural Science
Philadelphia, Academy of Natural Sciences

Victoria (Aust.), Royal Society

Washington, Smithsonian Institution
Westphalia, Natural History Society

Copies are also sent to British and Foreign Honorary Members.

LAWS AND BYE-LAWS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

I. LAWS OF THE SOCIETY.

CHAPTER I.

FUNDAMENTAL LAWS.

1. The Society shall be denominated "The Botanical Society of Edinburgh."

2. The object of the Society shall be the advancement of Botanical Science, by means of periodical meetings, correspondence, and the mutual interchange of specimens amongst its Members.

3. The Society shall consist of Honorary, Resident, Non-Resident, Foreign, and Corresponding Members, who shall have the privilege of denominating themselves Fellows of the Society; also of Associates; and of Ladies, who shall be denominated Lady Associates.

CHAPTER II.

ORDINARY MEETINGS.

1. A meeting of the Society shall be held on the second Thursday of every month, from November to July inclusive.

2. The following order of business shall be regularly observed:—

PRIVATE BUSINESS.

1. Chair taken.
2. Minutes of preceding Meeting read.
3. Report of Council read.
4. Applications for admission read.
5. Members proposed at preceding Meeting balloted for
6. Motions intimated at previous meetings discussed.
7. New motions intimated.
8. Miscellaneous business.
9. Society adjourned.

PUBLIC BUSINESS.

1. Chair taken.
2. Minutes of preceding Public Business read.
3. Papers and Communications for next Meeting announced.
4. Laws signed by new Members.
5. Specimens, Books, &c., presented.
6. Communications and Papers read.
7. Society adjourned.

CHAPTER III.

EXTRAORDINARY MEETINGS.

1. An extraordinary Meeting of the Society may be called at any time, by authority of the Council, on the requisition of three or more Resident Fellows.

CHAPTER IV.

ADMISSION OF MEMBERS.

SECTION I.—HONORARY MEMBERS.

1. The Honorary Members shall be limited to six British and twenty-five Foreign;—by British, being understood British subjects, whether resident in this country or not.

2. The Council shall have the privilege of proposing Honorary Members,—the names of the gentlemen proposed being always stated in the billets calling the Meeting at which they are to be balloted for. Three negative balls to exclude an individual.

3. Any Member may submit to the Council the names of individuals whom he would wish proposed as Honorary Members; and should the Committee decline to bring these forward, he may demand that they be balloted for.

4. Honorary Members shall be entitled to all the privileges of Resident Fellows.

Note.—Honorary Members receive copies of the "Transactions."

SECTION II.—RESIDENT FELLOWS.

1. A candidate for admission into the Society, as a Resident Fellow, must present an application, with a recommendation annexed, signed by at least two Resident Fellows. The application shall be read at the proper time during private business, and at the next Ordinary Meeting shall be determined by a majority of at least two thirds, provided fifteen Fellows are present.

2. Resident Fellows shall, on admission, sign the Laws, and pay the sum of Twelve Shillings and Sixpence to the funds of the Society; and shall contribute Twelve Shillings and Sixpence annually thereafter at the

November Meeting. Resident Fellows are entitled to receive the "Transactions" yearly as published.

3. Resident Fellows may at any time compound for their annual contributions, by payment of Five Guineas. They shall be entitled to receive the Transactions yearly as published.

4. Resident Fellows leaving Edinburgh, may be enrolled as Non-Resident Fellows, if they have paid, besides their Entry-Money, eight annual contributions ; or after that period, on payment of all arrears due at the time of their departure. They shall be entitled to receive the Transactions.

5. The Society shall from time to time adopt such measures regarding Members in arrears as shall be deemed necessary.

SECTION III.—NON-RESIDENT FELLOWS.

1. Any person not residing in Edinburgh may be elected a Non-Resident Fellow, on being recommended by two Members of a Scientific or Literary Society, and paying a contribution of Three Guineas. From such no annual payment is required.

2. Non-Resident Fellows wishing to become Resident, must be balloted for, pursuant to Sect. 2, Law 1, but shall be exempt from payment of Entry-Money. In the event of any such Candidate being black-balled, his name shall be struck out of the List of Members. Non-Resident Fellows, by payment of Two Guineas additional, shall be entitled to receive the "Transactions" yearly as published.

3. Non-Resident Fellows coming to Edinburgh shall, for a period of two months, be entitled to attend the Meetings of the Society, and participate in the other privileges of Resident Fellows ; after which, should they remain longer, they must become Candidates for Admission, and, if elected, pay the same annual contribution as Resident Fellows. Non-Resident Fellows must arrange with the Vice-Secretary for the transmission of their copies of the "Transactions," and the receipt of them must be acknowledged.

SECTION IV.—FOREIGN MEMBERS.

1. Any person residing abroad may be admitted a Foreign Member on the transmission of 500 specimens of Plants (including at least 100 species), or a Botanical work of which he is the author. If the former, he will be entitled to specimens from the Society's collection in exchange.

SECTION V.—ASSOCIATES.

1. The Society shall have power to elect by ballot Associates from those who, declining to become Resident or Non-Resident Fellows, may have acquired a claim on the Society by transmitting specimens or Botanical communications.

SECTION VI.—LADY ASSOCIATES.

1. Any Lady, whether Resident or Non-Resident, may become a Member for Life, on payment of a single contribution of Two Guineas.

Note.—Diplomas may be procured from the Vice-Secretary, the sum payable being Five Shillings, besides Two Shillings for a tin case. But no Fellow shall be entitled to receive a Diploma until his contributions shall amount to Three Guineas.

CHAPTER V.

OFFICE-BEARERS.

1. The Office-Bearers of the Society shall consist of a President, four Vice-Presidents, ten Councillors, a General Secretary, an Assistant-Secretary, and a Foreign Secretary, a Treasurer, an Auditor, a Curator, and an Artist ; who shall be elected annually, by means of signed lists, at the Ordinary Meeting in December. All of them may be re-elected except the two senior Vice-Presidents, and the three senior Councillors, who shall not be re-eligible to the same offices till after the interval of one year.

2. These Office-Bearers shall together form a Committee of Management or Council for the general direction of the affairs of the Society. Three to be a Quorum.

3. This Council shall nominate two Sub-Committees from their number,—one as a Finance Committee to assist the Treasurer in the management of the Society's Funds,—the other as a Museum and Library Committee to assist the Curator in these departments, and in the distribution of the Society's Duplicates.

4. Agreeably to an Act of the Town Council of the City of Edinburgh, dated January 8, 1839, the Professor of Botany in the University of Edinburgh is constituted Honorary Curator *ex-officio*, with free access to the Society's Collection, whether a Member of the Society or not.

CHAPTER VI.

THE PRESIDENT AND VICE-PRESIDENTS.

1. It shall be the duty of the President and Vice-Presidents when in the chair, and of the Chairman in their absence, to conduct the Business of the Society according to the order of the Business laid down in Chap. II. Law 2, and to attend carefully to the enforcement of the Laws of the Society.

CHAPTER VII.

THE SECRETARIES.

1. The General Secretary, or in his absence the Assistant-Secretary, shall give intimation of all General and Committee Meetings, shall Minute

their Proceedings in Books to be kept for the purpose, and shall conduct all the Society's Correspondence in Britain. The Foreign Secretary shall have charge of all the Foreign Correspondence.

CHAPTER VIII.

THE TREASURER AND AUDITOR.

1. The Treasurer, subject to the inspection and control of the Finance Committee, and the Auditor, shall receive and disburse all Money belonging to the Society, granting the necessary Receipts, and Collecting the Money when due. He shall keep regular Books of Accounts, and present them for inspection at each Ordinary Meeting.

2. It shall be the duty of the Treasurer to place all money belonging to the Society in one of the Chartered Banks of this City, unless the same shall have been ordered by the Society to be otherwise invested ; and he shall never keep more than Ten Pounds of the Funds of the Society in his hands at a time. The Bank Account shall be kept in the name of the Society, and all drafts thereon shall be signed by the Treasurer, and countersigned by the Convener or a Member of the Finance Committee.

3. The Auditor shall, at the December Meeting, submit a certified statement of the receipts and expenditure for the past year.

CHAPTER IX.

THE CURATOR.

1. The Curator shall have charge of the Society's Specimens, Museum, and Library, and, with the assistance of the Museum and Library Committee, shall arrange, classify, and keep a Catalogue or other account of the same.

2. In the arrangements of the Society's duplicates for distribution, the Curator is authorised to adopt that system which experience shall prove to be best adapted for carrying into effect the views and intentions of the Society in respect to these, and for meeting most effectually the wishes of Members in reference to the supplying of their desiderata. It is at the same time recommended that he should classify Foreign Plants according to their respective countries, to accommodate more easily those Members who assign a preference to the Botany of any particular country.

CHAPTER X.

THE COUNCILLORS.

1. Besides the duties already assigned to them as Members of the Committee of Management, the Councillors shall appoint three of their number.

including the President and General Secretary, to superintend the printing of the Transactions of the Society.

2. The Council may at any time be called upon by the President, Vice-Presidents, or Secretaries, to meet with them for the transaction of private business.

CHAPTER XI.

VISITORS.

1. Each Member shall have the privilege of admitting one visitor to the ordinary Meetings of the Society, at the close of the private business.

CHAPTER XII.

MAKING AND ALTERING LAWS.

1. When a motion is made for the alteration of existing Laws, or the enactment of new ones, it shall lie over till next ordinary Meeting, and if then approved of by two-thirds of the Members present, shall be held as carried. The purport of such motion to be stated in the Billets calling the Meeting at which it is to be considered.

II. BYE-LAWS AND REGULATIONS.

1. The distribution of the Society's duplicates shall be conducted by the Curator, with the assistance of the Museum Committee.

2. To entitle a Resident Fellow to a share of the Society's British duplicates, it is requisite that he shall not be in arrear, and shall have transmitted to the Society not less than fifty species of Plants, with as many duplicate specimens of each as possible. He must also communicate to the Secretary, at the same time, a signed list of his desiderata.

3. The same regulation shall also apply to Non-Resident Fellows and Associates.

4. Foreign Members must, subsequent to the year of their admission (see Laws, Chap. IV. Sect. 4.), transmit 300 specimens, including at least 50 species, in order to entitle them to a share of the Society's duplicates.

5. National Institutions, Universities, and Chartered Societies, forming Herbaria, and corresponding with the Society, shall be permitted to take precedence of the Members at the distributions; and all other Societies shall have specimens supplied to them in the order of their application on the same conditions, and in the same routine, as Members.

6. Any Member may commute his contribution of specimens at the rate of One Pound for 100 species; being entitled for each Pound to claim 200 species of British, or 100 species of Foreign Plants in return.

7. Members who contribute less than 500 specimens of British Plants, or have not commuted their contributions as above-mentioned, shall be entitled to British Plants only in return.

8. Any Member who contributes 500 specimens of British Plants, including at least 100 species, shall be entitled to a portion of the Society's Foreign Plants, *if desired*, but only at the rate of 100 species of Foreign for each 500 specimens of British Plants so contributed.

9. If the Society shall be unable adequately to supply the desiderata of any Member *not wishing Foreign Plants*, it shall be in the power of such Member either to take his parcel as made up, or allow it to lie over till the following year's distribution, in which it shall be placed according to his order in the list, without any farther contribution being required for that year ; this privilege, however, not to extend beyond three consecutive years.

10. Any Member about to leave Britain for some time, without the prospect of communication with the Society, on depositing along with his list of desiderata, a written promise of collecting for the Society during his absence, shall be entitled to his share of the duplicates in the same order and quantity as if he were present, in exchange for the specimens which he may present.

11. No Member shall be entitled to claim more than double the number of species he has contributed.

12. The Museum Committee are empowered to reject all bad and imperfect specimens in determining the number of species to which Members shall be entitled in return for their contributions.

13. After supplying the *desiderata* of Members, the Committee is authorised, in the farther distribution of the duplicates, to take into account the number and value of the specimens sent by any correspondent, and to assign him a preference accordingly.

14. All specimens issued by the Society shall be accompanied by labels having the words, "Societas Botanica Edinensis," with the name of the plant, locality, date of collecting, and donor's name, written or printed thereon.

15. An Herbarium shall be formed for the use of the Members of the Society, to which easy access may always be obtained for the purposes of consultation or reference, subject to such regulations as shall from time to time be found expedient. In the formation of this Herbarium, the Curator, and Museum Committee, shall have the power to select from all specimens sent to the Society such as they may think desirable to retain for that purpose.

16. The Society shall also have in view the formation of a Botanical Library and Museum, by means of donation and purchase.

17. No purchases of Books or Specimens for the Society's Library or Museum exceeding Two Pounds in value shall be made until the same shall have been approved of at an Ordinary Meeting.

18. The Secretary shall keep lists of all the Members of the Society, with the date of their admission, of the communications which shall be brought before it, of those from whom parcels of Plants are received, and of all Books, Specimens, &c., presented to, or purchased by the Society, and shall

keep a regular record of all the correspondence which he carries on for, or in name of the Society.

19. Intimation of all papers to be brought before the Society, must be given to the Secretary eight days at least previous to the Meeting at which they are to be read.

20. Any Member may transmit to the Society papers and communications, which, if approved of by the Council, may be read by the author, or, in his absence, by the President or Secretary at any of the Ordinary Meetings.

21. The Society shall print annually its Proceedings and Transactions (including a List of its Members).

III. GENERAL VIEWS AND OBJECTS OF THE SOCIETY.

The attention of the Society is turned to the whole range of Botanical Science, together with such parts of other branches of Natural History as are more immediately connected with it, and these objects are cultivated :—

1. By holding periodical Meetings for the interchange of Botanical information,—for the reading of original papers, or translations, abstracts or reviews of Botanical works, regarding any branch of Botanical knowledge, practical, physiological, or geographical,—and the application of such knowledge to Agriculture or the Arts.

2. By publishing in the Proceedings or Transactions of the Society, a selection of the papers read at the meetings.

3. By the formation in Edinburgh of an Herbarium of Foreign and British Plants, and of a Library and Museum for general consultation and reference.

4. By distributing annually amongst the Members the duplicates received, and thus contributing to the formation of authenticated Herbaria wherever the Society's correspondence extends, and affording to Botanists at a distance, opportunities of comparison and reference as accurate as are enjoyed by those having access to the Herbarium in Edinburgh.

5. By printing and distributing annual summaries of the Society's proceedings.

6. By printing from time to time Catalogues of Plants, with the view of facilitating the study of their geographical distribution, and furthering the principle of exchange.

7. By making Botanical excursions both in the neighbourhood of Edinburgh and to distant parts of Britain.

8. By appointing Local Secretaries, from amongst the Members of the Society, from whom, in their respective districts, all information regarding the Society's objects and proceedings may be obtained.

TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

SESSION XXXIII.

12*th November* 1868.—Charles Jenner, Esq., President, in the Chair.

Donations to the Library, Herbarium, and Museum of the Royal Botanic Garden were laid on the table.

The President delivered the following Opening Address:—

Elected by your favour to the highly honourable position of President of this Society, I essay, though with much diffidence, to acquit myself of the duty which by custom seems to belong to the office. I am engaged daily, as all around me know, in very active commercial labours, and have pursued the study of botany, only as an interesting and instructive occupation wherewith to fill up my leisure hours. If I could have found it at all consistent with my duty, I should have declined the task of this evening, for I did not see upon what branch of botany I could venture to offer any remarks of interest to the members of this Society. After much careful thought, however, it has appeared to me that I could serve the interests of Botany by setting forth to-night some of the advantages to be gained by making it a branch of ordinary mental training. This subject has long engaged my attention.

I have derived much pleasure and satisfaction from the study of plant life. It has had an important bearing on my general train of thought, and I would wish to induce others to labour in the same field, in the fullest confidence that they will find in doing so a very rich reward. This seems, moreover, by no means an inapt moment for us as a Society to set forth the high purposes to be attained by making the study of Botany a part of every man's education. Science, with a view principally to its industrial application, is making great advances in public estimation. There may be room to fear that this direction of scientific research may be too absorbing. Government, through the Science and Art Department, encourages the working classes to devote their leisure to scientific studies; and botany is one of those for proficiency in which it is willing to give prizes. In such circumstances we should, I think, set forth the high mental and moral purposes which a study of organic nature in particular may be made to subserve. The study certainly encourages industry and patient application; it imparts a sober, serious tone of earnestness to the mind; it inculcates habits of orderly arrangement, which reflect themselves in the incidents of daily life; and it encourages a love of the true and the beautiful, each for its own sake.

To be brought within the influence of the true, the good, and the beautiful, as these are manifested in the phenomena of the organic world, is as beneficial for the mind of man as air, light, and heat are for his physical frame.

When we first give our attention to Nature and her phenomena, we are not more struck with the illimitable which prevails everywhere than we are with the amazing and even perplexing diversities; and these diversities are scarcely less perplexing to the thoughtful young observer of to-day, than they were to kindred classes of minds in the earliest times. All-powerful forces, also, are found to pervade the universe, forming and shaping all things. These potentialities are ascertained to be determinate in their action. Their direction and intensity can be, under given conditions, exactly calculated upon. What seem causes, invariably, under the same circumstances, produce the same effect. Whether these forces are innate to material atoms of the universe, or whether they are manifestations of an intelligent supreme mind, was a disputed question in the dawn of human thought, at which we may not wonder, but it continues to be so down to our own day.

To arrange and classify the objects of nature, to distinguish between things different, and to recognise common resemblances, to investigate the properties and powers of objects, has been the work of great scientific men in all times. This study must be pursued by every inquirer who desires to inform himself on this wide subject. The advantages we possess in our time render the acquisition of this knowledge a work of comparative facility. The study of a system of classification is a healthy mental exercise. We have a noble heritage in the intellectual wealth of all past time. It comes to us in the form of educational institutions, books, and scientific instruments. We have other advantages also. Many questions that vexed, disturbed, and retarded the progress of science have been definitely settled, and we start now on our inquiries from vantage-ground that can scarcely be too highly valued. The most admirable facilities are offered for elementary instruction, by means of engraved representations of objects, models, and photographic pictures. Then, also, we have the microscope, with all its modern appliances and improvements. This instrument is of as much importance in the investigation of the more recondite and subtile processes of vitality as the telescope is in astronomical researches.

The first division of nature is into the organic and the inorganic.

Organic nature is our department of study,—the first great division of which is into *animals* and *plants*. There is, it is true, a substratum of mysterious vital atoms which, in the present state of our knowledge, cannot with any certainty be referred to either the vegetable or the animal kingdom. They are not visible even in masses to the naked eye. They are colourless, and their substance is, or seems to be, amorphous. The best magnifying glasses fail satisfactorily to resolve them. They seem to be on the very borders of the intangible. They are vastly important in the solution of any question as to vitality itself, but at present we are too ignorant of their nature and of the vital principle they represent to affirm more concerning them.

Like the root of the great tree Idrasgil, in the Norse mythology, the tap-root of vitality extends down to that great spiritual substratum whence all life springs. In its manifestations it becomes palpable to sense, but its origin must be sought for in the world of thought. All that we of a surety know is that the two great diverging lines of organic development converge in their simpler forms, if not in their origin, into common forms which may belong to both or either. Further investigations may determine the place in nature of some disputed denizens, but the fact in all probability will ever remain, that an intangible will be found to underlie the tangible, a transcendent lie beyond the appreciable. So surely as that we are finite, and that nature is a manifestation of the infinite, it will continue to be thus.

Botany is the scienceof the vegetable kingdom. Regarded as such, it is a wide subject. Its study interests man in various ways, according to the object he may have in view. I propose to-night to speak of the science under two aspects. One of these has for its special end the economical purposes to which plant-products can be applied; and this is called Applied Botany. It is an art rather than a science. It is the art of application. The other is the purely scientific. The study of botany is, then, the study of organic nature in one of her great departments, in order to arrive at a knowledge of the laws that govern the phenomena. The value of industrial or applied botany to man for all purposes of his life can scarcely be overrated. Our food is directly or indirectly drawn from the vegetable world; from the same source we derive a very large proportion of our constructive materials, whether for dwellings, attire, or other purposes of commerce. Plants yield all our fuel—coal, wood, and peat. The value to man of medicinal plants is better known to many here than to me. And besides all this, for a thousand purposes of need or fancy the plant kingdom ministers to man and his requirements. The world is under *deep* obligations to the able men who devote themselves to this department of botany for the services they render. The study of plants for their economic applications is a very useful business in life. The study of them, with a view solely to understand the manifestations of life in nature, is rather an occupation for the leisure of men. In support of the opinion that botanical studies elevate the mind, and to justify any conclusions we may draw, it seems desirable to review the vegetable kingdom in some brief manner at least. A preliminary statement of some of the more important conditions and processes in plant life may enable us, on the whole, to be concise, and yet clear.

1. The structural development of plants is of the first importance, and the individuality of the plant is constituted by it.

2. Second only in importance is the reproductive process. The continuation of the race depends upon this.

3. These elementary considerations lead to the question of embryonal development.

With regard to structural development, the lowest forms of plants are cells, and all the classes of lower plants are but repetitive developments of cells, and are thence called cellular. Cells vary from each other in many ways, and according to the nature of the cell is its method of multiplication. The various forms of structure that arise are due to this cause. As we rise to the plants of a higher order, structural differences appear, the homogeneous cellular tissue differentiates or passes into higher forms of cells, vessels, woody fibre, &c. These are called vascular plants. Speaking in a general way, before plants reach higher structures they pass through the more simple conditions of the forms below them, which may represent, as some authors have supposed, arrested stages of development. Plants are reproduced in two ways—by a vegetative method and a sexual method. The vegetative method is by the detachment from a plant of a vegetative cell, which has the power of development into a new plant. It is separated as a single ciliated cell which can move about, as zoospores or gonidia in the lower Algæ, but is detached in a more or less advanced condition in the higher Algæ, and in plants generally of more advanced structure. This form of reproduction is a very common method of increase among plants. In the lowest it is, so far as we know, the only method. These simple plants—Lyngbya, for instance—break up or divide into parts; each part develops into a plant such as that from which it was derived.

The sexual method of reproduction in plants was regarded at first, and still remains, one of the most extraordinary occurrences in nature. Our knowledge on the subject is quite a recent acquisition, and all that we know about it is due to the assistance we gain from the microscope. Although the sexual organs, in the two great divisions of the vegetable kingdom, the Cryptogamia and the Phanerogamia, differ very much from each other in structure, form, and mode of action, there is an essential unity in the purpose to be served, and the way in which it is attained. The essential female organ is a germinal vesicle, which is common to Phanerogams, as well as to all Cryptogams that rise above the very simple forms. The structures within which this vesicle has its origin are very simple in the sporangia of Algæ; more complex, but still comparatively simple, in the archegonia of the higher Cryptogams; while in the Phanerogamic plants it arises within organs of the most varied forms and complicated structures. In this respect no two genera are exactly alike. Some are simple, but others show the most strangely involved and intricate conditions. By whatever name the female organ is known, under whatever circumstances it is presented, the germinal vesicle is the one thing necessary, and its fertilisation the one object to be attained.

The male organs of plants are varied in their structure and forms, and so are the bodies that originate within them, and by means of which the fertilising influence is communicated to the germinal vesicle. The object is attained in two ways, according to the nature and structure of the female organ. In the Cryptogamia, when access to the germinal vesicle is obtained by an open canal, the fecundating element is embodied in a motile body of delicate substance, furnished generally with cilia, which give it the power of considerable activity and rapid motion; these find their way by the opened neck of the archegonium to the cavity at its base, where the germinal vesicle lies as in a chamber. In Phanerogamic plants the medium of impregnation is the pollen cell. The pollen cell, having reached the stigma, a filament protrudes, which elongates and finds its way with unerring certainty, by courses often devious, though never uncertain, to the foramen of the ovule, where it impinges on the germinal vesicle, and communicates the fecundating matter or principle.

We are now brought to the subject of embryonal development. The complicated ovular arrangements within the higher plants, and the enclosure of seeds within a seed-vessel, serve a high purpose in the economy of plant life. The plants in which these arrangements prevail are the most important in the vegetable kingdom. The development of the plant rudiment, which follows upon the fertilisation of the germinal vesicle, takes place within the ovary; and it attains to comparatively high stages of structural development while it is still in connection with the parent organism, from which it receives its nutriment. The envelopes that surround the embryo are provided by the parent; concentrated nutrient materials are stored within its reach, and when at length the connection between parent and scion is severed, and the young plant is placed in circumstances to begin its independently active life, it utilises the parental supplies until its further development enables it to supplement its requirements from the air and soil. In all plants lower than the Rhizocarpeæ, very limited nutrient aid is afforded to the rudimentary plant by the parent. In the Rhizocarpeæ (which form such a very important link in this, as in other respects, between Ferns and the Coniferæ, as the Coniferæ do between the Rhizocarpeæ and Phanerogamous plants) a transient connection only is maintained; while in plants still lower, the new young life is thrown upon its own resources almost as soon as the impregnation of the germinal vesicle has given it an individuality.

Plants may even now be most conveniently arranged into Cryptogamia and Phanerogamia, although the term Cryptogamia has lost its meaning for us as a word. It means concealed modes of reproduction, but by the improved power of vision afforded by the microscope, the processes have become palpable, and we can now follow them with the same precision that we can those of the Phanerogamia, which is an expressive term for those plants whose organs of reproduction are conspicuous.

The plants classed under the Cryptogamia are very various in their form and structure. *The higher* are represented by Ferns, Equisetums, and Lycopodiums. They have a cortical layer, vascular bundles, woody fibre, as well as parenchymatous tissue; while *the lower forms* are either single cells, or simple forms of cellular aggregation or multiplication. The intermediate conditions and forms show the ascending stages of development which characterise the vegetable kingdom. Setting aside the lowest forms, all the Cryptogamic plants fertilise the germinal vesicle by means of the motile body I have referred to, which is inscrutably subtle in its nature, intangible in structure, active in its motion, delicate, transparent, and colourless. The chambered recesses, termed female organs, within which the germinal vesicle is evolved, differ very much in form from one another, becoming more complex as the higher stages are attained. A cystose or capsular envelope is provided for the rudimentary plant in the higher Algæ, as well as in the highest orders of the vascular Cryptogams. The Cryptogamic cellular plants include all between the most simple cellular structures and the Ferns. Beginning with the lowest, in ascending series, we have Algæ, Lichens, and Fungi. The Liverworts, Jungermanniaceæ, and the Mosses follow in consecutive elevations: Our onward consideration introduces us now to a higher order of structures, still Cryptogams, but they have become vascular. In these plants the cellular parenchyma has attained to the power of differentiating itself into vessels, scalariform at first, but passing quickly into spiral vessels. These are Ferns, Equisetums, and the Rhizocarpeæ, with which the spermatozoidal method of fertilisation ends, and also the merely capsular envelopes for the embryo.

In the Algæ that grow in fresh water, and they have their marine representatives, we have at least three different cellular structures, reached by as many different methods of cell multiplication, and these lowly structures represent as many kinds of individual cells. In their unicellular stage, although they possess special potentialities, they are not distinguishable from each other. They are readily recognisable, however, when a very little advanced in growth. These three typical forms are the Globuliferæ, the Filiformæ, and the Nostochinæ. The Globuliferæ are free, spherical, or oval cells, always immersed in gelatine or mucus, of a more or less dense consistency. The cells are solitary in Palmella, associated in twos, or fours, or multiples of fours, within a large spherical retaining cell, as in Glæocapsa, and multiples of such cells are retained within a common cell in Botryocystis. The same principle of cellular multiplication and association, within a gelatine that holds the free cells together, spreads out into a flat frond in Ulva, obtains a branched tree-like form in Hydrurus, is tubular in Enteromorpha, and broadly saccate in Tetraspora. The Filiformæ are a second typical form of simple cell increase. Even in the earliest stages of development, the cells are longer or shorter cylinders, placed end to end in single rows, or a single cell extends greatly lengthwise; these latter are called Siphonia, and Vaucheria is a good example. Lyngbya and Zygnema are examples of the former. Branched forms too arise, simple in Cladophora, of beautiful tree-like forms in Draparnaldia and Chætophora. The Nostochinæ offer the third typical form. They are plants composed of globular cells, arranged as beaded filaments. They form amorphous gelatinous strata in Anabaina; definitely formed gelatinous balls, or foliaceous fronds, in Nostoc; are immersed filament by filament, in an elongated spiral sheath, in Monormia; and numerous filaments form one bundle, in a matrix of mucus, in Trichodesmium. The gelatinous investment, which is such a very important character in the lower Algæ, continues to hold this relative position in all the higher Algal structures. In many of them it constitutes the principal substance of the plant; in others it appears as an enormously thickened cell wall; it is soft and flexible, but tough, and adapted to live in a medium like water. The conditions in which these plants are placed may have influenced the direction of their development, which may also have been limited by those conditions. The vegetative structures of the higher Algæ are only variations of the simple form of cell multiplication; they offer no indication whatever of that differentiating power which constitutes the distinguishing characteristic of the cellular and vascular plants that live on the dry land. In ascending from the lower forms of Algæ, to the structural culminations of the Melanosporeæ and the Rhodosporeæ, we find a curiously increasing intricacy in the form of the organs intended to secure the impact of the germinal vesicle by the antherozoid.*

I do not in the course of my observations refer to the Diatomaceæ, the Desmidiaceæ, or to Urococcus, Petalonema, and Arthronema, nor to the Fungi, or the Lichens, or Chara, because the knowledge we have of them is too crude and indeterminate.

Of the cellular plants that live on the dry land, Anthoceros, the lowest member of the tribe of the Liverworts, is one of the most simple as well as one of the most common. It is a small, prone, frondose, green plant, about half an inch in diameter when fully grown, yet it manifests structural conditions higher than any of the Algæ. The principle of cell multiplication is that which usually obtains in the more highly organised plants. Cells, over a comparatively wide area, act in concert too, contemporaneously it may be or consecutively, for the attainment of a common end to an extent not hitherto observable. Anthoceros is at first ovate-oblong, with an irregular dichotomous ramification, but by amalgamation of the shoots it obtains a circular form. The formation of the antheridia in this genus, though simple in comparison with those that follow in structures a little higher, illustrates the consentaneous action of many cells in the formation of an organ in which they are only indirectly interested. Sixteen cells of the upper layer of a young shoot separate themselves from the underlying tissue; a small lenticular cavity is thus formed; a basal cushion is next constructed by the continued division of the basal cells of the cavity by septa, vertical, longitudinal, and transverse; a few of the cells so formed rise into the cavity as short hemispherical papillæ; in each case a septum divides the protruded portion from the cell that gave it origin. Then follow within each of these hemispherical cells a series of cell divisions, radial, longitudinal, and transverse. The result in each case is the formation of a clavate body,

* The processes of growth and reproduction can be followed with great facility in the Algæ. They are nearly all quite translucent; they can be seen through and through while living in their natural conditions, and by means of the microscope the wonders of organisation can be penetrated.

having a cortical layer of flattened tubular cells, and a central spheroidal mass of small quadrangular cells, each of which contains a delicate helicoid filament of from two to three and a half turns. This is a spermatozoid, whose nature leads it to find the germinal vesicle. The formation of the archegonia in Anthoceros is very simple, but it illustrates the fact of cells acting in concert. A cell within the tissue of the upper side of a young shoot, about five cells down, swells out; within it a free daughter cell is formed. The cells that separate this daughter cell from the surface of the frond are dissolved, and leave a hexagonal opening which is traversed by the spermatozoon, and fecundation of the daughter cell or germinal vesicle is effected.

I must not linger over the interesting processes of growth and reproduction in the succession of higher plants that follow Anthoceros. Every succeeding genus of the Hepaticæ, as well as of the leafy Jungermanniaceæ, shows some superadded organ to fulfil some new function. Instead of being immersed in the frond, archegonia of the most elegant forms rise from the surface, and a perigone or floral envelope is provided by the tissues, contiguous to the organ of fructification. Even in Anthoceros the surface of the frond is punctured with pores; but in Marchantia these simple punctures give place to stomata of extraordinary beauty, which are in communication with air cavities. Rudimentary leaves on the flat under surface of these leafless plants indicate, in a way the student of nature well understands, that structural elevation will soon result in a plant with a leafy stem. These leafy stems arise in the Jungermanniaceæ. The prone forms of the leafless frondose Hepaticæ are followed by the half-erect leafy stem. The fruit capsule in Anthoceros is a closed cyst, which at maturity ruptures irregularly in the higher Liverworts, and in the Jungermanniaceæ the fruit is a capsule, that opens by means of special valves. Special organs, called Elaters too, which, from their form and structure, serve to disperse the spores, appear in most of these plants. In Mosses, we reach the highest forms of non-vascular Cryptogams. They are in many ways closely allied to the Jungermanniaceæ, but they have a more highly developed and more perfect vegetative structure, especially in regard to the leaves and stem, and in the capsular accompaniments—calyptra, operculum, peristome, and columella. The vesicle or cell within the spore of a moss, which in germination develops into a new plant, manifests a differentiative, as well as developmental power, which, in my judgment, is not surpassed in interest by any phenomena of a similar kind. The spore case of a Moss contains a small membranous cell, which, under circumstances favourable for germination, bursts, and a vesicle protrudes. Repeated and long-continued division of the apical cell, by means of transverse septa, result in the formation of a lengthened, much ramified, filament. The apical cell of a branch develops into a leafy stem with roots. The cell divisions that lead to this result are highly differentiative and very complex; but Hoffmeister has traced them division by division, step by step. The tissues of the root, of the stem, and of the leaves, vary in structure as well from each other as in their various parts. The prospective purpose of all these changes, from the little vesicle within the spore case, too small to be seen with the unassisted eye, to the completed vegetative structure of the Moss, is the evolution at the apex of the stem, or in the axils of the leaves, according to the genus, of a cell that develops into an antheridium, within which spermatozoa are formed, and the evolution of a cell, which develops into an archegonium, within which a germinal vesicle is formed. In the fulness of time, the spermatozoon finds its way to the neck of the archegonium, which has set aside, by dissolution or separation, the cells that previously closed the aperture; it passes down to the germinal vesicle, and the process of impregnation is accomplished. Changes immediately commence within the germinal vesicle, which result in the formation of the fruit rudiment, and the subsequent development of the fructification.

Development of the Archegonia and of the Antheridia of Mosses, and of the Fruit.

The end of a branch destined to bear fruit changes from a conical form to that of a flattened hemisphere. Some cells grow out into papillæ; these papillæ form in a short time short cylindrical cellular bodies, composed of six vertical rows of cells from six to eight cells high; all the cells belonging to one of these longitudinal rows of cells divide by septa parallel to the chord of the arc of the free arched outer wall. Thus the rudimentary archegonium consists at this time of a central string of cells, surrounded by six longitudinal rows of cells; one of the central string of cells, about the third from the bottom, swells mostly in breadth; the cells that bound it below and around increase in number and in length as well as breadth, so that the lower portion of the archegonium becomes a pear-shaped cellular mass, surrounding the enlarged cell of the central string of cells, which has a large nucleus. At this time a daughter cell with a nucleus appears in the distended central cell, whose nucleus from this time becomes first faint, and then disappears. The daughter cell swells and fills the central cell, and its nucleus becomes large, globular, and bright. Contemporaneously with the enlargement of the daughter cell, the transverse septa by which the separate cells of the longitudinal line of cells are divided from one another dissolve from below upwards, and thus there originates in the axis of the archegonium, a canal which leads to the large cell below. The cells of the apex lastly separate from one another, and bend themselves backwards suddenly. The archegonium is now ready for impregnation.

The first stages of development of the antheridium correspond with those of the archegonia. A clavate mass of cellular tissue is formed, consisting of four or more vertical rows of cells; diagonal septa divide all these rows of cells, and the inner divided portions become the central cells of the antheridium, the outer portions result, by a combined series of bisections, in the formation of the peripheral wall. The inner cells multiply very rapidly, and soon constitute a group of small cellules, each of which contains a spermatozoon. At maturity the apex of the antheridium bursts, and sets the spermatozoa free; they have two thin motile cilia, which give them the power of rapid motion. They find their way to the neck of the archegonium, traverse the open canal, and by impact or coalescence fertilise the daughter cell, which is now to become the fruit rudiment. It is a well ascertained fact that archegonia produce no fruit unless male flowers are at hand. The first symptoms of the development of a fruit are a considerable enlargement of the impregnated daughter cell, and its bisection transversely. The upper terminal cell is then divided by alternate septa in different directions, and longitudinal growth of the fruit rudiment is the result. The neighbouring cells of the ventral portion of the archegonium multiply considerably during the development of the fruit rudiment. A series of cell divisions leads to the formation of a central string of elongated cells, the future columella, a peripheral layer of smaller cells, and several layers of cells surrounding the central string of cells. The fruit rudiment has become spindle-shaped. The cells of the upper ventral portion of the archegonium increase actively, so that it assumes the form of a bell, and becomes the calyptra. The cells of the inner tissue of the calyptra dissolve, and leave the outer layer of cells free. An expansion of the middle cells of the fruit rudiment causes the calyptra to break away by a circular fissure near its place of junction with the vaginula. The calyptra is carried upwards by the rapid elongation of the fruit rudiment. The cells a little beneath the apex (four or five cells below), now begin to multiply rapidly; the diameter of the fruit rudiment increases very considerably, and from spindle-shaped it becomes more or less globular. The peripheral cells, to the extent of three or four layers, then separate themselves from the axile portions of the rudimentary capsule, leaving a cavity in the shape of a hollow cylinder. The swollen hollow cylindrical cavity becomes filled with air, and divides the axile portion of the rudimentary capsule from the capsule wall. The annular layer of certain inner cells of the axile portion becomes the primary mother cell, within which, by repeated cell production, the spores are formed. The contents of each primary mother cell divide into halves, each of which surrounds a nucleus. A cell wall is formed round each divided portion, each of these secondary mother cells undergoes the same process of division, and the result is the formation of tertiary mother cells, within each of which cells a primordial utricle is formed, which ultimately contains four spores. The division of this primordial utricle is by means of six radial septa enclosing four spaces, within each of these spaces one spore is formed. The elongated cells of the axile portion become the columella, which at the base passes into the setæ. The teeth of the peristome are formed from the inner layer of cells of the wall of the capsule. The outer layer of cells at the apex below the calyptra forms the operculum, which is set free by a circumscissile dehiscence when the spores attain to their maturity.

Conclusion.

It was my intention to adduce to-night further proofs of an ascending series of plant structures, by reference to the vascular Cryptogams, from Ferns to Pilularia, from Pilularia to Isoetes and the Lycopodiaceæ. I had intended also to draw largely from the Coniferæ, as leading directly from the Cryptogamia to the Phanerogamia. I have carefully studied Hoffmeister's noble work with this view; but I have found it impossible, with the small leisure which day after day affords me, to reduce my notes within the concise limit allowed to me on this occasion, without losing some of their clearness and force. I have, therefore, to throw myself upon your kind indulgence, and ask you to accept my statement on trust, that Filices, Equisetaceæ, Rhizocarpeæ, and the Conifers afford more abundant, as well as more convincing, proof of the position I advance, than any lower department of the vegetable kingdom. In conclusion, I may observe that the great purpose in organic nature appears to be the evolution of a higher from a lower. In pursuance of this disposition in the plant kingdom, we find class rise above class, order above order, genus above genus, to the very confines of the Phanerogamia. I have not studied the Phanerogamia with this view of the subject before me, but there may be room within their limits for much distinction. A consequence of this *law of evolution* is that elevation after elevation is accompanied by a more complex structure, with more numerous special organs; new functions fall to be performed as more varied products are elaborated. In this way the vegetable unity is ever manifesting itself in greater diversity, and this diversity even resolves itself into a higher unity. We can trace the purpose in the constructive development of any one plant, as well as in the great aggregate of plants.

This seems to me the great scheme of nature in the plant world; and I venture to think it manifests in a wonderful way the power, the wisdom, and the goodness of God, and that an industrious and reverential study of this department of organic nature will aid in the elevation and improvement of the mind.

On the motion of Professor Balfour, a vote of thanks to Mr Jenner for his address was cordially awarded.

The following new Members were elected during 1867–68:—

Resident Fellows.—Dr Wm. Ramsay M'Nab, Dr George W. Davidson, Dr Thomas Alex. Goldie Balfour, W. A. Anderson, Esq.

Corresponding Members.—William Wilson, Warrington.

Associates.—James F. Robinson, Frodsham, Cheshire; John Brown, Adam Matheson, William Shaw.

The following deaths of Fellows of the Society were recorded, some of which had occurred in previous years:—

British Honorary.—Charles Giles Bridle Daubeny, LL.D., M.D., Professor of Botany, Oxford.

Foreign Honorary.—Le Chevalier Giovanni Gussone, Naples.

Resident Fellows.—John Baddeley, M.B. and C.M.; William Ivory of St Roque; Humphrey Graham; C. Webster Kerr, Dundee.

Non-Resident.—G. A. Walker-Arnott, LL.D., Professor of Botany, Glasgow; General Henry Drummond, H.M.I.S.; Rev. James Hamilton, D.D., London; Captain R. Bain Smith, H.M.I.S.; Nathaniel Bagshaw Ward, F.L.S., London; David Walker, M.A., Colchester.

Foreign and Corresponding Members.—Eugene Hepp, Strasbourg; P. W. Hubner, Dresden; A. C. J. Corda, Prague; M. Lechler, Würtemberg; John R. Roth, Ph. and M.D. Munich; Adalbert Schnizlein, Ph.D., Professor

Erlangen ; Carl Heinrich Schultz, Zweibrucken ; Cavalliere Tineo, Palermo.

Resignations—Resident Fellows.—Dr W. A. F. Browne, John Duncan, jun., Thomas Stewart Robertson, James P. Falkner.

Cancelled.—Andrew Taylor, Thomas Robson.

The following Communications were read :—

I. *Description of* Hieracium collinum, *of Fries, a new British Plant.* By Professor BALFOUR. (Specimens and drawings of the plant were exhibited.) (Plate I.)

On Saturday 27th June 1868, I took a botanical trip to Selkirk with some of my students, and while walking along the sandy banks of the Ettrick, between Selkirk and Philiphaugh, a *Hieracium* was gathered by my zealous pupil, Mr Mawson, which at once attracted my notice. It was quite distinct from any of the British *Hieracia*, and it was obviously growing in a wild station. Although, on account of the hot weather of last summer, many of the specimens were in a shrivelled state, still a sufficient number remained in a condition fit for examination, and I determined it to be *Hieracium collinum*, of Fries. I subsequently sent a specimen to Professor Babington, who agreed with me as to the species.

The following are the characters of the plant :—*Hieracium collinum*, Fries, Symbolæ ad Hist. Hieraciorum, p. 29 ; viride (raro glaucescens) ; caule inferne paucifolio apice cymoso-corymboso furcatove; *foliis* lanceolatis linearibusve acuminatis hirsutis, *subtus cano-floccosis*, infimis lingulatis obtusis ; *anthela* discreta *involucrisque e globoso-ovalibus cano-floccosis glandulosoque-hispidis*, *squamis* unicoloribus obtusis, siccitate *nigricantibus.*—*Pilosella major erecta*, Bauh. Pin. p. 262. *H. dubium*, Fl. Dan. t. 1044 ; Wahlenb. Suec. n. 872 (non Linn.), *H. cymosum*, var. *dubium*, Fries, Nov. p. 253. *H. collinum*, Germ. auctor. pro parte. *H. pratense*, Ledeb. Fl. Rossica. *H. prœaltum*, var. ε *hirsutum*, Koch, Synopsis, 3d ed. p. 383. *H. fallax*, Hartman, Skand. Flora, p. 19.

It occurs in Northern Europe, and after *H. Pilosella*, Linn.

and *H. Auricula*, Linn., it is the most common species in dry mountains throughout the middle and north of Sweden, as far as Lapland, and also in the interior of Norway, up to Finmark. It is rare in the mountains of Germany. It flowers in June.

The root is descending, oblique, and premorse, usually giving off stolons. The stem is hollow, straight, with 1–3 leaves, reddish, with stellate, hoary, glandular pubescence. The primary leaves are obtuse, the rest are lanceolate-acute, covered with hairs which are often crowded and give a floccose appearance to the leaves. The heads of flowers are clustered, the peduncles and involucres being densely hoary-floccose and usually glandular. The capitula ovate-oblong at first, and afterwards more or less globose, becoming black by dryness. The scales of the involucre are floccose and hairy. The achenes are small and brownish-black, with a whitish pappus.

The species belongs to section "C. Stirps *Hieracii præalti*," and in the subdivision "*Viridi-canescentia*" of Fries' "Symbolæ." It is placed near *H. præaltum*. In its habit, the arrangement of its capitula, its dark phyllaries, and its hoary floccose aspect, it differs from the other British species. It may be looked upon therefore as a well-marked and interesting addition to the British flora.

In Smith's "English Flora" (vol. iii. p. 356) there is a species of *Hieracium* described as *H. dubium*, L. It is figured in Eng. Bot. t. 2332, and its history is investigated in Smith's "Observations respecting several British species of *Hieracium*," published in the Transactions of the Linnean Society, vol. ix. p. 226. Smith states it to be *H. Auricula*, Flora Dan. t. 1111. It is said to have been found in Westmoreland, by Hudson, and to have been gathered in Scotland by George Don. It wants the hairy floccose appearance of *H. collinum*.

Another species, *H. Auricula*, L., is mentioned by Smith as having been found by Hudson, on Dalehead, near Grassmere, Westmoreland. He gives, as a synonym, *H. dubium*, Flora Dan. t. 1044, and remarks regarding it, "the most uncertain plant, perhaps, in our whole British catalogue, whose place in the English Flora depends on Mr Hudson's authority alone, for no other person has met with anything in Britain answering to his description." In examining Hudson's description as given by Smith, I do not find that it corresponds with *H. collinum.*

Hooker and Arnott in their "British Flora" (p. 209) say, "we omit here *H. dubium*, Huds., not L., as it is quite uncertain what plant was intended ; the description given by Woodward, in Withering's 'Botanical Arrangement,' and the figure in English Bot. t. 2332, both of garden specimens, belonging to *H. stoloniferum*, W. and K., while Smith's description in the 'English Flora' is taken from *H. Auricula*, L. We also omit *H. Auricula*, L., said to have been found in Westmoreland, the description and figure, Eng. Bot. t. 2368, given by Smith, being taken from a Swiss specimen of *H. glaciale*, Lach."

Explanation of Plate I.; representing *Hieracium collinum*, Fries, from specimens collected on the banks of the Ettrick, Selkirkshire.—Fig. 1. The plant, natural size. 2. A flower. 3. Bifid termination of a style. 4. A hair of the pappus. Figs. 2. 3, and 4 magnified.

II. *Notice of* Grimmia contorta *of Schimper, a New British Moss.* By Professor Dickie.

This moss was discovered for the first time in Britain by Mr John Sim, Gateside, Strachan, growing in considerable abundance on the exposed south and west sides of the great granite rock of Clochnaben, Kincardineshire, in June 1868.* It is the *Dicranum contortum* of Wahl., and *Grimmia uncinata* of Kaulf., Bryo. Europ., vol. iii. t. 248. The following description of the species is from Schimper's "Synopsis Muscorum Europæorum," p. 209 :—

"Cæspitulosa, cæspituli molles saturate virides inferne nigricantes et eximie discolores, stupa radiculosa basilari cohærentes. Folia patenti-incurva, sicca crispula, e lanceolato lineali-subulata, apice diaphana vel brevipila, basi carinato-concava margine recurva, dehinc subcomplicato-carinata, sola juniora viridia, cætera nigricantia vel fuscescentia ; rete e cellulis formatum majoribus, apice sinuoso-quadratis basi elongatis hexagono-rectangulis diaphanis. Perichætium 8–9-phyllum, longe productum, folia peri-

* This moss had been previously gathered on the Cheviots in May 1868 by Mr James Hardy.—J. H. B.

chætialia erecta basi longius vaginantia pallidiora. Capsula in pedicello subarcuato cernua siccitate erecta, ovalis, lævis, mollis, lutescens, respectu magnitudinus plantæ parvula. Operculum convexo-conicum, obtusum, basi erosum, aurantio-rubens. Annulus latus, e triplici serie cellularum compositus. Peristomii dentes infra medium usque bifidi et lacunosi, siccitate reflexi, aurantio-rufi."

III. *Extracts from Botanical Correspondence.* By Professor Balfour.

1. From Mr R. Shuttleworth, Berne, giving an account of the botany of the Var and of the Alpes Maritimes, and part of Liguria, a Flora of which he is preparing for publication.

2. From Professor Dickie, noticing the naturalisation of *Lupinus perennis* in Deeside. It has been known for many years growing in the woods at Balmoral, doubtless an outcast from the old garden. It has spread downwards along the course of the Dee, and occurs in great abundance on a small island a little west from the bridge at Ballater, and on another about a mile west from the old bridge of Dee at Aberdeen.

3. From Mr Gilbert C. A. Stuart, giving a list of the plants which he had found naturalised on the banks of the Tweed and Gala,—the seeds having been introduced by the wool brought to the Galashiels factories. They included *Herniaria ciliata*, *Illecebrum verticillatum*, *Lythrum hyssopifolium*, *Medicago denticulata*, *M. maculata*, *M. minima*, *Apera Spica-venti*, *Setaria viridis*, &c.

4. Mr Archibald Jerdon, transmitting specimens of *Polycarpon tetraphyllum* and *Medicago denticulata*, which he had collected near Melrose.

5. From Mr J. F. Robinson, giving a list of the Ferns found in the neighbourhood of Frodsham, Cheshire.

6. From Mr P. S. Robertson and Mr Henderson, presenting specimens of Potato tubers exhibiting the second growth where numerous tubers are produced from a parent tuber. The specimens were from the gardens of Mr Mowat, Trinity, and Mr Henderson, Burntisland.

Professor Dickson gave a demonstration on the hard structure of the pith in the Akazga ordeal poison plant of West Africa. Specimens were shown under the microscope.

Mr D. Roberts exhibited varieties of *Scolopendrium vulgare*, collected in Wales.

Mr J. W. Edmond presented a microscopical preparation of a petal of *Pelargonium*, in which the colour was beautifully preserved. The petal had been placed in a solution of sulphate of copper and carbolic acid, according to the following formula:—Cupri sulphatis, gr. i.; acidi carbolici, guttam i.; aquæ, ℥ii.

10th December 1868.—Charles Jenner, Esq., President, in the Chair.

The following Gentlemen were elected Office-Bearers for 1868–69:—

President.

Hugh F. C. Cleghorn, M.D.

Vice-Presidents.

Is. Anderson-Henry.
Alexander Buchan.
Charles Jenner.
Robert Traill.

Council.

A. Craig-Christie.
Thos. Alex. Hog.
James M'Bain, M.D., R.N.
James M'Nab.
Professor Archer.
William Gorrie.
Professor Dickson.
Thos. A. G. Balfour, M.D.
John Ballantyne, jun.
Thos. R. Fraser, M.D.

Honorary Secretary, . .	Professor Balfour.
Honorary Curator, . . .	The Professor of Botany.
Foreign Secretary, . . .	Professor Maclagan.
Treasurer, ...	Patrick Neill Fraser.
Auditor, ...	William Brand, W.S.
Artist, ...	Neil Stewart.
Vice-Secretary and Curator, ...	John Sadler.

Local Secretaries.

William Carruthers, British Museum, London, W.C.
Alexander Dickson, M.D., Professor of Botany, Glasgow.
George Dickie, M.D., Professor of Botany, Aberdeen.
Philip W. Maclagan, M.D., Berwick.
Charles C. Babington, Professor of Botany, Cambridge.

Thomas Shapter, M.D., Exeter.
James Gilchrist, M.D., Dumfries.
William Keddie, 5 India Street, Glasgow.
Joseph Dickson, M.D., St Helier's, Jersey.
Benjamin Carrington, M.D., Manchester.
William Alex. Stables, Cawdor Castle, Nairn.
Edward Charlton, M.D., Newcastle.
John Lowe, M.D., King's Lynn, Norfolk.
F. Buchanan White, M.D., Perth.
Rev. W. A. Leighton, Shrewsbury, Shropshire.

John Kirk, M.D., Zanzibar, Africa.
Ferdinand von Mueller, M.D., Ph.D., Melbourne, Australia.
Thomas Anderson, M.D., Calcutta.
W. H. Campbell, LL.D., Georgetown, Demerara.
Alexander Hunter, M.D., Madras.
George Lawson, LL.D., Ph.D., Dalhousie College, Nova Scotia.
R. J. Shuttleworth, Berne, Switzerland.

The Treasurer submitted a report on the state of accounts for the past session, and on the present financial condition of the Society.

The following Gentlemen were elected Fellows of the Society:—

1. *British Honorary Fellow.*

J. J. Bennett, F.R.S., British Museum, London.

2. *Foreign Honorary Fellow.*

Wilhelm Phillipp Schimper, Strasbourg.

3. *Resident Fellows.*

David Ferrier, M.A., M.B., and C.M.
R. A. Jackson.
Thomas Hardie, M.D., F.R.C.P.E.

4. *Non-Resident Fellow.*

James Collins, Esq., Curator of the Museum of the Pharmaceutical Society of Great Britain.

5. *Foreign and Corresponding Members.*

François Crépin, Professor of Botany, Ghent.
Johannes Martin Lange, Professor and Director of the Botanic Garden, Copenhagen.
Dr L. Radlkofer, Professor of Botany in the University of Munich.

6. *Associate.*

Robertson Munro, Bangholm Nursery, Edinburgh.

The following Members have been struck off the List of Fellows:—

Arthur Gamgee, M.D., University.
Robert Macbean, M.B., C.M., Langholm.

After the election of office-bearers for 1868–69, Dr Cleghorn, the newly elected President, took the Chair.

The following Communications were read:—

I. *Reports on Botanical Excursions in July and August* 1868. By Professor Balfour.

Dr Balfour referred to the great facilities afforded now-a-days to the botanist, by railways enabling him to visit many distant parts of the country for the purpose of examining the flora. There is no botanical school where there are better opportunities of practically studying wild plants in all kinds of localities, from the sea-shore to the alpine summit, than that of Edinburgh. During last summer the range of excursions was very extensive.

On the 11th of July, a party of thirty-four left Edinburgh per rail at 6.25 a.m., and proceeded by Burntisland and Perth to Dubton station, near Montrose, where they were met by Drs Howden and Simpson, and conveyed in omnibuses to the Royal Asylum, Sunnyside, where breakfast was kindly prepared for them. After breakfast the party proceeded in omnibuses through Montrose to Usan Mains. Here they commenced their walk, and examined in the course of it the shores at Usan, the Buddon, St Skeoch, and Dunninald Den. They returned to Montrose, which they left at 5.15 p.m., and reached Edinburgh again at 10 o'clock. Among the plants collected by the party may be noticed—*Sagina maritima*, *Vicia sylvatica* (in great profusion on the rocky banks by the sea-shore), *Astragalus glycyphyllos*, *A. hypoglottis*, *Carlina vulgaris*, *Campanula glomerata*, *Matricaria maritima*, *Mertensia maritima*, *Atriplex Babingtonii*, *Habenaria viridis*, *Juncus Gerardi*, *Asplenium marinum*, &c. Dr Howden distributed to the party fresh specimens of the following rare plants, which he had gathered in the neighbourhood of Montrose:—*Linnæa borealis*, *Trientalis europæa*, *Pyrola secunda*, *Goodyera repens*, and *Corallorhiza innata*.

On 18th July, a party of sixty, in addition to twelve psychological pupils under the direction of Professor Laycock, left the Caledonian Railway station at 7.40 a.m., and proceeded to Dumfries. The party were conveyed from the station to the Crichton Royal Institution, where they were entertained to breakfast by Dr Gilchrist. After breakfast the psychological party visited the asylum, and listened to a lecture by Professor Laycock on mental diseases. The botanical party went by omnibuses to Den Mill, Loch Rutton, and Cargen, where they were received by Mr Dudgeon. They returned to Dumfries, and left for Edinburgh at 6.10 P.M. Among the plants collected were the following:—*Sagina nodosa*, *Geranium sanguineum*, *Genista tinctoria*, *Lythrum Salicaria* (in its trimorphic states), *Sedum reflexum*, *Carum verticillatum*, *Meum athamanticum*, *Jasione montana*, *Lobelia Dortmanni*, *Littorella lacustris*, *Gymnadenia albida*, *Alisma ranunculoides*, *Sparganium simplex*, *Scolopendrium vulgare*, &c.

On Thursday, 23d July, a party of thirty-two left Edinburgh by the North British Railway at 1.10 P.M., and proceeded to Aberfeldy, where they took up their quarters at Mackenzie's Breadalbane Arms Hotel. The party included Dr H. A. Weddell, the well-known traveller on the Andes, who determined the species of Cinchona which yields the yellow bark (*C. Calisaya*). He was accompanied by his daughter, who nobly went through all the fatigues of the botanical expedition. The Rev. Mr Astley, Rev. W. H. Brown, Rev. R. F. Colvin, Dr Abney Walker and his son, and Dr Traquair also joined the party.

Next morning (Friday), at 5.30 A.M., the party started in omnibus, drags, and dogcart for the foot of Ben Lawers, which they reached between 9 and 10 o'clock. They ascended the mountain, and divided into several sections, with the view of examining the flora more completely. The day was favourable, and the fine weather of the summer had brought the alpine plants into a good condition. The following plants may be recorded:—*Thalictrum alpinum*, *Draba rupestris* (in large quantity at the summit), *D. incana*, *Cochlearia alpina*, *Silene acaulis*, *Sagina saxatilis*, *S. nivalis* (this plant was observed in considerable quantity on the steep sides of a ridge which leads to the summit), *Alsine rubella* (near the summit), *Cherleria sedoides*, *Cerastium alpinum*, *Sibbaldia procumbens*, *Potentilla maculata*, *Rubus Chamæmorus*, *Epilobium alpinum*, *E. alsinifolium*, *Saxifraga nivalis*, *S. cernua* (in the crater-like hollow near the summit, several specimens being gathered in full flower), *Cornus suecica*, *Hieracium holosericeum*, *Saussurea alpina*, *Erigeron alpinus*, *Gentiana nivalis* (on rocks to the south-west of the summit), *Myosotis alpestris* (in great beauty and profusion), *Veronica saxatilis*, *Salix reticulata*, *S. herbacea*, *Tofieldia palustris*, *Juncus biglumis*, *J. triglumis*, *Luzula spicata*, *Carex atrata*, *Sesleria cærulea*, *Poa Balfourii*, *P. alpina*, and *Botrychium Lunaria*. The party returned to the hotel at Aberfeldy in the evening, after a pleasant and most successful excursion.

Next morning (July 25) the party walked to Farrochill and the Falls of Moness, and were rewarded by collecting *Polypodium Robertianum* (*calcareum*), *Asplenium viride*, *Carduus heterophyllus*, *Melampyrum sylvaticum*, *Trientalis europæa*, *Nepeta Clinopodium*, *Campanula latifolia*, and a great number of the ordinary ferns. At 1.30 P.M. the party left Aberfeldy and returned to Edinbugh. Some of the party visited Killiecrankie, and gathered *Lathyrus niger;* others remained at Perth, and visited Methven Bog, where they collected *Scheuchzeria palustris*, *Carex limosa*, and *C. irrigua*, *Lastrea spinulosa*, *Genista anglica*, *Vaccinium Oxycoccus*, &c., returning by a late train to Edinburgh.

On Tuesday, 4th August, a party of nine left Edinburgh by the Caledonian Railway at 1.10 P.M. for Gatehouse, which was reached about 7 P.M. They took up their quarters in the Murray Arms Hotel, where they were comfortably accommodated. On Wednesday, 5th August, they started at 8 A.M. by omnibus for Glen Farm. From Glen Farm they ascended a hill called Cairn Harrow, which reaches the height of 1497 feet above the level of the sea. They were disappointed with the flora of the mountain. The dry weather had withered the grass, and there was little vegetation on the exposed parts of the hill. Among the plants gathered were—*Anagallis tenella*, *Carum verticillatum*, a radiant form of *Centaurea nigra*, and a mountain form of *Lastrea dilatata*. In a marsh near the top of a hill *Hippuris vulgaris*, *Vaccinium Oxycoccus*, *Empetrum nigrum*, &c. The party descended to the stream, which passes through a wooded ravine, to Kirkdale and Wigtown

Bay. In the glen were gathered *Polystichum angulare*, *Hypericum Androsæmum*, *H. dubium* var., *Viburnum Opulus*, and *Ulex nana*, which is the common furze of the country. On reaching the shore they proceeded, by Dirk Hatterick's Cave and Ravenshill, to Kirklaugh, where they were kindly entertained by Mr Alex. M'Culloch. From this they proceeded along the shore to Ardwell, the seat of Mr Walter M'Culloch, who entertained them most hospitably, after a long and fatiguing walk. On the shore were gathered *Lepigonum marinum* and vars., *Œnanthe crocata*, *Œ. Lachenalii*, *Scutellaria galericulata*, *Statice Bahusiensis* (*rariflora*), *S. Limonium* (in various states), *Juncus maritimus*, *Schœnus nigricans*, *Asplenium marinum*, *Lathyrus sylvestris*, and a peculiar variety of *Carduus lanceolatus*. The rocks on the shore belong to the Silurian series, and exhibited remarkable twistings in the strata. They did not disintegrate much, and their flora was by no means extensive. The muddy shores produced abundance of saline plants, such as *Salicornia*, *Sueda*, and *Statice*.

On Thursday (6th), the party went by omnibus to Kirkcudbright, which was reached about 10 A.M. They visited St Mary's Isle, a neck of land extending into the sea, the property of the Earl of Selkirk. They botanised on both sides of the peninsula, and also examined the wild tangled woods upon it. On the muddy shores there was great profusion of *Statice Bahusiensis* and *L. Limonium*, *Sueda maritima*, very large and luxuriant *Salicornia herbacea*, *Aster Tripolium*, &c. In the woods were gathered *Epilobium angustifolium*, *Convallaria multiflora* (introduced), *Epipactis ovalis*, *Ophioglossum vulgatum*, *Festuca gigantea*, *Acer campestre*, *Spiræa salicifolia*, and in watery places *Potamogeton polygonifolius*. From the isle they proceeded though Kirkcudbright to the banks of the Dee at Tongueland, where they found abundance of *Serratula tinctoria*, and *Hypericum dubium* var.; and on the roadside, *Lepidium Smithii*. On their return to Kirkcudbright, they proceeded by omnibus to Borgue, gathering on the way *Inula Helenium*, *Convolvulus Sepium*, *Verbascum Thapsus*, *Rosa mollissima* (*mollis*), *Senecio sarrasenicus*, and *Helleborus viridis*. Leaving Borgue village, they walked to Kirkandrew, and visited the rocky shores. On the rocks were gathered abundance of Samphire (*Crithmum maritimum*), *Carlina vulgaris*, *Artemisia maritima*, *Aster Tripolium*, *Haloscias scoticum*, *Sedum anglicum*, and *S. Telephium*. They returned by Marjary to Gatehouse in the evening.

On Friday (7th) they went by omnibus to Drumore. Here the party divided into two sections—one ascending a high mountain called Cairns More, and the other proceeding by train to Creetown, and examining the shore between that and Gateshouse. Cairns More is a dry hill, rising to the height of 2600 feet. It is one of the highest in the county, and therefore it was hoped that it would yield some good alpine plants. In this, however, the party were disappointed. There was no disintegration of the hard dry granite rocks, so as to supply soil for plants. The ascent, which was by the western side of the hill, was difficult and tedious. Large masses of rock occurred, with their surfaces so smooth and so free from herbage that it was impossible in many cases to climb over them, and thus many ascents and descents had to be made in order to get round them. After a fatiguing climb, the top was reached without having met with any plant of interest. The day, which was wet and misty in the morning, had now cleared, and an excellent view was obtained from the cairn of the hilly district of Kirkcudbright, the Isle of Man, the Cumberland hills, Ailsa Craig, and Arran. The rocks on the east side of the mountain were of a more crumbling nature, and there was more moisture on them. On these were collected *Salix herbacea*, *Saxifraga stellaris*, and *S. hypnoides*, *Cryptogramma crispa*, *Lycopodium clavatum*, *L. alpinum*, *L. Selago*, and *L. selaginoides*. Thus it will be seen that Cairns More is not a productive hill, and the alpine species of plants are very few. On the way back to Drumore, *Rhynchospora alba* was picked. Those who went to Creetown gathered *Crithmum maritimum* (Samphire), *Polystichum angulare*, *Scolopendrium vulgare*, *Asplenium marinum*, *Crambe maritima*, *Beta maritima*, *Glaucium luteum*, *Lathyrus sylvestris*, *Vicia sylvatica*, *Haloscias scoticum*, *Sedum rupestre*, *Salix Smithiana*, *Hypericum Androsæmum*, *H. dubium*, *Scirpus maritimus*, *Juncus maritimus*, *Rubus discolor*, *Hieracium boreale*, *H. umbellatum*, and *Ulex nanus*.

On the morning of Saturday, 8th August, the party inspected the marshy ground near Gatehouse, and gathered *Œnanthe crocata*, *Sium angustifolium*, and *Veronica Anagallis*. They also visited the grounds of Cally House. On the shores of the loch at Cally were found *Littorella lacustris*, *Peplis Portula*, *Nasturtium palustre*, *Lysimachia Nummularia*, &c. In the course of the day they attended a horticultural show in Gatehouse, and in the afternoon proceeded to Tarff station, where they picked *Genista tinctoria* and *Alisma Plantago*. On reaching Dumfries a delay of about an hour and a half enabled some of the party to visit the banks of the Nith. Near the old bridge were gathered *Medicago denticulata*, *Phalaris canariensis*, and *Xanthium spinosum* (introduced). At Lockerbie, *Symphytum officinalis* was gathered. The party reached Edinburgh about 10 P.M.

Professor Balfour concluded by giving a few notes on a visit he had made later in the autumn to Sandringham, near Lynn, in Norfolk, where he collected *Lastrea Thelypteris*, *L. cristata*, *Osmunda regalis*, *Ophioglossum vulgatum*, *Solanum nigrum*, *Arnoseris pusilla*, *Hypericum Elodes*, *Verbascum floccosum*, &c.

Specimens of the principal plants collected in the various trips were exhibited.

II. *Notes on the Flora of Malta and Sicily.* By Dr H. CLEGHORN.

(This is printed with the continuation of the paper read June 10.)

III. *On the Preparation of Fungi.* By Mr JAMES ENGLISH, Epping. Communicated by Professor BALFOUR.

The author remarks, that during his entomological rambles he has for many years observed fungi, and often thought that it was a pity that no plan had been adopted for preserving such beautiful vegetable forms, so as to have characteristic specimens in botanical museums. He resolved, accordingly, to endeavour to find out an easy mode of preservation. His efforts, however, were for a long time unsuccessful, and it was only three years ago that he fell upon a method which promised good results. He saw much depended on proper manipulation and the use of chemical agents. The soft fugacious species were special objects of attention. Their rapid growth, and their equally rapid decomposition, interfere much with all ordinary modes of preservation. By the process which he had adopted growth and decomposition are arrested, and the specimens are prevented from shrivelling, at all events to any great extent. In the case of a specimen of *Agaricus campestris*, nine inches in diameter, he ascertained that the shrivelling in diameter was little more than half-an-inch. Most fungi contain more or less of alkaline deliquescent salts. After being dried, they absorb moisture, and decay goes on with rapidity. The process adopted is that of waxing the specimens, and thus preserving their natural pileus and stipe. Specimens preserved in 1866 are now as fresh as when first prepared. He expects ere long to have a very complete collection of fungi, and thus to be able to direct more attention to an interesting order of plants which have been long neglected. A collection of a hundred species can be supplied at the rate of 10s. for each species. The species, however, are represented in groups; that is to say, the type and the variations in form and colour, when such exist, are given. Thus there are several specimens representing each species.

Numerous fungi thus prepared by Mr English, and now in the Museum at the Botanic Garden, were exhibited to the meeting. This includes the following species:—*Amanita muscaria*, *A. rubescens*, *Agaricus procerus*, *A. melleus*, *A. squarrosus*, *A. mucidus*, *A. rachodes*, *Boletus edulis*, *B. luridus*, *Cantherellus cibaridis*, *Peziza aurantia*, &c.

IV. *Miscellaneous Communications.*

1. Dr Thomas Anderson, Calcutta, sent a report on the number and distribution of Cinchona plants in the Government plantations at Darjeeling on 1st September 1868. The total number in the various plantations at that date was 2,075,078; viz., *C. succirubra*, 1,118,557; *C. Calisaya*,

20,354; *C. micrantha*, 29,667; *C. officinalis* and vars., 901,408; *C. Pahudiana*, 5092—total, 2,075,078.

2. Mr R. M. Stark gave an account of a botanical tour which he made last autumn through some parts of Switzerland, and noted the principal plants observed.

3. Professor Dickson gave a demonstration of the peculiar microscopical structure of the shell of the Brazil nut. Preparations were exhibited under the microscope.

4. Mr Stark exhibited growing plants of *Asperula azurea* and *Sedum Maximowizii*.

Thursday, 14*th January* 1869.—Dr Cleghorn, President, in the Chair.

The following Gentlemen were elected as Resident Fellows:—

T. Marshall Bennett.
Edward H. Dickinson.
William Livesay.
Thomas William Mawson.

Letters from J. J. Bennett, Esq., and Professor Crepin, were read, thanking the Society for their election as Honorary and Foreign Members.

The following Communications were read:—

I. *Obituary Notice of Professor C. F. P. von Martius, of Munich, and Adalbert Schnizlein, Erlangen.* By Dr Cleghorn.

Carl Friedrich Philip von Martius, M.D., died at Munich, on December 13, 1868, at the age of seventy-five. He was born at Erlangen, and prosecuted the study of medicine at that University, Theodore Nees von Esenbeck being one of his contemporaries. Martius was selected by Maximilian Joseph I., King of Bavaria, to travel in Brazil with Dr Spix, the zoologist. The narrative of their expedition, which occupied from 1817 to 1820, "Reise in

Brasilien," 3 vols. 4to, and an Atlas, folio, contains a mass of unrecorded facts and observations, and places the name of von Martius second only to that of Humboldt in important discoveries in physical geography and ethnology, while in the generous distribution of his rich collection, and his extensive acquaintance with botanists, he resembled Sir William Hooker or Dr Wallich.

When the distribution of the East India Company's botanical collection took place, Martius undertook the description of the Palms and Amarantaceæ.

He was for many years Professor of botany in the University of Munich, and Director of the Botanic Garden; he was also President of the Botanical Society of Ratisbon. His celebrity is chiefly drawn from his large and splendid work on the Palms, and his numerous works on the Flora and Natural History of Brazil. Some of these are beautifully illustrated with coloured lithographs. In the following list some of his most important writings are named :—

Enumeration of Plants in the Botanic Garden of Erlangen, 1814.
Cryptogamic Flora of Erlangen, 1817.
Genera et Species Palmarum, 1823–50.
Nova Genera et Species Plantarum Brasiliæ, 1824–32.
Monograph of Amarantaceæ, 1825.
On Eriocaulon, 1833.
On Erythroxylon, 1840.
Flora Brasiliensis, 1840–1857.
Materia Medica of Brazil, 1843.
Physiognomy of Vegetation in Brazil.
Drawings of Brazilian Cryptogamic Plants, 1828–34.
Plants and Animals of Tropical America.
History of the Botanic Garden of Munich.
General View of the Vegetable Kingdom.
On the Potato Disease.

Adalbert Schnizlein, Ph.D., died on 24th October 1868, æt. 55. He had suffered for four months from an accident which he met with on the Tyrol. He was Professor of Botany at Erlangen, and Director of the Botanic Garden. His chief work is the "Illustrations of the Natural Families of Plants," *Iconographia Familiarum Naturalium Regni Vegetabilis*—(unfortunately incomplete); he also recorded his observations on Typhaceæ and on the Flora of the Tyrol.

II. *The Lichen-Flora of Greenland.* By W. Lauder Lindsay, M.D., F.R.S.E., F.L.S.

I. *Introduction.*

My attention was drawn to the Lichen-flora of Greenland by being requested, in the winter of 1867–8, by my friend Robert Brown, F.R.G.S., to examine and determine the Lichens collected by him in West Greenland in the course of the "West Greenland Exploring Expedition" of 1867. On studying—in connection with the determination of the species so submitted to me—the literature of Greenland lichenology, I was surprised to find that there is not on record any separate and modern list of the lichens of that country. It has occurred to me to endeavour to supply this want in lichenological literature, by drawing up the enumeration, which is hereto appended, of all lichens up to this date found, or recorded as having been found, in Greenland—compiled from all the sources of information accessible to me.

The basis of the said list is a catalogue of the lichens collected by Mr Brown. But it includes also all those mentioned as occurring in Greenland by Th. M. Fries in his "Lichenes Arctoi Europæ Grœnlandiæque."* This work includes a record of all the Greenland lichen-collections of Danish botanists, by whom chiefly contributions to its Lichen-flora have been made. The largest and most important of these collections appears to have been that of J. Vahl, which was made exclusively on the *west* coast, as was also Mr Brown's. Minor collections were made by Rink and Wormskiold.

The localities of Mr Brown's collections were chiefly on, or in the vicinity of, Disco Island. They have been elsewhere particularly specified.† The additional localities mentioned by Fries include the following, which, having no means of ascertaining their exact geographical position, I arrange in alphabetical order:—

Alluk, Amaralik, Amitsuarsuk.
Godhaab.

* Trans. Royal Society of Sciences, Upsala, series iii. vol. iii. 1860.

† "Observations on Greenland Lichens."—Trans. Linnean Society, vol. xxvii. (1869).

Holsteinborg and district—including Ikkatok.
Isortok.
Julianshaab.
Kukiarsuk.
Neunese, Njarasurksoit, Nenortalik.
Okivisekan.
Pakitsok (Jakobshavn district).
Sarmalik, Serkunsuk, Sydostbugten (district).
Tiksulik, Tunnudliarbik, Tessarmiut.
Umanak, Upernivik.
Wajgattet.

I have also included in my enumeration all Greenland localities, or lichens, recorded in the following works or papers:—

1. Crantz: "History of Greenland" (1820.) His list of lichens (p. 318) is unimportant and very meagre, not amounting to thirty species, named according to the nomenclature and classification of Dillenius and Hudson. Several names it is impossible now to identify with modern species.

2. Th. M. Fries: "Lichenes Spitsbergenses," 1867: published in the "Kongl. Svenske Vetenskaps-Akademiens Handlingar."

3. Nylander: "Lichenes Scandinaviæ," 1861.

4. Walker and Mitten: Lichens collected by Dr Walker of the "Fox" Expedition, under Sir Leopold M'Lintock, on the coast at Frederikshaab, Godhaab, Fiskemær, Uppernavik, and on Disco (Godhavn). Determinations by Mitten. Journal of Linnean Society, Botany, vol. v. p. 87. This list contains some that are not mentioned by Fries. Extra-Greenland localities were—Port Kennedy, 72° N. lat., on the Boothian peninsula, which occupies a central position among the Arctic-American islands; Ponds Bay and Lancaster Sound, on the west side of Baffin's Bay; and Cape Osborne, with whose geographical position I am unacquainted.

5. Hayes and James: Lichens collected by Dr Hayes; determinations by Professor Thomas P. James; Proceedings of the Academy of Natural Sciences of Philadelphia, 1863, p. 96. These collections were made much more to the north than any of the others, viz., in Smith's Sound, between parallels 78° and 82°. It is not, however, always or clearly stated on which shore they were collected,* though it would appear to have been the eastern or Greenland side.

* Such an omission becomes of more importance where the Strait is much broader. Thus, in the Kew and other Herbaria, I have found specimens labelled "Baffin's Bay" or "Davis Straits." Now, Greenland occupies so decidedly an intermediate position between Europe and America in regard to its general flora, that it is always desirable to know on what side of the bay and straits in question given plant-collections have been made. In the

Professor James remarks, "Not a single *fruited* specimen was to be found in the entire collection," a circumstance of interest in connection with a fact I have pointed out elsewhere *—the frequency of barrenness (in apothecia) of the lichens of Arctic countries. It would almost appear that this sterility or its frequency bears a proportion to the northernness of the latitude.

James enumerates the following, which were not found, or are not recorded, by other collectors or lichenologists:—

Alectoria sulcata, *Lév.*†
Neuropogon Taylori, *Hook.*‡
Parmelia Borreri, *Turn.*§
Stereocaulon condensatum, *Hffm.*‖
Cladonia furcata, *Hffm.*
  var. racemosa, *Flk.*¶
Verrucaria popularis, *Flk.***
  maura, *Whlnb.*
    var. striatula, *Hffm.*††

But these determinations appear to me so little trustworthy, for the reasons assigned in the foot notes, that I have not included the lichens in question in my enumeration.

Kew Herb., however, I have frequently met with labels of a much vaguer kind, *e.g.*, "North Pole," "Arctic regions," "Franklin's first journey," or "Parry's first voyage"—without specifying any precise locality! *Vide* also p. 52.

* "Observations on Greenland Lichens."

† Nylander (Syn. p. 281) gives it only as an *Indian* species.

‡ Nylander (Syn. p. 273) gives it only as an *Antarctic* species. Probably it has been confounded with its Arctic representative *N. melaxanthus.*

§ Nylander (Syn. p. 389) gives its northern limit as Central Norway.

‖ Nylander (Syn. p. 250) gives its northern limit as Central Sweden and New England, U.S.

¶ Nylander (Syn. p. 206) records it as a central European form, and describes the type as becoming rare northwards. *Racemosa* is a not uncommon British form. I collected it both in Norway and Faroe ("Northern Cladoniæ," pp. 420–1; Journal of Linnean Society, vol. ix. Botany). It would appear to be a much more northern lichen than Nylander supposes. I have given its northern distribution in a paper on the "Arctic Cladoniæ," (p. 172, Transactions of Botanical Society of Edinburgh, vol. ix. 1867).

** This is probably a synonym, but I do not find it in any of the lichenological works in my library.

†† If this is *V. striatula*, Whlnb., it is recorded by Fries (Arct. p. 267) as occurring in Finmark.

It thus appears, that while in the case of certain of these lichens (*e.g.*, the *Alectoria* and *Neuropogon*) it is most unlikely they *can* occur in Greenland, in no case is the determination such that it can be relied upon!

6. Ross and Brown: Lichens of the East Side of Baffin's Bay, lat. 70° to 76°, and West Side of Possession Bay, lat. 73°; determined by the late Robert Brown, F.R.S., of the British Museum: published in the "Voyage of Discovery," by Sir John Ross (London, 1819, 2d ed., vol. ii. p. 195). The same lichens are probably what are enumerated as Baffin's Bay lichens in the collected works of the said Robert Brown (vol. i. 1866, p. 178). This list contains, however, no lichens not enumerated in my catalogue on other authority.

There are, probably, other minor papers on Greenland Lichens which I have not seen,* *e.g.*, one by Nylander, "Ad Lichenographiam Grönlandiæ quædam Addenda" (Regensburg "Flora," 1827), describing certain collections of J. Vahl, including, according to Krempelhuber ("Geschichte," p. 361), a record of three new species.

In general terms, Lichen-collections in Greenland may be said to have been made between lat. 60°, the extreme south, and about 75°, the latitude of Uppernavik. Certain exceptional collections have been made as high as lat. 82°, while the majority have come from about the latitude of Disco, 70°.

Geologically, Greenland appears to consist, for the most part, of—(1), granites; (2), the metamorphic slates, especially gneiss and mica slate; (3), various traps—porphyritic or amygdaloidal; and (4), various superficial tertiary strata, exhibiting at some points a rich *fossil* flora.

There is in Greenland a great scarcity of *arboreal* vegetation—a circumstance that, more than any other perhaps, determines the peculiarities of its lichen-flora. There is a total absence of *forests*, and, consequently, of the shade and moisture which they provide and conserve. Hence

* Thus Krempelhuber refers ("Geschichte," p. 361) to—

1. Collections by Breutel.

2. A List of Lichens, determined by Mr John Sadler, collected by Robert Brown, F.R.G.S., in North Greenland (Browne and Women's Islands), and on its west coast (Hare Island).—Trans. Bot. Soc. of Edin. vol. vii. 1862, p. 374. In a letter to me, Mr Brown himself describes the said lichens as "only a few" collected, in 1860, "on the Duck Islands, off the north (?) coast of Greenland. . . . There was only a short list. . . . When I landed that summer, which was rarely, the ground was covered with snow, and the only things which peeped out were a few lichens on the rock-summits, all of which I . . . collected."

there is a comparative absence of the *Graphideæ** *Sticta*, *Collemata*, *Calicia*, *Usneæ*, *Ramalinæ*, *Pertusariæ*, *Endocarpa*, and generally of the *corticolous* lichens, so common in Central Europe and America. The want of forests can scarcely, however, account for the paucity of *Verrucariæ*—many, at least, of which are saxicolous. Though, as a general rule, trees are absent, they occur—as they do in Iceland, Faroe, Shetland, Orkney, and the Hebrides—exceptionally, of stunted growth; while there seems to be no scarcity, at least at certain points on the western coast, of woody bushes or shrubs. Thus the following trees or shrubs are reported† as occurring in Greenland:—Service tree, birch, alder, willow, juniper, crowberry, whortleberry, and black crake berry.

While there is absence or scarcity of corticolous, fruticulose, and foliaceous lichens, there is an abundance of saxicolous forms, referable mostly to the genera *Lecidea*, *Lecanora*, *Squamaria*, *Parmelia*, and *Umbilicaria;* of terricolous species, referable to the genera *Cladonia*, *Alectoria*, *Cetraria;* and of muscicolous species and varieties belonging to the genera *Lecidea* and *Lecanora.* But the only prominent feature of the lichen-flora of Greenland recorded by travellers is the abundance of the *Umbilicariæ*, which in many localities give a character to the colouring of the landscape. Thus the author of the "Edinburgh Cabinet Library" volume on Greenland, writes of the interior:—"The mountains are either *entirely bare*, or covered with a mourning veil of black lichens" (p. 226). . . . "The dark rocks are clothed with numerous sombre-coloured lichens, which *grow with great rapidity* beneath the snow."‡ (P. 380.) Near Cape Lister, on the east coast, he describes a "pavement of loose quartz or hornblende stones, either *naked* or covered with *black* lichens. These, with a few tufts of hardy plants, were *all* the vegetation visible." (P. 247.)

Some parts of the country are described as *absolutely barren.* "Even the Greenlander, accustomed as he is to the

* *Arthonia trabinella* is the sole representative of this large family.

† Edinburgh Cabinet Library volume on "Iceland, Greenland, and the Faroe Islands," 1840, p. 377, chapter on Botany.

‡ This assertion, if it is founded on fact, is of much interest in connection with the question of lichen-growth as a test of age, a subject of which I have treated shortly in the Report of the British Association for 1867, p. 88, and more fully in "The Farmer" of October 23, 1867.

horrors of nature, calls these spots places of desolation." (P. 226). Of certain parts of the coast Graah says (1837), "*No sign of vegetation* was observable on these walls of rock. . . . at many places *not even a bit of moss*" (pp. 47, 48)—"moss" being a comprehensive and vague term generally used by travellers to include *lichens*, especially of the fruticulose kinds (*e.g.*, *Cladonia*, *Ramalina*, *Alectoria*, *Usnea*, *Cetraria*). In works of travel I not unfrequently find rocky or desert districts of country described as *barren* of vegetation. For instance Lord Haddo, speaking of the rocky banks of the Nile in Egypt and Nubia, says they were "without a particle of vegetation."* (P. 173). This does not expressly exclude *lichens*, as the term "vegetation" is in such cases used in reference to phænogamic vegetation only. But elsewhere, in the same narrative, he specially excludes even lichens, *e.g.*, where he describes "precipices and cliffs without the least particle of vegetation, or *even a lichen* on the surface" (p. 129). . . "they have *not even a single lichen*" (p. 134)—as if *lichens* were an inferior growth to "vegetation!"

All such pictures are imaginative or poetical; they are not scientific—not the assertions of naturalists with specially trained, all-observant eyes. They contradict the observations both of geologists and botanists, *e.g.*, Sir Charles Lyell's observations on the vegetation of the young lavas of Vesuvius and Etna, and my own on that of the older lavas of Iceland.† All observation and inquiry lead me to conclude that in no part of the world are rocks of any age—that is, of more than a few months old—absolutely devoid of lichenose vegetation. I have made careful observations on the rapidity of lichen-growth and development, and have shown elsewhere‡ that a very few months or years, in different localities, suffice for the appearance on fresh surfaces, whether of rock or wood, of a luxuriant lichenose vegetation. Beaumont therefore sings, with more truth than the travellers quoted—

* "Memoir of Lord Haddo," by Elliott. London, 1867.

† "Northern Lichen Flora," p. 403; Journal of Linnean Society, vol. ix. Botany.

‡ "To what Extent is Lichen-Growth a Test of Age?"—Report of Brit. Association, 1867, p. 88; Farmer, Oct. 23, 1867, p. 528.

"The *bleakest* rock upon the *loneliest* heath,
Feels in its barrenness *some* touch of spring;
And, in the April dew or beam of May,
Its moss *and lichen* freshen and revive."

Even in the desert of loose sand, or equally loose volcanic dust, where there is not sufficient cohesion of particles to permit of higher vegetable growth, lichens are developed both on the said sand or dust itself, and on all foreign substances of sufficient density to permit of the adhesion of their thallus, or their apothecia—for they are much more frequently athalline than is generally supposed. Thus they coat the bleached bones of the men and animals that have fallen victims to the inhospitality of nature; and all manner of articles of metal, leather, or wood, left by passing travellers. Tennyson sings, with perfect truthfulness of description,—

"And there they lay till all their *bones* were bleached
And *lichened* into colour with the crags."

Some deserts on the Pacific coast of South America appear to be as barren as any in Africa or Asia, if not so extensive. One of them is described by Darwin, who was all day riding across it, as "a complete and utter desert." But he goes on to say, that "the loose sand was strewed over with a *lichen*, which lies on the surface quite *un*attached.* This plant belongs to the genus *Cladonia*, and somewhat resembles the "Reindeer lichen."† In some parts it was in sufficient quantity to tinge the sand, as seen from a distance, of a pale yellowish colour. Further inland, during the whole ride of fourteen leagues, I saw only one other vegetable production, and that was a most minute yellow *lichen*‡ growing on the bones of the dead mules."§

The "Old Bushman," writing of East Finmark, describes "long stretches of shingle and gravel without the least signs of vegetation—*not even lichens*" (p. 373).‖ Von Baer¶ says that absence of vegetation is characteristic of

* A type of an *un*attached desert or steppe lichen is *Lecanora esculenta*, Pall.; described in my "Hist. Brit. Lichens," pp. 228, 211, 51.

† Probably a form of *Cl. rangiferina*, which is known to occur in Brazil.

‡ Probably a form of *Placodium elegans* or *Pl. murorum.*

§ "Naturalist's Voyage," chap. xvi.

‖ "Spring and Summer in Lapland."

¶ "Voyage to Nova Zembla:" Bulletin Scientifique de l'Acad. Impér. des Sciences de St Petersbourg.

the deserts of Nova Zembla. Nevertheless, he goes on to remark, that while foliaceous *lichens* are scarce, every block of augitic porphyry is clothed with crustaceous species, which occur also, though less frequently or copiously, on rocks or stones of other mineralogical character. He specialises *Lecidea geographica* and *Stereocaulon paschale** as prominent forms.

My catalogue enumerates 268 species and varieties (that is, those separately named by systematists) of lichens in Greenland. In 1840 the Greenland lichens on record amounted only to 59: and the difference between these figures shows the extent of the contributions that have been made in the interval to its lichen-flora. I have elsewhere estimated the lichens of Iceland at about 150.† But it must be borne in mind that Iceland is a greatly smaller country than Greenland—occupying only about 3 or 3½ degrees of latitude (from 63½° to 66½°)—while its lichens have certainly not been collected and studied to the same extent. I believe that the lichens both of Greenland and Iceland are at present *under*-estimated. I have no doubt that considerable additions remain to be made to the lichen-flora of both countries. That of Greenland cannot be set down at *less* than 300, and it will probably considerably exceed this. There are few special collections of lichens made in Greenland that do not contain new forms. Thus, Th. Fries, Nylander, and myself, have detected novelties in the collections respectively submitted to our examination—a circumstance that shows what might be achieved by the visit of an experienced lichen-collector even to Greenland. As regards the geographical distribution of Greenland lichens, it is sufficient here to refer to those—

1. That are confined to Greenland.
2. ,, ,, the Arctic regions.
3. ,, common to Britain.
4. ,, ,, the European Alps.

Those that are confined to Greenland, or that may meanwhile be held as so restricted in their distribution, are the new species or varieties described by Fries, Nylander, or

* *Vide* pages 48 and 52.

† "Northern Lichen Flora," pp. 393–4.

myself.* I have little doubt, however, that the majority at least of these lichens will sooner or later be found in other countries—arctic or more southern.

The purely or generally *Arctic* species are very few, viz.:—*Dactylina arctica; Usnea melaxantha; Pyrenopsis hæmatopis; Alectoria jubata*, var. *nitidula; Peltidea scabrosa; Umbilicaria Pennsylvanica; Pannaria lepidiota*, var. *tristis; P. Hookeri*, var. *macrior; Squamaria chrysoleuca*, var. *feracissima; S. melanaspis*, var. *alphoplaca; S. geophila; Lecanora tartarea*, vars. *grandinosa* and *thelephoroides; L. varia*, var. *leucococca; L. atro-sulphurea; L. ferruginea*, vars. *cinnamomea* and *hypnophila; Lecidea spilota*, var. *polaris; L. auriculata; L. armeniaca*, var. *melaleuca; L. pallida; L. insignis*, var. *geophila; L. scabrosa*, var. *cinerascens; L. urceolata*, and var. *deminuta; L. coronata; L. cumulata; L. castanea; L. Tornöensis; L. subfuscula; Arthonia trabinella; Verrucaria maura*, var. *aractina; V. ceuthocarpa.*

But some of these lichens occur in countries or districts south of the Arctic circle. Thus *U. melaxantha* occurs in Iceland (according to Th. Fries, Arct. p. 25, and Carroll in Seemann's "Journal of Botany," vol. v. p. 109). It occurs also very frequently in the southern hemisphere: in Patagonia and its islands, on the Andes, in New Zealand and Tasmania, and on the Antarctic islands. In the Arctic regions it is invariably sterile, while in the Antarctic it is often fertile. *P. hæmatopis* I have found in Iceland† nearly as far south as lat. 64°. *U. Pennsylvanica* occurs in the United States as far south, at least, as lat. 40°. *L. Tornöensis* descends below the Arctic circle, but apparently not many miles. *L. subfuscula* appears to be what Nylander named in my Herbarium *L. bacillifera*, var. *subfuscula*. It occurs in Iceland.‡ *L. coronata* (*Rhexophiale* of Th. Fries, "Arct.," p. 705) appears to be the *Lecidea rhexoblephara*, Nyl., ("Scand.," 240, and Carroll, 290). If so, it occurs in Scotland, on Ben Lawers, according to Jones.

Deducting the species that are mainly or entirely confined in their distribution either to Greenland or to Arctic countries, the majority at least of the remainder occur on

* The *new* species or varieties found by myself in Mr Brown's collections are described in my "Observations on Greenland Lichens."

† "Northern Lichen Flora," p. 370. ‡ Ibid. p. 372.

the Scandinavian alps, and many of them on the alps of Scotland and Switzerland, or generally on those of continental Europe; while a considerable number are common *British* forms. Some lichens, which are only alpine in Britain (Scotland), occur, as might be expected, at low elevations, and even on or near the sea-level, in Greenland (*e.g.*, *Thamnolia vermicularis*, which is abundant in the Jakobshavn district, on or about the coast).

The *non-British* species are the following:—

Alectoria divergens.
Cladonia carneola.
cyanipes.
Cetraria odontella.
Nephroma arcticum.
papyraceum.
Parmelia centrifuga.
Umbilicaria anthracina.
hirsuta.
spodochroa.
Squamaria chrysoleuca.
straminea.
Lecanora chlorophona.
epanora.
oreina.
peliscypha.
molybdina.
Lecanora Jungermanniæ.
turfacea.
nimbosa.
mniaræa.
Lecidea alpestris.
aglæa.
elata.
geminata.
obscurata.
fuscescens.
cuprea.
cinnabarina.
leucoræa.
squalida.
Endocarpon Dædaleum.
Verrucaria mucosa.
clopima.

A comparison of the Greenland lichen-flora with that of Arctic America (assuming Leighton's Catalogue of Sir John Richardson's collections in 1826 * to be representative of the Arctic-American lichen-flora), shows that there exists a considerable difference in the elements of which they are respectively made up. There are certain genera and species in Arctic America that do not occur in Greenland, while there are in Greenland at least many species that do not occur in Arctic America. The first category includes lichens that are more peculiarly *American*; the second those which are characteristically *Scandinavian*.†

In Arctic America there are four genera that are unre-

* Apparently during Franklin's second land expedition, 1825-6.—Journal of Linnean Society, vol. ix. Botany, p. 184.

† So far as we may venture to judge from the present imperfect data, it would appear that the affinities of the Greenland lichen-flora are greater towards that of Scandinavia—and generally of *Europe*—than to that of *America*.

presented in Greenland, viz., *Odontotrema*, *Gyrostomum*, *Xylographa*, and *Graphis*: and the following species:—

Nostoc commune.*
Cladonia cornuta; cariosa; pityrea.
Usnea barbata; lacunosa.
Ramalina calicaris.
Evernia Prunastri.
Nephromium tomentosum.
Platysma Richardsoni; lacunosum.
Sticta herbacea.
Physcia ciliaris; candelaria.
Umbilicaria pustulata; Muhlenbergii.
Squamaria ambigua.
Lecanora fulvo-lutea.
Pertusaria leioplaca.
Lecidea coarctata; vesicularis; tessellata; chalybeia; potrusa; parasitica.
Verrucaria Frankliniana; nigrescens; glabrata.
Odontotrema Richardsoni.
Gyrostomum urceolatum.
Xylographa flexella.
Graphis serpentina.
Arthonia intumescens.

There is, however, a much larger number of lichens belonging to the Greenland flora, and for the most part to that of Scandinavia, that do not occur in Arctic America. These include, besides the new forms found in Brown's collection, the following species enumerated in the present catalogue of Greenland lichens:—

Lecidea—all except geographica; sanguineo-atra; disciformis; atro-brunnea; turgidula; sabuletorum.
Lecanora—all save vitellina; cerina; cinerea; parella; subfusca; glaucoma; oreina; turfacea; varia; bryontha; smaragdula; verrucosa.
Parmelia—all save physodes; saxatilis; olivacea; lanata; stygia.
Umbilicaria—all except vellea; cylindrica; erosa.
Squamaria—all save elegans; chrysoleuca; saxicola.
Stereocaulon—all save tomentosum.
Verrucaria—all except epidermidis.
Ephebe—all.
Endocarpon—all.
Sticta—all.

* This may be included in lists of Greenland *Algæ*. Berkeley (in "Treasury of Botany") places *Nostoc*, and "Falling stars," among *Algæ*.

Urceolaria—all.
Sphærophoron—all.
Pyrenopsis—all.
Arthonia trabinella.
Pannaria lepidiota; Hookeri.
Cetraria aculeata; odontella.
Cladonia bellidiflora; digitata; carneola; cyanipes; verticillata; cervicornis.
Collema flaccidum; melænum; lacerum.
Usnea melaxantha.
Alectoria Thulensis.
Solorina crocea.
Peltidea scabrosa.
Nephroma arcticum.

The difference between the Greenland and Arctic-American lichen-floras is obvious from a comparison of the summary appended to my catalogue of the former with Leighton's similar summary of the latter (p. 185). But comparisons based on such tables alone are most fallacious, inasmuch as they are drawn up on very different principles. Leighton, for instance, gives 35 genera, while I give only 28; the number of species and varieties in Greenland being 268, and in Arctic America 203. My genera are fewer, however, mainly because I do not split up such genera as *Collema*, *Cladonia*, *Usnea*, *Alectoria*, *Cetraria*, *Nephroma*, *Parmelia*, *Physcia*, *Squamaria*, *Lecanora*, *Lecidea*, *Endocarpon*, and *Verrucaria* into the host of sub-genera into which they have been divided of late years by Continental lichenologists. Another class of discrepancies necessarily arises from the different position given to certain anomalous species, such as *Lecanora* or *Pertusaria bryontha*, *Thamnolia* or *Cladonia vermicularis*, *Endocarpon* or *Normandina viride* or *viridis*. Richardson's lichens, according to Leighton, amount to 163 (p. 184)—a number which does not correspond with the total given in his table or summary (p. 185). But he names or numbers a series of trivial or inconstant forms or conditions, which in the hands of some other lichenologists—certainly in mine—would not receive separate nomenclature or enumeration.* Treated in a similar way, the number of species

* His elaboration of the genus *Cladonia* may be taken as an illustration, and compared with my remarks on that genus in my "Arctic Cladoniæ" (p. 179, Trans. Bot. Soc. of Edin., vol. ix.)

and varieties given in the following catalogue of Greenland lichens would be largely increased, for I have neither named nor numbered the "various forms" or "several forms" of many variable species (*e.g.*) of the genera *Cladonia*, *Parmelia*, *Physcia*, *Lecanora*, and *Lecidea*.

Leighton's enumeration, however, is very far from giving an adequate idea of the lichen-flora of the vast area known as Arctic-America. Its deficiencies may be judged of by the number of species mentioned in other works or herbaria as Arctic-American lichens that are not enumerated by Leighton. Thus Tuckerman in his "Synopsis," published in 1848, records the following, which do not occur in Leighton's list:—

Trachylia tigillaris.
Calicium lenticulare, *Ach.*; subtile, *Pers.*; phæocephalum, *T. & B.*
Cladonia alcicornis; carneola; turgida, *Hffm.*
Sphærophoron fragile; globiferum, *L.*; compressum, *Ach.*
Alectoria ochroleuca and *var.* rigida; jubata, *var.* bicolor; implexa, *Fr.*
Ramalina polymorpha.
Dufourea ramulosa, *Hook.*
Cetraria odontella; aculeata.
Solorina crocea.
Nephromium arcticum; resupinatum, *Ach.*
Parmelia tristis; Fahlunensis; caperata; conspersa; diversicolor, *Ach.*
Physcia parietina, *vars.* polycarpa, *Fr.*, and laciniosa, *Duf.*
Pannaria hypnorum; triptophylla, *Fr.*
Squamaria straminea; muscorum.
Lecanora atra; tartarea; pallescens, *Fr.*; oculata; badia; ventosa; exigua; aurantiaca; fusco-lutea, *Hook. & Dicks.*
Urceolaria scruposa.
Thelotrema lepadinum.
Lecidea parasema; fusco-atra; confluens; lapicida; variegata, *Fr.*; rivulosa, *Fr.*; galbula; candida, *Ach.*; vernalis; decolorans, *Fr.*; lucida, *Fr.*
Umbilicaria proboscidea; hyperborea; hirsuta; anthracina, *var.* reticulata, *Sch.*
Pertusaria faginea.
Endocarpon miniatum: læte-virens.
Verrucaria punctiformis, *Pers.* (= *var.* of epidermidis).
Pyrenothea leucocephala, *var.* lecidina, *Fr.* (= Lecidea abietina, *Ach.*)

Nylander, in his "Enumération Générale des Lichens."* published in 1858, mentions in addition,—

Siphula ceratites.
Platysma septentrionale, *Nyl.*
Physcia aquila, *Fr.*, *var.* compacta, *Nyl.*
Umbilicaria arctica.
Lecanora frustulosa, *var.* subventosa, *Nyl.;* subsophodes, *Nyl.*
Pertusaria concreta, *Nyl.*
Lecidea cinnabarina.

In the Menziesian Herbarium (Edinburgh) I found the following—labelled as collected by Richardson, but not included in Leighton's list:—

Alectoria ochroleuca (type).
Parmelia conspersa.
Peltidea scutata.
Umbilicaria hyperborea.
Lecidea fusco-lutea, *Dicks.*

While that of Kew contains the following—also collected by Sir John—but in 1848–9: and not mentioned by Leighton:—

Parmelia saxatilis, *var.* furfuracea.
Peltidea scutata.
Physcia aquila, *var.* compacta; parietina (type).
Umbilicaria proboscidea.
Placodium murorum.
Lecanora polytropa.
Lecidea anomala.

These omissions amount to 84 species and varieties, which, added to Leighton's totals—163 or 203—give an aggregate of 247 or 287: the mean of the two estimates being 267—a number that may be said to equal the aggregate Greenland lichen-flora—268. Both Nylander and Leighton found new species in the Arctic-American lichen-collections which they examined. What is known as Arctic America comprises a very large area of country, much of it wooded; and there can be no doubt, I think, that if its lichens had been collected and studied with the same care as those of Greenland or Spitzbergen, its lichen-flora would have attained a much higher numerical position than that of either of these countries.†

* "Mémoires de la Société Impériale des Sciences Naturelles de Cherbourg," vol. v. 1857, p 85.

† The additions that yet remain to be made will occur, probably, in the group of microscopic saxicolous *Lecideæ* and *Lecanoræ*, which require for their

No proper comparison, however, can be made between Greenland and Arctic America as regards their lichenose vegetation. The area of Richardson's collections—catalogued by Leighton—lies between 47° and 67° N. lat., while that of the various Greenland collections reaches from 60, the southmost point of Greenland, as high as 82° N. lat. Though called Arctic, no part of the so-called Arctic America * of Leighton's catalogue lies within the Arctic circle; † while of equal importance with mere latitudinal difference is the abundance of forests in America, and their absence in Greenland,—a circumstance that has a similar influence in determining the difference between the lichen-floras of Iceland and Scandinavia.‡ In other words, America and Scandinavia possess a large and varied lichen-flora of *corticolous* § species, which cannot be looked for in Greenland or Iceland. This marked difference in the arboreal vegetation of the two countries renders it unnecessary to contrast the lichen-flora of Greenland with that of Scandinavia.

It is, however, both legitimate and interesting to institute a comparison between the lichen-floras of Greenland and Spitzbergen. The latter island is equally devoid of wood; it extends nearly as far to the north as Greenland (76° to 80° N. lat.): and its lichens have been examined and catalogued by the same distinguished Swedish botanist —Fries, the younger—so that uniformity of nomenclature and classification is secured. The lichens of Spitzbergen and its islets amount, according to Fries' "Lichenes Spitsbergenses," to 266,—that is, about the same as those of Greenland. Considering the greatly smaller area of Spitzbergen, this is a large total; but, on the other hand, that arctic island is so easily accessible from Norway that it has

collection, as well as examination and description, the eyes and the special knowledge of a skilled lichenologist.

* *Vide* definition of the term *arctic*, in the author's "Arctic Cladoniæ."

† Arctic America includes also what was, till lately, known as Russian America; and its lichen-flora ought to include the species collected by Dr Seemann during Beechey's voyage in 1848 between Norton and Kotzbue Sounds.

‡ "Northern Lichen Flora," p. 402.

§ It will be observed that Richardson's collections were in great measure of *corticolous* forms.

been repeatedly visited by Scandinavian botanists, specially with a view to plant-collection. Its lichen-flora has thus been much more fully studied than that of Greenland.

Prior to the publication of the "Lichenes Spitsbergenses," our knowledge of the lichen-flora of Spitzbergen consisted mainly of the determinations by Sir William Hooker * and Robert Brown † (of the British Museum), of the few lichens collected by Sir Edward Parry and Dr Scoresby. Parry's collection was made, apparently, chiefly on the Spitzbergen islets, viz :—

Low Island, . . .	80°	20′	N. lat.
Walden Island, . .	80	38	„
Little Table Island, . .	80	48	„
Ross' Islet, . . .	80	49	„

as well as in Hecla Cove, which is, I presume, on the main island. *En route* he also made collections ‡ at Hammerfest, near the North Cape of Norway, about 71° N. lat. Scoresby's collection, again, appears to have been made on the main island, in King's Bay or about Mitre Cape. The determinations of Hooker and Brown were, doubtless, made without microscopical examination ; hence their lists of Spitzbergen lichens are no exception to the rule, that all determinations founded exclusively on external non-microscopical characters include many forms that cannot be identified with modern species. The following illustrations will show the difficulty connected with synonymy in the catalogues of Hooker and Brown. §

Gyrophora deusta, *Ach.*, may be either Umbilicaria flocculosa. *Hffm.;* or, U. arctica ; or U. proboscidea,—to which both Leighton and Th. Fries refer it, and which is a Greenland species.

G. tessellata, *Ach.* is U. anthracina, *Sch.*, var. reticulata, *Sch.*, according to Fries.

G. hirsuta does not occur in Spitzbergen, according to Th. Fries (p. 53), and is therefore an error in determination. He suggests that the plant may have been a form of U. vellea.

* In the Appendix to "Parry's Fourth Voyage," 1827.

† In the Appendix to Scoresby's "Arctic Regions," vol. i. p. 75 ; and also in Robert Brown's collected works, edited by Bennett, 1866, vol. i. p. 181.

‡ Mentioned in his First, Second, and Third, as well as Fourth, Voyages.

§ Compare also "L. Spitsberg.," p. 53, "Species ab auctoribus allatæ, verisimiliter omnino excludendæ."

Cladonia alcicornis is a similar error for similar reasons (Th. Fries, p. 53). Fries suggests the plant was perhaps Cl. macrophylla.

Stereocaulon paschale, Fries suggests, was perhaps really a form of *S. tomentosum* (pp. 27 and 53).*

Sphærophoron fragile. He expresses a similar doubt here, suggesting that it may belong to *coralloides.* I hold such doubts and distinctions, however, to be unnecessarily nice, inasmuch as I see no good ground for separating the different forms of *Sphærophoron* or *Stereocaulon* under separate *species.*

Parmelia stygia, he suggests (p. 12), may belong rather to his *alpicola.* I have seen no authentic specimen of his *alpicola:* but from the circumstance of his recording its occurrence in Scotland, it appears to me that Nylander is probably correct in considering *alpicola* a mere form of *stygia.*

Nephroma polaris, *Ach.*; without fruit: Hammerfest; is probably *N. arcticum*, L.

Alectoria ochroleuca occurs only as var. *rigida*, and A. jubata only as *var.* chalybeiformis (*Th. Fries*).†

Isidium oculatum‡ is doubtless Lecanora oculata.

Parmelia recurva, *Ach.* = P. incurva, *Pers.*

Endocarpon sinopicum, *Whlnb.* = Lecanora smaragdula, *var.*

Lecidea atro-virens, *Ach.* = L. geographica.

Cornicularia spadicea, *Ach.* = Cetraria aculeata.

There is less or no difficulty as to the identification of the remainder of the lichens enumerated by Hooker or Brown, which are the following: §—

Cladonia rangiferina; pyxidata; gracilis; cornucopioides; furcata; bellidiflora.

Cetraria nivalis; Islandica; cucullata.||

Sphærophoron coralloides.

Peltidea canina; aphthosa.

Thamnolia vermicularis.

Parmelia saxatilis, *var.* omphalodes; lanata.¶

* *S. denudatum, Flk.* occurs in Kew Herb., labelled "Ross' Islet (Parry)."

† *Usnea melaxantha*—labelled "Spitzbergen, Sabine and Scoresby"—occurs in Kew Herb.

‡ The specimen in the Kew Herb., labelled "Walden Island (Parry)", appears to me, however, to be referable to *Lecanora tartarea.*

§ I have had the opportunity of examining several of them for myself in the Kew Herb.

|| *C. juniperina* occurs in the Kew Herb., labelled "Arctic Islets (Parry)."

¶ *P. caperata*—in abundant fruit—labelled "Spitzbergen, Ross," occurs in the Kew Herb. But I am not aware of Ross having visited Spitzbergen. *Physcia parietina* (sub nom., *candelaria*), labelled "Ross' Islet (Parry)," occurs in Kew Herb.

Umbilicaria proboscidea ;* erosa.†
Placodium elegans ; murorum.
Lecanora tartarea.‡
Solorina crocea.
Alectoria divergens.

The whole number of species and varieties enumerated by Hooker and Brown is only 37, while the Spitzbergen lichens catalogued by Fries amount to 266,—the very great difference being a measure of the progress that has been made in the collection and study of the lichens of that island since the voyages of Parry and Scoresby. All English lists of Spitzbergen lichens are included in the "Lich. Spitsbergenses" of Fries, which is—and is likely long to remain—a standard work on the lichens of that island.

Contrasting his list with the catalogue, which follows, of Greenland lichens, it is at once obvious that—as in the case of Arctic America—there is a large proportion of species in the one country that does not occur in the other.§ It must suffice, as an illustration, to enumerate those which—occurring in Spitzbergen—have not hitherto been found in Greenland. This category includes, in the first place, no less than 25 new species or varieties found for the first time in Spitzbergen, and described by Fries, viz. :—

* *U. hyperborea* occurs in Kew Herb., labelled "Walden Island (Parry);" and *U. vellea*, labelled, "Ross' Islet (Parry)." What is labelled in the same Herb. *U. proboscidea*, "Parry's Voyage to the North Pole," appears to me to belong to *cylindrica*. In the same Herb. *U. hyperborea* occurs, labelled "Spitzbergen, Parry, Voyage to the North Pole" (partly sub nom., *Gyrophora tessellata*, partly *G. vellea*).

† It does not appear which species of "very large Tripe de Roche" it is that is or are described by Parry as very abundant on rocks on the south side of Walden Island, and on the sides of Little Table Island. In his "Narrative" (1829, pp. 65, 67, and 175) he refers to the abundance on Walden Island of *Umbilicaria proboscidea*, *Cladonia rangiferina*, and *Alectoria divergens*, while the "Tripe de Roche" was more luxuriant than he had ever seen it elsewhere. Scoresby, too, describes the rocks of Spitzbergen as "covered with a mourning veil of black lichens" (consisting apparently of three species of *Umbilicaria; Parmelia stygia;* and *Alectoria chalybeiformis*).

‡ Var. *frigida* (sub nom., *Upsaliensis*) occurs in the Kew Herb., labelled "Spitzbergen, 1773, C. J. Phipps."

§ Some of the deficiencies of the Spitzbergen flora are remarkable, *e.g.*, *Parmelia saxatilis, physodes, olivacea, Fahlunensis; Cladonia furcata: Lecanora glaucoma, cinerea; Urceolaria scruposa: Lecidea fusco-atra, icmadophila; Endocarpon miniatum.*

Toninia conjungens.
Bilimbia microcarpa.
Biatorina globula, *Flk.*, *var.* polytrichina; tuberculosa; Stereocaulorum.
Lecidea polycarpa, *Körb.*, *var.* clavigera; ramulosa; pullulans; sulphurella; impavida; associata.
Sporastatia tenuirimata; Spitsbergensis; cinerea, *Sch.*, *var.* haplocarpa.
Buellia vilis; urceolata; convexa.
Arthonia excentrica.
Polyblastia Gothica.
Verrucaria rejecta; extrema.
Arthopyrenia conspurcans.
Sticta linita, *Ach.*, *var.* complicata.
Lecanora coriacea; erysibe, *Ach.*, *var.* personata.

Deducting these new species and varieties, there still remains the large number of 67 species and varieties not as yet found in Greenland, viz.:—

Dufourea muricata, *Laur.*
Sticta linita, *Ach.*
Physcia parietina, *var.* aureola, *Ach.*
Peltidea malacea, *Ach.*; polydactyla, *Hffm.*
Pannaria microphylla, *Sw.*; arctophila, *Th. Fr.*
Lecothecium asperellum, *Whlnb.*
Arctomia delicatula, *Th. Fr.*
Placodium albescens, *Hffm.*
Lecanora glaucocarpa, *Whlnb.*; subsimilis (*sub.* Gyalolechia) *Th. Fr.*; aipospila, *Whlnb.*; gibbosa, *Ach.*, and *var.* squamata, *Ach.*; mastrucata, *Whlnb.*; cinereo-rufescens, *Ach.*, *var.* alpina, *Smrf.*; rhodopis, *Smrf.*, *var.* melanopis, *Smrf.*; flavida, *Hepp*; Dicksoni, *Ach.*; pyracea, *Ach.*; oligospora, *Rehm.*
Hymenelia Prevostii, *Fr.*
Lecidea (*sub* Toninia) fusispora, *Hepp*; (*sub* Bacidia) viridescens, *Mass.*; venusta, *Hepp*; (*sub* Bilimbia) syncomista, *Flk.*; (*sub* Biatorina) fraudans, *Hellb.*; (*sub* Biatora) miscella, *Smrf.*; collodea, *Th. Fr.*; Lulensis, *Hellb.*; curvescens, *Mudd.*; rupestris, *Scop.*; terricola, *Anzi.*; (*sub* Lecidea) rhætica, *Hepp*; confluens, *Web.*; tenebrosa, *Fw.*; (sub Sporastatia) Morio, *Ram. v.* coracina, *Smrf.*; cinerea, *Sch.*; privigna, *Ach.*; (*sub* Buellia) punctata, *Flk.*; cæruleo-alba, *Kremp.*; Rittokensis, *Hellb.*; coracina, *Hffm.*; coniops, *Whlnb.*
Arthonia fusca, *Mass.*; clemens, *Tul.*
Endocarpon (*sub* Dermatocarpon) cinereum, *Pers.*; pulvinatum, *Th. Fr.*

Verrucaria (*sub* Microglæna) sphinctrinoides, *Nyl.*; (*sub* Polyblastia) theleodes, *Smrf.*, and *v.* Schæreriana, *Mass.*; Helvetica, *Th. Fr.*; hyperborea, *Th. Fr.*; bryophila, *Lönnr.*; gelatinosa, *Ach.*; sepulta, *Mass.*; (*sub* Thelidium) pyrenophorum, *Ach.*; (*sub* Verrucaria) margacea, *Whlnb.*; striatula, *Whlnb.*; rupestris, *Schrad. v.* integra, *Nyl.*; (*sub* Endococcus) gemmifera, *Tayl.*
Collema pulposum, *Bernh.*; ceranoides, *Borr.*; scotinum, *Ach.*
Leciophysma Finmarkica, *Th. Fr.*
Pyrenopsis granatina, *Smrf.*

Several, moreover, of the *genera* in the foregoing list are unrepresented in Greenland, *e.g.*, *Arctomia*, *Lecothecium*, *Hymenelia*, *Sporostatia*, *Polyblastia*, *Bacidia*, *Microglæna*, *Thelidium*, *Leciophysma*.

Did the necessary data exist, it would be interesting to compare the lichen-flora of Greenland with that of the *Arctic-American Islands*—those large islands north of the American continent, intervening between Greenland and what has hitherto been known as Russian America. But, as regards these islands, the necessary data do not exist. Almost all we know of their lichen-flora consists of the determination by Robert Brown (of the British Museum) of the collections of Parry on his first voyage* in Melville Island,† most of which lichens are now in the Kew Herbarium, where I have examined them. In that herbarium I found, labelled "Melville Island (Parry)"—

Alectoria bicolor; ochroleuca; divergens.
Cetraria aculeata.
Usnea melaxantha.
Dactylina arctica.
Pertusaria glomerata.

There are a few other lichens, foliaceous or fruticulose, which *may* have been collected on that or other of the Arctic-American Islands; but the labels are so vague in their reference to localities, that the species to which they

* In the Appendix to the first voyage, 1819–20, and reprinted in Brown's Botanical works, vol. i (1866), p. 250.

† There are probably other citations—*e.g.*, in the List of Dr Sutherland's collections in the "Lady Franklin" (Captain Penney), given by Professor Churchill Babington in "Hooker's Journal of Botany" (vol. iii. 1851, p. 248)—to which I have not at present access. The only quotation in my note-book is *Lecanora vitellina*, on bone used as an implement by the Esquimo on Cornwallis Island.

relate cannot be safely quoted in the present category. Thus one specimen (*Umbilicaria hyperborea*) is labelled, "North-West Passage" (Parry); another, "Arctic Islets;" a third, "Parry's Voyage to the North Pole;" others, "North Pole," or "North Polar Expedition." Such descriptions too frequently constitute *all* the information conveyed by the labels attached to Parry's Arctic lichen-collections contained in the Kew Herb. I have little doubt that they refer mainly, if not exclusively, to the *Spitzbergen* group of islets mentioned on page 47.

Tuckerman, in his "Synopsis," enumerates as Melville Island lichens, following Brown's determination of Parry's collections—

Usnea melaxantha (*sub nom.* sphacelata).
Cladonia pyxidata.
Cetraria odontella.
Stereocaulon paschale.
Parmelia stygia.
Placodium elegans.

Even to this very meagre list difficulties relating to synonymy—similar to those already pointed out under the head of the Spitzbergen collections of the same distinguished navigator, and the determinations of the same celebrated "Botanicorum Princeps"—attach themselves. Thus *Stereocaulon paschale* may be really, as in the Spitzbergen plant, *tomentosum*. I have elsewhere seen it recorded that *S. corallinum*, Fr., occurs both in Melville Island and Ross's Islet, as well as in the "barren lands" of Arctic America. This lichen may be *S. coralloides*, Fr.; but in the "*L. Arctoi*" (p. 142), it is given as not distributed more to the north than Lapland and Nordland. Equally probably it is *tomentosum*: or, according to my own view, it and all the arctic forms of *Stereocaulon* are referable, as mere conditions, to the type *S. paschale*.

The whole list of Melville Island lichens contains the insignificant number of twelve species, while there is no reason to doubt the lichen-flora of the Arctic-American Islands must be as rich, at least, as that of Spitzbergen.

Though by no means to equal extent, the lichen-flora of Iceland is, as I have elsewhere* shown, very defective,

* "Northern Lichen-Flora," pp. 393-4; *vide* also p. 39 of present Memoir.

amounting only to 147 species and varieties. It does not, therefore, any more than the lichen-flora of Arctic America, or the Arctic-American Islands, afford data for comparative generalisations in regard to the lichens of Greenland, and the countries or islands in similar latitudes east and west of it in Europe or America.

Most singularly, there is no record of any *Economical applications* of lichens in Greenland,* while there is no scarcity of evidence regarding the uses to which they are applied in Arctic America, Iceland, and Scandinavia:—(1.) As food for wild or domesticated animals; (2.) As food for man; (3.) As medicines; or (4.) As dye-stuffs. Mr Brown assures me, in more than one of his letters, that lichens are absolutely *un*applied to any useful purpose by the Greenlanders or by the native animals of Greenland. "I really believe," he says, "there are no economic uses for lichens in Greenland. . . . I made inquiries at all the Danish officials, and . . . I have re-examined Rink's 'Grönland Geographisk og Statistik' for any reference, and can find *none.* Now, Rink is Governor of South Greenland, and has passed some fifteen years in the country. Lichens may be used in Iceland and yet not in Greenland, where the Eskimo element is predominant. The Icelanders learned *their* use from their Norse ancestors."†

The author of the "Edinburgh Cabinet Library" volume on Greenland writes (p. 228), "The curious fact of finding reindeer in this desolate region would seem to imply that it was not *all* so barren or devoid of vegetation as the portion just described." But though Crantz, in his "History of Greenland," published in 1820 (p. 61), apparently describes the reindeer food as consisting—in winter at least—of *Cladonia rangiferina*‡—the so-called abundant "reindeer moss" of all arctic and sub-arctic countries—Brown says that it does not now at all constitute their food.§ On the other

* Parallel instances of non-use of lichens in countries in which useful species abound are given in my "Northern Lichen-Flora," p. 415.

† Letter of July 1868.

‡ He also describes hares as living partly on it (p. 66).

§ *Vide* my "Observations on Greenland Lichens," sub *Cl. rangiferina.* A short paragraph on the food of the Greenland Reindeer will be found in Mr Brown's paper "On the Mammalian Fauna of Greenland," in the Proceedings of the Zoological Society (of London) for 1868, No. xxiii. p. 355.

hand, in other parts of the north Polar regions,* if not in Greenland, Captain Hall describes *Cl. rangiferina* as the most important terrestrial vegetation, "for on it feed the herds of reindeer, which are the prey of the wolves, bears, and Esquimaux."† It is only possible to reconcile such discrepancies in evidence by supposing that in certain parts of Greenland, or the Arctic regions generally, "reindeer moss" is abundant, and constitutes the winter or other food of the reindeer; while in others the moss in question is absent or scarce, or it does not form the food, or part of the food, of that animal.

The abundance in Greenland of at least some of the lichens that in other arctic countries are, or have been, serviceable in supplying the wants of man or animals, and the possibility of developing the economical applications of lichens in a country whose resources are otherwise so limited, render it desirable here to make some reference to certain of the uses elsewhere of the more abundant arctic species.

In arctic America the various *Umbilicariæ*—as "Tripe de roche"—have played a very prominent part in the history of geographical exploration,—more especially so in the record of the now well-known land journey of Franklin, Richardson, Hood, and Back. When, in October 1821, Franklin and his companions were pushing on for the Coppermine River in a condition approaching starvation, under the joint influence of cold and hunger, that intrepid explorer writes:—"Our suffering from cold in a comfortless canvas tent, in such weather, with the temperature at 20 degrees, and without fire, will easily be imagined: it was, however, less than that which we felt from hunger. . . . . Weak from fasting, and their garments stiffened with the frost, after packing their frozen tents and bed-clothes, the poor travellers again set out on the 7th. . . . . After feeding almost exclusively on several species of *Gyrophora* (= *Umbilicaria*), a lichen known as 'Tripe de roche,' which scarcely allayed the pangs of hunger, on the 20th they got a good

* Mr Brown writes me, "Hall's Esquimaux Land refers, I suspect, wholly to the *western* shores of Davis Straits. In Danish Greenland there is scarcely a pure native living."

† "Life with the Esquimaux:" the narrative of Captain Hall of the whaling barque "George Henry." 2 vols. London, 1864.

meal by killing a musk ox. . . . . On the 17th they managed to allay the pangs of hunger by eating pieces of singed hide and a little 'Tripe de roche.' This and some mosses, with an occasional solitary partridge, formed their invariable food: on very many days even this scanty supply could not be obtained, and their appetites became ravenous. . . . . Mr Hood was also reduced to a perfect shadow from the severe bowel complaint which the 'Tripe de roche' never failed to give him. . . . . Not being able to find any 'Tripe de roche,' they drank an infusion of the 'Labrador tea plant' (*Ledum palustre*, v. *decumbens*), and ate a few morsels of burnt leather for supper. This continued to be a frequent occurrence."*

Horace Marryat, in his "One Year in Sweden,"† writes, "We now tread under foot what has served as food for men, baked into bread, and that right often in Sweden,"—referring, probably, to *Cladonia rangiferina*, for he mentions *Cetraria Islandica* separately. "The peasants are ready prepared for famine. . . . . In an old book are printed as many as thirteen receipts for what is termed 'Weed bread,' commencing with Bark." Iceland moss, or lichen-bread, is only one kind. Among others there are bone, grass, straw, sorrel, bran, and furze, breads! The substances which give the bread its name are, in these cases, probably only the *chief* ingredients as to bulk. Consul Campbell, in his report to the British Government on the trade of Finland for the year 1867, alluding to the famine of that year in that country, says, "The bread given to support life is composed of pease straw, combined with Iceland moss and a small proportion of flour."

The "Old Bushman," in his "Spring and Summer in Lapland,"‡ writes, "that the reindeer thrive (on *Cl. rangiferina*), is proved by the fact that no park-fed deer in England can look fatter and sleeker than the reindeer when they come down from the fells at the end of summer; in fact, 'fat as a reindeer,' is a common saying here." It would even appear to be occasionally too rich a fodder. The hair of

* Extracts from the narrative of Franklin's First Land Expedition (1819–21), in Simmond's "Sir John Franklin and the Arctic Regions."

† London, 1862, vol. i. p. 231, describing the Falls of Trollhättan.

‡ London, 1864, p. 173.

the animal becomes frequently very brittle; it snaps across as if rotten, and falls readily from the skin. This condition is ascribed to its feeding too much on "dry moss" (p. 220). That *Cl. rangiferina* contains a considerable percentage of starchy matter is shown by the fact, that quite recently a Swedish chemist has obtained *alcohol* from it in large quantity (as well as from other *amyliferous lichens*), by converting the *starch* into sugar by heat and acids, and the sugar into alcohol by fermentation.*

Parry points out the scarcity of *Cl. rangiferina* in certain parts of the North Polar regions, in relation to the requirements of tame reindeer. "It would be next to impossible to procure there a supply of provender sufficient even to keep them alive, much less in tolerable condition, a whole winter" (p. 206). He shipped reindeer—for sledge-drawing during his expedition—at Hammerfest, taking with him a supply of *Cl. rangiferina* as their only provender (p. 7).†

Franklin states that his party "used the reindeer moss for *fuel*, which afforded us more warmth than we expected" (p. 128)‡.

II. *Enumeration of the Lichens of Greenland.*

Gen. 1. *Ephebe.*

Sp. 1. *pubescens, *L.*§ Th. Fries mentions it only on authority of Nylander (Syn. p. 90).

Gen. 2. *Pyrenopsis.*

Sp. 2. hæmatopis, *Smrf.*

Gen. 3. *Collema.*

Sp. 3. *melænum, *Ach.*

4. *flaccidum, *Ach.* (Synechoblastus.) ||

5. saturninum, *Dicks.* (Leptogium.)

6. *lacerum, *Sw.*

var. pulvinatum, *Ach.*

* "Illustrated London News," November 7, 1868.

† "Narrative of an Attempt to reach the North Pole" (in 1827), by Captain Parry. London, 1829.

‡ Narrative of his First Land Expedition, 1819–22, vol. ii. 2d ed. London, 1824.

§ The prefixed asterisks indicate the species or varieties collected by Mr Brown. They have been already separately enumerated in his "Florula Discoana," Trans. Bot. Soc. Edin. vol. ix. p. 454.

|| The generic names given in parentheses are those of Th. Fries' classification of Arctic lichens (in his "L. Arctoi," 1860, and "L. Spitsbergenses," 1867).

Gen. 4. *Calicium.*

Sp. 7. *furfuraceum, *L.* (Coniocybe.)

Gen. 5. *Sphærophoron.*

Sp. 8. *coralloides, *Ach.*; various forms (*e.g.* isidioidea, *Linds.*); rarely fertile.

9. fragile, *L.*; frequently fertile.

Gen. 6. *Cladonia.*

Sp. 10. *pyxidata, *L.*; several forms.

11. carneola, *Fr.*; not mentioned by Th. Fries, but cited by Tuckerman (Syn. Lich. New Engl. p. 52), on authority of Fries père.

12. verticillata, *Hffm.*, and
var. cervicornis, *Ach.*; both rare.

13. *gracilis, *L.* (ecmocyna, *Ach.*); various forms.

14. *furcata, *Schreb.*, and
var. crispata, *Ach.*
subulata, *L.*
pungens, *Ach.*, and other forms.

15. *rangiferina,† *L.*, and
var. sylvatica, *Hffm.*

16. *uncialis, *L.*; various forms.

17. *amaurocrœa, *Flk.*; fruit common.

18. *cornucopioides, *L.*

19. *bellidiflora, *Ach.*

20. *deformis, *L.*; various forms.

21. digitata, *L.*

22. *degenerans, *Flk.*, and
var. coralloidea, *Ach.*

23. *alcicornis, *Flk.*

24. *squamosa *Hffm.*; various forms.

25. *fimbriata, *Hffm.*

26. *cyanipes, *Smrf.*

Gen. 7. *Stereocaulon.*

Sp. 27. *paschale, *L.*

28. *tomentosum, *Fr.*, and vars. or forms
*alpinum,‡ *Laur.*
coralloideum, *Linds.*

† Th. Fries spells this *Rhangiferina*; but the other, though probably etymologically *in*correct, is the spelling generally adopted.

‡ For remarks on the *gender* of the botanical names of *varieties*, see the author's "Contributions to New Zealand Botany," 1868, p. 95. On this subject Dr Donaldson, Rector of the Royal High School of Edinburgh, expresses the following opposite opinion:—"The true method with scientific names—as far as I am entitled to have an opinion—is that the *species* should be a noun: the *variety* should be expressed either by a noun in apposition, but much better by an *adjective agreeing with the noun denoting the species.* I think the word "*varietas*" should have no influence." (Letter, dated December 1868).

Sp. 29. *denudatum, *Flk.*, and
var. pulvinatum, *Sch.*

Gen. 8. *Thamnolia* (Cladonia).
Sp. 30. *vermicularis, *Sw.*

Gen. 9. *Usnea.*
Sp. 31. melaxantha, *Ach.*; always sterile.

Gen. 10. *Alectoria.*
Sp. 32. jubata, *L.* (Bryopogon), and
**var.* bicolor, *Ehrh.*
*chalybeiformis, *L.*
nitidula, *Th. Fr.*; all sterile.
33. *Thulensis, *Th. Fr*†.
34. *divergens, *Ach.* (Cornicularia.)
35. *ochroleuca, *Ehrh.*, and
vars. cincinnata, *Fr.*
sarmentosa, *Ach.*; very rare, on branches of *Salix glauca.*
*rigida, *Vill.*
*nigricans, *Ach.*‡

Gen. 11. *Dactylina.*
Sp. 36 *arctica, *Br.* (Cladonia; Dufourea). Always sterile, says Th. Fries (Arct. p. 160).

Gen. 12. *Cetraria.*
Sp. 37. *aculeata, *Ehrh.* (Cornicularia), and
**var.* alpina, *Hepp*, 360.
muricata, *Ach.*
*acanthella, *Ach.*; with other forms.
38. *odontella, *Ach.*
39. Islandica, *L.*; and vars. or forms
*leucomeloides, *Linds.*
platyna, *Ach.*
*crispa, *Ach.* §
*Delisei, *Bory.*
40. *nivalis, *L.*
41. *cucullata, *Bell.*
42. juniperina, *L.*
var. pinastri, *Scop.*
43. sæpincola, *Ehrh.* (on bark of *Betula.*)

Gen. 13. *Nephroma.*
Sp. 44. *arcticum, *L.*; always sterile.
45. papyraceum, *Hffm.* (Nephromium, *Nyl.*)
var. sorediata, *Sch.*

† Assigned to *A. nigricans* in Fries' "L. Spitsberg."

‡ Promoted to the rank of a separate species in Fries' "L. Spitsberg."

§ In the Edinburgh University Herbarium there are specimens labelled "*C. Boryi*, Dél., Greenland," from Fries; and "Newfoundland," from Bory, 1831.

Gen. 14. *Peltidea.*

Sp. 46. *aphthosa, *Ach.*

47. *canina, *Hffm.;* various forms. Not mentioned by Th. Fries, but cited by Tuckerman (Syn. Lich. N. Engl. p. 29), on authority of Giesecké.

48. *rufescens, *Fr.*

49. scabrosa, *Th. Fr.;* fruit.

50. *venosa, *L.*

Gen. 15. *Solorina.*

Sp. 51. *crocea, *L.*

52. saccata, *L.*, and
var. limbata, *Smrf.*

Gen. 16. *Sticta.*

Sp. 53. scrobiculata, *Scop.*

Gen. 17. *Parmelia.*

Sp. 54. *saxatilis, *L.*, and
**var.* omphalodes, *L.*
*panniformis, *Ach.*
*leucochroa, *Wallr.*
*sphærophoroidea, *Linds.*

55. physodes, *L.*, and
**var.* obscurata, *Ach.*

56. *encausta, *Sm.*, and
var. intestiniformis, *Vill.*

57. hyperopta, *Ach.* (= aleurites, *Ach.*)

58. *olivacea, *L.;* various forms.

59. *Fahlunensis, *L.*, and
var. sciastra, *Fr.*
polyschiza, *Nyl.*

60. *stygia, *L.;* various forms.

61. alpicola, *Th. Fr.* (Arct. p. 57.)

62. *lanata, *L.;* fruit abundant.

63. conspersa, *Ehrh.*

64. centrifuga, *L.*

65. incurva, *Pers.*

66. diffusa, *Web.* (= ambigua, *Ach.*)

Gen. 18. *Physcia.*

Sp. 67. *pulverulenta, *Schreb.*
var. muscigena, *Ach.*

68. *stellaris, *L.;* various forms.

69. *cæsia, *Hffm.*, and
var. albinea, *Ach.*

70. obscura, *Ehrh.*
var. orbicularis, *Neck.*

71. lychnea, *Ach.* (Xanthoria controversa, *Mass.*, *var.* pygmæa, *Bory*, Th. Fr. p. 68.)

Gen. 19. *Umbilicaria.*

Sp. 72. Pennsylvanica, *Hffm.*

73. *vellea, *L.*

74. *spodochroa, *Hffm.*

75. anthracina, *Wulf.*

76. *arctica, *Ach.*

77. *hyperborea, *Ach.*

78. proboscidea, *L.*

79. flocculosa, *Hffm.* Not cited by Th. Fries, but mentioned as occuring in Greenland by Tuckerman (Syn. Lich. New England, 1848, p. 71).

80. erosa, *Web.*

81. polyphylla, *L.;* only in one locality.

82. *cylindrica, *L.;* various forms.
    var. Delisei, *Despr.*, is frequent in Greenland according to Dr Nylander (Scand. p. 117)

83. hirsuta, *Ach.* Walker and Mitten† cite this from Greenland (Leively). It is not, however, mentioned in Th. Fries' "L. Arctoi" as a Greenland lichen, and doubtfully as an, or as a very rare, Arctic-Scandinavian species.

Gen. 20. *Pannaria.*

Sp. 84. *brunnea, *Sw.*, and
    **var.* coronata, *Hffm.*

85. lepidiota, *Th. Fr.* (Arct. p. 74), and
    var. tristis, *Th. Fr.*

86. Hookeri, *Sm.*
    var. macrior, *Th. Fr.*

87. hypnorum, *Vahl.* (Psoroma, *Fr.*, *Nyl.*)

88. muscorum, *Ach.* (Massalongia carnosa, *Dicks.*)

Gen. 21. *Squamaria.*

89. *saxicola, *Poll.* (Placodium.)

90. *chrysoleuca, *Sm.*, and
    **var.* opaca, *Ach.*
        *feracissima, *Th. Fr.* (L. Spitsb. p. 18.)

91. straminea, *Whlnb.*

92. gelida, *L.*

93. *elegans, *Link.* (Xanthoria.)

94. murorum, *Hffm.*

95. fulgens, *Sw.* (Placodium.)
    var. alpina, *Th. Fr.*

96. melanaspis, *Ach.* (Lecanora, *Nyl.*)
    var. alphoplaca, *Whlnb.*

97. geophila, *Th. Fr.* p. 85.

† Journ. Linn. Soc., Botany, vol. v. p. 87.

Gen. 22. *Lecanora.*

Sp. 98. *tartarea, *L.*, and
var. frigida, *Sw.*
*gonatodes, *Ach.*
vermicularia, *Linds.*
*grandinosa, *Ach.*
thelephoroides, *Th. Fr.* (L. Spitsb. p. 21.)
99. *parella, *L.* (pallescens, *L.*), and
var. Upsaliensis, *L.*
100. *oculata, *Dicks.* (Aspicilia); various forms, common.
101. atra, *Huds.*
102. *subfusca, *L.*, and
var. epibrya, *Ach.*
Hageni, *Ach.*†
103. *frustulosa, *Dicks.*
104. epanora, *Ach.*; doubtfully.
105. *badia, *Ehrh.*
106. varia, *Ehrh.*
var. symmicta, *Ach.*
*polytropa, *Ehrh.*
*intricata, *Schrad.*
leucococca, *Smrf.*
107. atro-sulphurea, *Whlnb.*
108. cenisea, *Ach.*
109. glaucoma, *Ach.* (sordida, *Pers.*)
110. *bryontha, *Ach.*
111. peliscypha, *Whlnb.* (Acarospora.)
112. molybdina, *Whlnb.*
113. *smaragdula, *Whlnb.*, and
var. sinopica, *Whlnb.*
114. chlorophana, *Whlnb.*
115. *ventosa, *L.* (Hæmatomma.)
116. nimbosa, *Fr.* (Dimelæna.)
117. oreina, *Ach.*
118. *turfacea, *Whlnb.* (Rinodina), and
var. depauperata, *Th. Fr.*
roscida, *Smrf.*
119. *sophodes, *Ach.*; various forms.
120. mniaræa, *Ach.*
121. exigua, *Ach.*
122. verrucosa, *Ach.* (Aspicilia), and
var. paryrga, *Ach.*
123. *calcarea, *L.*
var. contorta, *Hffm.*

† Stizenberger, in "Botanische Zeitung" (1868, p. 895), mentions var. *atrynea*, Ach., as occurring in Greenland.

Sp. 124. *cinerea, *L.*, and
**var.* Myrini, *Fr.*
aquatica, *Fr.*, and other forms.
125. lacustris, *With.*
126. ferruginea, *Huds.* (Caloplaca.)
var. cinnamomea, *Th. Fr.*
hypnophila, *Th. Fr.*
127. Jungermanniæ, *Vahl.*, and
var. convexa, *Sch.*
128. fusco-lutea, *Dicks.*
129. *cerina, *Hedw.*
var. stillicidiorum, *Œd.*
130. aurantiaca, *Lightf.*; doubtfully.
131. crenulata, *Th. Fr.*, p. 70 (Xanthoria).
132. vitellina, *Ehrh.*
133. leucoræa, *Ach.* (Blastenia.)

Gen. 23. *Urceolaria.*
Sp. 134. scruposa, *L.*

Gen. 24. *Pertusaria.*
Sp. 135. *P. paradoxa, *Linds.*

Gen. 25. *Lecidea.*
Sp. 136. contigua, *Hoffm.*, and
var. flavicunda, *Ach.*
137. *fusco-atra, *L.*
138. panæola, *Ach.*
var. elegans, *Th. Fr.*
139. spilota, *Fr.* (tessellata, *Flk.*), and
var. polaris, *Th. Fr.*
140. *lapicida, *Ach.*; rare, and only the ferruginous conditions of the ordinary form.
141. auriculata, *Th. Fr.* (Arct. p. 213).
142. alpestris, *Smrf.* ("fere *L. aggeratæ*, Mudd," says Th. Fries, L. Spitsb. p. 39). Nylander's *L. stenotera*, recorded as a Norwegian species in my "North. Lichen Flora," p. 385, Th. Fries refers to *alpestris* as a variety (L. Arct. p. 214).
143. arctica, *Smrf.*
144. aglæa, *Smrf.*
145. *sabuletorum, *Schreb.*, and
var. muscorum, *Wulf.*
146. *parasema, *Ach.*, and
var. enteroleuca, *Ach.*
euphorea, *Flk.*, and other forms.
147. turgidula, *Fr.*
var. denudata, *Schrad.*
148. atro-brunnea, *Ram.*

Sp. 149. armeniaca, *DC.*
var. melaleuca, *Smrf.*
150. elata, *Sch.* (= amylacea, *Ach.*)
151. pallida, *Th. Fr.* (Arct. p. 221).
152. vitellinaria, *Nyl.*
153. *disciformis, *Fr.* (Buellia).
154. insignis, *Næg.*
var. muscorum, *Hepp.*
geophila, *Smrf.*
155. *myriocarpa, *DC.*
156. *atro-alba, *Ach.;* by no means rare, according to Th. Fries (Arct. p. 231).
157. scabrosa, *Ach.*
var. cinerascens, *Th. Fr.*
158. urceolata, *Th. Fr.* (Arct. p. 233), and
var. deminuta, *Th. Fr.;* parasitic on thallus of various lichens.
159. coronata, *Th. Fr.*, p. 205 (Rhexophiale).
160. geminata, *Fw.* (Rhizocarpon); common.
161. *petræa, *Wulf.*, and
var. Œderi, *Ach.*, with other forms.
162. *Groenlandica, *Linds.*
163. *geographica, *L.*, and
**var.* alpicola, *Sch.*
164. globifera, *Ach.* (Psora), and
var. rubiformis, *Whlnb.*
165. atro-rufa, *Dicks.*
166. decipiens, *Ehrh.*
167. squalida, *Ach.* (Toninia.)
168. candida, *Web.* (Thalloidima.)
169. *obscurata, *Smrf.* (Bilimbia.)
170. cumulata, *Smrf.* (Biatorina.)
171. cinnabarina, *Smrf.* (Biatora.)
172. *vernalis, *L.*
173. cuprea, *Smrf.*
174. *castanea, *Hepp.*
175. Tornöensis, *Nyl.*
176. fuscescens, *Smrf.*
177. uliginosa, *Schrad.*
178. leucoræa, *Ach.* (Blastenia.)
179. pezizoidea, *Ach.* (Lopadium); rare.
180. flavo-virescens, *Dicks.* (Arthroraphis.)
181. icmadophila, *Ach.* (Icmadophila æruginosa, *Scop.*)
182. *sanguineo-atra, *Ach.;* various forms.
183. *fusco-rubens, *Nyl.*
184. *Discöensis, *Linds.*
185. *Campsteriana, *Linds.*

Sp. 186. Friesiana, *Linds.*
187. *Egedeana, *Linds.*
188. subfuscula, *Nyl.* Recorded as a Greenland species in Th. Fries' "L. Spitsb.," p. 35, though not in his "L. Arct."

Gen. 26. *Arthonia.*
Sp. 189. trabinella, *Th. Fr.* (Arct. 240); on fabricated wood.

Gen. 27. *Endocarpon.*
Sp. 190. miniatum, *L.* (Dermatocarpon), and
var. complicatum, *Sw.*
191. hepaticum, *Ach.*
192. Dædaleum, *Kremp.;* rare.
193. *viride, *Ach.* (Normandina, *Nyl.*)

Gen. 28. *Verrucaria.*
Sp. 194. clopima, *Whlnb.* (Staurothele).
195. maura, *Whlnb.*, and
var. aractina, *Whlnb.*
196. ceuthocarpa, *Whlnb.*, and
var. mucosa, *Whlnb.*
197. epidermidis, *Ach.* (Arthopyrenia).
var. analepta, *Ach.;* rare.
198. pygmæa, *Körb.* (Endococcus, *Nyl.*); parasitic.
199. tartaricola, *Linds.*

Pseudo-genus. *Pyrenothea.*
Sp. 200. *P. Groenlandica, *Linds.*

Summary.

Genus.	Number of Species and Varieties.	Genus.	Number of Species and Varieties.
1. Ephebe,	1	Brought forward,	76
2. Pyrenopsis,	1	16. Sticta,	1
3. Collema,	4	17. Parmelia,	21
4. Calicium,	1	18. Physcia,	6
5. Sphærophoron,	2	19. Umbilicaria,	13
6. Cladonia,	23	20. Pannaria,	7
7. Stereocaulon,	6	21. Squamaria,	11
8. Thamnolia,	1	22. Lecanora,	54
9. Usnea,	1	23. Urceolaria,	1
10. Alectoria,	11	24. Pertusaria,	1
11. Dactylina,	1	25. Lecidea,	63
12. Cetraria,	14	26. Arthonia,	1
13. Nephroma,	2	27. Endocarpon,	5
14. Peltidea,	5	28. Verrucaria,	8
15. Solorina,	3		
Carry forward,	76	Total,	268

The genera richest in *species* are, therefore, in the order of their richness.

1. Lecidea.	5. Cetraria.
2. Lecanora.	6. Umbilicaria.
3. Cladonia.	7. Squamaria. }
4. Parmelia.	8. Alectoria. }

These are not necessarily, however, the genera richest in *individuals*,—the genera, therefore, which give a character to or constitute predominant vegetation. There is insufficient evidence to show what the latter genera are. All that can be asserted, on the evidence of travellers, is, that in some localities the predominant lichens and the prevailing vegetation are species of *Umbilicaria* or *Placodium*. There is no evidence that the *Cladoniæ* occupy the same important position—as coverers of the soil—that they do in Northern Scandinavia and Russia,* or that the *Alectoriæ*, *Cetrariæ*, and *Parmeliæ* occur in the same gregarious assemblages that I have seen them do in Norway or Iceland.†

III. *Notes of Diatomaceæ from Danish Greenland, collected by Robert Brown.* By Professor Dickie, Aberdeen. No. I.

Mr Brown sent for examination small packets of material collected at various places along the coast of Danish Greenland, with a request that any Diatomaceæ they contained might be recorded.

The larger marine algæ, from high northern latitudes, I have invariably found to yield abundance of these organisms. The species collected by Mr Brown, as well as his special diatomaceous gatherings, have not yet been seen by me, andtherefore the present communication gives but an imperfect idea of the marine Diatomaceæ in the localities visited.

No. 1. A small mass, chiefly of *Hypnum fluitans*, in the sea at Jakobshavn, contained the following :—

Cocconeis scutellum.	Rhabdonema arcuatum.
Coscinodiscus eccentricus.	Cocconema cistula.
Stauroneis pulchella.	C. parvum.
Hyalodiscus subtilis.	

* *Vide* paper on the "Arctic Cladoniæ," p. 179.

† "Flora of Iceland," p. 24 (Trans. Bot. Soc. of Edin., or Edin. New Philosophical Journal, 1861); 'Northern Lichen Flora," p 403, *et seq.*

The two latter are fresh-water species, and were, doubtless, attached to the Hypnum before it was conveyed to the sea ; the marine species seemed not merely entangled among the mass, but attached to it.

No. 2. A mass of Ectocarpus, from Jakobshavn, contained the following—

Cocconeis scutellum.	Grammonema Jurgensii.
Coscinodiscus eccentricus.	Podosphenia gracilis.
C. radiatus.	

And very fine examples of two fresh-water species, viz.:—

Himantidium undulatum.	Pinnularia stauroneiformis.

No. 3. A mass of Schizonema and Cladophora, floating in Jakobshavn, contained—

Cocconeis scutellum.	Grammonema Jurgensii.
Synedra salina.	Biddulphia —— ; a few fragments, too imperfect for recognition.
Podosphenia gracilis.	
Podosira hormoides.	

The Schizonema is doubtfully referred to *S. Dilwynii*, being in a very imperfect condition.

No. 4. At a depth of three fathoms, Jacobshavn.

Cocconeis scutellum, *var.* β.	Navicula didyma.
Coscinodiscus radiatus? fragments only.	N. elliptica.
C. eccentricus.	N. liber.
Campylodiscus angularis, a solitary example.	Stauroneis pulchella.
Synedra salina.	Podosira hormoides.
Amphiprora alata.	Hyalodiscus subtilis.
Surirella gemma.	Rhabdonema arcuatum.
Nitzschia sigma.	Biddulphia aurita.
	Schizonema ?

No. 5. A mass, chiefly of Dictyosiphon, from sea-shore, Rittenbenk, contained—

Cocconeis scutellum.	Eupodiscus fulvus ?
Coscinodiscus eccentricus.	Grammonema Jurgensii.
C. radiatus.	Podosira hormoides.

And a single example of a fresh-water species, viz., *Gomphonema geminatum.*

No. 6. A mass, consisting mainly of Conferva Melagonium, Dictyosiphon, and Lyngbya, from Godhavn, contained—

Cocconeis Grevillei.
C. scutellum.
Coscinodiscus radiatus.
C. eccentricus.
Amphora membranacea, one only.
Synedra gracilis?
Navicula Jenneri.
N. elliptica.
Nitzschia angularis?
Podosira hormoides.
Grammatophora serpentina.

All the species recorded here are British, with the single exception of *Hyalodiscus subtilis*, originally described by the late Professor Bailey from Halifax, found also on shores of North-West America, and now on shores of Greenland.

IV. *Notice of Mosses found by Mr Charles Jenner and Mr Charles Howie in Inverness-shire and Ross-shire, in July* 1868. By Mr Howie, Largo.

In company with Mr Jenner, I again visited that part of Ross and Inverness which we had traversed last year.* We once more took up our quarters at Invergarry, and searched several lateral streams, their cliffs and waterfalls, that flow into Loch Garry and its river. We also ascended Gleorach, at the head of the Luing water, and searched the corries there, as well as those of Ben Tigh, on the opposite side of the glen. We passed the whole length of Glen Garry and Glen Quoich, to the rugged western district of Loch Hourn Head. Leaving Glen Garry, we went to Glen Urquhart and the valley of the Affrick, and there ascended Mam-Soul. Glen Urquhart has been noticed as the abode of men and the scene of cultivation, in contradistinction to the adjacent glens of the Garry and the Morriston, the Cannick and the Affrick, where deer and other game predominate. This state of things seems due to natural causes. Accumulations of drift alluvial soil to a great depth have been deposited in Glen Urquhart, and it offers to the agriculturist a profitable field for enterprise. It presents also a flora of an altogether different character from that of the surrounding glens. It seems that this is due to the circumstance, that the mighty glaciers, which in times gone by have swept down Strath Affrick from the lofty mountains at its head, Mam-Soul, Ben Attow, Frucharry, and others, have been turned aside into Strath

* Vol. ix. p. 312.

Glass by the great barrier of hard rocks that shut in Glen Urquhart on the north-west. We afterwards passed by Glen Morriston to Loch Duich, by Cluny and Glenshiel on our way to Loch Carron, and went aside to the falls and great gully of the Glomak. From Jeantown, on Loch Carron, we ascended Ben-y-Bhain by Loch Kishorn and the Pass of Beallach-na-ba. We now went on to our old quarters at Kinloch Ewe, searched again the mountains at the head of Loch Maree and Loch Torridon, and the glens, corries, and deep ravines and gullies of Ben Each and Ben Sleagach. The weather had been and was very dry, and many deep narrow gullies were thus visited, which had, as our guide told us, been untrodden by man within his memory; and he was an old man.

The following were the principal mosses collected, which we have arranged under their Natural Orders:—

1. *Andreæaceæ*—
   Andreæa alpina.
   falcata (rare).
2. *Sphagnaceæ*—
   The species of this order were found generally distributed throughout the district in pools and marshy places.
   Sphagnum cymbifolium.
   acutifolium.
   cuspidatum.
   contortum.
   var. obesum.
   molluscum. (Side of a pool on Ben Each).
   rubellum. (Side of a pool on Ben Each).
   squarrosum. (Dripping high cliffs of Ben Sleagach, associated with *Epilobium rosmarinifolium*).
3. *Weissiaceæ*—
   Gymnostomum rupestre. (Fissures of wet rocks).
   var. ramosissimum. (Ben Each).
   Rhabdoweissia fugax. (A small alpine form).
4. *Dicranaceæ*—
   Dicranum Starkii.
   falcatum.
   Blyttii. (Ben Sleagach)..
   scoparium.
   majus.
   Scottianum. (Ben Each).
   fuscescens. (A rigid form of this species was met with on Mam-Soul).

Campylopus setifolius. (Ben Each).
flexuosus.
densus.
fragilis.
atro-virens. (*C. longipilus* of Bridel. Common on wet rocks at the head of Loch Hourn).
alpinus.
Dicranodontium aristatum.
Leucobryum glaucum.

5. *Fissidentaceæ*—
Fissidens adiantoides.
osmundoides.

6. *Seligeriaceæ*—
Blindia acuta. (Frequent on wet rocks).

7. *Orthotrichaceæ*—
Ulota crispa.
Drummondii.
phyllantha.
Hutchinsiæ. (Only met with in one place on Ben Each).
Orthotrichum stramineum. (On birch trees overhanging a deep ravine).
leiocarpum.
affine.

8. *Grimmiaceæ*—
Grimmia apocarpa.
var. rivularis. (Frequent in the mountain streams).
Racomitrium aciculare.
sudeticum.
protensum.
lanuginosum.
canescens.
var. ericoides.
fasciculare.
heterostichum.

9. *Splachnaceæ*—
Two species belonging to this family were frequently met with.
Splachnum sphæricum.
Tetraplodon mnioides.

10. *Bryaceæ*.
Webera annotina.
Ludwigii.
elongata.
albicans.
nutans.
Zierii.
Bryum atro-purpureum.

Byrum Muhlenbeckii. (On Ben Sleagach).
Duvalii.
pallens.
pseudo-triquetrum.
julaceum.
var.
Mnium hornum.
punctatum.

11. *Bartramaceæ*—
Bartramia pomiformis.
Halleriana. (In fruit near the falls of the Glomak).
Breutelia arcuata. (In fruit on wet rocks at Loch Hourn Head.
Philonotis fontana.

The last species was of frequent occurrence in fruit, and amongst the dripping cliffs of the great corrie of Ben Sleagach, we collected (as we also did last year) a small slender form of it, which we submitted to Professor Schimper, and he considers it of sufficient interest to send the following description and drawings of it:—

TABULÆ EXPLICATIO.

Surculi Steriles Philonotis fontanæ.

"Fig. 1. Surculi magnitudine naturali. Fig. 2. Surculi pars superior aucta. Fig. 3, 4, 5, folia. Fig. 6. Caulis segmentum, foliorum insertionem demonstrans. Fig. 7. Folii rete basilare. Fig. 8. Ejusdem rete apicale. Fig. 9. Partes sectionis transversæ caulis. Fig. 10. Folii sectiones transversales.

"J. S. T. SCHIMPER.

"ARGENTERATI, 24° *d. Februarii*, 1868."

12. *Polytrichaceæ*—
Atrichum undulatum.
Oligotrichum hercynicum.
Pogonatum aloides.
alpinum.
urnigerum. (A small form).
Polytrichum sexangulare. (On Ben Each).
commune.
piliferum.

13. *Buxbaumiaceæ*—
Diphyscium foliosum.

14. *Fontinalaceæ*—
Fontinalis squamosa. (Frequent in the mountain rivulets).

15. *Orthotheciaceæ*—
Homalothecium sericeum.

16. *Leucodontaceæ*—

Antitrichia curtipendula.

17. *Hypnaceæ*—

Plagiothecium undulatum.
denticulatum.
sylvaticum. (In a ravine on Ben Each).
Muhlenbeckii.

Thamnium alopecurum.

Eurhynchium striatum.
prælongum.
Swartzii. (Quartz rocks on Ben Each).
crassinervium.

Hyocomium flagellare.

Isothecium myurum.
myosuroides.

Brachythecium salebrosum. (A pale coloured form, with bright-red smooth capsules).

Limnobium ochraceum.
var. fluitans.

Hypnum cupressiforme.
molluscum.
crista-castrensis.
revolvens.
sarmentosum. (In fruit in Corrie Glass).
commutatum.
scorpioides.
Schreberi.

Hylocomium brevirostrum.
umbratum.
triquetrum.
splendens.
squarrosum.
loreum.
Oakesii. (Rocks at Loch Maree).

V. *On the Staining of Microscopical Preparations.* By Dr W. R. M'Nab.

1. *Staining with Acetate of Mauvine.*

A. This can be used with very good effect in staining thin sections of wood. If these are preserved in Canada balsam they seem to be permanently stained, as a few specimens put up in January 1866 are now quite as brightly coloured as they were at first. By means of the colouring the high powers of the microscope can be used, bringing out points of structure not easily demonstrated without being so treated. Sections (transverse) of coniferous woods show beautifully the structure of the punctated tissue, as well as the junctions of the cell walls and the thickening layers of ligneous matter.

B. Sections of the young stems of ivy were last year (February 1868) successfully stained with acetate of mauvine and glycerine (see "Botanical Society Transactions.") Since then most of the specimens have faded. The contents of the cells have lost colour entirely, but the cuticular layer of the epidermis retains its colour, as well as the young ligneous cells. In a specimen now before us, the pith and the enclosed cell-contents are now colourless, but the zone of cells in which a deposit of ligneous matter has been formed are brightly coloured. The very small cambium cells bounding this layer are quite colourless. In the outer layer of cambium the cells become large, more like the bark cells, and here and there a few bundles of thickened cells can be seen, brightly coloured like the others. These, I suppose, are *bast cells.* A few of the laticiferous canals, described last year in "Botanical Society Transactions," are lying close to these small patches of bast-cells, but far more frequently they lie close to the small cambium cells. The layer of cellular tissue, external to the bast cells, is not coloured, and their thin walls contrast strongly with the greatly thickened cell-walls of the epidermal cells, on which the mauvine does not seem to exert any influence. The cuticle is well marked as a bright purple external layer, contrasting strongly with the colourless thickened cells on which it rests.

If any reliance is to be placed in the results obtained by staining specimens with mauvine, there is one very important point I wish to mention. Schacht* states that the so-called intercellular substance, joining the walls of contiguous cells together, forms on the free surface of cells what is known as the cuticle. By some the existence of this intercellular substance is denied; and by careful examination of many specimens now before me, I can find no

* Grund. der Anat. und Phys. der Gewächse. page 29.

trace of any such material. The cuticle is brightly coloured, and if the same material existed as intercellular substance between the cells, a coloured layer should be seen between each of these cells, but none can be seen. If, then, the test of colour can be relied on, either intercellular substance does not exist, or else its composition is essentially different from that of cuticle.

2. *Staining with Beale's Carmine Solution.*

When small portions of vegetable tissue are soaked in the carmine solution, only those cells containing protoplasm appear stained. The nuclei and the granules in the protoplasm seem alone to be affected. The depth of colouring depends, then, on the number of granules in the protoplasm and the size of the nucleus.

A. *Experiments in* Phalaris canariensis.—The rootlets of germinating seedlings of *Phalaris canariensis* were placed in a solution of carmine. When examined about twelve hours afterwards, the extremities of the rootlets were found to be very deeply coloured, while a faint tinge was visible along the other parts of the rootlet. Under the microscope the structure of the growing point of the root was beautifully seen. First a series of loose cells are seen at the extremity, continuing a short distance above the growing point. A very few of the most internal cells seem to be slightly coloured, the external ones being quite colourless. This mass of cells forms a regular sheath-like cap to the growing part of the root, very similar to the highly developed pileorhiza of Lemna. A well marked line of separation can be seen marking the boundary of the growing point, the cells being deeply coloured for a short distance. The cells are densely filled with granular protoplasm, and each contains a very large nucleus. A little higher up the colouring gets very faint, and at last is confined to the interior of the rootlet, where a few nuclei are seen closely surrounding the spiral vessels. The growing point of a root of the Phalaris, when treated with carmine, shows—1*st*, A number of large loose cells at the point, extending like a pileorhiza, a short distance from the extremity; 2*d*, The internal cells of this sheath are coloured, and therefore contain active protoplasm; 3*d*, The growing point of the root is very deeply coloured, the protoplasm is densely granular, and contains a large nucleus; 4*th*, A very short distance above the growing part the cells are only marked by an occasional nucleus; and, lastly, the nuclei are only found close to the spiral vessels.

B. *Experiments with* Sinapis alba (*White Mustard*)—*Series* 1.—These were begun in February 1868, and consisted in germinating white mustard both in water and in soil, and then examining the structure after staining with carmine. During the first stages of germination of the seeds, germinated both in soil and in water, no trace of staining could be found, and it was not till the radicle had attained some size that the point of the root became stained with the carmine. If we can depend on such tests, we must conclude that the germination of the white mustard is not dependent on the formation of *new cells*, but merely on the growth and enlargment of the pre-existing cells. Whenever growth by the formation of new cells had taken place these cells could be rendered distinctly visible by the action of carmine, the parts above this remaining white, although submitted to the action of carmine under precisely the same conditions.

Series 2.—A much more extensive series of experiments was tried in December 1868, by growing white mustard for a short time in carmine solution. After the plants were about two inches in height carmine was added, and they continued to grow for several days after. The youngest stages of development failed to furnish stained specimens, and it was only after a few days that the young radicles could be stained. The structure of the root is more complex than that seen in the *Phalaris canariensis*, but agreed in every essential point. The loose cells were seen at the tip, the growing point densely coloured, the colouring becoming less and less till it was no longer visible. The protoplasm near the growing point is densely granular, and the nuclei very large, filling up from one-fourth to one-third of the whole cell.

Transverse sections of the young root, above the growing point, showed the arrangement of the cells very clearly. In the centre is a mass of small thickened cells, containing protoplasm and nuclei in many cases. Immediately outside this are three layers of large cells with protoplasm and large nuclei. Surrounding this layer is a single series of small cells placed very close together, containing a densely granular protoplasm, and very large, often two, nuclei, probably a cambium layer. External to this is a layer of epidermal cells, not apparently thickened, the whole being enclosed by what appears to be a thickened cuticle. Parts of the young radicle are covered with hairs. These could be very clearly seen, and their mode of formation observed. I cannot detect any thickened cuticle at those parts where the hairs are developing. The hairs are direct prolongations of the epidermal cells, and in general the contents and nucleus can be seen to have been carried forward, and occupying the centre of the hair. The sections I have now before me, showing the hairs, are much farther from the growing point than that described above as having a thickened cuticle, but no cuticle is visible. The hairs elongate very much, without dividing; the nucleus in most was wanting, although the granular contents remained. Here and there large spaces filled with cell-sap were seen, and in one instance the contents of one of these long cells were seen oscillating backwards and forwards for some time. The use of the staining process does not seem to be attended with any great difficulty, and, I have no doubt, important results may be obtained by careful study of its action on germinating plants.

VI. *Letter from* Dr R. O. Cunningham *to* Professor Balfour, *dated H.M.S. "Nassau," Valparaiso*, 3d *November* 1868.

Rather more than a year ago I wrote to you, describing our experience during the first season we spent in the Strait of Magalhaens, and possibly you may be interested by a few notes of our proceedings during the past year. I shall confine myself principally, in the following remarks, to what I have observed in the way of botany:—

We entered the strait on the 17th of November 1867, and reached Sandy Point two days later, on a lovely spring morning, recalling the month of April at home. The fresh green foliage of *Fagus antarctica* was very refreshing to the eye after our sea cruise, and a considerable number of flowering plants were in bloom. The *Berberis empetrifolia* covered the ground in many places with its prostrate stems, thickly covered with blossoms, which diffused a faint perfume, and the *Primula Magellanica* was abundant, some specimens possessing white and others beautiful purple flowers. *Ribes Magellanicum* was also in full flower, and so were two or three Cruciferæ, and a pretty little Saxifrage (*S. exarata*), bearing a close general resemblance to our *S. tridactylites.* We remained at the settlement for about a week, during which I had many walks about the neighbourhood, obtaining a considerable number of specimens, botanical and zoological, and then moved eastward, spending a few days at Cape Negro, where I procured *Oxalis enneaphylla*, *Arabis Macloviana*, *Embothrium coccineum*, *Geum Magellanicum*, and a variety of other plants. Shortly after that, a long and tedious period ensued, the officers being occupied in deep soundings, and as the ship lay a long distance from land, and there were gales without number, I was very much confined on board. Towards the end of December we visited the Gallegos River, about thirty miles to the north of Cape Virgins, in search of a deposit of fossil bones of mammalia, but were unsuccessful in our quest, and about the middle of January we went across to the Falkland Islands to provision and coal. We remained in Stanley Harbour about ten days, and I was not more favourably impressed with the surrounding country than I was on my first visit. *Callixene marginata*, *Chabræa suaveolens*, *Drosera uniflora*, *Pratia repens*, *Empetrum rubrum*, *Gentiana* sp., *Lomaria Magellanica*, *L. alpina*, *Aspidium mohrioides*, and various other plants were procured. On our way back to the strait we passed through Falkland Sound, visiting the Tysson group of islands, where I saw the Tussac (*Dactylis cæspitosa*) in great luxuriance, and found the ripe fruit of *Rubus geoides.* We also spent a day at Fox Bay (West Falkland Islands), and there I obtained two orchids which I had not previously met with. We had very blowy weather for some time after our return to the Cape, which greatly retarded operations. I spent a week during that time tented-out in Patagonia, but got very little in the way of specimens for my trouble, the most interesting "find" being *Crantzia* *lineata*, which does not appear to have been previously recorded from the strait, though it is recorded in the "Flora Antarctica" as occurring in the Falkland Islands. I forget whether I mentioned in my former letter that *Apium graveolens* is extremely abundant on both sides of the eastern portion of the strait, wherever the land is at all damp, and, as Dr Hooker has observed, is perfectly wholesome. The survey of the eastern portion of the strait was at length brought to a close, and after a few days' sojourn at Sandy Point in the first week of March, we set out to get a fresh supply of provisions at Chiloe, passing through the western part of the strait and the channels leading northwards from it to the Gulf of Penas. We halted at various places on our way, and I made use of all the opportunities that came of going ashore and hunting for specimens. At Playa Parda Cove, in the western part of the strait, I obtained, among other plants, *Philesia buxifolia*, *Desfontainia spinosa*, *Escallonia macrantha*, and a myrtaceous plant, which seems to be *Metrosideros stipularis*, and which does not seem to have been previously met with to the north of the Chonos Archipelago. It is, however, abundant in the channels, and constitutes a well-marked feature in the vegetation, frequently forming a distinct belt where the precipitous land dips into the water. At Sholl Bay, where we spent two or three days, I found *Gaultheria antarctica*, generally growing along with *Myrtus Nummularia*, and easily mistaken for it at first sight, and *Tetroncium Magellanicum*. Here, as in most places in the channels where there was any open ground, a solid turf was formed of plants of *Gaimardia*, *Astelia*, and *Caltha dioneæfolia;* and a species of *Rostkovia* was plentiful in the shallow pools of fresh water. At Eden Harbour, in the Messier Channel, I met with *Podocarpus nubigenus*, forming handsome trees, and a curious little dwarf conifer, which also occurs on the mountains of Valdivia (and which Philippi has described under the name of *Lepidothamnium*), as well as *Mitraria coccinea*, not before obtained to the south of the Chonos Archipelago. We arrived at the port of San Carlos, Chiloe, at the close of March, and remained there about a fortnight, and I was greatly interested in the striking character of the vegetation. Here I saw for the first time thickets of an arboreous grass of the genus *Chusquea; Myrtaceæ, Bromeliaceæ, Escallonias,* and *Fuchsias* constituted a very prominent feature. The trunks of many of the trees were covered with *Sarmienta repens*, and their branches with a scarlet *Loranthus;* and *Gunnera scabra* covered many of the sandstone cliffs with its large rhubarb-like leaves. Other conspicuous plants were a yellow-flowered *Loasa*, and *Berberis Darwinii*, and last, but not least, our common *Digitalis*, which has completely naturalised itself. We left the bay of San Carlos on the 12th of April, to return to the channels, passing between Chiloe and the mainland, and calling at two forts in the island on our way. At the first of these (*Cova Oscura*) I found *Tricuspidaria* in flower, and was considerably puzzled as to its affinities (Dr Hooker has since set me right with regard to it). The drooping crimson flowers give the tree a most remarkable appearance.

Our next halting-place was Port Otway (Cape Tres Montes). I spent an afternoon on shore there, and found *Veronica decussata* growing six to eight feet high, and a beautiful Gesneraceous creeper, which I took for a species of *Drymonia*, but which I am inclined to suppose to be a *Columnea*. We entered the Messier Channel on the 17th of April, and remained there for about a month, surveying the harbours, during which we had almost perpetual rain. I was interested by procuring in several localities specimens of a handsome bignoniaceous creeper with rose-coloured flowers, and was in hopes that it might prove new, but have since found that it has been previously procured from Valdivia, being Philippi's *Tecoma valdiviana*. It does not appear to have been met before to the south of Valdivia, so this discovery of it in the channels extends its distribution several hundred miles. I have not said anything yet about the cryptogamic plants of the channels. There are some very beautiful ferns (chiefly *Hymenophylleæ*), musci, and lichens; but the greater number of them occur also in Chiloe and the south parts of Chili, and I did not meet with such a great number of species as I was led to expect. One, a species of *Hypopterygium*, greatly delighted me by the beauty of its growth, resembling that of a miniature palm tree. We left the channels in the middle of May, as the weather was so inveterately bad that surveying operations were rendered impossible, and, after a short stay at Chiloe, set out for Valparaiso, calling at Lota and Concepcion on the way. At Lota I saw for the first time that splendid creeper, the Copigue (*Lapageria rosea*). It was in great glory, flourishing even in the vicinity of copper-smelting works, where almost all other plants were killed by the sulphureous smoke. We reached Valparaiso on the 12th of June, and remained till the end of July, having an extensive experience of northerly gales, accompanied by rain. As it was winter when we arrived, but few plants were in flower. A little yellow *Oxalis*, known to the Chilians by the title of "Flor de Perdiz," formed bright-coloured patches on the hills, and a *Fuchsia* with small pink flowers was blooming abundantly. I made a short excursion to the small town of Santa Rosa de los Andes, at the foot of the Cordillera. There the lower hills bristle with tall cacti, usurping the place of all other vegetation, and in many cases covered with a parasitic leafless *Loranthus*, with bright scarlet flowers. We spent the month of August very agreeably at Coquimbo, and there I made the acquaintance of the *Nolanaceæ* for the first time—*Alona cœlestis* covering the lower slopes of the hills, and two species of *Sorema* being abundant on the lower ground. There, also, I saw for the first time the *Aristolochia chilensis*, the beautiful little *Schizopetalon*, *Carica pyriformis*, *Llagunoa glandulosa*, *Schizanthus fimbriatus*, two species of *Calandrinia*, a *Trichopetalum*, &c. We returned to Valparaiso in the beginning of September, and here we have been since. There is now a wonderful variety of plants in flower on the hills and intersecting quenadas. *Tropæolum tricolorum*, two yellow *Calceolarias*, a yellow and a deep purple Oxalis, a scarlet *Alonsoa*, several species of *Œnothera*, *Pasithea cœrulea*, *Puya coarctata*, a *Verbena*, species of *Adesmia*, *Salpiglossis*, *Argemone*, *Tupa*, *Schizanthus*, *Anemone*, *Polygala*, &c., being specially plentiful. To-day we start for the south, there to remain for the next six or eight months.

VII. *Report on the Open-Air Vegetation at the Royal Botanic Garden.* By Mr M'Nab.

The past portion of this winter has been in every respect similar to the corresponding portion of last winter, there having been little or no frost or snow about Edinburgh. The lowest thermometer readings since the 1st of December were on the mornings of the 12th, 13th, 30th, and 31st of December, being respectively 20°, 30°, 23°, and 28 ; also on 1st January, 21°, and on the 11th, 30°. Notwithstanding the general mildness, none of the ordinary spring-flowering plants and bulbs (with the exception of the snowdrop, which showed its first flower on the 9th), are yet in bloom, although the leaves of many are now pushing rapidly through the ground. Many of the summer and autumn plants are still flowering abundantly, such as stocks, wallflowers, blue gentian, *Viola odorata* and *tricolor*, *Primula Auricula vulgaris*, and *elatior*, *Potentilla alba*, likewise all the species of helleborus or Christmas roses. A few plants are now in bloom which generally come under the head of spring-flowering ones, but which have been in flower since the middle of December ; these are *Tussilago fragrans* and *alba ;* also *Phlox verna* and *Doronicum caucasicum.*

Of shrubby plants, the hazel, the *Garrya elliptica*, and *Jasminum nudiflorum* are now in full bloom. The warm summer experienced last year has been very beneficial for the ripening of the shoots of many shrubby plants, such as *Laurustinus*, which are this season covered with flower-buds to such an extent as we have not observed here for many years. The same remark holds good with regard to the early hybrid rhododendrons, which, although well budded, are not yet in bloom in the open air. The *Rhododendron atrovirens*, which is frequently in full flower long before this time, has only a few scattered blooms.

As a proof of the mildness of the season, many of the scarlet Tom Thumb geraniums are now quite green in the open borders, the freshest being those which stood unprotected during the winter of 1867-68.

VIII. *Report on the Botanic Garden of Natal.* By Mr M. J. M'Ken, Curator.

Mr M. J. M'Ken has issued a report on the Natal Botanic Garden, for the half-year ending 30th June last. He states that there have been no less than thirty-two applications for the quinine-yielding plant, *Cinchona succirubra*, and that if the directions respecting the growth of the seeds are strictly adhered to, we may hope soon to possess a good stock of this highly-valuable medicinal plant, especially in the higher and moister parts of the colony. He reports having passed a month's leave of absence in the Upper Umkomanzi and Umlass district, and there he made large collections of plants suitable for exchange with other botanical institutions, and with the same view he had repeatedly despatched natives to various parts of the country to collect plants, bulbs, and seeds. The arrivals from various public and private gardens are so numerous as to compel him to clear and open out fresh land. He then alludes to a most important addition to the Natal Botanic Garden, of which, however, he is at present expecting simply an estimate of the cost, viz., of a conservatory to be covered with glass, coloured green with oxide of copper, which Dr Hooker of the Royal Gardens, Kew, recommends as most effective in cutting off the heat rays of the sun, whilst not interfering with the luminous rays. A conservatory of this sort may be of the highest importance to the colony.

IX. *Miscellaneous Communications.*

1. The President read a letter from the President of the Horticultural Society of Russia, stating that a grand horticultural international exposition and botanical congress is to be held at St Petersburg, in May 1869, and expressing a wish that the Botanical Society of Edinburgh should be represented at the meeting.

2. Mr M'Nab exhibited the first part of an illustrated work on Ferns, by Mr Moore. The illustrations, which are beautifully executed, are done according to Baildon's patent nature-printing process.

3. Mr Jenner exhibited a flowering plant of *Saxifraga Rocheliana* from the Straits of Magellan.

4. Mr Henry Drew presented specimens of the Cape wax myrtle (*Myrica cordifolia*), along with a specimen of the wax yielded by it.

11*th February* 1869.—Charles Jenner, Esq., Vice-President, in the Chair.

Letters from Professor Lange, Copenhagen, and Professor Radlkofer, Munich, were read, thanking the Society for their election as foreign members.

Professor Balfour read a notice by Dr Call of the late Professor Strangeways, who was to have been balloted for as a member at this meeting. Professor Balfour also noticed the death of Mr Backhouse of York, an eminent horticulturist, and of Mr Humphrey Graham, W.S., members of the Society.

The following Communications were read :—

I. *Experiments on Colour-Reaction as a Specific Character in Lichens.* By W. Lauder Lindsay, M.D., F.R.S.E., F.L.S.

The colour-reactions of Lichens—the effects of certain chemical reagents applied, on the small scale, to their thallus or apothecia—have recently acquired considerable importance in consequence of the strong assertions of Dr Nylander of Paris,* and the Rev. Mr Leighton of Shrewsbury,† as to the value of the reactions in question in specific or *botanical diagnosis.*

These assertions‡ have led me to make a special series of experiments in order to test the accuracy of the statements made—the constancy of the results obtained ; and I now beg to submit the tabulated results of my researches, so far as these results were of a *positive* or noteworthy kind. The table, however, does not exhibit the *far greater number* of experiments or testings, the results of which

* Journal of Linnean Society (Botany), vol. ix. p. 358.

† Annals of Natural History, vol. xviii. p. 169 ; and vol. xix. p. 112.

‡ A recapitulation and criticism of both Nylander's and Leighton's statements or results may be found in the "Journal of the Linnean Society" (Botany), vol. xi. p. 36.

were *negative or unworthy of record!* It represents only the selected, typical, positive results of many hundred testings. I offer the following record of experiments as a mere contribution towards determining the value of chemical reaction as a specific character in lichens. My results are opposed to those of Nylander and Leighton; and I trust that their publication may lead other lichenologists to put the assertions of these authorities to the test, with a view to a final decision of the question at issue, which is one of great interest to every student of the natural history of Lichens. The illustrations given in my table contain not only a repetition, but an extension and variation, of the chief testings of Nylander and Leighton. They refer mainly to the *direct* application of reagents to the thallus or apothecia. Negative results are given only when they contrast with positive ones in different specimens of the same species, obtained either by myself or by Nylander and Leighton. The reagents employed were "Liquor Calcis chloratæ," "Liquor Potassæ," and "Liquor Ammoniæ" of the present British Pharmacopœia.

I. The chief reactions of *Liquor Calcis chloratæ* were various shades of crimson or lake, blood-red, and orange-red. These colours were more frequently fugitive than permanent. Generally they required for their development friction, so as to disintegrate the cortical, and bring the reagent in contact with the subjacent medullary, tissue. Occasionally the reaction was patchy, occurring only on particular parts of the thallus or apothecia (*e.g.*, the exciple), or only on soredia, or in sterile conditions.

II. The chief reactions of *Liquor Potassæ* were various shades of yellow—including lemon and gamboge tints—olive-green, crimson or lake, blood-red, and orange-red. These colours were permanent or transient, rapidly or gradually developed. They were also primary or secondary (*e.g.*, the yellows passing into browns or reds). In the latter case, the change was sometimes effected by a second application of the reagent, after a varying interval.

III. *Liquor Ammoniæ* gave generally the same results as Liquor potassæ; but the whole group of the lakes or reds—the Archil series of colours—is more rapidly and beautifully developed under the action of Ammonia.

These three classes of reactions occur of every degree of intensity, from the faintest or most obscure to the most brilliant and deepest. But in a far larger proportion of cases no reaction is exhibited at all; and in species in which it is usually developed, it is capricious in the extreme —its development being apparently determined by the most trivial circumstances affecting (*e.g.*) the freshness or other condition of the lichen on the one hand, and the reagent on the other. By reason of this extreme inconstancy of result, Chemical characters cannot, I think, be relied on as furnishing a means of *determining Species.* Certainly they have never afforded *me* any aid in this respect.

The general conclusions to which my experiments point, or the general results obtained, include the following:—

I. The same specimen—in the hands of the same operator, in its different parts, at different times—frequently exhibits colour-reactions different at least in degree.

II. The same species—in the hands of the same operator, and still more so in those of different experimenters, in different specimens from the same or different localities, differing in freshness of collection or age, occurring in different varieties or forms, or in different conditions of growth (fertile or sterile, hypertrophied or degenerate)—frequently shows colour-reactions differing equally in kind and degree.

III. Colorific quality is determined by circumstances (not fully understood) connected with

(*a*) Locality of growth—in relation (*e.g.*) to climatic, geographical, topographical, geological, or other, conditions.

(*b*) States of development—in relation (*e.g.*) to sterility hypertrophy, or degeneration, of the vegetative tissues proper

IV. This inconstancy of colorific property leads the Archil manufacturer never to depend on laboratory testings in the purchase of his "Orchella weeds," or in determining their commercial value; for it not unfrequently happens that a most promising *Roccella* even proves worthless, and is as such cast aside.

V. Colour-reaction, then, on the small scale, though interesting in itself in connection with the general subject of Lichen-colorific or colouring-matters, affords *no aid that can be depended on*, either

(*a*) To the systematist in defining Botanical Species; or,
(*b*) To the dye-manufacturer in determining the value of his Orchella weed!

RECORD OF EXPERIMENTS.

This Record was originally presented to the Society in a *Tabular* form, the Table consisting of the seven following *columns*:—

1. Name of Lichen operated on.
2. Locality where, and Authority by whom, collected.
3. Date of Collection (approximate).
4. Reaction of *Liquor Calcis chloratæ.*
5. ,, ,, *Potassæ.*
6. ,, ,, *Ammoniæ*, or other chemicals.
7. General or additional Remarks.

The arrangement here adopted by the printer has been adopted for economy of space. The numerals given *under* the heads of Species refer to the *headings of the columns* of the original Table, and are to be read thus—taking the first entry as a sample:—

1. *Leptogium tremelloides.*
   2, 3. Where, by whom, and when collected: Switzerland, Schærer, 1842.
   5. Effect of *Liquor Ammoniæ;* on thallus, olive-green.

In the case of published Fasciculi or *Exsiccati*, I have had to substitute their date of *publication* for the actual date of *collection*, which I have no means of knowing. Nylander's Exsiccati bear date 1855–57; but there is no separate dated index for each of the four fasciculi. Specimens from the India Museum collection were submitted to my examination in 1860; but they must have been collected at a much earlier date (probably prior to 1851, the date of the first London Exhibition). A similar remark applies to specimens sent me by Dr Müller of Melbourne in 1863. Again, the labels attached to Dr Hooker's Antarctic specimens in my Herbarium bear date 1839–43. It is evident in these, as in other cases, that the dates given indicate only approximately the length of time that has elapsed since collection.

Abbreviations:—Sw., Switzerland; Engl., England; Fr., France; Ger., Germany; N.Z., New Zealand; Scotl., Scotland.

1. *Leptogium tremelloides*, Ach. (*Collema cyanescens*, Sch.)
   2, 3. Sw., Schær. Exs. 409, 1842.
   5. Thallus; olive-green.
2. *Calicium tigillare*, Pers.
   2, 3. Sw., Hepp 159, 1853.
   5. Thallus; natural, beautiful yellow *un*changed.
3. *C. chrysocephalum*, Ach.
   2, 3. Sw., Hepp 329, 1857.
   5. Green thallus; brownish-red.
4. *Bæomyces rufus*, Ach.
   2, 3. Sw., Hepp 480, 1860.
   5. Thallus; beautiful orange-red.

   var. Hepp 481, 1860.
   5. Thallus; beautiful lemon (greenish) yellow.
5. *Cladonia rangiferina*, Hffm.
   2, 3. Engl., Mudd Exs. 19, 1861.
   5. Thallus; obscure deepening of green.

   vulgaris, Sch.; *nutans*, Sch.
   2, 3. Sw., Schær. Exs. 76, 1842.
   5. Thallus; obscure heightening of green or greenish-yellow.

   vulgaris; cymosa, Sch.
   2, 3. Sw., Schær. Exs. 77, 1842.
   5. Thallus; obscure heightening of green or greenish-yellow.

   rangiferina, L.
   2, 3. Ger., Dietrich Exs., 1856.
   5. Very white podetia; greenish yellow.

Cladonia rangiferina, Hffm.
gigantea, Ach. Leight.
2, 3. Arctic America, 1826.
5. Podetia; vivid greenish-yellow.
sylvatica, Hffm.
2, 3. Sw., Schær. Exs. 78, 1842.
5. Same reaction as in Schær. Exs. 77.
sylvatica, Hffm.
2, 3. Engl., Mudd Exs. 20, 1861.
5. Same reaction as in Mudd Exs. 19.
alpestris, Ach.
2, 3. Sw., Schær. Exs. 79, 1842.
5. Same reaction as in Schær. Exs. 77.

6. *Cl. furcata*, Hffm.
muricata, Del.
2, 3. Engl., Leight. Exs. 369, 1864.
5. White podetia; vivid greenish-yellow, very conspicuous and beautiful.
racemosa, Hffm.
2, 3. Engl., Leight. Exs. 374, 1864.
5. White podetia; vivid greenish yellow, very conspicuous and beautiful.
racemosa, Hffm.
2, 3. Engl., Leight., 1856.
5. Vivid yellowish-green.
fruticosa, Sch.
2, 3. Sw., Schær. Exs. 459, 1843.
5. Vivid greenish-yellow.
pungens, Fr.
(*tenella*, Rabenh., and *foliosa*, Flk.)
2, 3. Engl., Mudd. Clad. 54–56, 1865.
5. Vivid green.
6. Liq. am., none.
crispata, Ach.
2, 3. Ger., Dietrich Exs., 1856.
5. Vivid green.
recurva, Hffm.; *thyrsoidea*, Mass.
2, 3. Engl., Mudd. Clad. 49, 1865.
5 Thallus ; brown, or none.

7. *Cl. retipora*, Flk.
2, 3. Otago, N.Z., 1861.
5. Thallus white; very vivid green in some; none in others; or vivid green at tips, and none below.

8. *Cl. pyxidata*, L.
2, 3. Otago, N.Z., 1861.
5. Podetia; second application light crimson.
ochrochlora, Flk.
(*odontota*, Flk.)
2, 3. Engl., Mudd Clad. 25, 1865.
5. Podetia; vivid yellow.

Cl. pyxidata, L.
chlorophæa, Flk.
(*varia*, Coem.)
2, 3. Engl., Mudd Clad. 9, 1865.
5. Podetia and folioles; second application, slight brown, red, or lake; first application, greenish-yellow.
6. Liq. am. following Liq. pot., brown.
cariosa, Flk.
2, 3. Sw., Hepp 541–3, 1860.
5. Podetia; vivid greenish-yellow; second application, vivid lemon-yellow.

9. *Cl. fimbriata*, Fr.
denticulata, Flk.
2, 3. Engl., Mudd Exs. 8, 1861.
5. Podetia and folioles; slight fuscescence.
tubæformis, Ach.
2, 3. Engl., Leight. Exs. 377, 1864.
5. Second application; green conspicuously deepened, especially on folioles.
fimbriata, Fr.
2, 3. Otago, N.Z., 1861.
5. Second application; brown-red both on podetia and folioles. Rudimentary folioles vivid greenish-yellow; podetia not affected.

10. *Cl. degenerans*, Flk.
hypophylla, Nyl.
2, 3. Engl., Mudd Clad. 39, 1865.
5. Podetia; vivid greenish-yellow.
degenerans, Flk.
2, 3. Otago, N.Z., 1861.
5. Podetia and folioles; light red-brown.
lepidota, Ach.
2, 3. Otago, N.Z., 1861.
5. Podetia and folioles; chestnut-brown.

11. *Cl. gracilis*, L.
cervicornis, Ach.
2, 3. Engl., Mudd Exs. 9, 1861.
5. Podetia and folioles; green deepened.
7. Referable to *degenerans*.

12. *Cl. endiviæfolia*, Ach.
2, 3. Ger., Dietrich Exs., 1856.
5. Folioles; greenish-yellow.
7. Distinction between this and *alcicornis* is quite trivial and insufficient.

13. *Cl. deformis*, L.
2, 3. Engl., Leight. Exs. 275, 1858.

Cl. deformis, L.
5. Podetia and folioles; bright gamboge-yellow.
7. Natural colour of folioles sometimes deeply fulvous, and become blood-red with Liq. potassæ.

deformis, L.
2, 3. Ger., Dietrich Exs., 1856.
5. Podetia and folioles; yellow becoming red-brown.

14. *Cl. Papillaria*, Ehrh.
2, 3. Sw., Schær. Exs. 511–2, 1847.
5. Podetia and isidiiform pulvinuli; vivid lemon-yellow in 512; very obscurely so in 511.

Papillaria, Ehrh.
2, 3. Engl., Mudd Exs. 22, 1861.
5. Podetia; *permanent* and vivid greenish-yellow.
7. The true *Papillaria*. Some specimens are mere deformed states—probably of *furcata*—*un*affected by Liq. potassæ.

Papillaria, Ehrh.
2, 3. Fr., Nyl. Exs. 107, 1855.
5. Vivid greenish-yellow, especially on podetia.

Papillaria, Ehrh.
2, 3. Engl., Leight. Exs. 208, 1856.
5. Vivid greenish-yellow, especially on podetia.

15. *Cl. bellidiflora*, Ach.
2, 3, Engl., Mudd Exs. 23, 1861.
5. Podetia and folioles; pale greenish-yellow, becoming brownish or blood-red.

16. *Cl. cornucopioides*, Ach.
2, 3. Engl., Leight. Exs. 297, 1858.
5. Podetia and folioles; vivid green or gamboge yellow, followed or not by blood-red.

(*coccifera*, L.; *extensa*, Hffm.)
2, 3. Sw., Schær. Exs. 51, 1842.
5. Apothecia have already acquired a brownish tinge; brown not deepened.

17. *Cl. macilenta*, Hffm.
(*bacillaris*, Ach.)
2, 3. Sw., Hepp 113, 1853.
5. Podetia; in one specimen lemon-yellow distinct; in two others very faint or obscure.

macilenta, Hffm.
2, 3. Engl., Leight. Exs. 274, 1858.
5. Podetia and folioles; vivid

Cl. macilenta, Hffm.
green or gamboge-yellow, passing gradually or not into blood-red.

polycephala, Fw.
2, 3. Engl., Mudd Clad. 72, 1865.
5. Folioles (under mealy surface); bright gamboge-yellow.
7. Water applied to apothecia carries away the red-colouring matter; which stains the podetia.

monstrosa, Mudd.
2, 3. Engl., Mudd Clad. 79, 1865.
5. Podetia; gamboge-yellow, passing into blood-red.
6. Liq. am.; vivid greenish-yellow.

phyllophora, Mudd.
2, 3. Engl., Mudd Clad. 78, 1865.
5. Podetia and folioles; second application deep blood-red.
6. Liq. am.; vivid greenish-yellow, sometimes becoming on a second application brownish.

carcata, Ach.
2, 3. Engl., Mudd Clad. 71, 1865.
5. Podetia and folioles; second application crimson.

subulata, Rabenh.
2, 3. Engl., Mudd Clad. 74, 1865.
6. Podetia and folioles; Liq. am., vivid greenish-yellow.

tubæformis, Mudd.
2, 3. Engl., Mudd Clad. 76, 1865.
6. Podetia and folioles; Liq. am., vivid greenish-yellow.

ostreata, Nyl.
2, 3. Fr., Nyl. Exs. 108, 1855.
5. Folioles; vivid greenish-yellow, becoming dirty blood-red.

ostreata, Nyl.
2, 3. Engl., Leight. Exs. 371, 1864.
5. Horizontal, microphylline, mealy thallus; greenish-yellow, becoming brown-red.

clavata, Ach.
2, 3. Engl., Mudd Clad. 70, 1865.
5. Podetia; second application crimson-red.

polydactyla, Flk.
2, 3. Engl., Mudd Clad. 77, 1865.
5. Podetia; second application, light crimson-red.
6. Podetia and folioles; Liq. am., vivid yellowish-green.

polydactyla, Flk.
2, 3. Sw., Hepp 537, 1860.

Cl. macilenta, Hffm.
5. Podetia; vivid lemon-yellow in one specimen; obscure in another.
polydactyla, Flk.
2, 3. Engl., Mudd Exs. 27, 1861.
5. Podetia and folioles; vivid greenish-yellow, becoming brownish or blood-red.
polydactyla; corymbiformis, Flk.
2, 3. Engl., Mudd Exs. 28, 1861.
5. Podetia and folioles; vivid greenish-yellow, becoming brownish or blood-red.
incana; polydactyla, Flk.
2, 3. Sw., Schær. Exs. 454, 1843.
5. Podetia; vivid greenish-yellow.
filiformis, Sm.
2, 3. Sw., Schær. Exs. 33–37, 1842.
5. Podetia; greenish-yellow, so faint as to require the lens to see it in 34, 35; no perceptible reaction in 33, 36, 37.
filiformis, Sm.
2, 3. Engl., Mudd Clad. 75, 1865.
6. Podetia and folioles; Liq. am., vivid greenish-yellow.
Cl. macilenta, Ehrh.
(*filiformis*, Relh.)
2, 3. Engl., Mudd Exs. 29, 1861.
5. Podetia and folioles; vivid greenish-yellow, passing into brown or blood-red.

18. *Cl. digitata*, Hffm.
2, 3. Engl., Mudd Exs. 26, 1861.
5. Podetia and folioles; vivid greenish-yellow, passing into brown or blood-red.
digitata, Hffm.
2, 3. Engl., Mudd Clad. 69, 1865.
5. Horizontal thallus, under mealy surface; bright gamboge-yellow.
6. Liq. am., greenish-yellow, passing into dirty brownish-red on both podetia and folioles, but in patches only.
denticulata, Ach.; and *monstrosa*, Ach.
2, 3. Sw., Schær. Exs. 44–45, 1842.
5. Podetia; olive-green, passing into brown or blood-red.

19. *Cl. squamosa*, Hffm.
(*asperella*, Flk.)
2, 3. Engl., Mudd Clad. 41, 1865.
5. Foliaceous thallus; vivid green.
Cl. squamosa, Hffm.
leptophylla, Ach.
2, 3. Engl., Mudd, 1856.
5. Grey microphylline, rudimentary thallus; gamboge-yellow, or brownish-yellow, passing into blood-red.
cæspititia, Ach.
2, 3. Engl., Leight. Exs. 368, 1864.
5. Foliaceous, microphylline thallus; greenish-yellow, passing into brownish-red.
cæspititia, Ach.
2, 3. Engl., Mudd, 1856.
5. Brownish.
cæspititia, Ach.
2, 3. Scotl., Hardy, 1856.
5. Vivid greenish-yellow, becoming blood-red or brownish-red.
delicata, Ehrh.
(*parasitica*, Hook.)
2, 3. Sw., Hepp 112, 1853.
5. Podetia and apothecia; beautiful lemon (greenish) yellow.
delicata, Ehrh.
2, 3. Sw., Schær. Exs. 75, 1842.
5. Podetia and folioles; greenish-yellow.
delicata, Ehrh.
2, 3. Engl., Mudd Clad. 43, 1865.
5. Brownish; second application, dark port-wine red.
6. Liq. am., vivid green; followed or not by a brownish tinge.
delicata, Ehrh.
2, 3. Engl., Mudd Exs. 15, 1861.
5. Podetia and folioles; vivid green, becoming deep blood-red.
microphylla, Sch.; *prolifera*, Sch.
2, 3. Engl., Mudd Exs. 14, 1861.
5. Podetia and folioles; vivid green, becoming deep blood-red.

20. *Stereocaulon tomentosum*, Laur.
2, 3. Sw., Hepp 302, 1857.
5. Vivid lemon (greenish) yellow.
granulosum, Laur.
2, 3. Sw., Hepp 305, 1857.
5. Vivid lemon (greenish) yellow.

21. *S. alpinum*, Laur.
2, 3. Sw., Hepp 303, 1857.
5. Vivid lemon (greenish) yellow.

22. *S. incrustatum*, Flk.
2, 3. Sw., Hepp 301, 1857.
5. Vivid lemon-yellow.

23. *Roccella tinctoria*, Ach.
2, 3. Azores, Hepp 568, 1860.
4. With friction; crimson in six

Roccella tinctoria, Ach.
specimens; very brilliant, but in all cases fugitive; in one case no reaction.
6. Ammonia gave no noteworthy reaction with any of the *Roccellæ*.
7. Partly referable to *phycopsis*.

tinctoria, Ach.
2, 3. Corsica, Schær. Exs. 602, 1852.
4. Crimson; especially on friction.
5. Faint greenish-yellow.
7. Referable, I think, to *R. phycopsis*.

tinctoria, Ach.
2, 3. Cape Roca Moss, 1860.
4. No reaction even on soredia.
7. Passage-form between *tinctoria* and *phycopsis*; thallus very coriaceous.

tinctoria, Ach.
2, 3. Thick Lima Orchella weed, 1851.
4. Crimson, as vivid sometimes as in *fuciformis*, in thickest forms; frequently no reaction; thallus, naturally of a pinkish tinge (in Herbarium at least).

tinctoria, Ach.
2, 3. Cape (of Good Hope) Orchella weed, 1860.
4. No reaction.
7. Thallus long, slender, terete, but coriaceous; bearing both apothecia and spermogonia.

24. *R. phycopsis*, Ach.
2, 3. Fr., Hepp 357, 1857.
4. Crimson; but more brilliant on a pale coloured plant than on a darker, more coriaceous one.

phycopsis, Ach.
2, 3. Burmah, where it is used as a dye-lichen; 1860.
4. Scarcely any reaction.
7. Thallus coriaceous.

25. *R. fuciformis*, Ach.
2, 3. Fr., Hepp 567, 1860.
4. No reaction even on friction in two specimens, including one with soredia.
5. Lemon-yellow; more vivid in one specimen than in the other.

fuciformis, Ach.
2, 3. Fr., Schær. Exs. 553, 1849.
4. Crimson; a trace only here and there, where abrasion has been produced by glass

R. fuciformis, Ach.
rod on edges of laciniæ, verrucæ, or apothecia, and friction was superadded.
5. Lemon-yellow.

fuciformis, Ach.
2, 3. Channel Islands, Leight. Exs. 171, 1854.
4. No reaction.
7. Thallus very coriaceous.

fuciformis, Ach.
2, 3. Cape (of Good Hope) Orchella weed (pr. p.), 1860.
4. No reaction.
7. Thallus, deformed condition.

26. *Thamnolia vermicularis*, L.
2, 3. Sw., Hepp 298, 1857.
5. Brilliant orange-red.
7. Plant in Herbarium of a pale buff-red hue.

27. *Usnea barbata*, Fr.
2, 3. Sw., Schær. Exs. 86, 1842.
5. Vivid orange (greenish) yellow.

florida, L.
2, 3. Sw., Schær. Exs. 398, 1840.
5. Lemon-yellow on apothecia and branchlets; but no reaction in other specimens of same variety, nor in other varieties of type.

28. *Evernia vulpina*, L.
2, 3. Sw., Schær. Exs. 390, 1840.
5. None.

vulpina, L.
2, 3. Sw., Hepp 474, 1857.
4. None.
5. None.

29. *E. furfuracea*, Mann.
2, 3. Sw., Schær. Exs. 387, 1840.
5. Brilliant lemon (greenish) yellow, varying in depth or brilliancy in different specimens.

30. *E. prunastri*, L.
2, 3. Sw., Schær. Exs. 391, 1840.
5. Brilliant lemon (greenish) yellow, varying in depth or brilliancy in different specimens.

31. *E. divaricata*, Ach.
2, 3. Sw., Schær. Exs. 392, 1840.
5. None, or very faint greenish-yellow.

32. *Ramalina calicaris*, Ach.
2, 3. Scotl., 1855.
5. None, in any of its varieties.

33. *Solorina crocea*, L.
2, 3. Sw., Hepp 577, 1860.
5. Saffron coloured; under surface of thallus deep lake-colour; upper unaffected.

34. *Sticta aurata*, Ach.
    2, 3. Sw., Schær. Exs. 558, 1849.
    5. None, on the beautiful yellow soredia.
  aurata, Ach.
    2, 3. Sw., Hepp 372, 1857.
    4. None.
    5. None.
35. *Parmelia caperata*, L.
    2, 3. Berkshire, 1867.
    4. None, with either aqueous or alcoholic solution.
    5. None, with aqueous solution. Mere deepening of greenish-yellow tint of alcoholic solution.
    7. Aqueous solution scarcely coloured; alcoholic very distinctly greenish-yellow.
36. *P. perlata*, L.
    2, 3. India, where it is used as a dye-lichen; 1860.
    4. None.
    5. Lemon-yellow.
    7. Probably referable, like other forms of *perlata*, to *perforata.*
  perlata, L.
    2, 3. Canary Rock moss, 1860.
    4. Medullary tissue pale blood-red on friction.
    5. Vivid lemon-yellow.
  perlata, L.
    2, 3. Rockhampton, Australia. 1865.
    4. Vivid blood-red on friction.
    5. Vivid lemon-yellow.
    7. Thallus furfuraceous.
  perlata, L.
    2, 3. New S. Wales, 1865.
    4. Blood-red; less vivid.
  perlata; ciliata, DC.
    2, 3. Indian dye-lichen, 1860.
    4. None.
    5. Lemon-yellow; less vivid.
    7. Probably = *perforata.*
  perlata, L.
    2, 3. Grampians, Australia, 1865.
    4. Pale blood-red on friction.
  perlata, L.
    2, 3. Delhi, India, 1865.
    4. None, in four specimens.
    7. Probably = *perforata*, at least pr. p.
  perlata, L.
    2, 3. Engl. Leight. Exs. 76, 1852.
    4. None.
  perlata, L.
    2, 3. Scotl., Loch Lomond, 1855.
    4. None.
  P. perlata, L.
    2, 3. Scotl., Crinan, 1855.
    4. None.
    5. Lemon-yellow, or deep olive-green, in different specimens.
  perlata, L.
    2, 3. Sw., Hepp 578–580, 1860.
    4. None.
    5. Beautiful lemon-yellow, varying in tint in two specimens.
37. *P. Kamtschadalis*, Eschw.
    2, 3. India, 1860.
    4. None.
    5. Lemon-yellow.
    7. Medullary tissue, as exhibited in cracks of thallus, naturally orange-red.
38. *P. perforata*, Ach.
    2, 3. Otago, N.Z., 1861.
    4. None.
    5. Lemon-yellow, or olive.
    7. Medulla sometimes naturally of a pinkish or red hue, as in *saxatilis* and *Kamtschadalis;* similarly exhibited in cracks through cortical layer.
  perforata, Ach.
    2, 3. Engl., 1850.
    4. None.
    5. Lemon-yellow, or olive.
39. *P. sinuosa*, Sm.
    2, 3. Scotl., 1850.
    4. Faint blood-red on friction; or none; in different specimens.
    5. Bright lemon-yellow.
  (*P. revoluta*, f. Nyl.) Flk.
    2, 3. Sw., Hepp 581, 1860.
    4. None in some parts, blood-red in others, of same specimen.
    5. Beautiful lemon-yellow (permanent olive).
  sinuosa, Sm.
    2, 3. Sw., Schær. Exs. 561, 1849.
    4. Traces of crimson on friction.
  lævigata, Sm.
    2, 3. Scotl., 1850.
    4. None; or faint orange-red in medullary tissue.
    5. Bright lemon-yellow; permanent; conspicuous on the white, smooth thallus.
  lævigata, Sm.
    2, 3. Ceylon, 1865.
    4. None.
    5. Beautiful lemon-yellow.
  reticulata, Tayl.
    2, 3. New Zealand, Antarctic Expedition, 1840.

P. sinuosa, Sm.
4. None.
5. Beautiful lemon-yellow.
rugosa, Tayl.
2, 3. Ireland, 1858.
4. Obscure blood-red; on friction.
5. Bright lemon yellow.
hypothrix, Nyl.
2, 3. Fr., Nyl. Exs., 1855.
4. None.
5. Bright lemon-yellow.
Forsteri, Leight.
2, 3. Engl., 1856.
4. None.
5. Bright lemon-yellow.

40. *P. Borreri*, Turn.
2, 3. Engl., 1856.
4. Blood-red—on soredia, and on thallus—on friction; variable in depth of tint and amount of colour; fugitive.
5. Bright lemon-yellow to faint olive in different specimens.
Borreri, Turn.
2, 3. Ireland, 1858.
4. Blood-red, very faint in one specimen; absent in another (thallus being scarcely sorediiferous).
7. *P. Borreri*, *P. Forsteri*, *P. lævigata*, *P. rugosa*, and *P. sinuosa* appear to connect *P. saxatilis* with *P. perlata*.
Borreri, Turn.
2, 3. Sw., Hepp 582, 1860.
4. Crimson on friction (soredia).
5. Obscure olive-green.
Borreri, Turn., var.
2, 3. Sw., Hepp 583, 1860.
4. None.
5. Beautiful deep yellowish-green.
Borreri, Turn. (*dubia*, Sch.)
2, 3. Ger., Dietrich Exs., 1856.
4. Blood-red.
5. Lemon-yellow.

41. *P. physodes*, L.
2, 3. Ger., Dietrich Exs., 1856.
4. None.
5. Lemon-yellow.
physodes, L.
2, 3. Sw., Hepp 584, 1860.
4. None.
5. Beautiful greenish-yellow.

42. *P. enteromorpha*, Ach.
4. None.
5. Beautiful lemon-yellow.

43. *P. encausta*, Sm.
(*candefacta*, Ach.)
2, 3. Sw., Hepp 52, 1853.
5. Beautiful lemon colour (yellowish-green) on thallus and apothecial exciple.

44. *P. saxatilis*, L.
2. 3. Ger., Dietrich Exs., 1856.
5. Olive; becoming reddish-orange in cracks of thallus (medullary tissue).

45. *P. tiliacea*, Ach.
2, 3. Ger., Dietrich Exs., 1856.
5. Lemon, or olive.

46. *P. revoluta*, Flk.
(*quercifolia*, Sch.)
2, 3. Sw., Schær. Exs. 612, 1852.
4. Blood-red on friction.
5. Vivid greenish-yellow, becoming blood or brownish-red.

47. *P. acetabulum*, Neck.
2, 3. Engl., Leight. Exs. 362, 1864.
4. Blood-red on friction on soredia.
5. Natural olive deepened.

48. *P. aleurites*, Ach.
2, 3. Engl., Mudd. Exs. 71, 1861.
4. None.
5. Vivid lemon-yellow.

49. *Physcia parietina*, L.
2, 3. Berkshire, 1867.
4. None, either in aqueous or alcoholic solution.
5. Aqueous solution distinct, but pale port-wine red; alcoholic solution beautiful port-wine red at once; a lake gradually falls of a deep port-wine red, leaving the supernatant liquid very pale port-wine red.
7. Aqueous solution scarcely coloured straw-yellow; alcoholic solution much deeper greenish-yellow and turbid.
parietina, L.
2, 3. Ger., Dietrich Exs., 1856.
5. Dark crimson.
polycarpa, Ehrh.
2, 3. Sw., Hepp 54, 1853.
5. Magnificent crimson.
lychnea, Ach.
2, 3. Sw., Schær. Exs. 549, 1847.
5. Crimson.
varieties.
2, 3. Sw., Schær. Exs. 380–3, 1840.
5. Magnificent deep crimson, equally on thallus and apothecia.
turgida, Sch.
2, 3. Sw., Hepp 373, 1857.
5. Apothecia crimson.
7. Plant has no thallus, and is doubtfully referable to *P. parietina*.
ectanea, Ach.
(*Placodium fallax*, Hepp.)
2, 3. Sw., Hepp 633, 1860.

Physcia parietina, L.
5. Beautiful dark crimson.
7. A passage-form, apparently, between *P. parietina* and *Placod. elegans*.
parietina, L., vars.
2, 3. Sw., Hepp 595, 1860.
5. Crimson in one specimen (apothecia especially); pale crimson on thallus apparently derived from the apothecia. No immediate reaction in another specimen on either thallus or apothecia; crimson slowly developed.

50. *P. candelaria*, Nyl., and var.
2, 3. Sw., Hepp 392–3, 1857.
5. Thallus *un*affected.
(*candelaris*, Sch.)
2, 3. Sw., Schær. Exs. 382, 1840.
5. None.
(*Lepra candelaris*, Ehrh.)
2, 3. Sw., Schær. Exs. 233, 1852.
5. None.
7. *Lepraria flava*, E. Bot. referable, perhaps, to *P. parietina*.

51. *P. chrysophthalma*, L.
2, 3. Sw., Hepp 569, 1860.
5. Brilliant crimson-lake, both on thallus and apothecia; varying in depth and brilliancy in different specimens.
chrysophthalma, L.
2, 3. Sw., Schær. Exs. 389, 1840.
5. Brilliant crimson.

52. *P. flavicans*, Sm.
2, 3. Sw., Hepp 570, 1860.
5. Thallus; brilliant crimson-lake, varying in depth and beauty.
flavicans, Sm.
2, 3. Sw., Schær. Exs. 552, 1849.
5. Brilliant crimson.

53. *P. leucomela*, L.
2, 3. Fr., Hepp 573, 1860.
5. Beautiful lemon-yellow.

54. *P. stellaris*, L., and vars.
2, 3. Ger., Dietrich Exs., 1856.
5. Lemon-yellow, conspicuous on white thallus.
stellaris, L.
2. 3. Sw., Hepp 405, 1857.
5. Beautiful lemon (greenish) yellow.

55. *P. astroidea*, Fr.
2, 3. Sw., Hepp 501, 1860.
5. Beautiful lemon (greenish) yellow.
7. Same colour and habit of thallus as *Lecidea canescens*, and reaction similar.

P. astroidea, Fr.
2, 3. Sw., Schær. Exs. 610, 1852.
5. Vivid greenish-yellow on white thallus.

56. *P. cæsia*, Hffm.
(*erosa*, Borr.)
2, 3. Engl., Leight. Exs. 266, 1858.
4. None.
5. Vivid lemon-yellow.

57. *P. obscura*, Ehrh., and vars.
2, 3. Sw., Schær. Exs. 607–9, 1852.
5. Thallus vivid greenish-yellow.

58. *Umbilicaria vellea*, Fr.
2, 3. Sw., Schær. Exs. 606, 1852.
4. Light crimson on friction.
vellea, Fr.
2, 3. Sw., Hepp 117, 1853.
4. Faint tinge of orange-red in one specimen only, on friction, thallus being pale, whitish, or grey; in four other specimens no reaction.

59. *U. spadochroa*, Hffm.
2, 3. Sw., Hepp 306, 1857.
4. Faint orange-red on friction of paler parts of thallus.

60. *Squamaria crassa*, DC.
2, 3. Ger., Diet. Exs., 1856.
5. None.

61. *S. lentigera*, DC.
2, 3. Ger., Diet. Exs., 1856.
5. None.

62. *Placodium elegans*, DC.
2, 3. Ger., Diet. Exs., 1856.
5. Dark crimson.
elegans, DC.
2, 3. Sw., Schær. Exs. 481, 1843.
5. Apothecia; natural crimson deepened.
elegans, DC., and vars.
2, 3. Sw., Schær. Exs. 338 and 347, 1840.
5. Magnificent crimson; in both thallus and apothecia.
elegans, DC.
2, 3. Sw., Hepp 195, 1853.
5. Brilliant deep crimson.

63. *P. murorum*, DC. var.
2, 3. Sw., Hepp 397, 1857.
5. Pale crimson of apothecia deepened.
murorum, and var. *citrinum*, Ach. (saxicolous).
2, 3. Edinburgh (Grange-walls), 1855.
5. Thallus and apothecia beautiful blood-red.
(*Pl. citrinum*, Ach.)
2, 3. Sw., Hepp 394, 1857.

P. murorum, DC. var.
5. Apothecia, crimson-lake.
(*Pl. citrinellum*, Fr.)
2, 3. Sw., Hepp 395, 1857.
5. Apothecia, crimson-lake.
murorum, DC.
2, 3. Ger., Dict. Exs., 1856.
5. Crimson; thallus.
murorum, DC.
2, 3. Sw., Schær. Exs. 479, 1843.
5. Dark crimson on central pulvinuli; no reaction on sterile, subfoliaceous periphery of thallus.
murorum, DC.
2, 3. Sw., Schær. Exs. 480, 1843.
5. Dark crimson; both thallus and apothecia.
murorum, DC.
2, 3. Sw., Schær. Exs. 545, 1847.
5. Thallus; crimson.
7. Passing into *elegans*, says Schærer.
murorum, DC.
2, 3. Sw., Hepp 71, 1853.
5. Apothecia; dark crimson.
7. Colour of thallus and apothecia, and reaction, those of *elegans*.
murorum, var. *citrinum*, Ach.
2, 3. Sw., Hepp 72, 1853.
5. Thallus; no reaction, disk of apothecia crimson.
7. Undoubtedly referable to *murorum*.
murorum, DC.
2, 3. Sw., Hepp 196, 1853.
5. Apothecia, distinct crimson-lake, white crustaceous thallus *un*affected.

64. *P. circinatum*, Pers.
(*Lecanora radiosa*, Hffm.)
2, 3. Sw., Schær. Exs. 567, 1849.
5. Thallus; orange-red.
circinatum, Pers.
2, 3. Sw., Schær. Exs. 330, 1840.
5. Vivid greenish-yellow on a buff or pinkish thallus, slowly becoming orange-red and crimson.

65. *P. fulgens*, DC.
2, 3. Ger., Dict. Exs., 1856.
5. Crimson.
fulgens, DC.
2, 3. Sw., Schær. Exs. 339–40, 1840.
5. Magnificent crimson, both on thallus and apothecia.
fulgens, DC.
2, 3. Sw., Hepp 194, 1853.
5. Brilliant deep crimson.

66. *Pl. aureum*, Sch.
(sub. *Lecidea*, Sch.)
2, 3. Sw., Schær. Exs. 165, 1849.
5. Beautiful crimson-red.
aureum, Sch.
2, 3. Sw., Hepp 634, 1860.
5. Crimson.

67. *P. aurellum*, Hepp.
2, 3. Sw., Hepp 396, 1857.
5. Apothecia; none.

68. *P. cirrochroum*, Ach.
2, 3. Sw., Hepp 398, 1857.
5. Thallus intense crimson-lake.

69. *P. lividum*, Hepp.
2, 3. Sw., Hepp 403, 1857.
5. Apothecia; beautiful deep crimson-lake.
7. Apparently a muscicolous form of *Lecanora ferruginea.* In no case is the colouring matter of apothecia so easily dissolved out as in *ferruginea.*

70. *P. alphoplacum*, Whlnb.
(*Lecanora inflata*, Sch.)
2, 3. Sw., Hepp 621, 1860.
5. Thallus dark crimson; has a natural crimson tinge on periphery, especially where the surface is sorediiferous.

71. *P. callopismum*, Mér.
(sub. *Lecanora*).
2, 3. Sw., Schær. Exs. 337, 1840.
5. Very dark crimson.
callopismum, Mér.
2, 3. Sw., Hepp 197, 1853.
5. Thallus and apothecia; deep crimson.

72. *Lecanora tartarea*, L.
2, 3. Blaeberry Hill, Perth, 1855, and Craig-y-Barns, Dunkeld, 1856.
4. Blood-red, most vivid on friction; thallus sterile and sorediiferous.
tartarea, L.
2, 3. Belfast; corticolous, 1851.
4. None.
tartarea, L.
2, 3. Greenland; Illartlek glacier, 1867.
6. Ammoniacal solution same deep port-wine red as in Scotch and Norwegian specimens.
tartarea, L.
2, 3. Scotl., Braemar, 1856.
4. Faint blood-red on friction, or none: or dirty orange-red—in different specimens.
5. Dirty olive.

Lecanora tartarea, L.
2, 3. Sw., Schær. Exs. 541, 1847.
4. Crimson, both on apothecia and thallus, but only on friction.
5. Citrine yellow on both apothecia and thalline pulvinuli.

tartarea, v. *Turneri*, Sm.
2, 3. Ireland, corticolous, 1858.
4. Reaction sometimes of *tartarea*, sometimes of *parella*.
7. Certainly not autonomous; thallus mostly sterile, and sorediiferous.

73. *L. parella*, L.
2, 3. Botany Bay, N. S. Wales, corticolous, 1862.
4. None; or faint orange-red.
5. None; or very obscure olive or lemon-yellow (on thallus) —in different specimens.

parella, L.
2, 3. Kyles of Bute, 1852.
4. Vivid blood-red on a sorediiferous thallus.
7. Doubtfully referable to *parella*.

parella, L.
2, 3. Sw., Hepp 622, 1860.
4. None.
5. None.

(*pallescens*, L.)
2, 3. Sw., Hepp 623, 1860.
4. None.
5. None.

parella, L. (corticolous).
2, 3. Sw., Hepp 188, 1853.
4. None.
5. None.

parella, L.
2, 3. Sw., Schær. Exs. 570–571, 1849.
4. None; or very faint orange-red on friction.
5. None; or faint greenish-yellow on thallus.

(*pallescens*, L.)
2, 3. Sw., Schær. Exs. 316–317, 1840.
4. None.
5. None.

74. *L. glaucoma*, Hffm.
(*L. rimosa*, Œd.)
2, 3. Sw., Hepp 60, 1857.
4. None.
5. Beautiful lemon-yellow on thallus.

glaucoma, Hffm.
2, 3. Sw., Schær. Exs. 305, 1840.
4. Brilliant crimson on sterile, sorediiferous thallus.
5. None.

L. glaucoma, Hffm.
4. None.
5. Olive, becoming on apothecia orange.

(*Isidium corallinum*, Ach.)
2, 3. Sw., Schær. Exs. 236, 1852.
4. Cærulean *blue* on thallus (quite an exceptional reaction).
5. Thallus; lemon-yellow.
7. Thallus thick, white, sorediiferous; doubtfully referable to *glaucoma*, or to *Lecanora* at all.

(*Cyphelium corallinum*, Hepp.)
2, 3. Sw., Hepp 531, 1860.
5. Beautiful deep lemon-yellow, passing into orange-red.
7. Thallus white, tartareous, granulose-verrucose.

75. *L. chrysosticta*, Tayl.
2, 3, Otago, N.Z., 1861.
4. None.
5. Thallus vivid olive-green; apothecia deep crimson.

76. *L. subfusca*, Ach. (saxicolous).
2, 3. Sw., Hepp 380–381, 1857.
5. Thallus; lemon (greenish) yellow.
7. Thallus thick, verrucose or tartareous as in *frustulosa*.

subfusca, Ach.
2, 3. Sw., Hepp 402, 1857.
5. Thallus; greenish-yellow.

subfusca, Ach. and vars.
2, 3. Ger., Diet. Exs., 1856.
5. Thallus; lemon or olive.

subfusca, v. *albella*, Pers.
2, 3. Sw., Schær. Exs. 618, 1852.
5. Thallus and apothecia; orange-red.

subfusca, v. *albella*, Pers.
2, 3. Sw., Hepp 187, 1853.
5. Thallus; olive (greenish-yellow).
7. Thallus white, thin, tartareous.

(*intumescens*, Rebent.)
2, 3. Sw., Hepp 614, 1860.
5. Thallus; lemon-yellow.

77. *L. frustulosa*, Ach.
2, 3. Sw., Hepp 178, 1853.
5. Natural pale yellow of thallus heightened.

78. *L. esculenta*, Evers.
2, 3. Sw., Hepp 632, 1860.
4. None.
5. None.

79. *L. Reuteri*, Schær.
2, 3. Sw., Schær. Exs. 614, 1852.
5. White thallus; lemon-yellow.

80. *L. ventosa*, Ach.
2, 3. Sw., Hepp 643, 1860.
4. None.
5. Natural greenish-yellow of thallus heightened.
7. *L. ventosa* is a dye-lichen yielding a *blue* and *red* colouring matter, according to Gümbel and Liljeblad.

81. *L. hæmatomma*, Ach.
2, 3. Sw., Hepp 641–642, 1860.
4. None.
5. Lemon-yellow; sometimes obscure.

82. *L. calcarea*, Ach.
2, 3, Sw., Hepp 627, 1860.
4. None.
5. None.

calcarea, Ach.
2, 3. Fr., Nyl. Exs. 126, 1855.
4. None.
5. None.

83. *L. cerina*, Ach.
2, 3. Sw., Hepp 197, 1853.
5. Apothecia; brilliant deep crimson.

cerina, Ach.
2. 3. Sw., Hepp 405–406, 1857.
5. Apothecia; brilliant deep crimson.

cerina, Ach.
2, 3. Sw., Schær. Exs. 219, 1852.
5. Apothecia; vivid crimson.

84. *L. pyracea*, Ach.
(*Placodium luteo-album*, Turn.)
2, 3. Sw., Hepp 73 and 196, 1853.
5. Apothecia; deep crimson at once.

pyracea, Turn.
2, 3. Sw., Hepp 500, 1860.
5. Apothecia; beautiful crimson-lake.

(*P. luteo-album*, Turn.)
2, 3. Sw., Hepp 635, 1860.
5. Apothecia; brown-red.

85. *L. aurantiaca*, Lightf. and vars. (saxicolous).
2, 3. Sw., Hepp 636–637, 1860.
5. Thallus and apothecia; dark crimson.

aurantiaca, Lightf.
2, 3. Sw., Hepp 198, 1853.
5. Thallus and apothecia; obscure crimson.

aurantiaca, Lightf.
2, 3. Sw., Schær. Exs. 193 and 537, 1847 and 1849.
5. Beautiful dark crimson, of different shades.

aurantiaca, Lightf.
2, 3. Sw., Schær. Exs. 475, 1843.
5. Apothecia; beautiful crimson.

L. aurantiaca, Lightf.
2, 3. Sw., Hepp 399, 1857.
5. Apothecia; beautiful crimson.

aurantiaca, v. *erythrella*, Ach.
2, 3. Sw., Schær. Exs. 222–224, 1852.
5. Apothecia and thallus; vivid crimson.

86. *L. ferruginea*, Huds.
2, 3. Sw., Hepp 400–402, 1857.
5. Apothecia; deep crimson-lake; colouring matter easily dissolved out by the alkali, staining thallus.

ferruginea, Huds.
2, 3. Sw., Schær. Exs. 448–449, 1842.
5. Apothecia; dark crimson.

ferruginea, Huds.
2, 3. Sw., Schær. Exs. 583, 1849.
3. Natural beautiful crimson of apothecia deepened.

ferruginea, v. *festiva*, Ach.
2, 3. Sw., Hepp 201, 1853.
5. Apothecia; crimson.

ferruginea, v. *arenaria*, Sch.
2, 3. Sw., Schær. Exs. 632, 1852.
5. Apothecia; dark crimson.

ferruginea, v. *arenaria*, Sch.
2, 3. Sw., Hepp 199, 1853.
5. Apothecia; crimson.

87. *L. vitellina*, Ach.
2, 3. Sw., Hepp 250, 1857.
5. Apothecia; orange-red.

vitellina, Ach.
2, 3. Sw., Hepp 70, 1853.
3. Apothecia; no change in saxicolous form; but, in two corticolous specimens, became orange-red, though not of a deep tinge.

vitellina, Ach.
2, 3. Sw., Schær. Exs. 450, 1842.
5. None.

vitellina, Ach.
2, 3. Sw., Hepp 391, 1857.
5. None (apothecia).

88. *Lecanora orcina*, Ach.
2, 3. Sw., Hepp 209, 1853.
5. None.

orcina, Ach.
2, 3. Sw., Schær. Exs. 331, 1840.
5. None.

89. *L. chlorophana*, Ach.
(*L. flava*, Sch.)
2, 3. Sw., Schær. Exs. 336 and 615, 1840 and 1852.
5. None.

90. *L. cinerea*, L.
2, 3. Sw., Schær. Exs. 620, 1852.
5. Thallus; orange-red.
cinerea, L.
2, 3. Sw., Hepp 388, 1857.
5. Thallus; olive (greenish-yellow).
91. *L. polytropa*, Ehrh.
2, 3. Sw., Schær. Exs. 572, 1849.
5. Thallus; vivid greenish-yellow, in one specimen; no reaction in another.
92. *L. Lallavei*, Clem.
(*L. erythrocarpia*, DC.)
2, 3. Sw., Schær. Exs. 584, 1849.
5. Thallus and apothecia; beautiful crimson.
93. *L. horiza*, Ach.
(sub *Psora*).
2, 3. Sw., Hepp 409, 1857.
5. Thallus; vivid greenish-yellow.
94. *Urceolaria scruposa*, Ach.
2, 3. Sw., Hepp 210, 1853.
4. Crimson.
scruposa, Ach. (muscicolous).
2, 3. Sw., Hepp 702, 1860.
4. Crimson; obscure.
5. Lemon-yellow.
scruposa, Ach. and vars.
2, 3. Sw., Schær. Exs. 289–292, 1836.
4. Thalline verrucæ (apices), and apothecial exciple; crimson; varying in degree, most brilliant and rapid in var. *cretacea* (No. 291); sometimes mere mottling.
scruposa, Ach.
2, 3. Sw., Schær. Exs. 132, 1842.
4. Vivid crimson-red at once.
95. *U. ocellata*, Vill.
2, 3. Sw., Hepp 389, 1857.
5. Thallus; olive (greenish-yellow).
ocellata, Vill.
2, 3. Sw., Schær. Exs. 477, 1843.
4. None.
5. Various shades of citrine-yellow passing into orange-red.
96. *U. actinostoma*, Sch.
2, 3. Fr., Nyl. Exs. 46, 1855.
4. Faint blood-red on friction.
97. *Dirina repanda*, Fr.
2, 3. Sw., Hepp 408, 1857.
4. Crimson, on friction.
5. None.
Dirina repanda, Fr.
7. Thallus and apothecia resemble those of *Lecanora parella*.
98. *Pertusaria communis*, DC.
2, 3. Sw., Hepp 676, 1860.
5. Lemon-yellow; generally more vivid on sterile and isidiiferous thallus than on apothecia.
communis, var. *sorediata*, Fr.
2, 3. Sw., Hepp 672, 1860.
4. None.
5. Beautiful lemon-yellow on white, thin, effuse thallus.
var. *sorediata*, Fr. (saxicolous).
2, 3. Sw., Hepp 673, 1860.
4. None.
5. Thallus and soredia, lemon-yellow.
var. *isidioidea*, Sch.
2, 3. Sw., Hepp 678, 1860.
5. Sterile thallus; beautiful lemon-yellow; becoming rich orange-red.
var. *variolosa*, Wallr.
(*Variolaria globularis*, Sch.)
2, 3. Sw., Hepp 677, 1860.
5. Soredia, lemon-yellow; colour not very vivid.
99. *P. Wulfenii*, DC.
(*lutescens*, Sch.)
2, 3. Sw., Schær. Exs. 594–595, 1849.
5. Natural lemon (greenish) yellow heightened.
fallax, Ach., var. *sulphurea*, Sch.
2, 3. Sw., Hepp 679, 1860.
5. Natural lemon (greenish) yellow heightened (sterile thallus).
100. *P. ceuthocarpa*, Fr.
2, 3. Sw., Hepp 674, 1860.
4. None.
5. Beautiful lemon-yellow, especially where thallus is tartareous or verruculose; becoming rich orange-red.
101. *P. leioplaca*, Sch.
2, 3. Sw., Hepp 675, 1860.
5. Lemon-yellow; very faint.
102. *P. ocellata*, Wallr.
2, 3. Sw., Hepp 671, 1860.
5. Thallus and soredia; lemon-yellow.
103. *P. rupestris*, DC.
(*areolata*, Ach.) saxicolous.
2, 3. Sw., Hepp 670, 1860.
5. Apothecia; lemon-yellow.
rupestris, DC.
2, 3. Sw., Schær. Exs. 648, 1852.

P. rupestris, DC.
4. None.
5. Thallus; lemon-yellow.

104. *P. velata*, Turn.
2, 3. Otago, N.Z., 1861.
4. None in some parts of its thallus; in others blood-red, but patchy and difficult to obtain.

105. *Phlyctis agelæa*, Wallr., and vars.
2, 3. Sw., Hepp 703–705, 1860.
5. Beautiful lemon-yellow on the thin, white, effuse thallus (= *Lepraria alba*, Auct.) varying in depth and vividness.

106. *Lecidea canescens*, Ach.
2, 3. Sw., Schær. Exs. 576, 1849.
5. Thallus; vivid greenish-yellow.

canescens, Ach.
2, 3. Sw., Hepp 527–528, 1860.
5. Thallus; beautiful lemon-yellow.

107. *L. contigua*, Fr.
var. *albo-cærulescens*, Wulf.
2, 3. Sw., Schær. Exs. 185, 1849.
5. Vivid olive-green on white thallus.

var. *calcarea*, Fr.
2, 3. Sw., Schær. Exs. 184, 1849.
5. White mealy thallus, mottled lemon (greenish) yellow.

108. *L. galbula*, Ram.
(*Wahlenbergii*, Ach.)
2, 3. Sw., Schær. Exs. 166, 1849.
5. None; on beautiful yellow thallus.

109. *L. citrinella*, Ach.
(*flavo-virescens*, Borr.)
2, 3. Sw., Schær. Exs. 532, 1847.
5. None.

110. *L. fusco-lutea*, Dicks.
(sub *Placodium*.)
2, 3. Sw., Hepp 404, 1857.
5. Apothecia; deep crimson-lake.
7. Referable to *Lecanora ferruginea;* reaction the same.

111. *L. lutea*, Dicks.
2, 3. Sw., Hepp 501, 1860.
5. Apothecia, unaffected.

112. *L. cinnabarina*, Smrf.
2, 3. Sw., Hepp 485, 1860.
5. Thallus, lemon-yellow; apothecia, crimson-lake.

113. *L. rupestris*, Scop.
(sub *Biatora*.)
2, 3. Sw., Hepp 274–275, 1857.
5. Apothecia, *un*affected in 274; crimson in 275.

114. *L. testacea*, Ach.
(sub *Biatora*.)
2, 3. Sw., Hepp 236, 1857.
5. Apothecia, crimson.

115. *L. pineti*, Ach.
2, 3. Sw., Schær. Exs. 136, 1842.
5. None (apothecia).

116. *L. luteola*, Ach.
(*rubella*, DC.)
2, 3. Sw., Schær. Exs. 147, 1842.
5. None (apothecia).

117. *L. rosella*, Ach.
(sub *Biatora*.)
2, 3. Sw., Hepp 522, 1860.
5. None (apothecia); thallus, lemon-yellow.

118. *L. carneola*, Ach.
(sub *Biatora*.)
2, 3. Sw., Hepp 521, 1860.
5. None (apothecia); thallus, lemon-yellow.

carneola, Ach.
(*Biatora effusa*, Sm.)
2, 3. Sw., Hepp 520, 1860.
5. None (apothecia).

119. *L. sanguinaria*, Ach.
2, 3. Sw., Hepp 483, 1860.
5. Thallus, lemon-yellow.

120. *L. quernea*, Ach.
(sub *Biatora*.)
2, 3. Sw., Hepp 494, 1860.
5. Thallus, lemon-yellow.

121. *L. fallax*, Hepp.
(sub *Biatora*.)
2, 3. Sw., Hepp 505, 1860.
5. Apothecia *un*affected.

122. *L. vernalis*, Ach.
(*Biatora sphæroides*, Dicks.)
2, 3. Sw., Hepp 513, 1860.
5. Apothecia; colour deepened (or crimson-red).

123. *L. geographica*, L. and vars.
2, 3. Sw., Schær. Exs. 623, 1852.
5. Thallus; none.

124. *L. geminata*, Flot.
2, 3. Sw., Hepp 308, 1857.
5. Thalline pulvinuli greenish-yellow.

125. *L. discolor*, Hepp.
2, 3. Sw., Hepp 320, 1857.
5. Thallus (white, areolate, crustaceous); greenish-yellow.

126. *L. pachycarpa*, Duf.
(sub *Biatora.*)
2, 3. Sw., Hepp 234, 1857.
5. Thallus, olive-green.

127. *L. clata*, Sch.
(sub *Biatora.*)
2, 3. Sw., Hepp 256, 1857.
5. Thallus (white, thick, crustaceous); greenish-yellow.

128. *Arthonia pruinosa*, Ach.
(*impolita*, Ach.)
2, 3. Sw., Hepp 535, 1860.
5. Thallus (white, mealy, crus-

taceous); deep lemon-yellow.

129. *A. cinnabarina*, Fr.
(*Coniocarpon gregarium*, Sch.)
2, 3. Sw., Hepp 162, 1853.
5. Natural crimson of both apothecia and thallus intensified.

130. *Lecanactis illecebrosa*, Duf.
2, 3. Sw., Hepp 533, 1860.
5. Thallus, lemon-yellow.

II. *Notice of a Trip from Deyrah Dhoon to Jumnotri.* Part I. By Mr William Bell.

Having some leisure time in October last (1868), it occurred to me that I could not spend it more pleasantly or more profitably than in visiting the famous boiling springs on the hills at Jumnotri. Accordingly, accompanied by Mr Nelson of the Saharunpore Botanic Garden, I left Deyrah Dhoon about the 1st October, and reached Jumnotri in seven or eight days. Being rather pushed for time, we walked double marches both there and back. Our difficulties were increased by food being both scarce and bad. We expected that, after getting over the third range, and away from Mussoorie, game would be tolerably plentiful; in this we were sadly mistaken. In every village we passed through, however, we found one or two men who made a living by the gun. Collecting pheasants' (chiefly Monaul) skins, and musk, gives employment to a great many. We heard of a Mr Wilson who has amassed a large fortune from the proceeds of the skins and musk which he sends to the London market. For the purpose of collecting these he is said to employ no fewer than eighty men. Mussoorie is tolerably well supplied during the summer season with game, which is brought from a great distance. Many gentlemen employ men for the sole purpose of supplying their tables with birds, and these men spare neither age nor sex; and what makes matters worse is, that the time when game is in greatest demand, and of course the greatest quantity killed, is during the breeding season. Such being the case, it is not surprising that some of the fine Himalayan pheasants in that district are fast becoming extinct.

The same class of men, both on the hills and on the plains (who are thus destroying the game), have not a little to do with that pernicious system of forest burning which has already done so much towards the ruining of the Indian forests. The northern slopes of the first, second, and third ranges are pretty well covered with oak and rhododendron, while the southern slopes of the second and third ranges are extremely bare, with only here and there a few starved-looking Euphorbias, Viburnums, &c. In some of the large ravines there are a few stunted trees and scrub. These ranges have all apparently, at one time, been cultivated to their very summits, by a system of terracing; but the terraces are generally so badly constructed that the soil gets washed down. Many of the fields now in cultivation have exactly the appearance of a newly metalled road, the soil having all been washed away, and only the stones left—the whole presenting an appearance very similar to that of a mixture of sharp gravel and road-metal. Land in such a state seems quite unfitted for rice or wheat, which is generally cultivated on soils, close to the villages, better levelled and better manured. For rice cultivation, the villagers are much more careful in terracing, levelling, and constructing water-courses, than for cultivation of any other kind. On those fields where the soil has been partially—in some cases it might be said wholly—washed off, Panicum, Phaseolus, and Amaranthus (several varieties or species), thrive most surprisingly. All of them are remarkably handsome, particularly an Amaranthus, of a deep purplish colour, with pendant spikes 1½ to 2 feet in length. On the third and fourth ranges patches of forest of considerable size are cleared for its cultivation. Its peculiar colour attracts notice at a considerable distance, contrasting markedly with the green all around. Still further back, and at higher altitudes, the common buckwheat, and also a Chenopodium, are extensively cultivated. The leaves as well as the seed of the latter are used. What its specific name is, I have no means of ascertaining. Much has been said lately about the great advantages likely to be derived from the introduction of *Chenopodium Quinoa*, a South American food-plant. It is a matter for surprise, that those gentlemen who expect such great things from the introduction of the American species have given no statement of its value as compared with the Indian species. It seems strange that the Indian one should be extensively cultivated on the ranges just under the snow, and no notice taken of it by those who speak of the supposed advantages to the hill districts of the American plant. If the latter plant possesses all the qualities attributed to it, its introduction would be a great advantage, at least for cattle-feeding. In many of the villages they have nothing during snow-storms for that purpose, except oak and mulberry twigs, and the leaves of a Ferula? A stem of the latter, that had been broken about the middle of an internode, presented a remarkable appearance. The break was about five inches above a leaf, and as much beneath one, and from the broken surface (not from the axil of the leaf beneath) arose a great number of buds, some having two or three minute leaves on them. It looked exactly as if they had sprung from the ends of the broken vessels.

The further back one goes, the more steep do the southern faces of the ranges seem. This is most observable where the rock is quartzose. They are also drier, as the strata all dip north or north-east; and the northern slopes become flatter, better wooded, and better watered. Some of the precipices along the course of the Jumna look really frightful; being almost perpendicular walls of rock, probably more than 1000 feet high. The waterfalls, too, must be striking during the rainy season. Although there cannot be any great body of water rushing over them, still their great height will always render them marked objects to the tourist. Some of them have, perhaps, not less than 500 feet of an uninterrupted fall.

It is not until after crossing the third and fourth ranges that the *Deodar*, *Abies Morinda*, and *Pinus excelsa* are observed. *Pinus longifolia* covers some of the slopes exclusively. It also occurs on the Sewalick range, and likewise does well on the plains. In those districts where it occurs, the collecting of resin from the growing trees, by barking and charring them, seems to form no inconsiderable branch of industry. On most of them the foliage acquires a yellow colour after the bark has been stripped off at the base, for about one-half the circumference of the tree, and a fire applied. Judging from the great number of trees on the ground, such a practice seems to be highly injurious to their health and longevity. At one place on the banks of Jumna a considerable deal of felling had been done, and, judging from the great length of the stumps left standing, that must be rather difficult work. The fellers do not seem to have troubled themselves much about the direction in which the trees came down. In accordance with native ideas, it seems entirely left to fate;—whether they smash other trees in their fall, or get smashed themselves, is equally a matter of indifference to them. They seem to think that it is not in their power to prevent a tree from falling in one direction rather than another, even over a precipice, and that there is no need for care in this respect, as there are plenty trees in the forest.

It has been already remarked that, on account of the steepness of the slopes, where terraces were badly constructed, the soil soon gets washed away. In many places terraces are not constructed at all, and where such is the case, cultivation is carried on for two or three years, and then a fresh piece of forest cleared. The system of clearing practised is to girdle the trees, lop off the branches, and allow the trunks to remain standing. These operations are generally performed the year previous to breaking up. Oak seems to stand such hard usage much better than pines. The former sometimes recovers from such treatment, while the pines never do. After the oaks have been headed over and girdled, an insect—I cannot say whether a beetle or a grub—attacks them most vigorously. Handfuls of gnawed wood, resembling sawdust, may be gathered round the roots of the tree. Under such a vicious system, it is not a matter for surprise that large tracts of forest are fast disappearing. Did seedlings come up and occupy their place, the case would be quite different, but such is not the case. Only scrub succeeds cultivation; indeed the very cause—want of soil—that rendered these cleared tracts unfit for cultivation also renders them unfit for again supporting forest trees. There is something melancholy in the appearance which these headless, branchless trunks present to the stranger. Trunks which had lately been fine symmetrical trees of *Abies Morinda*, 100 to 150 feet high, and as straight as an arrow, are seen standing without a branch, partly denuded of bark, and as dry as tinder. Thus they remain until the roots become so rotten that they will no longer support the trunk, and then these princes of the forest, which have withstood many blasts, fall, and lie until they crumble to dust.

From many of the localities now alluded to, the timber could not be floated; from others, it perhaps might, although only with great difficulty, as the streams are very rapid, and their courses crooked and rocky; and until timber sells at a much higher price than it now does, it would not pay to transport it by coolies. However, prices seem to be still rising, and good timber year by year is becoming scarcer. Some enterprising Yankee may yet make a fortune by shipping pine from Vancouver Island or British Columbia for the use of the public works department in India. If these magnificent trees were only valuable as timber, it might be of comparatively small importance whether they were growing or rotting, but if they are subservient to other valuable ends in the economy of nature, they cannot be too carefully preserved. As to whether or not they in any way affect the rainfall of a district, there is some difference of opinion, but none regarding the influence they exercise over the regularity and abundance of the flow of the springs in a district. Every drop of the upper waters of both the Ganges and Jumna is taken up during the hot season for irrigation purposes, and they are far too little for the wants of the districts through which the canals pass. Until the minimum supply be increased, general irrigation cannot be extended. That system of wholesale destruction of forests now in operation, only for the purpose of keeping alive a wretched system of cultivation—of which laziness is the parent, and, if report be true, misrule the supporter—is fast making the districts in which it is practised treeless wastes, or, at best, only partially covered with scrub such as Prinsepia, Berberis, Indigofera, &c., which will tend to diminish, not to increase, the water supply for hot-weather irrigation.

I may remark, for the benefit of those who are not well acquainted with Indian geography, that the forest tracts now spoken of lie in western Ghurwal, which is under the benign rule of the Teera Rajah; but whether they are under the supervision of the Government forest officers or not, I cannot say. I have heard that some of them are. Near Byratt, there seems to be a considerable deal of timber felled, and under the supervision of qualified forest officers, felling seems to be done promiscuously. The young trees are taken as well as the old—at least I infer so, from the fact that no young trees worth speaking of are to be seen on tracts that had lately been cleared of old timber. There may have been none to leave in that district; still, as a rule, where there are old trees, there are also young ones. Perhaps the idea may have occurred that it was better to make a clean sweep at once, and thus save the cultivators the trouble of clearing.

III. *Remarks on some Deep-Sea Dredgings, transmitted by* Captain WILLIAM CHIMMO. By Professor DICKIE.

The dredgings, which were taken by Captain Chimmo from great depths in the Atlantic, immediately under the Gulf Stream, at 2000 fathoms, in latitude 47° 3′ north; longitude, 23° 21′ west, and at 600 fathoms in latitude 45° 42′ north, and longitude. 47° 39′ west, had been minutely examined by Professor Dickie. He found that in the matter from 2000 fathoms there were two Diatoms—one identical with *Coscinodiscus minor*, and the other a species of Cocconeis, which he had not yet determined. He had treated some of the material with weak acid, in order to judge, from the amount of sarcode left, whether the foraminifera (which were abundant) were living, or merely the shells after death and decay. He had come to the conclusion that they were living, but whether the Diatoms mentioned were so he could not say. Among the sarcode he found several species of Polycystina, mostly in fragments. Specimens of the dredgings were shown under the microscope.

IV. *Notice of the occurrence of* Amblystegium confervoides *of Bruch and Schimper, in Westmoreland, by* Mr J. M. Barnes. Communicated by Mr P. N. Fraser.

Mr Barnes gathered this moss in 1867, in considerable abundance on loose stones in damp wood, near Levens. He has found it in many different places since. It always occurs on limestone, and is apt to be overlooked for a small form of *A. serpens.* Specimens were exhibited and presented by Mr Barnes to the Herbarium.

V. *Report on the Open Air Vegetation at the Royal Botanic Garden.* By Mr M'Nab.

Since the last meeting of the Botanical Society, Jan. 14th, the weather has been unusually mild, the lowest thermometer readings being on the mornings of Jan. 18, 22, 23, 26, and 27 ; also on Feb. 3, being respectively 28, 29, 31, 24, 29 and 28 degrees. The highest morning temperatures were on Jan. 31, Feb. 4, 5, 6, and 7, marking 50, 52, 53, 47, and 46 degrees. This excess of temperature has brought vegetation very rapidly forward, both foliage and flowers being in advance of former years. In continuation of my former list, the following shrubs and herbaceous plants came into flower by rotation :—

Jan. 16. Eranthis hyemalis.
16. Rhododendron Nobleanum.
17. Andromeda floribunda.
17. Leucojum vernum.
18. Erica herbacea.
20. Juniperus chinensis.
21. Nordmannia cordifolia.
21. Populus tremula.
22. Crocus susianus.
23. Hepatica triloba.
25. Orobus vernus.
26. Galanthus plicatus.
29. Daphne Mezereum.
Jan. 30. Cydonia japonica.
30. Mahonia Aquifolium.
30. Crocus vernus, and *vars.*
Feb. 1. Sisyrinchium grandiflorum.
2. S. album.
3. Scilla bifolia.
7. Nuttallia cerasiformis.
10. Aubretia grandiflora.
10. Symphytum caucasicum.
10. Omphalodes verna.
11. Symplocarpus fœtidus.

Mr M'Nab remarked that the "Bunch grass" growing in the Botanic Garden had, on 5th February, a growth of

18 inches, which proved it to be by far the earliest and strongest grass in cultivation. Mr Robert Brown, who introduced the plant from British Columbia, made a few remarks on its value as a pasture grass in that country.

VI. *Miscellaneous Communications.*

1. *Aster salignus.*—A note was read from Miss Beever, recording the occurrence of *Aster salignus* on the shore of Derwentwater, where it was collected by Miss Edmonds, in 1868, in flower. This plant also occurs near Cambridge, and in several places on the banks of the Tay, between Dalguise and Seggieden. In one locality below Perth, Dr White remarks that it is associated with several introduced plants, such as *Linaria repens*, *Petasites alba*, *Sanguisorba canadensis*, *Mimulus luteus*, *Crocus vernus*, and *Narcissus Pseudo-Narcissus*, which are all more or less common, and well established along the banks of the river. In France, *Aster Novæ-Belgii* seems to hold the same place as *A. salignus* does in Britain—that of an exotic plant, well established on the banks of several rivers, as near Strasbourg, Laugre, and Lyons.

2. *Rare British Mosses.*—Mr Sadler read a note from Mr James Hardy, Old Cambus, enclosing specimens of *Dicranum elongatum*, which he had collected near the summit of Hedgehope, Northumberland, in July last; and recording the occurrence of *Dicranodontium aristatum* in Roxburghshire, where it was first gathered by Mr Jerdon in 1864, and *Grimmia contorta*, on the Cheviots, collected by himself in May 1868.

3. Professor Balfour exhibited a series of beautifully coloured photographs of plants, executed by the Rev. D. T. K. Drummond; also a picture frame prepared by Miss Drummond from the scales of fir cones.

4. Professor Balfour noticed the "Fasciculi of Willows," now being issued by the Rev. J. E. Leefe. The first fasciculus (which can be had for 8s.) has been added to the Herbarium.

5. Professor Dickson made some remarks on the structure of the fruit of *Hippophae rhamnoides*, specimens of which he exhibited.

6. Professor Dickie sent specimens of the spermatozoids of *Sphagnum cymbifolium*, which were exhibited under the microscope.

7. Mr Gorrie made some remarks on the roots of *Oxalis crenata*, the Okas of the Peruvians, and presented specimens to the Museum.

8. Dr Post presented a collection of dried plants from Beyrout; Dr Buchanan White, alpine plants collected in Ross-shire; and Miss Beever, forked specimens of *Blechnum boreale* and *Asplenium viride.*

11*th March* 1869.—Dr Cleghorn, President, in the Chair.

The following Gentlemen were elected as Resident Fellows:—

W. F. Forsyth, Esq.
Robert Scot-Skirving, Esq.

Donations to the Library, Herbarium, and Museum, at the Royal Botanic Garden, were announced.

The following Communications were read:—

I. *Notes on the Botany and Agriculture of Malta and Sicily.* By H. Cleghorn, M.D.*

The island of Malta lies in 35° N. lat. and 14° E. long. Its greatest length is 17 miles, its breadth 9, the circumference 60, and the entire superficies under 200 square miles.

The rock is calcareous, dry, and bare; the soil consists of a thin covering of earth, five or six inches in depth, on a soft whitish sandstone, and is increased by breaking up the surface of the stone into a sort of sandy debris, and mixing it

* These Notes were made during the months of December 1867 and January and February 1868. The pleasure of my stay in Malta was much enhanced by the kindness of His Excellency Sir Patrick Grant, G.C.B., from whom I received cordial assistance in my inquiries.

through the earth. A considerable portion of the area of the island is so rocky as to be incapable of cultivation.

Climate..—There is an average rainfall of eighteen inches from October to March. Taken as a whole, the climate is not one of extremes. In February, the coldest month, the mean temperature is 56° Fahr., and in August, the hottest season, it is 83°. The mean temperature of the year is 68°. A full account of the climate is given in Dr John Davy's work on Malta; in Hennen's "Medical Topography of the Mediterranean" (1830); and more recently in Dr Scoresby-Jackson's "Medical Climatology," p. 477 (1862), and in Dr Sutherland's "Report to Parliament on Barrack and Hospital Improvement of the Sanitary Condition of the Mediterranean Stations," part ii. Malta and Gozo, 1863.

Want of Trees.—Dr Sutherland remarks truly, "The great improvement required everywhere, but particularly in the vicinity of the barracks, is shade from trees; this can only be obtained at considerable labour and cost," owing to the nature of the soil. A good beginning has, however, been made in the public gardens of Florian, and several parts of Valetta have been successfully planted with beautiful trees by the late governor, Sir J. Gaspard Le Marchant. The subject of planting has lately been under the consideration of the local Government, and, I believe, the chief difficulties are to set aside a sufficient area of land for the cultivation of wood, and to allow an adequate supply of water for the first three years, which is an essential to success. All timber for building is imported from Trieste or America, while charcoal is brought from Sicily and Greece. There is no evidence to show that Malta ever was a wooded island, and the tradition that its soil was imported from Sicily tends to confirm this view. In Sandys' time (1611) there were no woods in the island, which he describes as "a country altogether champion, being no other than a rocke covered over with earth, but two feete deep where the deepest; having but few trees but such as beare fruite . . . so that their wood they have from Sicilia." ("Sandys' Travels," p. 412.)

Water Supply.—The Bengemma Hills, containing the fertile valleys of Boschetto and Entahleb, from the presence of the soft marl and porous sandstone, which retain the rain-water, form the great sponge or reservoir for the supply of Valetta. The only permanent stream in the island flows from the Bengemma Hills, and is conducted by a fine aqueduct of several thousand arches and nine miles in length, to Valetta. This great and admirable work was begun in 1610, by Grandmaster Vignacourt, and completed in five years. From the source to the city there is a fall of 192 feet, and the supply of water is about 425,000 gallons a day. The gratitude of the inhabitants of Valetta is due to the founder of this, the most useful public work which the city possesses. The following inscription is on the main arch of the aqueduct:—

"Hac Valetta tenus functum jacuisse cadaver visa est, nunc laticis spiritus intus alit, incubuit primus olim ceu spiritus undis spiritus evixa, sic modo fertur acqua Bontadino de Bontadinis."

The reverse side of the arch bears the following:—

"Fri. Alophio de Wignacourt magno magistro Valletam urbem et arcem dulcissimis acquis vivificanti æterna salus. Ren. in 1739."

Additional water is obtained by rocky cisterns, in which the rain is collected. These are sometimes cemented, and the water is led off as required to terraces and fields. Great efforts are now being made to increase the supply of water by tapping new springs, and very considerable success has followed these attempts, which promise to be of lasting benefit to the island. It is hoped that there may be no return of the scarcity experienced in 1866 and 1867.

Agriculture.—Notwithstanding the thinness of the soil and the smallness of the rainfall, the crops, by aid of irrigation, are in general abundant. The fertility of the island was noted by Ovid—

> "Fertilis est Melite, sterili vicina Cosyræ,
> Insula, quam Lybici verberat unda freti."
> *Ovid, Fast.* i. 3.

And, again, by Cornelius a Lapide:—

"Altera est vicina Siciliæ vulgo *Malta* dicta, et hic intelligitur, quæ coelo est clemente, aquis salubribus, agro benigno et frugifero, a bonitate mellis laudata, indeque Malta ut videtur appellata."
P. Cornelius a Lapide in Comm. 1 *Act. Ap. cap.* 28.

The fields are small, and generally enclosed with high stone walls, built so as to form terraces, thus preventing the rain from washing away the soil, and also keeping out trespassers. These walls are formed of the broken stones from the quarries, or from the fields, and they give an irksome appearance of sameness to the country, concealing the crops, and reflecting the sun's rays. There is no game on the island, except occasionally birds of passage, particularly quail and plover, which visit it in incredible numbers.

The principal staples are cotton, wheat, carob beans, and various fruits. Cotton must have been an early production of Malta, as it is mentioned by Cicero.* Two species are cultivated—*Gossypium herbaceum* and *religiosum*. The culture of cotton was much extended during the American war.

Wheat, maize, and barley are raised. Of the first the annual crop is estimated at 100,000 hect.: the other two are produced in smaller quantities. Immense subterranean granaries, cut out of the rock by the Knights of St John, are stored with corn for the use of the garrison. The apertures are closed with square blocks of stone, and sealed up. The grain remains fit for use for many years.

Hedysarum coronarium, L. (D.C. Prod. ii. p. 341. Flore de Serres, t. 1382), "silla" of the Maltese; *Sainfoin d'Espagne*, red clover of the English, is abundantly produced during the rainy season. Originally from Calabria, this strong biennial grows to four or five feet in height, with a large crimson flower, and forms an excellent forage plant for horses and mules in winter; what remains is used as hay in summer, and may be seen in large bales in the seaports of South Europe. Barley and carob beans are also used for fattening cattle, the former being cut green; but the culture of fodder grasses is not known, probably because of the dryness of the climate.

Ceratonia Siliqua, L. (karuba), abounds in the island, and is green all the year. It is a rather small tree, scattered everywhere, and growing in the most stony and rocky soil. There is seldom a main trunk, and the finely-arched branches sweep the ground, often requiring the support of props to prevent them from breaking down. The dark glossy evergreen foliage forms a fine feature in the scenery

* Verrine Orations, ii. iv. 46.

of this generally treeless island. The pods are long and hard, not unlike those of the tamarind, and of the greatest value to man and beast. They are sold in all the shops;* the poorer classes use the beans as food, and when baked in the oven the flavour is not disagreeable. The fruit, mixed with honey—*karu mela*, from *karuba* and *mel*—is a favourite sweetmeat for children. This is the origin of the French *caromel*, commonly applied to a kind of barley-sugar drops. Beggar children in the streets call out "*hubba karubee.*" This tree, *algaroba* of the Spaniards, *karoubier* of the French, grows all along the shores of the Mediterranean Sea, and abounds in the Levant. The fruit forms a staple article of food of the Moors in Barbary and Algiers; and so great is the importance of this natural product as a source of public aliment, that it has been the subject of a special commission, which reported to the Académie des Sciences and the Académie Impériale de Médecine, 1864. In a memoir, by M. J. Prevet, presented to these learned Academies, it is stated that those persons using the *karouba* as an article of food are remarkable for their healthy appearance, and that cattle fed on it become speedily fat and well-conditioned. M. Prevet recommends the use of karuba pods, baked and pulverised, as a substitute for chicory, mixed with coffee, and even for coffee itself, as it has, he states, the pleasant warmth of coffee, without the exciting effects. It is understood that the carob bean forms the basis of "Thorley's Cattle Food." Sir Gaspard Le Marchant, late Commander-in-Chief at Madras, urged the importance of attempting to introduce the sainfoin and carob into India. So far as I could judge, there is hope of acclimatising the carob in Mysore and the Punjab, but the sainfoin seems less adapted to a tropical climate.

Fruit.—During the fruit season (November to April) it is a fine sight to see the great number of carts, laden with fruit, converging to the city gate, "Porte des Bombes." The demand, however, being great, the market is supplied partly from Sicily and Gozo, a number of boats, called "speroneras," constantly passing to and fro. Malta produces a large supply of excellent fruits, among which are the oranges and melons for which it is celebrated, grapes, pome-

* The pods are now sold in our provincial towns at 3d. per pound.

granates, almonds, peaches, prunes, apricots, pears, and figs. Figs are cultivated with care, and the process of caprification is practised. Among other introduced fruit trees, the Loquat (*Eriobotrya japonica*) is abundant. It is a handsome evergreen, twelve to fifteen feet high. The flowers have a fragrance resembling hawthorn. It bears fruit twice a year, which is sold in the markets in large quantities at a cheap rate. This Japanese tree is now widely spread in temperate regions. The Azarole fruit (*Cratægus Azarolus*, L.), when fully ripe, has an agreeable taste, and is served up for dessert. At Montpellier it is called *Pommette de deux closes.* Pomegranates are cultivated as much for their beautiful scarlet blossoms as for their fruit, which is imported of superior quality.

Great attention is directed to the cultivation of oranges; the groves are numerous and increasing, and a large trade is carried on. The Maltese are careful to protect the gardens from the injurious effects of wind by walled enclosures, but the orange bushes are never overshadowed by large trees. It is remarkable that when the orange plants overtop the walls, the extremities are blighted by the sirocco. The trees are planted in pits, fifteen feet apart, leaving a saucer-like depression, and a connecting channel for irrigating the roots. Water, which is scarce, is applied according to circumstances, once in fifteen or twenty days, during the hot weather; and the trees are heavily manured in January, after the crop is picked, but not with lime, which is abundant in the soil. The mandarin orange is a much esteemed variety, easily recognised by the smaller leaf and the loose rind of the fruit. The blood and egg oranges are much larger, and are also luscious fruits, almost devoid of seeds; when these occur they are usually abortive. The Malta blood-orange, when cut, is variegated with the usual hue, and red spots like clotted blood; it is the most prized of all. The tradition as to its being produced by grafting on a pomegranate stock is unworthy of notice. In December and January the Malta gardens are filled with trees laden with ripe and ripening fruit, presenting a beautiful scene—from the dark-green foliage, the golden fruit, and the bright and exquisitely fragrant flowers, which often appear while the fruit is still on the branches. The annual produce, in a well-managed garden, is from 100 to 200 dozen per tree, but the former may be considered a fair average. Young orange plants, of the finer varieties, have been transmitted successfully to Ootacamund, Nagpore, and the Punjab.*

Botanical Literature.—Previous to the sixteenth century, it does not appear that any person had devoted his attention to the natural history of the island, but the following botanists have subsequently recorded their observations regarding the flora of Malta:—

1. *J. F. Bonamicus*, a medical practitioner in Valetta, may be regarded as the first Maltese naturalist. He wrote a dissertation, "Di fuco spicato coccineo Melitensi," and afterwards, "Brevis Notitia plantarum, quæ in Melita et Gaules insulis observantur," 1670. In this 243 species are enumerated.

2. *Paul Boccone*, an inhabitant of Palermo, drew the attention of naturalists to the special products of Malta, in various learned works. "Icones et descriptiones plantarum Siciliæ, Melitæ, Galliæ, et Italiæ," Lugdoni 1674, et Oxonii 1674. In this work, *Statice reticulata*, L., was first figured. This author has also noticed some Maltese plants in another work, "Museo di piante rare, della Sicilia, Malta, Corsica, Italia, Piemonte, e Germania." Venezia, 1697. A third work of this laborious man remains in manuscript, in the public library, viz., "Storia Naturale di Malta."

3. *Dr G. Zammit* (according to Dr G. Gulia) occupied the Botanical chair in the Maltese University in 1675, which was founded at that time by Nicolas Cottoner, Grand-Master of the Knights of St John. He established a botanical garden in the ditch of Fort St Elmo. He died in 1740, at the age of ninety-four. His portrait is suspended in the public library, Valetta.

4. *Ph. Cavallini.*—"Pugillus Meliteus, seu omnium herbarum in insula Melita ejusque districtis enascentium perbrevis enumeratio." Roma, 1689. This little work consists mainly of Bonamicus' "Notitia," with the addition of eighty-three plants, and a preface.

5. *Peter Forskåhl*, of Denmark, published his "Flora

* Sir William Reid rendered good service by translating and circulating extracts from Risso's work on the "Natural History of Orange Trees."

Ægyptiaco-Arabica," Havniæ, 1775, in which are noted nine cultivated, and seventy-eight indigenous plants of Malta.

6. *Admiral Dumont d'Urville* inserted forty-two Maltese plants in his "Enumeratio plantarum quae in insulis Archipelagi aut littoribus Ponti-Euxini collegit atque detexit," 1822, Paris; and first described *Thymus melitensis* (*Micromeria microphylla*, Benth.)

7. *Cav. Boisgelin.* In "Malta Antica et Moderna," 1805, are some botanical observations, with the Flora of Cavallini and Forskähl reprinted.

8. In 1805 Sir A. Ball, the first British Governor, appointed *P. C. Giacinto* professor of Botany, who, assisted by Dr Naudi, wrote some interesting papers on botany and agriculture, which were published in 1825.

9. *S. Zerapha.* In 1827, a descriptive Flora was undertaken, of which a second part appeared in 1831. This work, "Floræ Melitensis Thesaurus," by the venerable Zerapha, far excels anything of the kind previously published; but, unfortunately, the arrangement is alphabetical, and the indigenous and naturalised plants are not distinguished. It contains much valuable information as to the vernacular nomenclature, economic uses, local habitats, and synonyms. The number of species described in the Thesaurus are—

Cryptogamia, ...	9
Phanerogamia—	
Indigenous, . . .	489
Cultivated, . . .	146
	644

10. *G. G. Aquilina.* Alcune Piante Maltesi selvatiche servire da nutrimento. Malta, 1848.

11. In 1853, *Dr J. C. G. Delicata*, the present professor of Botany in the University, published a "Flora Melitensis," in which the phanerogamous plants are arranged according to De Candolle's Prodromus, and are thus divided—

Monocotyledons, . . .	167
Dicotyledons, . . .	549

Or may be thus classed—

Annuals, ...	357
Biennials, ...	32
Perennials, ...	238
Low Shrubs, ...	40
Shrubs, ...	38
Trees, ...	11
	716

The following summary of the vegetation made by Dr Delicata shows the predominance of certain families:—

Fabaceæ, . .	85	Chenopodiaceæ, .	19
Asteraceæ, . .	79	Boraginaceæ, . .	17
Graminaceæ, . .	77	Cyperaceæ, . .	17
Apiaceæ, . . .	29	Orchidaceæ, . .	15
Brassicaceæ, . .	27	Rubiaceæ, . .	13
Lamiaceæ, . .	25	Caryophyllaceæ, .	12
Liliaceæ, . . .	23	Malvaceæ, . .	10
Scrophulariaceæ, .	21	Iridaceæ, . .	9
Ranunculaceæ, .	19	Juncaceæ, . .	7
Euphorbiaceæ, . .	19		

The flora of Malta, without doubt, nearly resembles that of Sicily, and, on this account, Delicata has not entered descriptions of species, but refers the student to the "Floræ Siculæ Synopsis" of Gussone. Three species are peculiar to Malta, viz., *Statice reticulata*, *Centaurea crassifolia*, Bert., and *Parietaria populifolia*, Nyman.

12. *G. Gulia.* "Repertorio Botanico Maltese." Malta, 1855.—This popular work contains the scientific names and their corresponding English and Italian terms, with some notice of economic uses, seasons of flowering, and method of propagation.

Of the natural productions of the island the most remarkable is a plant long known as *Fungus melitensis*, and formerly held in such estimation on account of its medicinal virtues, that the Grand Masters reserved to themselves the exclusive privilege of its collection. It is chiefly found on a small rock, about eighty feet from the shore of Gozo, accessible by means of ropes, to which a bucket is attached. The approach to the locality is by a flight of steps cut out of the solid rock, and the extremity of the village bears the eccentric name "Strada Fungus Rock."

The plant was first designated by Bonamico as *Fucus spicatus coccineus melitensis, planta singularis et rarissima nunc primum curiosis evulgata.* MS. in public library, Malta. In Boccone's* work on the rare plants of Sicily and Malta, it is described as "*Fungus coccineus melitensis typhoides, usu nulli secundus,*" "*et nunquam fallenti medicina.*" Micheli drew up a little treatise on the plant in 1731, and called it *Cynomorium.* Linnæus thereafter published a dissertation ("Amæn. Acad." tom. iv. diss. 65), showing it to be bisexual, and naming it *Cynomorium coccineum.* It grows from January to April, when it flowers, being then six to seven inches in height, of a conical form and pink colour. It is scaly and fleshy, with a styptic (?) juice. It was long considered an excellent remedy in dysentery, hæmoptysis, and menorrhagia, but has fallen into disuse, and is no longer employed by the Maltese physicians, though still used by a few illiterate inhabitants of Gozo. In Palermo I found "Fungo di Malta" painted on the drawers of a "Drogheria," or druggist's shop, but the herbalist informed me that the remedy was obsolete. In the "Catalogus Plantarum in agro Calata-Hieronensi collectarum ab Emanuel Taranto et Xavierio Gerbino," Catania, 1845, it is recorded that *Cynomorium coccineum*† is parasitic on the roots of *Cistus complicatus.* Delicata states that it occurs "in arenosis paras. ad radices *Inulæ crithmoidis et Halimi portulacoidis.* Recent observers have shown that this plant is an inhabitant of the whole Mediterranean region and Canary Islands, growing parasitically on the roots of various shrubs. It has been fully described by Hooker (Lin. Tr. xxv. 1) and by Weddell (Archives du Museum, x.)

Florian Garden.—A long narrow enclosure (400 yards) within the fortified suburb called Floriana, is dignified with the name of Botanical Garden. It is much frequented as a public walk, and, to a certain extent, is used for the study of botany. It contains many interesting

* Bocc. ic. et descript. rar. pl. t. 45.

† This curious plant is abundant in Algeria (Munby, &c.), in Sicily, Lampeduza, and *in dumetis Tamaricis Gallicæ*, Granada, fide E. Bourgeau, pl. d'Espagne, No. 1439. Cosson.

plants, as *Poinciana regia*, *Platanus orientalis*, *Pinus pinea*, *P. halepensis*, *Brugmansia suaveolens*. The garden was planned by Sir A. J. Ball, and the following inscription is over the entrance:—"Questo orto botanico fu cominciato e ridotto a termine sotto l'administrazione del. Cav. e baronetto A. J. Ball per Georg. iii. re della Gr. Bretagna il luogo a publico divertimento consecrato." A bust of Dr Pisani has lately been erected in the garden by English and Maltese residents, as a mark of gratitude for his self-sacrificing labours in times of epidemic sickness.

Further on is another garden called Argotti, adjoining the fortifications, adorned with statues and fountains, where the military band plays. From the terrace a fine view of the country beyond is obtained, and close by there is a small garden, more specially devoted to the study of botany, but the resources for keeping it in good order appear to be insufficient.

The *St Antonio Gardens* are situated about four and a half miles from Valetta, and are a common resort of the Maltese on festival days. A long row of fine cypresses leads up to the gate; these are of great age, but in full vigour of growth, and not inclining to decay. Loquat and orange trees are alternated with them. The old orange bushes bear the best fruit, which is retailed in Valetta from 3d. to 7d. per dozen, according to the varieties, the best and sweetest being "*Arancio sanguineo*," the blood orange, which here grows in great perfection.

The largest trees in the garden were measured, January 1868, at four feet from the ground, and I append the measurements. These were chiefly planted during the administration of Sir Thomas Maitland, and are consequently about fifty years old.

		Feet.	Inches.
Pinus pinea, . . .	girth	6	9
Gleditschia triacantha, . .	,,	6	1
Cupressus sempervirens, .	,,	6	0
Olea europea, . . .	,,	6	0
Melia azaderach, . .	,,	4	2
Juglans regia, not measured.			

There are some fine specimens of *Pinus pinea*, the stone pine, with its peculiar flat top; the Aleppo pine (*P. hale-*

pensis) has also been introduced. There are four specimens of Norfolk Island pine (*Araucaria excelsa*) in the private garden, planted by members of the royal family when they visited the island. These show remarkable vigour, and as their age is exactly known, the subsequent growth may be watched with much interest. Many plants from other countries have been introduced into these gardens. Among these are—

*Australia.**

Acacia argyrophylla.	Eucalyptus resinifera.
decipiens.	Hardenbergia digitata.
lophantha.	Kennedya coccinea.
Callitris quadrivalvis.	Pittosporum undulatum.
Casuarina torulosa.	Stenocarpus salignus.
Eucalyptus globulus.	Sutherlandia frutescens.

Asia.

Abutilon indicum.	Melia azaderach.
Acacia farnesiana.	Moringa pterygosperma.
Adhatoda zeylanica.	Musa sapientum.
Calotropis procera.	Plumieria acuminata.
Canna indica.	Poinciana regia.
Carica Papaya.	Poinsettia pulcherrima.
Daphne indica.	Polianthes tuberosa.
Ficus elastica.	Sida rhombifolia.
Hibiscus mutabilis.	Tetragonolobus purpureus.

North Africa.

Opuntia vulgaris.	Pinus halepensis.
Phalaris canariensis.	Sempervivum arboreum.
Phœnix dactylifera.	Tamarix africana.

South Africa.

Gladiolus (*var. spec.*)	Plumbago capensis.
Gomphocarpus fruticosus.	Polygala myrtifolia.
Melianthus major.	Portulacaria afra.
Mesembryanthemum deltoides.	Schottia tamarindifolia.
„ crystallinum.	Stapelia (*var. spec.*)
Oxalis cernua.	Strelitzia reginæ.
	Tecoma capensis.

* A case containing these Australian plants was sent to Malta about ten years ago by Sir Wm. Hooker, Director, Royal Gardens, Kew, and their growth has been encouraging.

America.

Anona cherimolia.	Mirabilis jalapa.
Argemone mexicana.	Passiflora quadrangularis.
Bougainvillea spectabilis.	Physalis flexuosa.
Cestrum laurifolium.	Phytolacca decandra.
Duranta Ellisii.	Schinus molle.
Epiphyllum Hookeri.	Solandra grandiflora.
Gynerium argenteum.	Thevetia neriifolia.

South Europe.

Cercis siliquastrum.	Plumbago europea.
Genista tinctoria.	Tamarix gallica.

The roots of a fine specimen of *Ficus elastica* had found their way into one of the water channels in the private garden, and obstructed them for a length of thirty-six feet. *Nerium oleander* grows luxuriantly to a height of twelve to fifteen feet, and is an ornamental shrub. *Bougainvillea spectabilis* covers one side of the palace, and blossoms freely in the open air.

The garden of Lady Hamilton Chichester, at Pietà, is a remarkable illustration of what can be done by protection from injurious winds. It was made thirty years ago, at great expense, and consists of several terraces, on which, at the time of my visit, there was a great show of liliaceous plants, among which I noted a fine specimen of *Dracæna draco.*

Agricultural Show.—The late governor, Sir William Reid, tried to turn the festival of St Peter and St Paul to a practical use, by the institution of agricultural shows. It is the custom of the people to flock to Boschetto and Citta Vecchia, where they have pic-nics and merry makings. He appointed a committee, and offered liberal prizes for cattle, corn, vegetables, machinery, potatoes, and silkworms. The result was fairly successful, and every one, from the governor to the poorest peasant, was in attendance. The exhibition has become an annual display.

Plants in Flower.—Owing to the mildness of the climate, every month of the year exhibits its peculiar flowers, but the vegetation is most luxuriant in March and April. These two months are the best for botanising, and I regretted that I was obliged to leave the island in February. In January the aspect of the fields is much more green than in December. The following plants were in flower or fruit during this month:—

Adonis vernalis.*	Narcissus tazetta
Ceratonia siliqua.	Oxalis cernua.*
Clematis cirrhosa.	Ranunculus bullatus.
Erica peduncularis.	Sedum cæruleum.
Fumaria capreolata.	Sinapis arvensis.
Gleditschia triacantha.*	Sonchus oleraceus.
Medicago denticulata.	Thrincia tuberosa.

In gardens—*Daphne indica*, *Bougainvillea spectabilis*, *Epiphyllum Hookeri*, *Genista tinctoria*, *Polianthes tuberosa*, *Tecoma capensis*, *Medeola asparagoides*.

The following trees bore the fruit of the previous year:—*Cupressus sempervirens*, *Melia azaderach*, *Phytolacca dioica*, *Pinus halepensis*, and *Schinus molle*.

On February 3d, a bright sunny day, the following plants were gathered in flower:—

Aloe vulgaris.	Dianthus chinensis.*
Amygdalus communis.*	Erodium cicutarium.
Asphodelus ramosus.	Euphorbia peplus.
Bellis sylvestris.	Hedysarum coronarium.*
Capsella bursa pastoris.	Jasminum.*
Cardamine hirsuta.	Pisum sativum.*
Clematis cirrhosa.	Reseda fruticulosa.
Cytisus laburnum.*	,, alba.

Besides these, there were *Opuntia vulgaris*, occasionally used as a hedge, but more frequently planted at regular intervals, and cultivated for its fruit. *Arundo donax* flourishes in marshes, and is used for fences, baskets, and tobacco pipes. *Thymus capitatus* is used as fuel, and forms excellent material for kindling fires. *Oxalis cernua*, with its bright yellow flowers, has overrun the cultivated grounds and roadsides, and is now a troublesome weed. It was introduced in 1811 (Delicata). *Mesembryanthemum deltoides* also grows in great profusion on the bastions of Valetta, where it was planted a few years ago.

The sea-shore abounds with many maritime plants, which

* Not indigenous.

occur along the coasts of the Mediterranean Sea. Among the most frequent are—

Ambrosia maritima.
Arundo donax.
Asphodelus ramosus.
Crithmum maritimum.
Crucianella maritima.
Juncus maritimus.
Lygeum spartium.
Malcolmia maritima.
Matthiola incana.
Polygonum maritimum.
Scirpus maritimus.
Urginia scilla.*

On the 4th January I made an excursion to St Paul's Bay, and gathered the following plants:—

Beta maritima.
Calendula maritima.
Capparis spinosa.
Colchicum cupani.
Diplotaxis erucoides.
Hypecoum procumbens.
Mesembryanthemum nodiflorum.
Pancratium maritimum.
Plantago coronopus.
Salicornia herbacea.
Scolymus grandiflorus.
Stipa tenacissima.
Thrincia tuberosa.
Urtica dioica.

The following shells of testaceous mollusca (named by Dr A. A. Caruana) were found near the water-mark on the beach, close to the chapel:—

Patella vulgaris.
lusitanica, *Gm.* Very abundant.
Haliotis tuberculata, *L.* (two specimens). Common.
Phasianella pulla, *L.*
speciosa. Common.
Cypræa europæa, *Mont.*
spuria, *L.*
lurida, *L.* Very common.
Conus mediterraneus, *Brug.* Common everywhere.
Rissoa calathiscus, *Laskey*, with several other minute and beautiful species adhering to seaweeds.
Nerita viridis, *L.*
Natica Dillwynii, *Peyr.* Not common. Often found on the fronds of *Caulerpe prolifera.*
Trochus langieri, *Peyr.* Not common.
crenulatus, *Brocc.* Common, and several others.
Cerithium mammillatum, *Risso.* Abundant in shallow water with sandy bottom.
Pleurotoma philiberti, *Mich.*
lenfroyi, *Mich.*, and others broken. Species not determinable.

* The large bulbs are exported.

Buccinum mutabile, *L.*	
Mitra ebenus, *Lam.*	
Marginella secalina, *Phil.*	Common.
miliacea, *Lam.*	Very common.
Columbella rustica, *L.*	

Holothuriæ are very abundant. Sponges are plentiful, but not of much value. They are often studded with prickly points, and are perforated with osculi.

In a short visit to the ruins of Crendi, on the south side of the island, I gathered the following plants:—

Asparagus acutifolius.	Echium italicum.
Asphodelus ramosus.	Erica peduncularis.
Arisæmum vulgare.	Inula viscosa.
Calendula arvensis.	Plumbago europea.
Cerinthe aspera.	Sinapis arvensis.
Clematis cirrhosa.	Sonchus oleraceus.
Cuscuta epithymum.	Theligonium cynocrambe.
Cynara horrida.	Thymus capitatus.

A few land shells were also picked up, which Dr Caruana named—

Bulimus decollatus, *L.*	Helix aspera, *Müll.*
Clausilia papillaris, *Müll.*	flavida, *Zieg.*
Cyclostoma melitense, *Sow.*	rugosula, *Arad.*

Libraries.—The public library of Malta, founded by the Knights of St John, is in a large building adjoining the Governor's palace, and the public have free admittance. Dr Cesar Vassallo, the learned librarian, has printed a catalogue *raisonnée*, and is most courteous to strangers. I obtained the loan of several valuable books on merely granting a receipt for them. This fine library is very rich in books of the fifteenth, sixteenth, and seventeenth centuries, and the naturalist has an opportunity of referring to the researches of such authors as Aldrovandi, Clusius, Acosta, Prosper Alpinus, the Bauhins, Fabius Columna, and Schmidel. Among the rarer works are Bonelli's "Hortus Romanus," 1772, and Delile's "Flore d'Egypte." The public library contains little modern botanical literature, but in the garrison library there is a fair collection of systematic works on natural history, and a good series of modern travels. In the public library is a classified collection of the Maltese testacea, arranged, according to Lamarck's classification, by the late Dr Guiseppe Mamo, of Valetta, whose private collection of Mediterranean shells is of great value, and has been fully described in a treatise by Dr A. Caruana, secretary to the University. The more recent works on the zoology and geology of Malta are as follows:—

"Catologo Ornitologico del Gruppo di Malta," by Antonio Schembri. Malta, 1843.

"Ornithology of Malta," by Mr C. Wright, published in the Ibis. 1864. Mr Wright has a very fine private collection of birds and plants.

"A Catalogue of the different Kinds of Fish of Malta and Gozo," by Gaetano Trapani. 1838. This last is a popular compilation, prepared from observations made in the market. The arrangement adopted is alphabetic Maltese. Dr John Davy, formerly principal medical officer of the island, assisted him.

"Pesci di Malta," by Gavino Gulia. Malta, 1861.

"Corso Elementare di Entomologia Maltese," by Gavino Gulia. 1858.

E. Forbes' "Report on the Ægean Invertebratæ." British Association for Advancement of Science. 1843.

"Enumeratio ordinata Molluscorum Gaulo Melitensium" of the late Guiseppe Mamo, by Dr A. A. Caruana. 1867.

Professor E. Forbes. "Proc. Geol. Soc." vol. iv. p. 232.

"On the Geology of Malta and Gozo," by Captain Spratt, R.N. Malta, 1854.

"Outline of the Geology of the Maltese Islands," by Dr Leith Adams, 22d Regiment; with "Descriptions of the Brachiopoda," by Thomas Davidson, F.G.S., F.R.S. Annals and Mag. Nat. Hist. xiv. Third series. 1864, p. 1.

"Second Report on the Maltese Caves," by Dr Leith Adams. Read Brit. Assoc. for Advancement of Science, 1866. See Abst. in Jour. of Science, vol. iii. p. 539.

"On the Fossil Echinodermata of Malta and Gozo," by Thomas Wright, M.D. Ann. and Mag. Nat. Hist. Second series, xv. 1855. These fossils are deposited in the public library, and the plates were lithographed by Sir W. Reid in 1857, with a view to encourage further investigation into the geology of the island.

"On the Bone-caves of Malta," by Capt. Spratt. "Proc.

Geol. Soc." Nov. 1867. A very clear statement of the contents of the three Maltese caverns.

University Museum.—In the Museum attached to the Malta University are various interesting collections of the Fauna of the island. The Ornithological series consists of 340 specimens, arranged according to Cuvier's classification. There are 252 fishes well preserved, but not yet classified. The Conchological collection comprises 1035 specimens from all parts of the world. An excellent local collection of shells, as already mentioned, is deposited in the public library.

Maltese Palæontology is acknowledged to be of great interest, and the local collection of fossils was named with Dr Leith Adam's assistance. There are osteological fragments of *Elephas melitensis*,* *Myoxus melitensis*, *Hippopotamus Pentlandi*, and *Stereodon melitensis*, determined by Professor Owen.

The Institution is maintained at a very small cost, and the want of space and adequate resources prevents further development at present. Dr A. A. Caruana, the active and learned Secretary of the University, takes great pains in explaining the collections to visitors.

Tapestries.—The Council Chamber, in the palace of Valetta, is adorned with an interesting series of tapestry illustrations of natural history. These were brought to the island by the Grand Master Perellos, who was elected in 1697. It appears probable that the delineations were taken from Rheede's *Hortus Malabaricus*, the only work published at that date, with good drawings of tropical vegetation.

Sicily.

Having been invited by an esteemed friend to visit him at Palermo, I arranged to make a short stay in Sicily, that most beautiful island of the Mediterranean, which offers so many objects of surpassing interest to travellers, and has been the theme of the poet and the historian, and continues to reward the investigation of the naturalist and antiquarian. In college days I had read the classical pages of Cicero and Thucydides, and the ancient descriptions of Dioscorides,

* For Mr Busk's lucid Memoir on the Elephant remains of the Zebbug cavern, see "Trans. Zool. Soc." vol. vi. part v. 1868.

Theophrastus, Diodorus Siculus, and Strabo, and in later years the survey of Admiral Smyth, and the journals of Brydon, Bartlett, and other recent travellers, and I rejoiced that an opportunity of visiting Sicily under favourable circumstances had offered.

On the 11th February 1868, I left Malta in the postal steamer "Cariddi" (Charybdis), built in Glasgow for Messrs Florio & Co. of Palermo. We reached Syracuse in nine hours (3 A.M.), and anchored in the magnificent natural harbour alongside of H.M.S. "Caledonia," ironclad, Capt. Allen Gardiner, with whom I breakfasted.

Syracuse is a pitiful wreck of one of the greatest and most celebrated cities of the ancient world. Here Archimedes lived and died; here Cicero was prefect; and here the ship of Alexandria, whose sign was Castor and Pollux, first touched after leaving Malta (Acts xxvii. 11, 12); and it was here that St Paul tarried three days on his way to Rome.

The cathedral looks down upon the harbour; it occupies the site, and is constructed from the ruins, of the Grecian temple of Minerva, which has lost much of its beauty in the transformation, and is now dedicated to the Virgin. The women bear a resemblance to their Hellenic ancestors, and wear the faldetta as in Malta, here called *papica*.

The celebrated fountain of Arethusa has always been considered one of the greatest curiosities of Syracuse. I regretted that as the mail steamer sailed at 8 A.M. there was not time to examine this renowned station of *Papyrus antiquorum*, which is close to the harbour, and may be easily found by Cicero's description :—"In hac insula est fons aquæ dulcis, cui nomen Arethusa est, incredibili magnitudine plenissimus piscium, qui fluctu totus aperiretur, nisi munitione, ac mole lapidum a mari disjunctus esset," &c. The Papyrus grows luxuriantly on the banks of the Cyane,* amongst flags, reeds, and water plants. The locality is easily reached by boat, and forms a charming excursion. There appears to be no other spot in Europe where this interesting plant flourishes in a natural state. The clumps are very thick, attaining a height of 15 to 18 feet. It is supposed to have been sent from Egypt by Ptolemy Philadelphus to Hieronymus II., 250 B.C. This rush served a

* See Illustration in "Le Tour du Monde," 1866, p. 412.

variety of purposes in olden times—fuel, food, bedding, clothing, medicine, and paper stuff.* The process of manufacturing paper is described by Pliny (Book xxi. sect. 12), and paper is now prepared as a curiosity by Signor Politi in the same way, viz., by cutting the stem into thin slices, which are placed at right angles and subjected to pressure. Politi's paper is probably as good as was made in ancient times, and resembles that found in the sarcophagi of Egyptian mummies. It is strong, thin, and tolerably white, but is apt to tear when folded, and is otherwise much inferior to our worst varieties. There is no real manufacture. Scraps are made to sell to travellers as curiosities, which cost one franc a sheet, about ten inches square.

The view of Etna, in skirting the coast, is very grand. The isolated cone, rising to 11,300 feet, is often seen from Malta, which is distant nearly 130 miles. The belt of forest at the base, six or eight miles in breadth, is well worthy of inspection. Timber is not now felled to any extent, but of old the fleets of Syracuse were constructed of materials taken from the forest slopes of Mount Etna.

Catania (from κατ Αιτνης, under Etna) is in population the third city of Sicily, but in intellectual eminence it yields to none. With a southern aspect, it has the finest winter climate in Sicily; and if it had a harbour, and immunity from eruptions, it would rise again into great importance. The streets are wider than in Palermo and Syracuse. The people call their city "la chiarissima."

The *Museo Biscari* is a very large and fine collection of ancient relics, such as urns, amphoræ, statues, bronzes, bas reliefs, cameos, &c., but it is falling into a neglected state. There is an abundant collection of Sicilian lava and marble, with amber, fossil-wood, &c. The celebrated agates, so called from the river Achates in this neighbourhood, are much prized, and the preparation of jasper, marble, and crystalline quartz, gives occupation to a considerable number of workmen. In the library of the Benedictine convent there are some curious botanical works, amongst others Apuleius' Herbarium, 4to. 1471.

* In Loudon's Mag. Nat. Hist., vol. ii. p. 324, Mr John Hogg gives drawings of rafts on the Nile, formed of a double bundle of papyrus reeds, resembling a Madras catamaran.

The *Botanical Garden* is situated in the higher part of the town, about a mile from the landing-place. It is under the direction of Dr Francesco Tornabene of the Reale Università of Catania, who at the time of my visit was engaged in printing a catalogue of the plants in the garden, which are named and arranged according to De Candolle's system. There is a commodious circular class-room, ornamented with statues of Pliny, Aristotle, and other veteran naturalists; and eighty-four pupils were under botanical and agricultural instruction. Above the door-way stand the following inscriptions:—

1. Summa agriculturæ utilitas plantarum cognitio.
2. Universæ rei herbariæ incremento hortus botanicus Catanensis gymnasii.
3. Plantarum studio artes perficiuntur, medicamina parantur.

In one wing of the building there is the library, herbarium, and seed store-room, and in the other the Director has his official residence, as is usual in Italy, France, and Germany.

There is a remarkably fine series of *Cactaceæ* in cultivation, thriving vigorously upon an old lava bed. The heat at Catania, with its southern exposure, is considerably greater than at Palermo. Here *Bougainvillea spectabilis* was most luxuriant in the open air, while at Palermo we found it under glass. In a rapid inspection of the garden the following plants were observed:—

Dodonea viscosa.	Hibiscus (several).
Cæsalpinia Sappan.	Gossypium (several).
Erythrina corallodendron.	Oryza sativa.
Acacia farnesiana.	Ficus elastica.
Araucaria.	Casuarina muricata.

The Dodonea and Acacia were in fruit, showing that the temperature resembles that of a subtropical climate. Professor Tornabene was very courteous, but our time only permitted me to have a brief conversation with him. He has published several botanical memoirs. There are other zealous naturalists at Catania, and the activity of the *Academia* is well known.* Travellers ought to take the

* The fourth Congress of Italian naturalists has just been held in Catania, and was attended by upwards of 100 members. Professor Licopoli proposed

morning train from Catania to Messina. The line passes through a beautiful and interesting country, and close to the ruins of Taormina, which deserve to be visited by every one. Six hours may be spent at Giardina between the trains.

We reached Messina late at night, and anchored in its spacious harbour. It is a large and fine city, with a population of 180,000, and lies close to the water's edge, a panorama of steep hills rising behind; the surrounding scenery is classical and picturesque, "*Messana situ mœnibus portuque ornata*" (Cicero in Verrem). The suburbs abound in large fruit gardens; in one we obtained some fine camellias grown in the open air. I visited the Cathedral, the Nunnery of S. Gregorio, and the University. A few days afterwards I saw in the public library of Palermo, "Petri Castelli Hortus Messanensis," 1640, containing a remarkable chart of the Botanical Garden of Messina at that date, divided into twelve "hortuli," named after the apostles, and the plants classified in the hortuli according to the number of their seeds, thus—1. Una semen. 2. Bi semina. 3. Tri semina, &c.

At Messina, Luigi Benoit published, a few years ago, "Ornitologia Siciliana," a useful little work; and Anastasio Cocco has done much to elucidate the ichthyology of the island. The lamented Philippi has done good service in elaborating the "Enumeratio Molluscorum Siciliæ," 1844. On leaving the harbour, we see the abrupt rock of Scylla projecting into the sea, and a pool of curling eddies produced by the meeting of currents in the Faro, is the perilous Charybdis described by ancient poets. At daybreak, on the 14th February, we entered the bay of Palermo from the north, and at seven o'clock the mail steamer occupied her usual place in the harbour amongst a crowd of other vessels, several of them bearing the British flag. There was not much difficulty at the Custom-house, and we were soon permitted to land on the Palermitan plain, already adorned with the treasures of spring, and showing various zones of culture on the mountains which encircle it. The slopes were now clothed with their first verdure, destined to become yellow in the parching heat of

that a work should be written on the flora of Etna, similar to that of Professor Pasquale on the flora of Vesuvius.

summer. Monte Pellegrino attracts attention by the barrenness of its rocks, which are almost destitute of vegetation. We went to the Albergo Sant' Oliva, situated near the English garden.

About three miles from Sant' Oliva, under the precipices of Monte Pellegrino, lies the villa of "La Favorita," built by Ferdinand I. in a grotesque Chinese style. From the roof is obtained a beautiful view of the "Conca d'oro," the plain of Palermo, with its rich covering of orange groves, fields of young wheat, olive gardens, and plantations of almond trees now covered with their snowy blossoms, and the grand amphitheatre of rugged mountains which bound the plain ; while both to the east and west the sea appeared with its contrasting colouring. The grounds of the villa are very extensive, interspersed with avenues of various trees, viz , *Schinus molle*, which resembles the weeping willow ; *Cupressus sempervirens*, *Viburnum Tinus*, now in flower ; *Fraxinus rotundifolia*, the manna ash, which I here saw for the first time, with its bark scored to obtain the exudation. There was abundance of seed on the trees, and the first shoots were now appearing of a brilliant green. The fine old olives reminded me of the "pilu" in the Punjab (*Salvadora oleoides*). Besides those named, the following trees and shrubs were also abundant:—*Arbutus Unedo*, *Platanus orientalis*, *Juglans regia*, *Quercus ilex*, *Phillyrea* sp., *Myrtus communis*, *Punica granatum*, and *Rhus coriaria ;** the last, "sumacco," being lopped annually, is scarcely ever seen as a tree.

Orto Botanico.—Having sent in my card to the Director of the Botanic Garden, Professor Agostino Todaro, he readily volunteered to accompany us round the garden, which is well situated near the extremity of the Marina, sheltered from the north-west and south winds. The space occupied is 270 by 90 yards, and it is only separated from the Flora or Public Gardens of the Palermitans by a railing, which gives an appearance of greater extent. At the entrance is a handsome modern building with a portico, surmounted by a cupola. In the centre is the class-room, lighted from above ; and in the wings are an exten-

* For a detailed account of the cultivation of Sumach, near Palermo, *vide* Tr. Bot. Soc. ix. 341.

sive library and herbarium on one side, and the director's residence on the other. Over the entrance is inscribed in large letters "Schola regia Botanica;" and in the portico are large statues of Æsculapius and Hygeia, the preserver and protectress of the city; while at the corners of the inner hall are smaller statues of Dioscorides, Theophrastus, Linnæus, and Tournefort. There are also busts of eminent botanists ranged round the class-room, viz.:—

Gaspar Commelyn, Batavus.	Joannes Bauhin.
Francesco Cupani, Sicilianus.	Sebastianus Vaillant, Gallus.
Sylvius Bocconé, Panormitanus.	Bernard de Jussieu, „
Fabius Colonna, Neapolitanus.	J. J. Dillenius, Anglus.
Caspar Bauhin, Basiliensis.	Joannes Rai, „

The following inscription is over the door:—"Nihil non herbarum vi effici potest sed plurimarum vires sunt incognitæ, et quare non noscantur causa est, quod eas agrestes literarum que ignari experiuntur ut qui soli inter illas vivant." (Pliny, Lib. xxi.)

A photograph of Dr Ferd. von Mueller of Melbourne, who has sent many seeds to the garden, was conspicuous in the herbarium. On the calidarium or hothouse all the signs of the zodiac are carved.

The Palermo garden was established by the Viceroy Caramanico (who also instituted the University and Observatory) about 1778. Previous to that there was a small garden in the old fashion on the bastion, where the Hospital of the Concezione now is. The succession of Professors was—

1. Guisseppe Tineo. Bernhard d'Ucria, his assistant, printed "Hortus Panormitanus," 1827.
2. Vincenzo Tineo, his son, who published "Catalogus plantarum Horti Regii Panormitani," 1827.
3. Agustino Todaro.

That the climate of Palermo is remarkably favourable for horticulture is proved by the productiveness of the gardens, and the circumstance that tropical plants flourish along with those of Sicily and other temperate European climates. Many plants of North India ripen their seeds at Palermo, and an interchange of plants and seeds has been initiated with the Calcutta Garden; two large cases from Dr

Anderson arrived while I was there. Among plants from the tropics, I noticed the plantain, bamboo, sugar cane, sago palm, and date palm.* This last attains a remarkable height compared with its ordinary appearance in Malta and Italy, and resembles more nearly the plant as seen in the rich valley of the Nile, but, like the plantain, it does not mature its fruit. The *Nelumbium speciosum* flowers in the garden ponds. Plants introduced from Australia, New Zealand, and the Cape of Good Hope find a suitable climate. I observed *Acacia falcata*, *A. decipiens*, and *A. verticillata* flowering in the open air. The following are among the acclimatised plants :—

Tropical Asia.

Erythrina corallodendron.	Ficus religiosa.
Melaleuca leucadendron.	elastica.
Paritium tiliaceum.	bengalensis.
Melia azaderach.	macrocarpa.
Hibiscus rosa sinensis.	Lagerstrœmia indica.
syriacus.	Polianthes tuberosa.
Cycas circinalis.	Eugenia pimento.

Africa.

Mesembryanthemum (sp.)	Coffea arabica.

America.

Magnolia grandiflora.	Rhipsalis grandiflora.
Cheirostemon platanoides.	Cobæa scandens.

The following conifers are in the pinetum :—

Pinus pinea (a magnificent specimen).	Cedrus Libani.
halepensis.	Cupressus pyramidalis.
laricio.	Juniperus phœnicea.
brutia.	Araucaria imbricata.
	Thuja orientalis.

There are some very fine trees of *Platanus orientalis.*

Fruit and Vegetables.—Loquats (*Eriobotrya japonica*), custard apples, and mandarin or Tangerine oranges ripen and are sold in the market. Peaches and nectarines are produced in vast numbers, but in quality are worthless, and,

* In Kington's Life of Emperor Frederic II., mention is made of the culture of dates in Sicily.

indeed, almost uneatable except when cooked. Professor Inzenga ascribes this to some natural defect of soil or climate, just as we find the apricot dry and insipid in some valleys of the Himalaya. Artichokes are cultivated in extraordinary abundance, and are generally consumed in the unripe state, being eaten entire. The cauliflower and brocoli are remarkably large and good, and many other vegetables are plentiful. Peas and artichokes are exported as far as Genoa. Beans and lupins are the food of the poor. *Lycopersicum cerasiforme*, "pomo d'oro," is largely used. The panels of country carts are ornamented with pictorial illustrations, representing the seasons, Christopher Columbus, Scipio Africanus, or the like, surmounted by a motto, as *Viva la divina providenzia.* The pictures are classical, scriptural, or histrionic.

Herbalists.—There is a large number of dealers in *erbi medicinali.* I observed seven or eight *Drogherias* within a mile of the Albergo; the indigenous medicinal plants being exposed for sale fresh or dry, such as

Althæa officinalis, . . .	Altea.
Malva sylvestris, . . .	Marva.
Rosmarinus officinalis, . .	Rosamarina.
Origanum vulgare, . . .	Riganu.
Thymus serpyllum, . . .	Timo.
Nepetia cataria, . . .	Nepeta.

Of sweet fennel (*Fœniculum dulce*), both cultivated and wild, "Finocchiu di montagna," there is a very great consumption, every labourer eating it (raw or boiled) with cheese and bread. In the drug collections are some obsolete medicines, as turbet, Fungo di Malta, &c.

Papireto.—My friend pointed out to me the locality where it is said the Papyrus formerly grew, now called the *Papireto.* The Papyrus of Sicily is not mentioned by Theophrastus, Dioscorides, Pliny, nor Ovid, nor even by Diodorus Siculus, and Theocritus, who were Sicilians. The first notice of it is contained in a translation by Prof. Amari, quoted by Prof. Parlatore,* from the Arabic of Ibn Haukal,

* The distinguished Director of the Botanic Garden at Florence, a native of Palermo, published in 1853 an elaborate memoir, in which he traces the history of two species, named by him *Cyperus syriacus* and *C. siculus* ("Mémoires de l'Académie des Sciences," tom. xii.).

a learned Arab, who visited Palermo in the tenth century. The following is an extract:—"Among these marshes (on the streams about Palermo) there is a bottom covered all with Papyrus, from which writing paper is made. I had not believed that it grew anywhere on the earth except in Egypt, but here I have found it in Sicily. The greater part is twisted into ship cables, and the remainder serves to make paper for the Sultan, who, however, hardly gets as much as he requires." Amari adds:—"The place, now dry, and partially filled up, retains the name of Papireto." Till 1591 it was a vast swamp, full of Papyrus. The waters which filled it now escape by underground channels, near the old bed, to the sea, passing under the streets of Della Guilla, Monte di Pieta, &c. (From "Archivio Storico Italiano Appendice," vol. iv. p. 15.)

Olive culture.—The olive is largely cultivated in Sicily. It grows in most soils, but flourishes best on calcareous slopes. The young trees are planted in rows, at such a distance from each other as is supposed will allow room for the branches to spread to full growth, the expansion being equal to their height. The value of a tree increases with time. It continues to bear fruit from one to three centuries, but in extreme age it gradually becomes barren. As in the Punjab, the wild olive bears small fruit especially when shaded by other trees, and it yields little oil. The Sicilians graft the cultivated on the stock of the wild olive. The culture is very profitable, and both the fruit and the oil form staple articles of food as well as commerce. "Some idea of the importance of the olive orchards may be formed from the fact, that Sicily has exported to Marseilles alone 2,000,000 pounds weight of olive oil annually, for the last twenty years." (Marsh's "Man and Nature," p. 312, 1864.)

Manna cultivation.—Manna in Sicily is chiefly derived from the *Fraxinus ornus*, called in Italy *avorniello*, and sometimes *amollei;* in Sicily *Frascinu di manna*, and in some districts *muddia* or *middia*. Another species has been proposed, as *Fraxinus rotundifolia*, but there is no sufficient ground for such a distinction, as in raising the *ornus* from seed, there is an immense variation in the form of the leaves, from roundness to extreme elongation, and the *rotundifolia* is only one of the varieties so produced.

Manna is also derived in some situations, where the soil is more moist than that adapted to the *ornus*, from the common ash, *Fraxinus excelsior*, Frassino (It.), Frascinu and Dardanu (Sic.) This is especially the case about Cefalu; but there is no such employment of *F. excelsior* about Palermo. *F. ornus* flowers only every third or fourth year, and when it flowers and seeds abundantly it gives no manna. A peasant's proverb notes this—

> "Si ciurisce la muddiu
> Esi inchi di semenza,
> Picca manna ti fara!"

> "If flowers the manna
> And fills with seed,
> Little manna you will get!"

The soil suited to *F. ornus* is open, dry, and somewhat calcareous. It produces best in low, sunny sites, or the southern slopes of a hill-side. In cold, elevated positions there is no produce.

It may be propagated either by seed or by suckers, but the first is much preferred. The seed should be selected from the most productive trees, and, when ripe, is of a whitish-brown colour. The ground should be well crumbled and manured. The sowing may take place either in autumn or spring, but the former is preferable. At the beginning of winter of the second year, the young plants should be thinned to an interval of 18 inches. When about 3 feet high, and as thick as a finger, they are transplanted to holes of 18 inches cube, and placed in their permanent site at about 7 feet apart, in quincunx fashion, the interval being dependent on the quality of the soil. The method used by some of planting with a dibble is bad. Frequent weeding is important, and manure should be applied every two years. Vegetable manure is best, and it should be mixed with beans and the like, to be dug into the soil after they have grown. If the trees are to be introduced into a wood, it is sufficient to make trenches 4 inches deep, drop in the seeds, and cover them. The natural moisture and shade will suffice to maintain the plants.

Culture is limited to opening up the roots in December, throwing up the soil in March, and levelling again in April.

Some think it sufficient to dig about the roots in December and April. It is important to get the stems to go straight, and to hinder low branching. The trees, however, should not be pruned, but only dead twigs cautiously removed. It is not usual to graft, but if a tree be unproductive, it should be cut down, and a sucker, grafted from a productive tree, tended in its stead. Sometimes the common ash is grafted with the manna ash. Till the stem is of a good size, all shoots from the root should be removed, but at a later period they should be cherished, in order to have a substitute ready when the original stem is exhausted.

When the stems have a thickness of at least 3 inches, the gathering of produce may begin. The best time for notching is in July and August, when the leaves show an inclination to change colour. The cuts are made in the bark, just reaching to the wood without entering it, and are from 1½ inch to 2 inches long, and 1 inch apart vertically. One cut is made daily, beginning at the bottom of the tree, the next directly above the first, and so on while dry weather lasts. In wet weather or sirocco the manna dissolves, and cannot be collected. The weather most favourable to produce is that in which there are steady north and north-west winds, dry air, moderate heats, and calm nights. In the second year the cuts are made in the untouched part of the stem, and, as it were, in continuation of those already made. When after some years the tree has been cut all round, it is exhausted, and should be felled. In the last year the cuts may be made more boldly, so as to draw as much manna as possible.

The cuts are made in the morning, and at noon the manna begins to exude more copiously, which it does till evening. Small pieces of stick are inserted in the wounds, round which the manna congeals like stalactites. This forms the pipe manna, *Manna a cannolo*, which is the most valuable. That which runs down to the root is gathered on tiles, or half-dry cactus leaves, and is termed *Manna a sminuzzo*, *in frasco*, or *grosso*. When gathered, the manna is dried and stored in clear jars, or packed in boxes, kept as dry as possible, and protected from the atmosphere.

The following returns, converted into English money, are abstracted from the records of the British Consul's

Office at Palermo. I cannot say whether the data are reliable :—

Value of Manna Exported from Sicily.

	U. States.	Baltic.	France.	Great Britain and Colonies.	Italy.	Other countries.	Total.
	£	£	£	£	£	£	£
1863	758	368	2593	9,841	...	3377	16,937
1864	1377	1500	4446	10,048	100	5259	22,730
1865	3514	500	2141	4,257	200	2200	12,812
1866	4079	1500	2384	4,354	300	2258	14,875

In Murray's "Handbook to Sicily" (p. xxiii.), it is stated that the Sicilian export of manna in 1852 was L.34,895. The merchants concur in saying that the demand is falling off.

Manna in Calabria.—The practice of obtaining the manna in Calabria seems to be much the same as in Sicily, but in making the cuts a peculiar curved and two-handled knife is used, and a line of bark is removed from each notch. Among the qualities produced here, it is stated that, in the height of summer, a small quantity distils from the trunk without incision, forming crystalline *tears*, and this is reckoned the most valuable of all. It is called *manna a corpo.* Some also exudes from the leaves.

Manna in the Tuscan Maremma.—The chief difference in treatment appears to be, that an actual surface of bark, about 4 by 2 inches, is removed from the sunny side of the tree. From this the manna continues to exude for about twelve days, and then the wound cicatrises, and a new wound is made. This is done some ten times.

School of Agriculture.—In returning from La Favorita, we saw the Istituto Agrario Castelnuovo, a large building with a Doric colonnade. The late Prince of Castelnuovo, who died in 1829, endowed this institution (which was opened in 1847) for instruction in the most improved methods of agriculture. I visited the establishment, distant about three miles from Palermo, and was conducted over it by its active and intelligent director, Professor Inzenga. Besides the director's apartments, the building is capable of accommodating thirty-two students, eight of whom are educated free of charge. There are a library of agricultural works, a herbarium of Sicilian plants, a collection of local woods, and a room designed for the study of meteorology, all contained in the edifice. The pupils are instructed in geometry, botany, physical science, and drawing, and are taught practically in the fields the science of agriculture and the management of farm stock, as well as arboriculture in the woodlands.

The grounds, which extend to about thirty acres English, are partly set aside for cultivating the crops peculiar to Sicily, such as olive, manna-ash, orange, and pistachio, while the greater part of the land is used as nurseries and for annual grain crops. There is also an extensive collection of agricultural implements, machines for making wine and oil, and hydraulic apparatus. The training of the youths seemed to be eminently practical. One of the pupils was a British subject from Malta. An abstract of the Progress Report of the institution* for some years would be a useful contribution to our agricultural literature when the value of model farms is so much discussed.

Some of the villas of the Sicilian noblemen, now unhappily falling to decay owing to the unsettled state of the country, are surrounded by fine gardens, in which many rare plants were introduced. The old garden of the Casino Butera, long the pride of florists in Palermo, has been ruthlessly destroyed. The most interesting private garden now is that of the Casino Serra di falco, where Gussone laboured. The grounds are artistically laid out, and are adorned by some large specimens of *Liriodendron tulipifera*, *Magnolia grandiflora*, *Ficus elastica*, *Paulonia imperialis*, &c.

Regia Studiorum Universita.—A massy pile of building close to the Post-office, and the Quatro Cantone contains a library of 30,000 volumes, and many antiquities are being removed for want of space. The collection of objects of natural history is excellent. The geological section is under Dr Gemellaro and his assistant, Dr Di Blasi, both

* See "Annali di Agricoltura Siciliana." This journal contains interesting articles on the progress of agriculture, the culture of cotton, the growth of saffron, the improvement of cattle, and kindred subjects, which might be usefully translated for the benefit of English readers.

industrious and learned men. Many interesting fossils from the Sicilian caves have been named by Dr Hugh Falconer. The series of specimens from the sulphur mines is remarkable; the mineral wealth of Sicily, including the marbles of Taormina, and the lavas of Etna, are well represented in a large, well-lighted hall. The zoological collection was partly closed, but the fishes and birds were well preserved and arranged.

Librario del Commune contains 75,000 volumes in walnut cases, and is open to the public, without introduction, from 9 A.M.* to 3 P.M. There are many works on natural history, but it is difficult to find them, from the complicated classification. The works of the Sicilian botanists—Boccone, Cupani, Lagusi, and Ucria—with the later publications of Tineo, Todaro, and Parlatore, were made available; and I was glad to find, amongst other standard works, Rheede's "Hortus Malabaricus" and Curtis's "Botanical Magazine."

The soil of Sicily is for the most part remarkably fertile. The following table, condensed from Murray's Handbook, shows approximately the area occupied by the principal vegetable products:—

Agriculture.

	Acres.		Acres.
Corn, . . .	3,500,000	Cactus, . .	18,000
Grazing (pasture), .	1,500,000	Hazel nuts, .	13,200
Vine, . . .	360,000	Manna ash, .	8,000
Forest, . .	170,000	Chestnut, . .	6,900
Olive, . . .	125,000	Almond, . .	5,300
Sumach, . .	26,700	Carob, . .	5,200
Oranges (citrons, lemons, &c.), .	19,000	Mulberry, . .	3,000
		Cotton, . .	2,000

Figs, walnuts, liquorice, hemp, flax, saffron, &c., are cultivated on a smaller area.

Works on the Botany of Sicily.

Boccone.—Manifestum Botanicum de plantis Siculis. Folio. Cataniæ, 1668.

Boccone.—Icones et descriptiones rariorum plantarum Siciliæ, Melitæ, Galliæ, et Italiæ. 4to. Lond. 1674.

Cupani.—Catalogus plantarum Sicularum. Fol. Panormi, 1692.

Cupani.— Hortus Catholicus. Noapli, 1696.

* In the Sicilian mode of counting time the day begins at sunset (Ave Maria), so that the library is open from 15 to 21 o'clock.

Cupani.—Panphyton Siculum. Panormi, 1713.

Lagusi.—Erbuario Italo-Siciliano. 4to. Palermo, 1743.

Ucria.—Hortus Regius Panormitanus. 8vo. Panormi, 1789.

Bivona-Bernardi.—Sicularum plantarum, Centuria 1 and 2. Panormi, 1806.

Bivona-Bernardi.—Stirpium rariorum in Sicilia descriptiones. 4to. Panormi, 1813–16.

Tineo (*Giuseppe*).—Synopsis plantarum Horti Acad. Panormitani. Panorm. 1802–7.

Rafinesque.—Caratteri di alcuni nuovi genere della Sicilia. 4to. Palermo, 1810.

Tineo (*Vincent*).—Pugillus plantarum Siculæ rariorum. 8vo. Panorm. 1817.

Tineo (*Vincent*).—Catalogus plantarum Horti Regii Panormitani. 8vo. Panormi, 1827.

Presl (*C. B.*)—Flora Sicula. Vol. 1. 8vo. Pragæ, 1826.

Gussone.—Catalogus plantarum horti in Bocca di falco prope Panormum. Napoli, 1821.

Gussone.—Floræ Siculæ Prodromus. Vols. 2. 8vo. Napoli, 1827–8.

Gussone.—Floræ Siculæ Synopsis. Napoli, 1842–5.

Parlatore.—Rariorum plantarum Siciliæ, fasc. 1 and 2. 8vo. Panorm. 1838–40.

Parlatore.—Flora Panormitana. 8vo. Panorm. 1839.

Parlatore.—Flora Palermitana. 8vo. Firenze, 1845.

Sava.—Lucubrazione sulla Flora dell' Ætna. Milan, 1844.

Nyman.—Observationes in Floram Siculam. Linnea, 1844. Pp. 625–665.

Todaro.–Rariorum plantarum in Sicilia, Decas 1. 4to. Panorm. 1845.

Todaro.—Orchideæ Siculæ.

Taranto.—Catalogus plantarum in agro Calata-Hieronensi collectarum. 4to. Catania, 1845.

Tornabene.—Memorie Botaniche. In one volume.

Philippi.—On the Vegetation of Etna. Linnea, vii. 731.

Works on the Geology of Sicily.

Borch (*Comte de*).—Mineralogie Sicilienne. 8vo. Turin, 1780.

Dolomien (*Deodat de*).—Catalogue raisonnée des produits de l'Etna. 8vo. Paris, 1788.

Ferrara.—Descrizione Fisica e Mineralogica della Sicilia. Messina, 1810.

Ferrara.—Mineralogia della Sicilia. Catania, 1813.

Descrizione dell' Etna con la Storia. Palermo, 1818.

Recupero.—Storia naturale e generale dell' Etna. Vols. 2. 1814.

Daubeny.—Sketch of the Geology of Sicily. Jameson's Ed. Phil. Jour. xiii. 107. 1825.

Smyth (*W.H.*)—Memoir Descriptive of the Resources of Sicily and its Islands. 4to. London. 1823.

Hogg.—Geography, Geology, and Vegetation of Sicily, in Loud. Mag. Nat. His. iii. 105. 1830.

Mr John Hogg, F.L.S., who visited the island in 1826, published a catalogue of Sicilian plants (Ann. Nat. Hist. vol. v. pp. 287–335), but it is a meagre list, containing less than half of the known species, and is arranged according to the Linnean system. The same author has published an account of the island in Loud. Mag. Nat. Hist. vol. iii. pp. 105–116; and also "Observations on the Classical Plants of Sicily," in Hook. Jour. Bot. vol. i. pp.98–203. 1834.

Mr J. Ball contributed "Notes on the Botany of Sicily," made during a rapid tour, and has appended a very full list of the Sicilian *Graminaceæ*, enumerating 240 species and varieties, in the Ann. Nat. Hist. vol. xi. pp. 338–351. A portion of the plants collected by Mr Ball were presented to the Botanical Society in March 1842. (*Vide* Ann. Rep. 1843–4, p. 40.)

Palermo is an excellent headquarter for a Sicilian herboriser, as the railway and diligences bring many interesting localities within a day's reach, and there is an early prospect of railway extension. In 1868 it was not safe to wander far from the city without a guard of Bersaglieri, which was kindly granted to my friend by the general commanding the division, on an excursion we made to a distance of about ten miles from Palermo. This precaution was perhaps not necessary so near the capital, but the fact that the General allowed an escort betokens that there was some reason for sending the guard. For a detail of the outrages committed prior to the rebellion in September 1866, see "Quarterly Review," 1867, p. 103.

The late Professor Daubeny of Oxford sketched out a month's tour through Sicily, which he recommended to the traveller wishing to study the physical structure of the island. See "Ed. Phil. Jour.," xiii. 268 (1825). Dr Daubeny was a geological visitor, but the botanical traveller will find his route and map useful for obtaining a complete view of the island. The hotel accommodation at Palermo, Messina, Catania, and Syracuse, is good, but in the interior of the island it is very miserable. To those who do not care to visit the interior, the coasting steamers offer a cheap and easy medium of communication.

II. *Report on the Cultivation of Cinchona in Bengal for the Year* 1867–68. By Thomas Anderson, M.D., Superintendent, Botanical Gardens, and in charge of Cinchona Cultivation in Bengal.

The cultivation of the cinchonas has been most successfully carried on during the year. The open air cultivation has been greatly extended, and now consists of four times the amount of plants reported last year. I shall follow the arrangement of the report of last year, and shall consider the plants in their different stages of growth.

Stock Plants.—These plants, which are all grown under glass panes, are in excellent condition, and notwithstanding the vast amount of cuttings they have yielded, their vigour has increased during the year.

Seedlings.—A quantity of excellent seedlings of *C. officinalis*, and a very few of *C. succirubra*, were reared from seed yielded by the plants planted at Rungbee in October 1864. Besides these, I received during the year several packets of seed of *C. officinalis* and of *C. succirubra* from Mr Thwaites, the director of the Botanical Gardens, Ceylon. The number of seedlings raised during the year amounted to 101,750. The number of seedlings obtained during the previous year was 38,500.

Nursery Beds.—Large additions were made to the nursery beds. Most of the plants in these beds remained unprotected throughout the winter.

Permanent Plantations.—The formation of the open air plantations, and the tending of the plants in them, are the simplest parts of the cultivation of cinchona as practised at Darjeeling. As the process of planting followed by me at Darjeeling has not yet been fully stated in any of my previous reports, the time has now arrived for narrating the various stages of the open air cultivation, from the clearance of the forest-covered land until the end of the second year of the growth of the plants. Hitherto, the land selected has consisted of ground on which Lepchas had previously carried on the cultivation of maize, millets, and rice (a peculiar variety, which is grown without being irrigated) in the manner known as joom* cultivation, with patches of virgin forest occurring every here and there among the partially cleared spaces.

Nepalese coolies with their kookeries (short heavy curved knives), and Lepchas with their long straight sword-like knives, are sent to fell the jungle as close to the ground as possible.

The scrub, and even young trees as thick as a man's body, fall rapidly before the knives of these clearers. Where patches of virgin forest are met with, the axe must be used, but here every tree is not felled, as the smaller ones, being notched near the ground, are borne down by the fall of the full-grown trees. In preparing ground for cinchona planting at Darjeeling, the practice has always been to clear the land entirely of all vegetation, not a tree of even the smallest size ever being spared. In these hills, forest should not be felled before the middle or the end of November; if the land is cleared earlier, the grasses and underwood spring up among the branches of the fallen trees, and thus their burning is prevented. Felling may be continued until the middle of March. After two or three months' exposure to the bright sunshine and dry air of the cold season, the felled trees are in a fit state to burn. By the end of March, therefore, fires may be lit in the afternoon, when the sun has thoroughly dried up the heavy dew, at the bottom of the slope covered with felled and dry jungle. The fire rapidly consumes the whole of the brushwood and the branches of the trees, leaving only the large branches and trunks to smoulder for weeks.

Wherever virgin forest or bamboo jungle has existed, it has been necessary, after burning the lighter vegetation, to cut up the trunks of the trees and the bamboos into short pieces, and either to pile them into heaps for burning, or to roll them into the steep ravines which are too stony for planting cinchonas. The land thus cleared by fire is ready

* Joom cultivation is the term used to designate the rude cultivation practised by most of the hill tribes of India. It consists of felling and burning virgin forest (leaving the stumps of the trees standing), for the growth of sub-tropical grains. After two or three crops have been obtained, the ground is abandoned for a freshly cleared patch of forest. The piece abandoned soon becomes covered with a dense vegetation of shrubs, gigantic grasses, and young trees.

for laying out the ground for planting, and for marking the bridle paths required to give easy access to all parts of it. These paths are made about 4 or 5 feet wide, and are connected with the principal roads of the plantation. The sites for the plants are fixed by means of a cord about 100 feet in length, on which marks are tied at intervals of 6 feet for *C. succirubra*, and at shorter distance for *C. officinalis*. This marked cord is stretched along the ground, and at each mark on it, a stick, about 2½ feet in length, is thrust into the ground, thus indicating the place where a cinchona is to be planted. In order to secure uniformity in the plantation, each line is continued to the full extent of the ground to be planted before another line is commenced; the lines in properly laid out plantations will thus be parallel.

In the plantations of *C. succirubra*, the lines are fixed at 6 feet from each other, and as the plants are 6 feet apart in the lines, a uniform distance of 6 feet between the plants is maintained.

At first, *C. officinalis* was planted with an interval of 5 feet between the plants, but I have lately altered this plan for a system of close planting in lines, the lines being 4 feet apart.

After the ground has been "staked out," the next preparation for planting consists of digging the soil to the depth of a foot, removing the roots at the same time in a circle about a foot in diameter, of which the stake is the centre. The planting of the ground thus prepared is performed in dull, cloudy weather, when showers are frequent, but when the ground is not saturated by long-continued heavy rain. The thoroughly hardened plants are brought from the adjoining nursery beds in shallow boxes, which the men carry on their heads. The plants are given to the coolie engaged in planting, who, with his hands, makes a hole in the loose soil sufficiently large to admit the roots of the plant, and the soil is gently pressed around the roots to prevent the plant being beaten down by heavy rain. The plants when taken from the nursery-bed should not be less than 4 inches, and should not exceed a foot in height, but plants varying from 6 to 10 inches in height are of the best size.

After the plants have been planted for three weeks, it is necessary to cut down the weeds which had sprung up around them, as in a few weeks more the young cinchonas would soon be smothered in a jungle 5 or 6 feet high. These weeds require to be cut down once a month, from May until the end of October; they are laid in lines following the slope of the hill, and the slightly raised ridges soon disappear as they are decomposed by the heavy rain and high temperature. During the same period of the year, it is necessary to weed every six weeks the prepared circles in which the cinchonas are growing, and at the same time to loosen the soil round the plants by lightly hoeing with a kodalie or furroah. In November, the entire surface of the plantations is thoroughly hoed, and by this means the weeds receive a great check by being exposed to the drying sunshine of the cold season after having been uprooted. After hoeing, the plantation requires no attention until the end of April, when a light covering of weeds having sprung up again, the circles round the plants should be lightly hoed and somewhat enlarged. From May again, until the end of October, the periodical cutting of the weeds must be continued, but not so frequently as in the previous season, as many of the strongest growing weeds by this time have succumbed to the hoeing in November. The growth of the plants is greatly favoured by a hoeing of the ground in November again, after the second growing season is over, and if this is done in the following year, their third growing season, the plants are tall and strong enough to outgrow the jungle, which then begins in its turn to be smothered under the dense foliage, at least of *C. succirubra.*

The Selim Tea Association purchased 10,000 plants of *C. succirubra* in July 1867, and all of these, which were planted on steep slopes of the Himalaya, immediately above the Terai, are inferior in condition and promise only to the splendid plants of cinchona in the Government plantation at Rishap, close to Rungbee.

Chemical Analysis of the Bark.—The bark of *C. succirubra* and *C. officinalis,* referred to in the last annual report as having been sent to London for analysis, was analysed by Mr Howard. The analysis was most satisfactory, one specimen of *C. succirubra*, thirty-one months old, yielding no less than 7·30 per cent. of precipitated alkaloids, of which 3·20 was quinine, and 2·27 cinchonidine mixed with a little quinine—a larger percentage of alkaloids than has been found in any other bark of the same age. The bark of *C. officinalis*, taken from plants twenty-eight months old, gave 3·20 of alkaloids. The conclusion drawn by Mr Howard from this analysis is, " that there is no reason to think the Darjeeling barks at all inferior to those grown at Ootacamund; the difference of climate does not appear to have much effect on the alkaloids therein contained."

Flowering and Seeding.—A small number (270) of plants of the varieties of *C. officinalis*, planted in October 1864, have again produced a profusion of flowers, and already many of them are covered with most promising panicles of seed vessels. A considerable amount of good seed was obtained from several of these plants in August and September 1867. Out of 389 plants of *C. succirubra*, planted in October 1864, only two plants produced flowers and seed last year, and a few seedlings were raised from their seed. These plants, which were in an unhealthy state at the time of flowering, soon after became healthy and vigorous, and this year they have not flowered. Another plant of *C. succirubra*, from whose stem a large piece of bark was taken, has put forth a few flowers from one or two of the branches. With these exceptions none of the *C. succirubra* plants have flowered at Darjeeling, although many of the oldest plants are above 12 feet in height.

Distribution of Cinchonas.—11,390 plants of *C. succirubra* were distributed during the year. Of these, 10,290 were sold to planters in the district of Darjeeling, 1000 plants were despatched to Chittagong for distribution among the tea planters, and 100 were sent to the deputy commissioner of Hazara in the Punjab.

Private Cultivation of Cinchona in Darjeeling.—100 acres were planted with *Cinchona succirubra* during the year by the Darjeeling Cinchona Association, the area being 120 acres. At Coombe Banks, the cinchona estate of Major Fitzgerald, 25 acres have been planted.

The Darjeeling Tea Company possesses some fine plants of *C. succirubra* planted in May 1864. This company is also forming plantations of red bark on land well adapted to the cultivation of cinchona.

Mr Robson, the superintendent of the cinchona plantations of the Tuckvar Tea Company, has made large additions to the plantations of *C. officinalis* and *C. succirubra*. Some of the older plants of *C. officinalis* on this estate are now in flower.

The Selim Tea Association possesses 10,000 plants of *C. succirubra*, which were purchased from the Government plantations in July 1867.

One thousand plants of *C. succirubra* were sent to Chittagong in February 1868, and most of them arrived in good order.

Khasia Hills.—The establishment of a small nursery at the Khasia Hills was sanctioned by Government early in 1867. The nursery was intended only for raising plants of cinchona for distribution among the planters in Assam. One of the European gardeners from the Darjeeling plantation was sent, in February 1867, in charge of the plants from Darjeeling, with which the cultivation was to be commenced. He reached Shillong in the Khasia Hills in the end of March, and early in May the cultivation was commenced near the Dak Bungalow of Nunklow.

The plants had been increased from 650, the original number sent from Darjeeling, to 6778 on the 31st March 1868. The distribution was begun in March 1868 by the sale of 100 plants, and other applications had been registered. The species in these nurseries is *C. succirubra*, the only species that will probably succeed in Assam.

III. *Notes of a Visit to the Hot Springs of Jumnotri in 1860.* Part. II. By Mr William Bell.

The hot springs of Jumnotri are about six miles above the village of Kursalla, but as the crow flies perhaps they are not more than two, and the road leading to them is up the bed of the Jumna. For the first mile and a half it is passable, at least not much worse than many of the other public highways through the Terai Rajah's dominions; but the remaining four and a half miles have to be accomplished both on hands and feet—the exceptions to this mode of progression being jumping and sliding. The views along the road, although limited, are generally grand. The cliffs on each side are sometimes rugged and irregular, sometimes perpendicular, at other times overhanging from having their bases worn away by the action of the water. The bed of the river varies much in width. In many places it is so much contracted as to seem quite a narrow gorge, with overhanging rocks on either side. The character of the rock also varies considerably. In some places it is slaty; in others schistose, and in others a close-grained quartz, brownish in colour. In some places, masses of rock, of enormous size, piled above each other, occur in the bed of the stream. Some of these are considerably water-worn, whilst others have their outlines so little altered that the places from which they have been detached can be distinctly seen. The appearance of the broken faces almost indicates the dates on which they fell. One mass, in particular, a little above the village, attracted notice, perhaps from the circumstance of its being closely covered with a species of *Grimmia*, resembling *apocarpa*. This single stone measured nearly 60 feet in length, about 20 feet in thickness, and about the same in breadth. It was much weather-worn, with its corners rounded off, and regularly furrowed. It was a schist, containing a large amount of mica. Rock of the same character only occurs *in situ* several miles further up the stream. Lots of blocks, nearly the same in size and of the same character, are also found further down in the bed of the stream. How these blocks got transported there can only be accounted for by supposing that, at some period of the physical history of Hindostan, glaciers must have occurred at much lower altitudes than they do now. Another fact, perhaps, also corroborative of that supposition is, that at the mouths of all the valleys opening into that of the Jumna, enormous beds of drift occur, fine sections of which are occasionally seen where cut through by the river. They are composed of earth and small stones, distinctly water-worn, and largish blocks with only their corners and edges rounded. It is generally at the upper angles of those beds that the villages are located, and the land between them and the river terraced for rice and other kinds of cultivation.

Behind the barriers formed by these blocks of rock in the bed of the river, are piles of branches, trunks, and roots of trees, splintered and broken into pieces; all of them without bark, and battered so that the annual layers of wood, to a considerable depth, can be easily peeled off by the finger and thumb. Some of these fragments seemed but recently broken; while others, from their being battered and chopped until they were perfectly oval, seemed to have been subjected to the action of many a flood. A considerable number of these masses of rock lying in the bed of the river were also variously split and shattered in a manner that I could not account for, as this occurred in places where loose masses from above could not have been the cause, neither had they been brought by the water from places where they might have been thus broken, as in many cases the position of the fragments showed that they had not been disturbed since they were split. The hills on either side are very steep and rugged, but tolerably well wooded. A great number of the trees have their tops and large limbs broken off by the snow.

The hot springs are situated on the right bank of the Jumna, which is there only a small mountain torrent rushing between and over the masses of rock that obstruct its course, in many places forming pretty little cascades. What the exact altitude of the place is, I cannot say; it is only a little below the upper edge of the region of trees and shrubs. On either side are stupendous walls of rock, and on the side on which the hot springs are it overhangs frightfully. The rock is a close-grained quartz, of a reddish brown colour, regularly stratified, and dipping N., or perhaps N. by E., at an angle of 45°, or a very little less. The strata are transversely fractured, but irregularly, which gives the wall somewhat the appearance of being built of massive blocks, all lying on their edges. The springs are on a shelving recess, partially covered with grass, brambles, &c., the lower end of which is perhaps 10 feet higher than the bed of the stream, but the upper end slopes abruptly into the water. Out of the perpendicular face of the lower end of the recess, which is the one first approached, issues a small jet, about three-quarters of an inch in diameter, discharging alternately steam and hot water, with a loud hissing noise. Another jet, similar in size, and running smoothly, issues from the wall of rock behind the recess. It is directly over the lower one, and about 6 or 8 feet higher. The water coming from it is scarcely so hot as that of the first. On the lower end of the shelf are three wells and a small fountain. The uppermost well is only milk-warm, and discharges very little water. The second is separated from the first by a ledge of rock about a foot in width. It is on a lower level, and seems to boil violently. The water rises through the bottom of the well in a stream, seemingly as thick as a man's arm, still the discharge is considerably less than it should be from a spring of such dimensions. It is probable that a considerable portion of what seems to be water may be only steam, which gets condensed before it reaches the surface. The water looks very dirty, from the great quantity of mud and minute flakes of mica which it holds in suspension. Not having a thermometer with me, I cannot say what the temperature of the water actually is, but judging from the manner in which it affected my finger, its temperature is fully 212°; in fact, the hill men told me that it cooks rice quite as quickly as ordinary boiling water would. The third well is a short distance from the second, and is on a still lower level. Its water is not nearly so hot. A small steady stream runs into it from a fissure in its side. Nearly opposite to the middle well, and between it and the edge of the shelf, is a third jet, which discharges both steam and hot water. The water rises about 3 feet, and falls in spray all round. The jet is situated in the centre of a small mound, flattened on the top, and regular in outline, about 1½ foot high, and 3 feet through, and composed of a substance resembling rust. The water from this jet feels quite as hot as that of the middle well.

A few pilgrims annually resort to these springs, the water of which is considered as efficacious as that of the Ganges for the removal of impurities, both physical and moral. I should fancy it was far better for the removal of physical impurities than the Ganges water, as one good application makes their black skins red. The wells are only shallow basins, and contain but little water. I did not observe any traces of either animal or vegetable life in them; but in the little streams which flow from them, and also under the spray from the jets, there occurred a great quantity of a lurid green slimy substance, probably a conferva. The upper end of the ledge slopes abruptly into the Jumna, where there is a small pool, in which there is another hot spring, the existence of which is indicated by the steam rising from the surface of the water. But the frightfully overhanging mass of rock, directly over the pool, made me afraid to venture in to look at it. On the side of the river opposite to the springs first mentioned, but a little further down, is another hot spring, not milk-warm; it shows itself at the base of a great mass of *debris*. About four miles below it, and on the same side of the river, there occurs another, also showing itself at the base of a large bank of rubbish that has dropped from the cliffs above. The temperature is considerably lower than that of the last. Another occurs still further down, perhaps thirty miles; it also shows itself at the base of a great bed of gravel; its temperature is similar to that of the second. The vegetation in and around these two last mentioned is peculiar and marked—*Chætophora endiviæfolia*, *Hypnum filicinum*, *H. ruscifolium*, and *H. molluscum*, *Veronica* sp., also a conferva, all seemingly in a high state of health. What renders the vegetation in those springs more an object for notice and remark than it otherwise would be, is the entire absence of life, animal and vegetable, in the Jumna and other streams which, like it, take their rise from the snow. There is not even a conferva except at that particular spot, where the water from the hot springs falls into it, for a great number of miles below its source. I infer that animal life is equally scarce, from the fact that neither kingfishers, ouzels, nor dippers are to be met with. The plumbeous water-robin is now and again to be seen, but even it, although so common on streams a little lower down, is far from being so up there.

Growing closely around the boiling springs, first in order was a Bartramia, which is common everywhere and usually fruits freely, but there all the specimens were sterile. Next a Bryum, in habit not unlike *B. Ludwigii*, and, in company with it, *B. argenteum*, and a *Gymnostomum*. *Adiantum Capillus-Veneris* also seems to agree well with the steam and heat. The lurid green gelatinous substance, above noted, grows almost under the spray from the jets, and a little farther from them, as the water becomes cooler, a conferva occurs, perhaps an undeveloped state of the one that grows so luxuriantly in the little pool at the upper end of the shelf.

Of other plants noticed in the bed of the stream and on its banks, were a beautiful little trefoil-like plant; *Astragalus*, two species, in flower; *Epilobium*, several species, one of them like *alpinum ; Cherleria; Sibbaldia; Cerastium*, two species; one *Myosotis ;* one *Primula ; Rumex*, two species, one like *obtusifolius ; Oxalis corniculata ; Polygonum vacciniifolium ; Gnaphalium*, several species; *Gentiana*, two species; *Senecio vulgaris; Galega*, one species; *Sedum*, one species; *Adiantum*, three or four species; *Asplenium*, several species; *Polypodium*, several species; *Betula Bhojpattra ; Corylus lacera; Rubus; Leycesteria; Piptanthus ; Rhododendron*, four or five species, one of them of a small creeping habit, much resembling *Azalea procumbens.* On the way back some fine specimens of *Lilium giganteum* were seen, and a few small specimens of the Oriental Plane—the *Cheenar* mentioned by Moore in his "Lallah Rookh" in describing the Vale of Cashmere.

Rhododendron campanulatum comes in at the lower limits of the birch and hazel, and rises rather above them. It occurs in patches of great extent, and grows so close that it is impossible to walk through it. When it has become old and scraggy, the stems present a rather remarkable appearance ; all of them are decumbent at the base, and seem as if they had been propagated by layers from the central plant of the patch. Amongst the birches and hazels, but rather on the upper side of them, a fine rowan tree, with waxy white berries, was observed. Properly, it is not a tree, only a strong-growing shrub. The fruit is produced on very regular, rather flattish, corymbs, and in shape the berries are globose, or somewhat oval ; some of those most exposed to the light are faintly streaked with red. They do not seem to be eaten by either birds or animals, still they may be so during the dead of winter, when other food is scarce. Above it grows a small Salix, in appearance like *S. herbacea;* this was the last shrub observed on the north side of that range. A pretty little Gentian was also met with on the very top of that ridge, growing in the cliffs of the rocks, and I suppose a great many other things might have been found equally interesting if we had had either time or patience to have looked for them. But the morning was bitterly cold, and the ground frozen hard. Thin clothing, bad food, and little of it, with a cutting wind, and the immediate prospect of having our road blocked up with snow, made us almost wish that we had been in Moultan, rather than on a spur of Jumnotri.

IV. *On the Form of Archetypal Leaf.* By Dr Joseph Bullar.

The author believed that the orbicular form of leaf was the Archetypal one, the divisions of its veins representing the divisions in the calyx, corolla, and the other whorls of the flowers. Professors Balfour and Dickson doubted the correctness of Dr Bullar's theory. The paper was illustrated by drawings.

V. *Notice of the Occurrence of* Rhamnus Frangula *in Ross-shire.* By Dr F. Buchanan White.

To determine whether a plant (regarding whose claims there may be more than one opinion) is truly native in a country or district, is, I think, admitted by all botanists to be by no means an easy matter. In forming a decision on such a question, many things should be taken into consideration. Not only should the possibility of introduction, either intentional, for economic or ornamental purposes, or unintentional, as with the seeds of other plants, be duly looked into, but also the range of the species throughout the world. After these matters have been investigated, we should examine the specimens on which the claim is founded, in respect to their place of growth, temperature, and climate of the district, and plants with which they are associated. We may then see what other species of plants, truly native, but still wanderers to a certain extent from the metropolis of the species, occur in the country. Finally, we should try and bring additional corroboration, if possible, from the fauna of the locality.

The plant regarding whose merits as a native of Ross-shire I beg the Society to decide, is *Rhamnus Frangula.* It is not, I believe, a plant in general cultivation anywhere, as its economic value is of little (though of some) importance; neither is it likely to be cultivated for ornamental purposes. Little can be said on either side regarding the possibility of its accidental introduction in seed. In Britain the range of *Rhamnus Frangula* extends throughout England, but in Scotland it has only been recorded from Ayrshire; and even there, according to some botanists, its claim to rank as a native is doubtful. Its exotic range is, I believe, throughout Europe, and it is also found in Siberia.

Ross-shire, as a county, is well known for the mildness of the climate; and the parish of Contin, in which I found the *Rhamnus*, is especially noted in that respect.

The plants (of whose number I cannot, owing to the dense growth of other bushes, speak with certainty) were well-established bushes, about four feet in height, flowering and fruiting freely, and growing in the marshy ground, which is said to be the proper habitat of the species. Its associates were all native plants—*Myrica Gale*, *Calluna*, *Alnus*, *Salix*, *Betula*, &c. The place where it grows has never been enclosed, and is bordered by the road running along the shore of Loch Achilty. The nearest plantation is one of larch, of about thirty years' growth.

The principal plants in the district of a southern character were *Lycopus europæus* (which grows very abundantly in a small stream that issues from the loch), not a common plant in Scotland, and *Funaria hibernica*, not before, I believe, recorded as a native of Scotland, nor of England north of Derbyshire.

Among the insecta of the district, there are several species not before known as natives of Scotland, and many others recorded before only from more southern Scottish localities. In the first class it will be sufficient to mention the lepidopterous *Acronycta megacephala* (common in the southern and midland counties of England), *Lithosia mesomella*, *Macaria notata*, &c.; and the hemipterous *Sigara minutissima* (up to last year only recorded from the fens of Cambridgeshire, but since found in Yorkshire as well), *Psallus querceti*, &c. In the second class come the butterflies, *Argynnis Euphrosyne* and *Thanaos tages*. Both are common in England, but rare in Scotland; neither, I believe, being found near Edinburgh. Some of the mollusca may be also cited, to show the southern character of the fauna—*Zonites excavatus*, a native of the south of Scotland (Mr J. Gwyn Jeffreys tells me, however, that he found this species at Aberdeen two years ago), *Helix aculeata* (northern limit at Aberdeen), *Pupa ringens*, &c.

In conclusion, I may state that a French botanist, who paid me a visit, told me that the aspect of the district greatly reminded him of the forest of Fontainebleau; a fact of no great matter in itself, but rather curious when taken in connection with what Mr Stainton says ("Entomologist Annual," 1867, p. 136) regarding the fauna of Fontainebleau, and with what I have already mentioned regarding the fauna and flora of the district. Mr Stainton remarks—"I should observe that Fontainebleau, with its sandy soil and numerous rocks, is a particularly warm locality; and that some insects occur in the forest there, which are not again met with till the collector has proceeded 250 miles farther towards the south." I now leave the answer to the question, Is *Rhamnus Frangula* a native of Ross-shire? to the consideration of the Society.

VI. *Report on the Open-Air Vegetation at the Royal Botanic Garden.* By Mr M'Nab.

Since the last meeting of the Botanical Society (Feb. 11), the weather has been very changeable, attended with frequent snowfalls, but of short duration; the temperatures were also somewhat fluctuating, falling considerably below the maximum temperatures recorded in my last report. The highest morning markings were on Feb. 18, 21, 24, March 5, 6, and 7; being respectively 41°, 43°, 48°, 42°, 42°, and 42°. The lowest thermometer readings were on the mornings of Feb. 19 and 28, March 1, 2, 3, and 4, marking 31°, 29°, 29°, 31°, 25°, and 27°. All other mornings averaging 32° to 40°. The following plants have come into flower since last report, viz.:—

Feb. 18. Narcissus pumilus, first flower opened.
19. Hyoscyamus scopolia.
20. Sisyrinchium grandiflorum album and Narcissus minimus.
21. Scilla bifolia alba and Scilla bifolia major.
26. Tussilago nivea and Tussilago alba.
28. Muscari botryoides.
29. Puschkinia scilloides.
Mar. 1. Ribes sanguineum, first flower seen open.
2. Scilla sibirica and Mandragora vernalis.
Mar. 4. Corydalis cava.
5. Muscari botryoides alba.
5. Primula nivalis and Gagea lutea.
6. Erythronium dens canis.
7. Ribes sanguineum album.
8. Scilla bifolia rubra and Scilla bifolia patula.
9. Erythronium grandiflorum and Muscari botryoides pallida.
10. Hyoscyamus orientalis.
11. Draba azoides.

VII. *Miscellaneous Communications.*

1. Dr Buchanan White presented specimens of *Funaria hibernica*, which he had collected in September 1868, growing on rocks on Tor Achilty, Ross-shire. This is the first time that this moss has been detected in Scotland.

2. Professor Dickson made some remarks regarding the indurated structure of the albumen in the seed of *Convallaria majalis*, preparations of which he exhibited under the microscope. The cells are indurated much in the manner of those of the albumen of the *Ivory-nut palm*. The induration in *Convallaria*, however, is not so great, and the canals in the indurated cell-walls shorter, and much wider.

3. Dr Cleghorn exhibited some stems of coffee plant injured by the boring of a coleopterous insect, commonly called the White Borer. He remarked that this species of injury was very frequent in the Wynad and Ceylon coffee plantations.

4. Mr E. Whymper presented dried plants from Greenland.

8th April 1869.—Dr CLEGHORN, President, in the Chair.

The following Gentleman was elected a Foreign Member:—

Senhor JOACHIM CORREA DE MELLO, San Paulo, Brazil.

Donations to the Library, Herbarium, and Museum were announced.

The following Communications were read:—

I. *Notes on Range in Depth of Marine Algæ.* By Professor DICKIE.

The bathymetrical range of animal life has been of late attracting a due share of attention, and facts of great interest have been ascertained. Very little has been done regarding the range of depth of marine plants; few instances have been recorded, and even some of these are not quite trustworthy.

When the dredge ceases to scrape the bottom, it becomes in its progress to the surface much the same as a towing net, capturing bodies which are being carried along by currents, and therefore great caution is necessary in reference to any marine plants found in it. Sea-weeds are among the most common of all bodies carried by currents near the surface or at various depths below, and from their nature are very likely to be entangled and brought up.

The present communication is offered chiefly with the view of directing attention to the subject, and of recording a few facts, which may, perhaps, stimulate algologists to add to the number of such.

There are two effects which diminished supply of light at great depths may be expected to produce upon Algæ—decrease of size and modification of colour. The proportion of light necessary for the germination of the spores, and subsequent development, surely deserves the attention of physiologists.*

* In "Annals of Natural History," Dec. 1868, there are some remarks by Mr Jeffreys regarding various mollusca, with bright-coloured shells and well-developed eyes, at depths from 200 to more than 1500 fathoms.

The influence of the law, that in water there is a limit of obliquity beyond which transmission into the air cannot occur, giving rise to total reflection, and the unequal absorption exerted on the different separable rays of light, can only be hinted at here in relation to this subject. According to Bougouer, sea-water at a depth of 700 feet loses all transparency.

M. H. Wild, in a recent number of Poggendorff's Annalen, states that light in traversing five metres in depth has its intensity reduced to one-third. He, however, adds that the transparency of water at low temperatures is greater than at higher.

Further, it is very notable that in high northern latitudes, where thick ice covers the surface of the sea during great part of the year, and where, moreover, the absence of direct sunlight for several months together produces very peculiar conditions, nevertheless sea-weeds abound, the number of species not much more than fifty, but some of large size, and most of them individually plentiful.*

The late Professor E. Forbes adopted the following zones in relation to the distribution of marine organisms on the British shores :—1*st*, *Littoral* zone, comprehending the space between tide marks; 2*d*, The *Laminarian*, from low-water mark to 15 or 20 fathoms; 3*d*, The *Median* zone,† from 15 or 20 fathoms to 50; 4*th*, The *Infra-median;* and 5*th*, The *Abyssal.* In the first two of these sea-weeds are abundant; they are rare in the lower part of the median zone, and very rare indeed beyond it.

In recording habitats of British Algæ (as in "Phycologia" of the late Professor Harvey), the expression "cast up from deep water" is often used; it is somewhat indefinite, nevertheless, as many delicate species are thrown on shore in very perfect condition, they cannot have come from any great distance; and if we examine the tidal chart in "Johnston's Physical Atlas," where depths round the British and Irish shores are also given, it will be seen that the line of 10 fathoms on the general coast is very narrow, but is wider in bays and arms of the sea; and as these localities yield many

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† He used the term median or coralline zone, the latter very loose or incorrect if applied to the corallinidæ of algologists.

species, 10 fathoms may be considered a common bathymetrical range. The following may be mentioned as reaching to or beyond 15 fathoms:—*Chorda-Filum*, *Cutleria multifida*, *Zonaria parvula*, *Polysiphonia parasitica*, *Chylocladia kaliformis*, *Melobesia calcarea*, *Rhodymenia cristata*, *Phyllophora rubens*, *Phyllophora Brodiaei*, *Peyssonelia Dubyi*, and species of *Delesseria*. Several of these are also found in the littoral zone.

It is of interest, however, to ascertain the absolute limit of vegetable life on our own shores, and the only case which has come under my own notice is the following:—About ten years ago, in company with the late Mr Hyndman of Belfast, and Mr Waller, when dredging near the Maiden Rocks, coast of Antrim, our dredge got fast on rocky bottom at a depth of about 80 fathoms. With some difficulty we recovered it. On examination it contained a few mollusca, abundance of living zoophytes,* and two red algæ, the largest being *Phyllophora Brodiaei*, quite fresh, and of the usual colour. It appeared to have been recently torn from its site; still, as it is not unfrequently cast upon the Antrim coast, it is just possible that the specimen may have been loose, and accidentally entangled in the dredge. Regarding the other species, I have no doubt it was attached near the base of one of the living zoophytes, and although not more than a quarter of an inch in length, it could be referred to *Delesseria sinuosa*, a species very widely distributed along the British and Irish shores.

In vol. ii. p. 464, of the "Antarctic Flora," Dr J. D. Hooker states that "8 to 10 fathoms are the utmost depth at which, judging by our experience, submerged sea-weed vegetates in the South Temperate and Antarctic Ocean." This may be the general limit, but *Macrocystis pyrifera* is reported in the same work as attached to the bottom in 40 fathoms, though most of the very long stem—700 feet—lies near the surface. Lamouroux speaks of the algæ growing at 100 to 200 fathoms, but the statement is more than doubtful. Humboldt records *Fucus vitifolius* (*Caulerpa viti-*

* It may be interesting to state the species: *Sertularia abietina*, *S. rugosa*, *S. argentea*, *S. rosacea*, *Tubularia indivisa*, *T. Larynx*, *Tubulipora serpens*, *Halecium Beanii*, *Flustra avicularis*, *Crisia eburnea*, *Laomedea* —— (?), and *Caryophyllia Smithii*. The latter lived in an aquarium for nearly two years after.

folia, Lamx.; *Chauvinia vitifolia*, Kutzing) as growing in 30 fathoms, and quite green. In "Nereis Americana," *Anadyomene stellata* is stated to grow in 20 fathoms, and of the usual green colour, in the Gulf of Mexico. In his report on the Ægean Sea, the late Professor E. Forbes states that *Constantinea reniformis*, P. and R., occurs at 50 fathoms, and he considered this as the greatest depth, accurately observed, at which algæ vegetate. In a recent number of Silliman's Journal, Count Pourtales states that *Centroceras clavulatum* came up in a dredge which had been at the bottom in 270 fathoms; this species is stated in "Nereis Americana" as abundant at Key West, everywhere near low-water mark. I doubt very much whether this plant was brought from the bottom; most likely it was caught by the dredge in its progress towards the surface. In Areschoug's "Phyceæ Scandinavicæ Marinæ," p. 11, it is stated that *Desmarestia aculeata* has been got between Jutland and Norway at a depth of 90 fathoms.

In the supplement to Captain Inglefield's "Summer Search for Sir John Franklin," 1853, there are some cases which were recorded by myself in the Botanical Supplement to the work. They were given on the authority of Dr P. Sutherland, from whom I received the specimens, viz.—

	Fathoms.
Fucus vesiculosus, . . .	40 to 50
Desmarestia aculeata, . . .	80 ,, 100
Dictyosiphon fœniculaceus, . .	50 ,, 100
Agarum Turneri, ...	10 ,, 100
Laminaria longicruris, . . .	50 ,, 100
Chordaria flagelliformis, . .	80 ,, 100
Chætopteris plumosa, . . .	25 ,, 30
Ectocarpus Landsburgii (?), . .	70 ,, 80
Euthora cristata, ...	98 ,, 100
Ptilota serrata, ...	30 ,, 40
Kalymenia Pennyi, . . .	20 ,, —
Conferva Melagonium, . . .	20 ,, —

Respecting the greater depths in the above list, I have much doubt. It is a well-established fact that masses of algæ are set adrift by the action of the ice in summer, and are seen floating in great masses. Under such circumstances, though the dredge may have been at the bottom in

100 fathoms, it is rash to conclude that all its contents, especially algæ, have been growing at that depth.

During the voyage of the "Fox," under command of Sir L. M'Clintock, Dr Walker dredged *Rhodymenia interrupta* at the east end of Bellot Strait, in about 60 fathoms as estimated. The plant is now known to be an Arctic form of *Phyllophora Brodiæi*, and this is of some interest in relation to the probable existence of the plant at 80 fathoms on the Irish coast, already alluded to. Captain Thomas Mitchell, late commander of the "Queen of Nations," belonging to Aberdeen, gave me some material which came up adhering to the sounding lead, from the Abrolhos shoal, in 40 fathoms, in lat. 18° 0′ 11″ S., long. 37° 47′ 15″ W., 30 miles from the nearest part of the coast of Brazil. Most of it consisted of a species of Melobesia, much decayed, but partly also fresh and entire; adhering to it, growing on it, in fact, there is a solitary specimen of a bright crimson alga. On examination, I had no hesitation in referring it to the genus Peyssonelia. It is not very prudent to describe supposed new species from solitary examples; nevertheless, as it seems to differ from others known to me, and being of interest in relation to the subject, it may be legitimate to record it under the provisional name of *Peyssonelia abyssicola*, sp. n.* If a single cast of the sounding-lead did such good service, how much more would the dredge accomplish on this Abrolhos shoal?

Finally, it is worthy of notice that species which reach the lowest depth where algæ vegetate are chiefly Rhodosperms; next in order the olive-coloured. The Chlorosperms prevail in the littoral and upper part of the laminarian zones.

Diatomaceæ are usually considered to rank among the lower forms of algæ. I may close with a brief reference to their range. Although some few species have been certainly brought up from the greatest depths reached by the dredge, it does not necessarily follow that they live and propagate there. Many of the marine species adhere to the higher forms of sea-weeds, and necessarily have a limited range; while not a few of the free species occur at or not far below

* *Peyssonelia abyssicola.*—Nearly circular, faintly zoned concentrically, subtomentose beneath, about half an inch in diameter, colour bright red, upon *Lithothamnium mamillare* (*Melobesia mamillaris*, Harvey).

the surface. Along with the Delesseria already mentioned as growing at 80 fathoms, I only detected three Diatoms—viz., *Melosira marina*, *Coscinodiscus radiatus*, and *C. eccentricus*. These minute organisms are so indestructible, so abundant, and widely diffused, that it is not surprising to find them in matter dredged at various depths. The Melobesia from the Abrolhos shoal yielded at least a dozen species; but I cannot positively assert that they were living.

It is to be hoped that in future more attention will be paid to this subject. Exact records of depth will add to the interest pertaining to the algæ procured, besides contributing to a department of inquiry very much overlooked; in this respect zoologists are far ahead of algologists.

II. *Note on* Scirpus parvulus, *Römer & Schultes.* By Alex. G. More, F.L.S.

Mr A. G. More sent from Glasnevin some specimens of *Scirpus parvulus*, R. & S., accompanied by the following note:—

Scirpus parvulus has for some years past occupied a doubtful position among British plants. Since its discovery at Lymington, in Hampshire, by the Rev. G. E. Smith, in 1837, no botanist has gathered the species in England. The re-discovery, therefore, at Arklow is of the greater interest, as it will restore a long-lost plant to the British flora.

It was in July last that, while waiting for the train at Arklow, I took a short walk along one of the muddy creeks which run in among the sand-hills close to the mouth of the river Avoca. My attention was at once drawn to a dwarf green, grassy-looking plant, which I saw covering the mud-flats that had just been left bare by the falling tide. It was evidently no seedling of any one of the usual maritime species; and, after a short search, I succeeded in finding a few of the flower-spikes, when no doubt was left as to the identity of the plant with *Scirpus parvulus*.

It grows in tiny tufts, showing above the surface of the mud only about an inch of the upper part of the stem, which is green; the lower part is white, probably from being buried in the soft mud. The little tufts grow close together, and are connected with each other by very slender thread-like stolons, terminating in minute tubers, which serve apparently as the starting-point for future stems. The tufts consist of six or eight stems, which are mostly barren; sometimes one or two, sometimes all are tipped with the very small pale-coloured spikelets. The stems themselves are soft and fistular, semi-transparent, especially below, and are composed of four (rarely five) longitudinal tubes, which are divided at irregular intervals by numerous transverse partitions, a structure somewhat resembling that found in the fronds of Isoetes—and *Scirpus parvulus*, too, is subaqueous during at least a good part of its existence—but there is this great difference, that in *Scirpus parvulus* the stems do not inclose each other, but all spring independently each alongside of its neighbour, and each is sheathed at the base by a very thin transparent membranous sheath, several of which may be seen overlapping each other in the centre of the tuft. These sheaths are so thin and delicate that they appear to have escaped the observation of several describers, and it is possible that they decay or fall away as the plant advances in growth; still, I have constantly found them on the young and vigorous stems, and they may always be distinguished at the centre of the tuft when the young stems are rising through them.

In the cellular structure of its stem, *Scirpus parvulus* differs remarkably from any other Scirpus with which I am acquainted, and though the pale whitish spikelets bear some resemblance to those of *S. fluitans*, there are quite sufficiently distinctive characters to be found, both in the habit of growth and in the presence of the three (or more) hypogynous bristles which surround the nut. The lowest glume seems to be always empty, as in *Eleocharis uniglumis*. I could find no ripe seed in October, so that it remains to be seen whether the plant increases by tubers only in this outlying locality.

On the Continent, *Scirpus parvulus* is irregularly distributed along the coast of Europe, from the Baltic to the Adriatic, and is especially abundant on the mud-flats near the mouth of the river Gironda. In Germany it has been found at some distance inland, but always, I believe, along the estuaries of tidal rivers, or in places exposed to the influence of water slightly salt.

III. *Notes on the varieties of Tea cultivated in India.* By Mr Wm. Bell.

Whether *Thea Bohea* of botanists and *T. viridis* be distinct species, or only varieties dependent on soil and climate for their existence, matters but little to the Indian tea manufacturer. So far as my experience goes, any variety of that commonly known as the China tea plant, which produces leaves suitable for the manufacture of a first-class black tea, is equally suitable for the production of a first-class green tea.

The only plausible reason that I can see for asserting that the plant cultivated in black tea districts is *T. Bohea*, and that cultivated in green tea districts *T. viridis*, is, that because one class of tea is manufactured in one district, and another class in some other district, green and black tea must be produced by two different plants. It should be kept in mind that Chinese manufacturers, like British ones, find that, by confining their attention to the production of a particular article, it can be turned out at a cheaper rate, and of better quality, than if engaged in the production of two or three.

In some districts I am told that a custom prevails, as restrictive as *caste* in India, which prevents men from engaging in more than one kind of work. For instance, a box-maker is not permitted to try his hand at sheet-lead making, or lining, or soldering down; neither is he permitted, even if out of employment, to try his hand at manufacturing. Nor is a man who has served an apprenticeship to the manufacturing of green tea permitted to try the manufacturing of black. These facts may to some extent account for the plausible supposition, that green and black teas are the produce of two altogether different plants.

There are, no doubt, a great number of varieties of *T. Bohea* in cultivation, some of them of little value—not worth cultivating, as a small papery leaf is not well suited for making a fine tea. Some of the small myrtle-leaved varieties are said to have a hardier constitution, and therefore to be better adapted for cultivating at high altitudes than any of the large-leaved varieties, which are best suited for low, moist, warm localities. All of these different varieties seem to intermix or cross readily with each other; at least there is now a greater number of varieties in cultivation than were originally introduced. The specimen No. 1 is from one of the plants first introduced into India. It is an excellent variety, and still unsurpassed by any of the recent introductions. The other specimens are from younger plants, and lately pruned, merely illustrative of the quality of leaf required for the manufacture of good tea.

No. 2 is *T. Assamica*, a well-marked species, differing from the China plant in size, habit, foliage, and flower. The tea made from it also differs from the China tea. By some it has been condemned—I suppose without a trial—as worthless rubbish; but, to my taste, it is superior to the other. The Assam was originally neglected for the China plant, but it has long since been found that the yield is greater in quantity and the quality better than that from the China plant when cultivated in Assam. It seems to have a rather tender constitution for the climate of the north-west and the Punjab. In the Deyrah Dhoon the points of the young wood are often killed back by the frost, besides losing nearly all their leaves. If not in a sheltered situation, during the months of May and June, the young leaves get scorched by the hot winds that generally then prevail, although they are nothing compared to those experienced on the plains. For these reasons, it is doubtful if it can ever be cultivated with success in Northern India. They cultivate extensively in Assam a well-marked variety generally known as the hybrid. I have tried to cross *T. Assamica* with *T. Bohea* for the male parent; also *T. Bohea* with *T. Assamica* for the male parent, but never could get a single fruit to set. However, some suspect that the so-called hybrid is only a sport from the original one, with a more compact habit, and broader, thicker leaves. *T. Assamica* is said to be not so well suited for the manufacture of green tea as the China plant; but whether that be a fact or only a supposition, I cannot say. In testing samples of the tea manufactured from the Assam and China plants, weight for weight, the Assam tea surpasses the China both in the strength and colour of the infusion; in flavour, some think that of the China more delicate and agreeable. The out-turn (after infusion) of the Assam plant is much paler and generally more uniform than that of the China; perhaps, from the fact, that in manufacturing it ferments more quickly and regularly than the China does.

Specimen No. 3 is from a plant that differs not less from the Assam than it does from the China plant. From the latter it differs in habit and foliage, also in the flavour of the manufactured tea. I cannot say anything regarding the strength of the infusion or the out-turn, as I have never made an infusion of it. From the Assam plant it differs in habit, foliage, and flower. I have heard it said that it was a hybrid, but on what ground, other than supposition, this assertion was based I could not learn. A Chinaman told me—and I have not the slightest reason for misdoubting his statement, as he was a most shrewd, intelligent, and truthful man—that the plant now spoken of was well known in China, but the leaves were only used for medicinal purposes. In infusion, it was used in cases of venereal disease. The plant now spoken of was, I understand, sent from China by Mr Fortune. It seeds freely, and the seeds germinate well; even in the seedling state it retains its character, and seems perfectly distinct from seedlings of any varieties of the China, also from seedlings of the Assam plant, both the typical and the hybrid, so-called. Seedlings of some of the best marked varieties of the China do not, as a rule, retain the peculiarities of the parent. Some of the most useless varieties in cultivation have occasionally better leaves for tea-making purposes than the parents had; while, again, seedlings from some of the finest varieties for tea-making purposes not unfrequently fall far short of their parents, not in the colour or flavour of the manufactured article—in that I never detected any differences worthy of notice—but in the amount of red leaf and dust. Small thin-leaved varieties always—no matter how careful the manufacturer may be—give a greater amount of inferior tea than thick large-leaved varieties do.

Samples of the teas and dried specimens of the plants were exhibited.

IV. *Notes of a Botanical Excursion to Shetland in* 1868. By Alexander Craig-Christie, Esq.

The author gave an account of the various places he had visited in Shetland, and enumerated the plants he met with. He stated that he has been enabled to add twenty species to the list of plants contained in Edmondston's "Flora of Shetland." The following is the list of plants which were collected between 31st August and 24th September 1868:—

Thalictrum alpinum. Balta Sound, Unst; Rona's Hill, Mainland.
Ranunculus Flammula. Lerwick; Unst; Rona's Hill, &c.
Ranunculus acris. Burrafirth, Unst; &c.
Caltha palustris. Unst; Yell; &c.
Papaver dubium. East side of Unst.
**Nasturtium officinale.* Sand Lodge (Mr Bruce's).
Arabis petræa. Serpentine hills, Balta Sound, Unst.
Cardamine pratensis. Unst; Yell; &c.
Sinapis arvensis. Unst.
Draba incana. Serpentine hills, Balta Sound, Unst.
Cochlearia officinalis. Mousa; Lerwick; Unst.
Capsella Bursa-pastoris. Lerwick; Unst.
Cakile maritima. Burrafirth and east side of Unst; exceedingly large.
Raphanus Raphanistrum. Unst.
**Viola palustris.* Unst; Yell; Rona's Hill.
Viola canina. Burrafirth, Unst.
Viola tricolor. Balta Sound, Saxaford, &c., Unst.
Polygala vulgaris. Balta Sound, &c., Unst; Rona's Hill.
Silene maritima. Mousa; Unst; Yell.
Silene acaulis. On serpentine, Unst; in great quantity. Hunie.
Lychnis Flos-cuculi. Unst.
Lychnis diurna. Halligarth, Unst.
Sagina procumbens. Unst; Yell; &c.
Sagina nodosa. Balta Sound, Unst.
Sagina maritima. East side of Unst.
Honkeneya peploides. Burrafirth, &c., Unst.; Lochend, Mainland.
Arenaria norvegica. On serpentine hills, at the north side of Balta Sound, Unst; in quantity.
Lepigonum sp. (?) South side of Balta Sound, Unst
Spergula arvensis. Lerwick, Lochend, Mainland; Unst; Yell.
Stellaria media. Lerwick; Unst; Yell.
Stellaria uliginosa. Burrafirth, Unst.
Cerastium sp. (?) Millbrae, Unst.
Cerastium glomeratum. East side of Unst; Scalloway, &c.

Cerastium triviale. Lerwick; Unst.
Cerastium semidecandrum. Unst.
Cerastium tetrandrum. Hunie.
Cerastium β Edmondstonii. On serpentine hills, north of Balta Sound, Unst; in quantity.
**Montia fontana.* Scalloway; Yell; Unst.
Hypericum pulchrum. Rona's Hill; Unst.
Linum catharticum. Unst; Scalloway.
Trifolium pratense. Unst.
Trifolium medium. Unst.
Trifolium repens. Unst.
**Lotus corniculatus.* Unst.
Anthyllis Vulneraria. Unst.
Vicia Cracca. East side of Unst; West Sandwick, Yell.
Lathyrus pratensis. Unst.
Lathyrus maritimus β acutifolius. Sands at Burrafirth; in quantity, not in flower.
Spiræa Ulmaria. Belmont, Unst.
Alchemilla alpina. Rona's Hill, Mainland.
**Alchemilla arvensis.* East side of Unst.
Potentilla anserina. Lerwick; Yell; Unst.
Potentilla Tormentilla. Mousa; Rona's Hill; Yell; Unst.
——— *β procumbens.* Hardswick.
Comarum palustre. Unst.
Fragaria vesca. Valafield, Unst.
Rubus saxatilis. Balta Sound, Unst.
Rosa. Burrafirth, Unst.
Pyrus Aucuparia. Rona's Hill, Mainland.
Epilobium palustre. Unst.
**Epilobium alsinifolium.* Rona's Hill.
Hippuris vulgaris. Unst; Mainland.
Sedum Rhodiola. Rona's Hill; Burrafirth, Unst.
Parnassia palustris. Unst.
Hydrocotyle vulgaris. Unst; Yell, &c.
Haloscias scoticum. Burrafirth, Unst.
Angelica sylvestris. Lochend, Mainland; Scalloway, &c., Unst.
Anthriscus sylvestris. Balta Sound, Unst.
Lonicera Periclymenum. Rona's Hill, Scalloway, Mainland; Burrafirth, Unst.
Galium verum. Unst; Yell; Mainland.
Galium saxatile. Unst; Yell; Mainland.
Scabiosa succisa. Unst; Mainland.
Apargia autumnalis. Unst; Mainland.
Sonchus oleraceus. Unst.
Sonchus arvensis. Unst; Yell; Mainland.
Hieracium sp. (?) Rona's Hill.
Carduus lanceolatus. Unst.

Carduus arvensis. Unst; Mainland.
Carduus palustris. Unst; Yell; Mainland.
Bellis perennis. Unst; Yell; Mainland, &c.
Solidago Virgaurea γ cambrica. Unst, &c.
Achillea Ptarmica. Unst; Yell; Mainland.
Achillea Millefolium. Unst; Mainland.
Matricaria inodora. Mousa; Unst.
Artemisia vulgaris. Unst; Mainland.
Tanacetum vulgare. Balta Sound, Burrafirth, Unst.
Gnaphalium uliginosum. Haroldswick, Unst.
**Gnaphalium sylvaticum.* Near the Burn of Sunday Banks, Mainland.
Antennaria dioica. Hills in Unst; and Rona's Hill, Mainland.
Senecio vulgaris. Unst.
Senecio aquaticus. Mousa; Unst; Mainland.
Jasione montana. Unst; Lerwick, and Rona's Hill, Mainland.
Vaccinium Myrtillus. Unst; Rona's Hill.
Vaccinium uliginosum. Saxaford Hill, Unst; Rona's Hill.
**Vaccinium Vitis-Idæa.* Rona's Hill, Mainland.
Arctostaphylos alpina. Rona's Hill; in great quantity.
Arctostaphylos Uva-ursi. Rona's Hill; in great quantity.
Calluna vulgaris. Unst; Yell; Mainland.
Erica Tetralix. Unst; Yell; Mainland.
Erica cinerea. Unst; Yell; Mainland.
Azalea procumbens. Rona's Hill; plentiful.
Gentiana campestris. Unst.
Menyanthes trifoliata. Unst; Mainland.
Lycopsis arvensis. East side of Unst; and near Sand Lodge, Mainland.
Mertensia maritima. Lochend, Mainland.
Myosotis palustris. Unst.
Myosotis versicolor. Unst.
Pedicularis palustris. Yell; Mainland.
Pedicularis sylvatica. Unst; Mainland.
Rhinanthus Crista-galli. Unst; Mainland.
Euphrasia officinalis. Unst; Mainland.
**Euphrasia Odontites.* East side of Unst.
Veronica officinalis. Rona's Hill.
Veronica serpyllifolia. Unst.
**Veronica agrestis.* Unst.
Thymus Serpyllum. Unst.
Prunella vulgaris. Unst; Mainland.
Lamium intermedium. Unst.
Lamium purpureum. Unst.
Galeopsis Tetrahit. Unst; Mainland.
Pinguicula vulgaris. Unst; Mainland.
Anagallis tenella. Near Burrafirth, Unst

Glaux maritima. Yell; Unst.
Armeria maritima. Unst; Yell; Mainland.
Plantago Coronopus. Mousa; Unst; Mainland.
Plantago maritima. Unst; Yell; Mainland.
Plantago lanceolata. Unst; Mainland.
Plantago major. Unst.
Littorella lacustris. Unst.
Suæda maritima. Balta Sound, Unst.
Chenopodium album β viride. East side of Unst.
Salicornia herbacea. Balta Sound, Unst.
Atriplex sp. East side of Unst.
Rumex aquaticus. Unst; Mainland.
**Rumex acetosa.* Unst.
Polygonum amphibium. Lerwick; Unst.
Polygonum aviculare. Unst.
Polygonum Raii. Sands of Burrafirth, Unst.
Empetrum nigrum. Unst; Mainland.
Euphorbia Helioscopia. East side of Unst.
Urtica urens. Unst; Lerwick.
Urtica dioica. Unst.
Salix repens. Unst.
**Salix herbacea.* Saxaford Hill, Unst; Rona's Hill, Mainland.
Alnus glutinosa. Lerwick.
Orchis maculata. Balta Sound, Unst.
Orchis latifolia. Balta Sound, Unst.
Habenaria viridis. Balta Sound, Unst.
Iris Pseud-acorus. Unst; Lerwick.
Scilla verna. Unst; Lerwick; Rona's Hill.
Narthecium ossifragum. Unst; Yell; Mainland.
Juncus conglomeratus. Unst.
**Juncus trifidus.* Near the top of Rona's Hill.
Juncus supinus. Unst.
Juncus squarrosus. Unst; Lerwick.
Juncus bufonius. Unst.
Luzula sylvatica. Hermaness; Sunday Bank.
**Luzula multiflora β congesta.* Hermaness.
**Luzula spicata.* Rona's Hill.
Triglochin palustre. Unst.
**Sparganium ramosum.* Lerwick.
Potamogeton sp. (?) Lerwick.
Zostera marina. Balta Sound, Unst.
**Eleocharis acicularis.* Rona's Hill; Unst.
Eriophorum polystachyon. Unst.
Carex pulicaris. Rona's Hill.
Carex arenaria. Unst.
Carex stellulata. Rona's Hill.
Carex rigida. Rona's Hill.

**Carex flava β lepidocarpa.* Rona's Hill.
Carex binervis. Rona's Hill.
Phalaris arundinacea. Unst; Mainland.
Anthoxanthum odoratum. Unst.
Alopecurus geniculatus. Lerwick; Unst.
Nardus stricta. Rona's Hill.
Phragmites communis. Near Sand Lodge.
Psamma arenaria. Burrafirth, Unst.
Agrostis vulgaris. Unst; Rona's Hill.
Holcus lanatus. Unst.
Aira præcox. Unst.
Triodia decumbens. Unst; Mainland.
Molinia cærulea. Unst; Mainland.
Poa annua. Unst; Lerwick.
Glyceria fluitans. Unst.
Festuca ovina β vivipara. Unst; Mainland.
Triticum junceum. Unst; Yell.
Elymus arenarius. Burrafirth, Unst; West Sandwick, Yell.
Lolium perenne. Lerwick.
Equisetum arvense. Unst.
Equisetum sylvaticum. Sunday Banks.
Equisetum limosum. Lerwick.
Polypodium vulgare. Rona's Hill; Unst.
**Lastrea dilatata.* Unst; Yell; Mainland.
Athyrium Filix-fœmina. Unst; Rona's Hill.
**Asplenium Adiantum-nigrum.* On the serpentine hills, Balta Sound.
Blechnum boreale. Unst; Yell; Mainland.
Pteris aquilina. Unst; Mainland.
Hymenophyllum Wilsoni. Top of Saxaford Hill, and hill at the west side of Burrafirth.
**Lycopodium clavatum.* On the banks of stream near Valafield, Unst; scarce.
Lycopodium alpinum. Rona's Hill.
Lycopodium Selago. Unst; Yell; Mainland.
Lycopodium selaginoides. Unst; Mainland.

Remarks.—As far as my observations go, the Natural Order Compositæ is the most prolific in species. I collected 19. Then follow—Caryophyllaceæ, 17; Gramineæ, 17; Rosaceæ, 10; Cruciferæ, 9; Leguminosæ, 8; Scrophulariaceæ, 8; Juncaceæ, 8; Cyperaceæ, 8; Filices, 7; Ericaceæ, 6; Labiatæ, 5; Plantaginaceæ, 5; Polygonaceæ, 5; Ranunculaceæ, 4; Umbelliferæ, 4; Boraginaceæ, 4; Chenopodiaceæ, 4; Lycopodiaceæ, 4; Violaceæ, 3; Galiaceæ, 3; Vacciniaceæ, 3; Amentiferæ, 3; Orchidaceæ, 3; Equisetaceæ, 3; Onagraceæ, 2; Gentianaceæ, 2; Primulaceæ, 2; Urticaceæ, 2; Papaveraceæ, 1; Polygalaceæ, 1; Portulacaceæ, 1; Hypericaceæ, 1; Linaceæ, 1; Halorageaceæ, 1; Crassulaceæ, 1; Droseraceæ, 1; Caprifoliaceæ, 1; Dipsacaceæ, 1; Campanulaceæ, 1; Lentibulariaceæ, 1; Plumbaginaceæ, 1; Empetraceæ, 1; Euphorbiaceæ, 1; Iridaceæ, 1; Liliaceæ, 1; Juncaginaceæ, 1; Typhaceæ, 1.

The above numbers can only be regarded as an approximation to the truth, as my observations were made in the months of August and September.

The Natural Order Caryophyllaceæ is the most interesting, including the *Arenaria norvegica* and *Cerastium Edmondstonii*, plants found nowhere else in Britain.

About twenty species were found by me which are not given in Edmondston's "Flora." They are marked with a *. Specimens of all the species were exhibited by the author.†

V. *Notice of Plants Naturalised on the Banks of the Gala and Tweed.* By Gilbert C. A. Stuart, Esq.

Many of the plants referred to by the author are new to Scotland, most of them are rare even in England, and not a few of them are evidently entire strangers to Great Britain. Only one or two specimens of some could be found, but many of the others were abundant, and bore all the appearance of having established themselves. Among the plants mentioned in the paper were:—*Camelina sativa, Lepidium ruderale, Saponaria officinalis, Silene anglica, Medicago maculata, M. denticulata, Lythrum hyssopifolium, Polycarpon tetraphyllum, Daucus gummifer, Caucalis daucoides, Erigeron acris, Centaurea solstitialis, Xanthium spinosum, Solanum nigrum, Amaranthus Blitum, Chenopodium murale, Rumex palustris, Cannabis sativa, Setaria viridis, Apera Spica-venta, Polypogon monspeliensis, P. littoralis, Gastridium lendigerum, Festuca uniglumis*, and *Hordeum pratense.* Mr Stuart exhibited specimens of the above-named plants, and of about thirty other species which he has not yet fully examined. He considers that the plants must have been introduced by the wool brought to the manufactories in the district.

† For further remarks on the flora of Shetland, see page 255.

VI. *On some British Plantagines allied to* Plantago maritima, *L.* By Dr Buchanan White.

Most of the books that have appeared from time to time upon the Flora of the British Isles agree in stating that of all the various European Plantagines allied to *Plantago maritima,* L., one only is a native of Britain. Professor Babington, however, in the last edition of his "Manual," suggests a possibility that the mountain form (or what is considered as such) of *P. maritima,* L., may be probably a distinct species, and referable to *P. serpentina,* Vill.

My attention being called to this genus by the occurrence of a *Plantago* in great abundance in the interior of Ross-shire, I applied to Professor Balfour for the loan of a specimen of *Plantago serpentina,* Vill., for comparison, and he, with his usual kindness, obligingly forwarded to me for examination the whole of the dried specimens of Plantagines belonging to the *maritima* group, contained in the University Herbarium.

After a careful examination of these, I think I am justified in stating that, instead of having *P. maritima* as the only British representative of the group, we have altogether three species in Britain—*Plantago alpina,* L., *P. maritima,* L., and *P. serpentina,* Vill. Whether, however, the last two should not be considered as merely forms of one variable species, is still, I think, an open question.

The *Plantago serpentina* of Villars must not be confounded with the *P. serpentina* of Lamarck, which is a totally distinct and well-marked species (=*P. carinata,* Schrad.)

Full descriptions (and synonymy) of the three species will be found in the "Flore de France" of Grenier and Godron; but for the convenience of those botanists who do not possess that book, the following is an attempt at a slight sketch of the distinctive characters:—

A. Leaves herbaceous; lateral nervures nearer to the margin of the leaf than to the midrib, *P. alpina.*

B. Leaves coriaceous; nervures of the leaf equidistant.

1. Leaves plane; bracts as long as or longer than calyx, ... *P. serpentina.*
2. Leaves channeled; bracts scarcely as long as calyx, ... *P. maritima.*

P. alpina, L.—Leaves linear-lanceolate or linear, entire or subdentate, 3-nerved (1 to 3 nerved, Koch Syn.), the lateral nervures nearer to the margin than to the median nervure, plane, herbaceous, glabrous or pubescent; spike oblong-cylindrical, dense; bracts ovate-acuminate, as long as the calyx.

♃. July–August—Alpine pastures. Ben Voirloch, Dumbartonshire. Professor Balfour, July 1846.

Distinguished by its leaves, which are of a soft herbaceous texture, and by the position of the nervures, as well as by the shape and length of the flower-spikes and of the bracts.

P. serpentina, Vill.—Leaves linear-lanceolate or linear, entire, or often furnished with a few small teeth, 3-nerved, nervures equidistant, plane, coriaceous, pubescent or glabrous; spike linear elongate-cylindrical, dense; bracts ovate-acuminate or lanceolate, as long as or longer than the calyx.

♃. June–October—Grassy alpine or subalpine pastures. Perthshire, Forfarshire, Banffshire, Ross-shire, &c.

Closely approaches the next species, but may be distinguished by its plane, unchanneled leaves, and by its longer and more lanceolate bracts. "Bractèes saillant avant l'anthése," Grenier and Godron. Professor Babington thinks ("Manual," p. 282) that the capsule is different in shape from that of *P. maritima*, but my data (which, however, are not extensive) do not tend to confirm this.

P. maritima, L.—Leaves linear or lanceolate-linear, entire or dentate, glabrous or pubescent, coriaceous, channeled, 3-nerved nervures equidistant; spike linear, elongate-cylindrical, dense; bracts ovate-mucronate or shortly acuminate, scarcely as long as the calyx.

♃. June–October—Beside the sea, more rarely on the mountains.

May be distinguished from the last by its channeled leaves, and shorter, generally broadly, ovate bracts. "Bractèes non-saillant avant l'anthése," Grenier and Godron.

There appears to be a variety of opinions among botanists regarding the shape and size of the bracts in this species. Babington says that they are "ovate-mucronate;" Hooker and Arnott, "ovate-acuminate;" Irvine, "ovate;" Koch, "ovatis acutiusculis;" Grenier and Godron, "lanceolèes."

My own idea is that all these opinions are more or less correct; the most usual form perhaps being "ovate, shortly acuminate."

In conclusion, I may remark that specimens of Plantagines of the maritima group found growing on the mountains must not *therefore* be considered necessarily *P. alpina* or *P. serpentina,* because *P. maritima* seems also to occur (though rarely) on the mountains. It would be likely, however, that the plant of the high mountains would be *P. alpina;* that of the country bordering on the mountains, *P. serpentina;* and that of the sea-coast and banks of tidal rivers, *P. maritima.*

VII. *Notice of some new and rare British Mosses.* By Mr John Sadler.

The first species referred to was *Grimmia anodon,* discovered for the first time in Britain on Arthur's Seat, in March last, by Mr William Bell. 2d, *Didymodon luridus,* which had been gathered by James Fernie in March, and Mr William Bell in April, in the neighbourhood of Edinburgh. 3d, *Pottia minutula,* found in considerable quantity in the Queen's Park, near the powder magazine. Specimens were presented to the Herbarium.

VIII. *Report on the Open-Air Vegetation in the Royal Botanic Garden.* By Mr N'Nab.

Since the last meeting of the Botanical Society, March 11th, vegetation has been very much retarded by the prevalence of low night temperatures; on fourteen mornings only was the thermometer seen above the freezing point at six A.M. The lowest markings were on the mornings of the 13th, 15th, 17th, 18th, 23d, 27th, and 31st, when the readings were respectively 29°, 26°, 28°, 26°, 29°, 28°, and 25°. The highest early morning temperature was 43° on the 5th April.

Arboreous vegetation, which advanced rapidly during the month of February, has made comparatively little progress since that time, and is considerably behind what was reported last year. Notwithstanding the dry cold season, herbaceous plants are flowering much about the same dates as last year, which may be accounted for by the forward state of the plants, owing to the mildness of the month of February.

The following table exhausts my usual list of annuals:—

March 16.	Narcissus moschatus.	April 1.	Carex montana, Pulmonaria virginica, and Menziesia empetriformis.
18.	Corydalis bulbosa rubra and Adonis vernalis.	2.	Epimedium rubrum, Saxifraga virginica, and Ornithogalum montanum.
24.	Fritillaria imperialis.	3.	Primula ciliata purpurata and Anemone nemorosa.
25.	Muscari racemosum.	4.	Menziesia cœrulea.
27.	Narcissus Pseudo-narcissus.	6.	Pulsatilla vernalis.
28.	Tritelia uniflora and Corydalis tuberosa alba.		
29.	Narcissus bicolor.		
30.	Ornithogalum exscapum.		

IX. *Miscellaneous Communications.*

1. Miss Walker, Drumsheugh, exhibited a plant of *Rhododendron arboreum*, about a foot high, and in full flower.

2. Mr Anderson-Henry exhibited some hybrid primulas, with leafy calyxes; also a small plant of *Abies Numidica*, and flowering twigs of *Cupressus Lawsoniana, C. fragrans*, and *Retinospora obtusa*.

3. Mr Adam Mathieson presented a fasciated branch of Scotch fir, and a microscopical section of wood of ash.

13*th May* 1869.—ISAAC ANDERSON-HENRY, Esq., Vice-President, in the Chair.

Donations to the Library, Herbarium, and Museum were announced.

The following Communications were read:—

I. *On the Geographical Distribution of the* Coniferæ *and* Gnetaceæ. By ROBERT BROWN, F.R.G.S., &c.

It must be at once patent to any one who has studied the laws regulating the distribution of plants and animals over the globe, that if we expect to arrive at anything like sound generalisations, we must consider the geographical and hypsometrical distribution of faunas and floras, not as a whole, but as divided into classes, orders, and even smaller groups. All plants and animals do not live under the same conditions of existence; hence what may limit or extend the range of one group may have a contrary effect on another, or even none at all. Hence we have the results of zoologists given regarding the distribution of limited groups of the animal kingdom—such as Murray on the mammalia,* Gunther on reptiles,† Sclater on birds,‡ and, in a more specialised group, Finsch on the parrots.§ For some time past I have been engaged in the task of attempting to arrange the species of the great and important order of the *Coniferæ* (including *Gnetaceæ*), under certain natural geographical areas, and to ascertain the physical or other causes which have gone to produce this peculiar distribution. This work is not yet concluded, though already the facts collected are of such extent that to give them in detail would far exceed the limits of this paper. In, therefore, briefly sketching the general results to which my investigations have tended, it must be premised that these are merely the abstract of a wide subject, to which I may return at another period.

* Geographical Distribution of Mammals, 1856.

† Proceedings of the Zoological Society of London, 1858.

‡ Journal of the Linnean Society—Zoology, vol. ii.

§ Petermann's Geographische Mittheilungen, 1867.

In the study of the geographical distribution of the coniferæ we are met at the very outset by several difficulties. First, there is the almost impossibility of arriving, in many cases, at the precise localities and habitats of the species, these being too often very vaguely given. Such loose localisation of a species as "North-West America," "Oregon," "California," "Himalayas," "India," "China," and so on, as will be afterwards seen, is worse than useless, as these countries possess several floras widely distinct from each other, and are all very extensive areas. In the second place, there is the difficulty of distinguishing species—a difficulty, I regret to say, rather increased by the publication of every new monograph or revision of the order—each author being apparently intent on cancelling certain species, while in their place he erects others equally dubious. Thus the mere name of a species conveys little meaning to the physical geographer, if he is not at the same time familiar with its affinities to other allied species. He may mark out two areas distinguished by the prevalences of certain nominal species—to all appearance as widely distinct as *Pinus sylvestris* and *Pinus Sabiniana,* while in reality these are so closely allied as to be separated from each other with dubious propriety. Therefore, instead of characterising a distinct phyto-geographical area, they in truth lead to an idea that they are mere "geographical species," derived by the influence of physical causes operating, or which have operated, in the region in which they are found, from the parent species found in the adjoining district. Lastly, there are immense tracts of country, such as Persia, Turkey in Asia, Thibet, and North China, which have been little, if at all, botanically explored, or the species of coniferæ found in these countries are very vaguely known as to localities, heights, and distribution within their own area. Studying the coniferæ in reference to their geographical distribution, I have distinguished great tracts, characterised by a number of species, the majority of which are peculiar to it, as a *Province.* These "provinces" are composed of minor subdivisions, marked by the presence of certain trees not found in the neighbouring subdivisions. These I have called *Regions,* which are again divided into *districts,* distinguished by the prevalence within their borders of some particular tree.

In other words, that tree (or shrub) attains its maximum of development there. In several instances only the "province" can be indicated; in only a few instances do we know the peculiar local distribution sufficiently well to characterise the "district."

For the sake of uniformity, I have in general adopted the nomenclature of Parlatore, in his synopsis of the order in the sixteenth volume of De Candolle's "Prodromus,"* supplying such species as he has omitted in apparent ignorance of their having been described, or altering the generic or specific name when I have felt myself at liberty to differ with the synonymy of this otherwise able and distinguished monographer.

Within the limits of the American continent we find a group of coniferæ exclusively confined to this quarter of the world—with the exception of one or two species which are common to the western shores of America and the eastern shores of the Asiatic continent. The northern limit of trees on the American continent corresponds tolerably well with the annual isotherm of 17°·5 Fahr., the July isothermal of 50° Fahr., and the isocheimenal line of 15° Fahr. The northern termination of forest differs on the two sides of the continent. On the eastern or Atlantic side of America no forests are found above the River Egg, in 60° N. latitude, while on the western or Pacific side they extend as far as latitude 66° 44′, the climate of that coast being much milder than the other. Kotzebue Sound is the furthest northwestern American limit of conifers. North of this, we have the treeless or Eskimo Province, which differs but little in species from one side of the continent to the other. It may be remarked that, as we ascend further to the northward, the uniformity of the geographical distribution of the species is more marked, and that as we go southward the species get more divided into local floras. Dr Hooker has, however, with characteristic perspicuity, divided this Eskimo Province into a number of sub-regions.† South of this the true arboreal tracts of America commence. As far as the country to the east of the Rocky Mountains is concerned, I have for the

* Pp. 345–524. Paris, 1868.

† Transactions of the Linnean Society, vol. xxiii. (1862), p. 251.

most part adopted the divisions assigned by Dr Cooper, my study having tended to conclusions almost identical with his. To his admirable memoir I refer for other details.*

I. The Lacustrian Province comprehends the country surrounding the great lakes, south of the Eskimo Province. It may be divided into—

A. *The Alonquin Region,* bounded southward by a line drawn from Newfoundland to Lake Superior, thence northerly to Hudson's Bay.

Characteristic species:—

Thuja occidentalis, *L.*	Taxus canadensis, *L.*, &c.

B. *The Athabascan Region.*—This is circumscribed by a line drawn from thence to the Rocky Mountains, the southern boundary line keeping more northward as it runs west.

Characteristic species:—

Pinus Banksiana, *Lamb.*	Larix pendula, *Soland.*
Picea balsamea, *Linn.*	Abies alba, *Ait.*
Abies nigra, *Ait.*	

As I shall afterwards show, in all likelihood this region extends right across the Rocky Mountains to the Pacific, where it is distinguished by the presence of *Abies alba* var. *arctica,* Parl. (*Abies arctica,* Murr.), and that the Aliaskan range of mountains running down the peninsula of Aliaska, is the southern boundary of this region. South of that range commences the true Pacific flora.

C. *The Canadian Region* lies south of this, but is not so well marked, as the valleys have the flora of one region and the mountains another.

Characteristic species:—

Pinus Strobus, *L.*	P. resinosa, *Soland.*
Abies canadensis, *Linn.*	

II. The Appalachian Province comprises the following regions:—

A. *The Alleghany Region,* bounded by a line drawn south of Nova Scotia down into Georgia, and again sweeping nearly straight northward, ending near New York. The area circumscribed comprehends one region.

* Smithsonian Report, 1858, p. 246, and 1860, p. 438.

Characteristic species :—

Pinus inops, *Ait.*	Picea Fraseri, *Pursh.*
P. pungens, *Michx.*	Juniperus virginiana, *Linn.*
P. rigida, *Mill.*	

To the west and south the line is not well marked, but in the south-east the line between it and the next region is the metamorphic rocks of the hills, those of later date corresponding to the change in soil characteristic of the sandy flat country.

B. *Carolinian Region,* is well marked. The western boundary line runs through New Jersey, Pennsylvania, Maryland, East Virginia, the two Carolinas, Georgia, and cuts off the peninsula of Florida. The southern limit is not yet fixed, as we are sufficiently ignorant of the natural history of Florida as to render the geographical distribution of its coniferæ still a problem.

Characteristic species :—

Pinus serotina, *Michx.*	Chamæcyparis sphæroides, *Spach.*

This last species marks the "cedar swamps," so characteristic of some portions of this region. The other regions may be tolerably well marked by the boundaries of the State, the names of which they bear :—C. *Tennessee,* D. *Ohio,* and E. *Mississippi,* distinguished by the presence of *Taxodium distichum,* Rich.; *Pinus mitis,* Michx.; *P. Tæda,* Linn., &c.

III. The Campestrian Province comprises the great prairies of—A. *Texas,* B. *Illinois,* C. *Saskatchewan,* D. *Dacotah,* and E. *The Comanche Indian Country.* It is distinguished by an almost entire absence of trees, forest being only found round its borders ; but, as it has a group of plants and animals almost peculiar to itself, it deserves the prominence of being marked off as a special region. The abrupt termination of the mountain region to the westward, and the forest to the east, make an entire change in the phytogeography. These prairies seem to be due to the want of moisture sufficient for tree growth, though their distance from the rain-laden sea-breeze does not prevent their acquiring sufficient for the purposes of agriculture.

IV. The Caurine Province.—This comprehends all the region to the west of the Rocky Mountains north of 33°

N. latitude, and contains a group of coniferæ almost peculiar to it. It is so broken up by mountains, and with so many different climates, that it contains more distinct regions and districts than any other portion of America. The Cascade range of mountains, which also, under the name of Sierra Nevadas, runs longitudinally through North-West America, divides the country into two great regions—the one to the west of the range (A), and the other to the east of it (B). The region to the west of the Cascade is a moist, forest-clothed country; while the moist breezes of the Pacific, being intercepted by the mountains, the eastern side of the Cascade, and on to the Rocky Mountains, except where local circumstances bring about a few exceptions, is very dry, and, in some cases, even a desert—thinly scattered with, or wholly wanting in trees. Accordingly, both great regions are distinguished by peculiar faunas and floras. First, then, the region to the west of the Cascade is divided into various districts, distinguished by the predominance of some particular species of conifer. I have reasons to fix the commencement of the true Pacific flora south of the peninsula of Aliaska, the species found north of that belonging to the flora of the eastern side of the Rocky Mountains—in all probability, to the Athabascan Region of the Lacustrian Province. In most maps, the Rocky Mountain range is prolonged in a straight line corresponding to the general trend of these mountains to the Northern Ocean. Mr W. H. Dall, of the late Collins' Overland Telegraph Expeditions, has pointed out that this is an error. About lat. 64° N., the Rocky Mountains trend to the westward, and meet the coast range (a lower range lying between the Cascades and the Pacific) in a confined high rolling country, the distinctive characteristics of both ranges being lost. These mountains, however, soon appear to merge into one high volcanic range, trending to the westward, and afterwards to the southward, and forming the backbone of the peninsula of Aliaska. A gap occurs to the northward, between the Mackenzie and Porcupine Rivers, filled with low rolling hills. Along the shores of the Northern Ocean, from the mouth of the Mackenzie westward, a separate range exists, following the trend of the shore, nearly parallel with the southern volcanic range, and terminating in a few high peaks near the mouth of the Colville River. This range has long been marked as the Romanzoff Mountains, being a landmark for whalers who pass Point Barrow. For the southern volcanic range, Mr Dall proposes the name of the Aliaskan Mountains. The gap before mentioned leads to unexpected faunal differences. The west coast fauna is bounded on the north by the Aliaskan Mountains, while the valley of the Youkon possesses a northern and eastern fauna. Birds like *Colaptes auratus*, *Ampelis garrulus*, &c., abound, the western or midland faunal types of *Colaptes* (*hybridus* or *mexicanus*) being wanting.* South of this is a district (1.) which, from the name of the Indians who, under various tribal names, inhabit it, may be called the *Kalosh District*, distinguished by forests of *Thujopsis borealis*, Carr., and the absence of various species which make their appearance subsequently. The next district (2.) begins with the forests of *Abies Douglasii*, Lindl., in 54° N. lat., and extends to about 43° N. lat. From the prevalence of the Douglas fir, it may be called the *Douglasian District*. In addition to this species, the most characteristic trees are *Abies Mertensiana*, Lindl.; *Picea amabilis*, Dougl.; *P. grandis*, Dougl.; *Abies Menziesii*, Dougl.; *Thuja gigantea*, Nutt.; *Juniperus Henryana*, R. Br. min. &c. (3.) *The Umpqua District*, from 43° to about 42° N. lat., distinguished by the forests of *Cupressus fragrans*, Kell. Here *Libocedrus decurrens*, Torr., first begins to make its appearance on the mountains. (4.) *The Sequoian District* begins with the forests of *Sequoia sempervirens*, in 42° N., confined to the western slope of the coast range. This inferior range hitherto has not interfered with the distribution of species. However, in this latitude, it possesses a flora peculiar to its own sides, and divides California into two districts—1*st*, that which we have already spoken of (the Sequoian); and 2*d*, the one between the Coast range and the Cascades. (5.) The *Sequoian District* possesses as characteristic species, in addition to *Sequoia sempervirens*, *Pinus insignis*, Dougl.; *Pinus muricata*, Dougl.; *P. tuberculata*, Don; *P. Coulteri*, Don; *Picea bracteata*, Don; *Torreya californica*, Hook.; *Cupressus MacNabiana*, Murr.; *C. macrocarpa*,

* Proceedings of the Boston Natural History Society, vol. xii. Nov. 4, 1868, p. 144; and in "Die Telegraphen—Expeditionen auf dem Jukon in Alaska," in Petermann's "Geographische Mittheilungen," 1869, p. 361, tafel 19.

Benth., &c.; while the second district is marked by the presence of *Pinus Sabiniana*, Dougl.; *P. Lambertiana*, Dougl. *P. Balfouriana*, Oreg Com.; *Cupressus Lawsoniana*, Murr.; and *Sequoia* (*Wellingtonia*) *gigantea*, Lindl. The region east of the Cascade may be divided into two—1. A *Northern* or *Youkon District*, very little known, scattered thinly with *Pinus contorta*, Dougl., and *P. ponderosa*, Dougl. 2. A *Kootanie District*, commencing near Fraser River. Here, through the Columbia gap in the Cascades, the moist breezes penetrate, and we have forest clothing the hills almost to the water's edge. Its southern termination may be said to be when the moist influence of these breezes ceases. 3. The *Shoshonne District* comprehends all the desert arid tracks between the Cascades and the Rocky Mountains. In all likelihood, it is divisible into several districts; but we are as yet too ignorant of the botanical features of a great portion of it to decide this with any certainty. It is better, therefore, to allow it to remain as I have given it. One of the most characteristic conifers in it is *Juniperus occidentalis*, Dougl. *Pinus ponderosa* and *P. contorta*, covering dry, arid tracts, without underbrush, are the other most characteristic, though not peculiar, trees. It comprehends Cooper's *Wasatch* and *Padonean Regions*.

C. *The Colorado Desert* region (equivalent to Cooper's *Nevadian*, which name is apt to confound this with the flora of the Sierra Nevadas, with which it has nothing in common). It comprehends the Colorado desert, Lower California, and Arizona. There are few coniferæ in it—its characteristic trees and shrubs being species of *Populus*, *Yucca*, *Fremontia*, *Strombocarpa pubescens*, *Algaroba glandulosa*, *Cereus giganteus*, *C. Thurberi*, and other Cacteæ, &c.

D. The last region in North West-America is the *Montane*. On the mountain ranges throughout the province, no matter in what latitude, after an average height of 4000 feet is reached—the height varying with latitude—a group of pines are found nowhere else. These are *Pinus flexilis*, James; *P. cembroides*, Zucc.; *P. monophylla* (*Fremontiana*), Torr.; *Abies Pattoniana*, Jeff.; *Larix Lyallii*, Parl.; *L. occidentalis*, Nutt., &c. There is also a fauna peculiar to the same elevation, as well as an extensive alpine herbaccous flora, many species of which are also found through the Arctic regions.*

V. The Mexican Province may be divided into three regions.

A. *The New Mexican*, comprising the region of which the state of that name is the centre.

Characteristic species:—

Pinus Greggii, *Engl.*
Abies Engelmanni, *Parry.*
Pinus edulis, *Engl.*
Picea concolor, *Engl.*

B. *The Aztec or Mexican Region proper.*

Characteristic species:—

Pinus Teocote, *Ch.* and *Sch.*
patula, *Schred.* and *Deppe.*
Chihuahuana, *Engl.*
Montezumæ, *Lamb.*
β. macrophylla, *Lindl.*
Lindleyana, *Gordon.*
Hartwegii, *Lindl.*
leiophylla, *Schiede* et *Deppe.*
oocarpa, *Scheede.*
Pinus pseudo-Strobus, *Lindl.*
ayachuite, *E. Ehr.*
Taxodum mucronatum, *Ten.*
Cupressus Lindleyi, *Klotsch.*
thurifera, *Humb.*
Juniperus mexicana, *Schiede.*
tetragona, *Schlecht.*
flaccida, *Schlecht.*
Taxus globosa, *Schlecht.*

C. *The Guatemalan Region.*—Southern Mexico and Northern Central America.

Characteristic species:—

Pinus filifolia, *Lindl.*
tenuifolia, *Humb.*
Picea religiosa, *Benth.*
Cupressus Benthami, *Endl.* (which is, however, also got further north.)

VI. Tropical American or Columbian Province.—The higher ranges of mountains of equatorial America produce the following characteristic species:—

Podocarpus silicifolia, *Klotsch.*
P. Sprucei, *Parl.*
P. macrostachya, *Parl.*
P. taxifolia, *Kunth.* (Also in Peru.)

* These phyto-geographical regions will be fully described in the author's separate work on the Phyto-geography and Forest Trees of North-West America, now in preparation. Those to the northward have been already to some extent described in various papers in the Transactions of this and the Royal Geographical Society, in my memoir *Das Innere der Vancouver Insel* (Petermann's Geogr. Mitt. 1869, heft i.–iii. tafel i.), in various papers in Cassell's "Illustrated Travels," and *Vancouver Island Explorations* (Victoria, V. I., 1865).

VII. Brazilian Province.—The Brazilian Andes and the mountains in the vicinity of the upper reaches of the Amazons.

Characteristic species:—

Gnetum paniculatum, *Spruce.*
Leyboldi, *Tul.*
amazonicum, *Tul.*
thoa, *R. Br.* (English Guiana.)
nodiflorum, *Brong.* (French Guiana.)
venosum, *Spr.* et *Benth.*
macrostachyum, *Spr.* et *Benth.*

Ephedra humilis, *Wedd.* (Bolivia.)
Tweediana, *Fisch.* et *Mey.* (Buenos Ayres.)
americana, *Humb.* (Buenos Ayres.)
triandra, *Tul.*
Araucaria braziliensis, *A. Rich.*
Podocarpus Sellowii, *Klotzch.*

VII. Chilian Province, comprising Peru, Chili, and Patagonia. It is divisible into—

A. *The Araucarian Region*—Chili and Peru.

Characteristic species:—

*Ephedra andina, *Pöppig.*
Araucaria imbricata, *Pav.*
chilensis, *Endl.*

Lepidothamnus Fonki, *Phil.*
*Podocarpus oleifolia, *Don.*
* chilina, *Rich.*

B. *The Magellanic Region,* comprising Patagonia.

Characteristic species:—

†Fitzroya patagonica, *Hook. fil.*
Saxe-Gothæa conspicua, *Lindl.*

†Podocarpus nubigena, *Lindl.*
† andina, *Pöppig.*

These regions, more especially the *Magellanic,* have some connection with the Australasian in the nature of the genera, and indeed (in herbaceous species) with species too.

VIII. The Antilles Province.—The West Indies and Florida.

Characteristic species:—

Pinus cubensis, *Griseb.* (Cuba.)
occidentalis, *Swartz.* (San Domingo, Cuba.)
Juniperus bermudiana, *Linn.* (Bermuda and Florida.)

Torreya taxifolia, *Arn.* (Florida.)
Podocarpus coriacea, *Rich.* (Jamaica and Montseratt.)
P. Purdieana, *Hook.* (Jamaica.)
aristulata, *Parl.* (Cuba.)

* Those marked * are common to Peru and Chili. The others are, as far as we yet know, peculiar to Chili.

† Those marked † are common to Chili and Patagonia.

It thus seems as if this province could be divided into at least two regions—A. *The Floridan,* and B. *The West Indian.* The species are, however, so few in number, as scarcely to admit of such generalisations being indulged in. Notwithstanding the proximity of these islands to Central America, and their similarity of climate, the two countries do not possess a single species in common.

IX. Japanese Province.—Asia, near Behring Straits, is closely connected with the opposite American shores, and, accordingly, we need not be surprised to find that some species of coniferæ are common to both sides. The Asiatic islands included in the Japanese Archipelago, and the greater portion of the peninsula of Kamschatka, are, however, sufficiently distinct in species to merit being divided off into a separate province. The connection of the Japanese and the North-West American floras has been pointed out by various observers, and the similarity of the zoology of the two provinces has been also remarked.* That these islands, the opposite Asiatic and American coasts, were originally part of one continent, there can, I imagine, be but little doubt. The Japanese province resolves itself into two very natural and extensive regions. These are—

A. *The Cipangian*† *Region,* comprising all the Japanese islands north-west to the Kuriles.

Characteristic species :—

Pinus densiflora, *Sieb.* et *Zucc.*	Abies obovata, *Ant.* (Kuriles only).
Thunbergii, *Parl.*	aragagi, *Sieb.*
parviflora, *Sieb.* et *Zucc.*	Picea brachyphylla, *Parl.*
Larix leptolepis, *Endl.*	firma, *Ant.*
Abies Alcoquiana, *Veitch.*	selenolepis, *Parl.*‡

* Spence Bates, in Lord's "Naturalist in British Columbia," vol. ii. &c.; *vide* also Asa Gray on the Flora of Japan, in Mem. American Acad. of Arts and Sciences, vol. vi. n. s.; and Miquel, in the Transactions of the Royal Academy of Sciences of Amsterdam, 1866; and in the Archives Neerlandaises, 1867.

† The old voyagers, in search of a North-West Passage, used to speak much of the land of *Cathay* (China) and *Cipango* (Japan), which they hoped to reach. The phrases have now become classical.

‡ *Picea Veitchii,* Lindl., changed by Parlatore to the present name, on account of Roezl having already applied Mr Veitch's name to a Mexican species of *Pinus.*

Sciadopytis verticillata, *Sieb.* et *Zucc.*
Thujopsis dolabrata, *Sieb.* et *Zucc.*
Chamæcyparis pisifera, *Sieb.* et *Zucc.*
C. obtusa, *Sieb.* et *Zucc.*
C. squarrosa, *Sieb.* et *Zucc.*
Juniperus rigida, *Sieb.* et *Zucc.*
Juniperus conferta, *Parl.*
Taxus tardiva, *Laws.*
Cephalotaxus pedunculata, *Sieb.* et *Zucc.*
C. drupacea, *Sieb.* et *Zucc.*
Torreya nucifera, *Sieb.* et *Zucc.*
Podocarpus nagela, *R. Br.*
Podocarpus macrophylla, *Don.*

B. *The Kamschatkan Region*, comprising a part of the Amur River Region near the coast, and all Kamschatka, cut off by a range stretching down from the Arctic Sea and joining the Altaic Range, which again limits the southern range of the Siberian flora.

Characteristic species:—

Pinus Cembra, *Linn.*, *var.* pumila.

(This is also found at Kotzebue Sound. I am, however, inclined to believe it a member of the Athabascan American flora (*ut antea*) common to the Asiatic coast, rather than belonging to the flora under question.)

Pinus koraiensis, *Sieb.* and *Zucc.* (Japan, Kamschatka, and Corea).
Abies polita, *Ant.* (Japan & Corea).
Picea holophylla, *Parl.*
Abies Menziesii, *Dougl.*

(The last mentioned is one of the most remarkable members of the characteristic North-West American flora, which stretches down to the Kurile Islands in stragglers. It has also been found in Eastern Siberia and Japan.)

Many of the Japanese coniferæ, though nominally distinct, are closely allied to the North-West American species, as has been well shown by Mr Murray in his well-known work on the Japanese Coniferæ.*

X. Cathayan Province.—China, south of the Altai Mountains, seems to have some coniferæ peculiar to it, but we know too little of the flora of China, more especially of the northern portion, to map out its phyto-geography with any approach to precision. It appears, however, that the Corean flora is more allied to the Japanese than to the

* Proceedings of the Royal Horticultural Society, 1862.

Chinese, and that the coniferæ, at least of Cochin-China, are members of the Indian province.

Characteristic species:—

Pinus Massoniana, *Lamb.*
Larix Kæmpferi, *Lamb.*
Abies Fortunei, *Parl.*
Cunninghamia sinensis, *R. Br.*
Cryptomeria japonica, *Don.*

(Also Japan, but probably introduced, as several of the Japanese ornamental plants appear to have been, from China.)

Glyptostrobus heterophyllus, *Endl.*
Juniperus taxifolia, *H. & A.*
sphærica, *Lindl.*
Cephalotaxus Fortunei, *Hook.*
Torreya grandis, *Fortune.*
Gingko biloba, *Linn.*
Podocarpus chinensis, *Wall.*

XI. Indian Province, comprehending the species of coniferæ belonging to the warmer portion of India and Cochin-China, &c., distinct from those found on the higher reaches of the Himalayas. It is nearly connected with the Indo-Malayan Province, to be presently described.

Characteristic species:—

Pinus longifolia, *Roxb.*
Podocarpus latifolia, *Wall., &c.*

Limited as are the number of species, they are, though not all *peculiar* to this province, yet so *characteristic* of it, as to justify us in dividing it into a separate province.

XII. Indo-Malayan Province.—Some years ago Mr Alfred Wallace showed in a paper, which is now becoming almost classical,* and more recently in his work on the "Malay Archipelago,"† that the fauna of the islands of the Malay Archipelago might be divided into two distinct faunas—the one of the islands nearest the Indian continent partaking of the characteristics of the fauna of India—hence the name he applied to it. The other was of the peculiar Australian character, he therefore designated it the *Austro-Malayan*. He does not seem to have claimed for this division the merit of also holding good with regard to the floras; but if his grand generalisation is sound, one

* Journal of the Royal Geographical Society, vol. xxxiii. (1863), p. 217.
† London, 1869.

would think that this would also hold true. In studying the coniferæ of the Malay Archipelago, I have found that the species resolve themselves into two groups on either side of "Wallace's Line,"—the only exceptions being so doubtful that they almost confirm the law,—I have therefore kept up his name, though I ought to remark, as far as we yet know, only two of the coniferæ of the Malay Archipelago have been found in India, and not one in Australia.

Characteristic species (of Indo-Malayan Province):—*

Gnetum Griffithsii, *Parl.*
  neglectum, *Blume.*
  β microcarpum, *Blume.*
  scandens, *Roxb.* (also in Sikkim.)
  funiculare, *Blume.*
Dammara Motleyi, *Becc.*
Pinus Merkusii, *Jungh. et de Vriese.*
†Dacrydium elatum, *Wall.*
  Beccarii, *Parl.*
Phyllocladus hypophylla, *Hook. fil.*
Cephalotaxus sumatrana, *Miq.*
Podocarpus Blumei, *Endl.*
  Beccarii, *Parl.*
  falciformis.
  polystachya, *R. Br.*
  †leptostachya, *Blume.*
  Rumphii, *Blume.*
  Teysmanni, *Mig.*
  amara, *Blume.*
  neglecta, *Blume.*
  cupressina, *R. Br.*
  Cummingii, *Parl.*

XIII. Austro-Malayan Province.—The species in this province are fewer than in the former, possibly for the reason that the botany of the islands nearer India has been more closely studied than the others. They are as follows:—

Characteristic species:—

Gnetum latifolium, *Blume.*
Dammara alba, *Rumph.*
Podocarpus bracteata, *Blume.*

XIV. The Australasian Province.—Australia and the neighbouring islands have, as has been long familiar to all physical geographers, a peculiar flora as well as fauna. This flora is of a mass so peculiar as to constitute a very natural and great phyto-geographical region, though in

* De Boer: Conif. Arch. Ind. (teste Parlatore, *lib. cit.*)

† Those marked with a dagger † are species common to both sides of the line.

reality it contains various subordinate floras, each region being in importance almost equivalent to the provinces in other parts of the world. For the present, however, we must consider them merely as regions of the great Australasian province. They are as follows:—

A. *The Polynesian Region*, comprising the Fiji Islands. It has but two species peculiar to the islands, as well as characteristic of them, viz.:—

Dammara macrophylla, *Lindl.*
Dammara vitiensis, *Seem.*

B. *Eastern Australia and the Northern Part of New South Wales.*

Araucaria Bidwilli, *Hook.*
Eutacta Cunninghami, *Ait.*
Dammara robusta, *C. Moore.*
Frenela Maclayana, *Ferd. Mull.*
  Parlatorei, *Ferd. Mull.*
  rhomboidea, *Endl.* (also in Tasmania and islands lying between it and New South Wales.)
  Moorii, *Parl.*
Frenela Endlicheri, *Parl.*
  Muelleri, *Parl.*
  Fremantlei, *F. Mull.*
  verrucosa, *All. Cunn.*
Podocarpus spinulosa, *R. Br.*
  elata, *R. Br.*
  ensifolia, *R. Br.*
  alpina, *R. Br.* (also in Tasmania.)

C. *Southern Part of New South Wales, South Australia, and Victoria.*

Actinostrobus pyramidalis, *Mig.*
  acuminatus, *Parl.*
Frenela subcordata, *Parl.*
  canescens, *Parl.*
  Drummondii, *Parl.*
Frenela Roei, *Endl.*
  Gulielmi, *Parl.*
  robusta, *All. Cunn.*
Podocarpus Drouyniana, *Ferd. Mull.*

D. *Tasmania.*

Arthrotaxus cupressoides, *Don.*
  taxifolia, *Hook.*
  selaginoides, *Don.*
Frenela Gunnii, *Endl.*
Diselma Archeri, *Hook. fil.*
Dacrydium Franklinii, *Hook. fil.* (also at Port Macquarrie.)
Dacrydium tetragonum, *Hook.*
Pherosphæra Hookeriana, *Archr.*
Phyllocladus rhomboidalis, *Rich.*
Podocarpus alpina, *R. Br.* (also in S. E. Australia.)
  β Laurencii, *Hook. fil.*

E. *New Zealand.*

Dammara australis, *Lamb.* (also in E. Australia.)
Libocedrus Doniana, *Endl.*
  Bidwilli, *Hook.*

Dacrydium cupressinum, *Soland.*
laxifolium, *Hook. fil.*
Colensoi, *Hook.*
Kirkii, *Ferd. Mull.*
Phyllocladus trichomanoides, *Don.*

Podocarpus Totara, *Don.*
ferruginea, *Don.*
nivalis, *Hook.*
spicata, *R. Br.*
dacrydioides, *A. Rich.*

F. *New Caledonia, New Hebrides, and Norfolk Island.*—Though I have included Norfolk Island in this region, yet that island has all its species peculiar to itself. It is, however, so close to the others, that I cannot but think that further exploration will show species on other islands common to it also. Those marked with an asterisk are peculiar to this island:

Araucaria Rulei, *Ferd. Mull.*
*Eutacta excelsa, *R. Br.*
*Cookii, *R. Br.*
Dammara ovata, *C. Moore.*
obtusa, *Lindl.* (New Hebrides.)
Moorii, *Lindl.*
Frenela sulcata, *Parl.*
subcordata, *Parl.*

Dacrydium taxoides, *Brongn.*
araucarioides, *Brongn.*
Podocarpus minor, *Carr.*
Novæ - Caledoniæ, *Viell.*
usta, *Brongn.*
tenuifolia, *Carr.*
Viellardii, *Parl.*

XIV. The Thibeto-Himalayan Province.—This province appears to stretch away into Persia, and to join the Caucasian. The species found on it, on the Himalayas, and on the borders of Hindostan and Thibet, are best known. The others are but vaguely described, while large portions of the region over which it seems to stretch is simply a *terra incognita.* The following seem to be characteristic of the province :—

Ephedra alte, *C.A.Mey.* (Mount Sinai and Persia.)
Pinus persica, *Strangw.* (Persia.)
Gerardiana, *Wall.*
excelsa, *Wall.*
Cedrus Deodara, *Rox.*
Larix Griffithii, *Hook. fil.* et *Thoms.*
Abies Smithiana, *Lamb.*
Picea Pindrow, *Boyle.*

Picea Webbiana, *Wall.*
Abies dumosa, *Don.*
Cupressus torulosa, *Don.*
Juniperus recurva, *Hamilt.*
pseudo-Sabina, *Fisch.* and *Mey.* (also on the Altai range, in Siberia.)
Podocarpus neriifolia, *Don.*

XV. Russo-Siberian Province.—Russo-Siberia may be probably divided into three phyto-geographical regions—A. That part of Siberia north of a range running south near the Lena and westward to the East Cape; B. Siberia to the Oural Mountains, with Eastern Russia; and, C. The rest of Russia east of the Baltic.* The southern limit of the Siberian flora in Asia I take to be the Altai and Yablonoi Mountains. Taken as a province, the characteristic species of conifers are as follows:—

Ephedra monosperma, *Gmel.*
Larix davurica, *Fisch.*
Larix Ledebourii, *Endl.*
Pinus Cembra, *Linn.*
Abies obovata, *Ant.*
  β Schrenkiana, *Fisch.* (Kirghis desert, &c.)
Picea sibirica, *Turcz.*
Juniperus davurica, *Pall.* (Altai.)
  pseudo-Sabina, *Fisch.* et *Mey.*

The last species is also found on the Himalayas, throughout the flora of the Altai, &c.; is connected with the former province (XIV.)

XVI. The Caucasian Province, comprising the Caucasus and its continuations:—

Characteristic species:—

Ephedra procera, *Fisch.* et *Mey.*
  lomatolepis, *Schrenk.*
  stenosperma, *Schrenk.*
Cedrus Libani, *Barr.*
Abies orientalis, *Linn.*
Picea cilicica, *Ant.* et *Kotchz.*
Juniperus drupacea, *Labill.*
  excelsa, *Breb.* (on to Persia.)
  fœtidissima, *Willd.* (also in Greece.)

This province seems to be connected in one direction with the Mediterranean Province, on the other with the Himalayan. For instance, *Cedrus libani* is but doubtfully distinct from *C. Deodara*, and so on.

XVII. Northern European Province.

Characteristic species:—

Pinus sylvestris, *Linn.*
Abies excelsa, *DC.*, &c.

This province (or it is only a region of the great Germanic flora) is more distinguished by the collective indi-

* "Many years ago, Gmelin considered the Yenesi River as the boundary between the Asiatic and European floras. Here, in addition to new plants, new animals also begin to make their appearance."—Pref. *Flora Sibirica*, xliv.

viduals of one or two species forming forests than by a number of species.

XVIII. Mid-European or Germanic Province extends south to about the Carpathians.

Characteristic species :—

Pinus maritima, *L.*	Larix europæa, *DC.*
Cembra, *Linn.*	Picea pectinata, *Du Roi*, &c.

XIX. Mediterranean Province.—This is a most extensive province, the species throughout which are widely scattered. It includes the countries bordering the Mediterranean, &c., and may be divided into the following regions :—

A. *Iberian and North African,* comprising Spain, Portugal, and North Africa immediately adjoining.

Characteristic species :—

Ephedra nebrodiensis, *Tn.* (also throughout Sicily.)	Cedrus atlantica, *Man.* (*var. of* C. libani, *Barr.*)*
fragilis, *Duf.*	Picea Pinsapo, *Borr.*, &c.
alata, *Decsne.* (N. Africa only.)	

B. *Italian,* comprising the middle region of the Mediterranean shores.

C. *The Cyprian,* comprising Greece and other islands. This flora joins in with that of the Caucasus.

Though these two latter regions are indicated, yet they can be but little more than indicated. Though there seems a natural bent of the species to group themselves into these regions, yet it is difficult on paper to map them out by lists of species. The following species are found within their limits :—

Ephedra vulgaris, *Rich.* (also in Himalayas.)	Pinus pyrenaica, *Lapeyr.*
Pinus Pinea, *Linn.* (also in Azorean region.)	Laricio, *Poir.* (also Western Asia.)
halepensis, *Mill.* (also Palestine and Georgia.)	Picea cephalonica, *Loud.*
Pinaster, *Soland.* (all Mid. region.)	Cupressus sempervirens, *Linn.* (Also in India), &c.

* *Cedrus atlantica,* Manetti in Cat. Hort. Madoet Suppl. p. 8. *Cedrus libani* γ *atlantica,* Parlatore, in *Lib. cit.* p. 408.

D. *The Azorean Region*, comprising the Canaries and neighbouring Atlantic islands.

Characteristic species—

Pinus Hamiltoni, *Lindl.* et *Gord.*	Juniperus Cedrus, *Webb.*
canariensis, *Ch. Sm.*	brevifolia, *Ant.*

Besides some other species common to the mainland.

XX. Abyssinian Province.—Africa has so very few coniferæ that we are sometimes puzzled into what geographical group to throw its species. For instance, Abyssinia is only known to possess one species of conifer, but that is peculiar to it. The species is *Juniperus procera*, Hochst.; and therefore, provisionally for it, we must make out Abyssinia as a special province of coniferous distribution. Of a like nature are some of those which follow.

XXI. Dammaras Province. — Characterised by the remarkable *Welwitschia mirabilis*, Hook. fil.*

XXII. Madagascar and Mauritius.

Characteristic species:—

Widdringtonia Commersonii, *Endl.*	Callitris quadrivalvis, *Vent.* (also in Barbary.)
Ephedra altissima, *Def.*	

XXIII. Cape of Good Hope and Natal.

Characteristic species:—

Widdringtonia juniperoides, *Endl.*	Podocarpus Meyeriana, *Endl.*
natalensis, *Endl.*	falcata, *R. Br.*
cupressoides, *Endl.*	elongata, *L'Herit.*
Podocarpus Thunbergii, *Hook.*	

XXIV. Guinea, in which is found alone *Podocarpus Mannii*, Hook. fil.

As these regions become better explored, some of the provinces will be shown to be merely arbitrary, and not natural. In the present state of our knowledge they are, however, useful, if for nothing better than as pegs to hang our knowledge on.

* As I have adopted Professor Parlatore's arrangement, I have put *Welwitschia* among the *Gnetaceæ*. Dr Hooker, however, originally described it as a member of the *Cycadaceæ*.

General Conclusions.

1. Coniferæ are found all over the globe; but they affect cool situations. Whenever a northern species wanders southward of the region where it obtains its maximum of development (such as *Abies Douglasii* to Mexico), it climbs to an elevation where the mean temperature approximates to that in which it is found farther northward, and *vice versa.*

2. Each species spreads in the direction of the least (α) meteorological change, and (β) physical change. Mountain ranges are, next to meteorological conditions, the most important elements affecting the range of species.

3. Each species has, in all likelihood, an isotherm of its own, and the whole Order only prospering within certain limits, these limits not being very wide.

4. Temperature is not so important to the growth of coniferæ as moisture. This is the all-important element in the growth of forests; the great steppes of Asia and prairies of America being almost entirely due to the absence of sufficient moisture for the prosperity of trees. Trees require at least from fifteen to sixteen inches of rain during the growing season. The dense forests, for instance, of the western slope of the Cascades is wholly due to the abundant supply of rain that region obtains. Its effect is well seen in the treeless aspect of San Diego, in southern California, which has an annual rain-fall of only eight and a half inches, while Sitka, in the territory of Alaska, is deluged under the enormous rain-fall of nearly seven and a half *feet* per annum!

5. Each species has a region where it obtains its maximum of development. Out of this region it decreases in individuals, as well as in the vigour and general appearance of these individuals.

6. Each *natural* genus seems to have been created in the centre, in which the greater number of its species is found. That these centres of creation have undergone many modifications by great geological changes since their original creation there can be but little doubt, and many of these anomalies of the distribution of plants may be thus explained. The question of the origin of these species does

not, I conceive, come within the province of this paper. With the modification stated, I consider that I am justified in saying (though with much diffidence, as many illustrious naturalists hold an entirely contrary opinion), that the idea of specific centres is not yet established as a "perfect delusion."* When we find a large number of closely allied species of a genus wholly confined to one limited district, we may conclude that these species have originally sprung from some parent type.

7. The range of species is no way, however, limited to systematic classification, species of one genus being found in widely distant localities. There may, however, have been some original connection between these localities.

8. It is most erroneous to say that in every case climate, elevation, &c., do not affect the distribution of plants and animals. Whatever may have been the effect of former geological and physical changes—as exemplified in distributing the Malayan flora and fauna—this is not so in some other parts of the world, such as North-West America, &c.

9. Geological structure of a country has a considerable influence in limiting the distribution of a species—for instance, *Sequoia sempervirens* is bounded by the metamorphic sandstone of the coast range, and the line of junction between the Carboniferous rocks of the Illinois region with the Cretaceous and Tertiary, is a distinct limitation of many species of trees—by rendering the soil more porous and drier.

Such, in a few words, are a few of the general conclusions I have arrived at as far as I have gone. I beg that they will be received merely as *primitiæ*—a sort of programme of a more extended essay which I may crave permission to lay before the Society at another time. I may mention, that since this paper was written, the treatise of Dr Hildebrand, "Die Verbreitung der Conifern in der Jetztzeit und in den früheren geologischen Perioden," † who also quotes Th. Beinling, "Ueber die geographische Verbreitung der Conifern," has reached me. As both authors

* Bentham: Address to the Linnean Society, May 24, 1869. "Proceedngs," lxxviii.

† "Verhandlungen des naturhistorischen Vereines der preussischen Rheinlande und Westphalens. Zweite Hälfte." Bonn, 1861, p. 199.

appear to treat the subject from a totally different standpoint from mine, I have nothing to remark regarding their elaborate memoirs further than to recommend their general accuracy and the painstaking work displayed in them.

II. *On the Distribution of Forests in North-West America, with Notes on the Deciduous Trees and Shrubs.* By Robert Brown, F.R.G.S., &c.

[This paper will form a portion of the author's "Horæ Sylvanæ," now in course of publication. An abstract of the general conclusions is given in the foregoing paper, as well as in "Die Wälder im Nordwestlichen Amerika," in Petermann's "Geographische Mittheilungen," 1860, p. 308.]

III. *Notes of an Excursion to Clova in April* 1869. By Professor Balfour and Mr Bell. Communicated by Professor Balfour.

Dr Balfour stated that as the Highland mountains were seldom visited by botanists in spring, he thought that it might be useful to take an excursion to Clova before the commencement of the summer session. Accordingly, on the 22d April last, he, along with one of his sons and Mr William Bell, started for Kirriemuir. They were conveyed by dogcart from Kirriemuir to Clova, and took up their quarters at the Ogilvy Arms Hotel, now kept by Mr James Alexander, where they were comfortably accommodated. On the day of their arrival they paid a visit to Loch Brandy and the rocks in its vicinity. There were few flowering plants to be seen. Those noticed were *Saxifraga oppositifolia* in full flower, *Eriophorum vaginatum* and *Luzula campestris* (small form). Many good mosses, however, were met with, such as *Mnium subglobosum*, *M. cinclidioides*, *Bryum duvalii*, *Splachnum sphæricum*, *Hypnum molle*, *Fontinalis squamosa*, &c. On the 23d they paid a visit to Glen Fee, and collected the following species:—*Arctostaphylos Uva-ursi*, *Vaccinium Vitis-Idæa*, *Pyrola media*, *Empetrum nigrum*, *Viola sylvatica*, *Anemone nemorosa*, *Eriophorum angustifolium*, *Draba incana*, *D. verna*, *Caltha palustris*, *Lycopodium clavatum*, *alpinum*, *Selago*, *selaginoides*, and *Woodsia hyperborea*. They met also with old specimens of *Oxytropis campestris*, and a great number of cryptogamous plants, especially mosses in fruit, including *Trichostomum glaucescens* and *Encalypta rhaptocarpa.* The day was remarkably fine, and the views from the hills were extensive. Snow was lying in large quantity on all the hills. On the 24th they proceeded to Loch Wharral, and examined the rocks round the loch. Here *Saxifraga oppositifolia* adorned the rocks with its gorgeous pink blossoms. From Loch Wharral the party passed along the top of the moutains to Loch Brandy and the corrie beyond it, collecting by the way *Azalea procumbens*, some willows coming into flower, and several good mosses. They examined the land-slip which has been taking place gradually in the mountain range to the east of Loch Brandy. The rent at the summit is becoming more extensive, and ere long there may be an enormous rupture of the rocks, which by their fall will fill up a large portion of the loch. The chasm at the summit was filled with snow. Monday, the 26th, was one of the brightest days experienced, and the snow patches of the hills shone beautifully in the sun. They visited Bachnagairn, a shooting-lodge in Glen Esk, and examined the mountains around. The same plants were gathered as on the previous days; but Mr Bell was enabled to add to the list of mosses *Bryum intermedium*, *B. torquescens*, *Hypnum flagellare*, *H. elegans*, *Cylindrothecium Montagnei*, *Grimmia unicolor*, &c.

The following is the List of Mosses collected, as drawn up by Mr Bell.

Andreæa rupestris, Rothii, alpina.
Bryum acuminatum, alpinum, bimum, carneum, crudum, elongatum, intermedium, julaceum *var.* concinnatum, pallens, torquescens, ventricosum, several *vars.*
Cylindrothecium Montagnei.
Dicranodontium longirostre.
Dicranum Blythii, heteromallum, longifolium, polycarpum, squarrosum, Starkii.
Encalypta rhaptocarpa.
Fissidens adiantoides, osmundoides.
Fontinalis squamosa.
Grimmia Doniana, spiralis, torta, unicolor.
Gymnostomum curvirostrum.
Hypnum aduncum, catenalatum, cupressiforme (*vars.* cupressum, lacunosum, and minus), denticulatum, elegans, filicinum, fluitans *var.* stenophyllum, and other *vars.*, molle, molluscum *var.*

croceum, ochraceum, palustre several *vars.*, pulchellum, revolvens, sarmentosum, scorpioides, sylvaticum, uncinatum, *var.*
Mnium cinclidiodes, subglobosum.
Orthotrichum Bruchii, rupestre.
Pogonatum aloides *var.* minus.
Polytrichum juniperinum *var.* gracile.
Rhabdoweissia fugax.
Schistidium apocarpum *vars.* rivulare and gracile.
Sphagnum compactum, plumosum.
Splachnum sphæricum.
Trichostomum glaucescens, mutabile, tophaceum.
Weissia cirrhata.

IV. *Notes of Vegetable Products used as Food during the late Famine in Rajpootana.* By Dr G. King, Indian Service. Communicated by Professor Dickie.

The following plants were noted, and products shown:—

1. *Acacia leucophlœa*, Roxb.—The bark reduced to rough powder, and made into cakes.

2. Unexpanded capsules of *Tribulus lanuginosus*, L. (N. O., *Zygophyllaceæ*).—Used in same form as No. 1.

3. Seeds of *Achyranthus aspera*, W.

4. *Sesamum indicum*, W.—Refuse of seed after extraction of the oil. Stored by Marwar merchants during plenty, and sold at a high price during famine.

5. Seeds of a species of *Eleusine.*

6. Seeds of various *Cucurbitaceæ*, pumpkin, &c.

7. *Hymenochæte grossa*, Nees.

Specimens of the prepared food and seeds were presented to the Museum.

V. *On the Scarcity of Wood suitable for Railway Sleepers in India.* Communicated by Dr Richardson.

The Great Indian Peninsular Railway Company has commenced the importation of sleepers from Australia. The variety of timber fixed upon for this traffic is the "jarrah wood," which is said to be excellently adapted for laying the permanent road of railways. If that be found the case, we shall probably see a new and considerable trade springing up between the Australian continent and India. The Peninsula has little as yet except the main lines of her traffic system, and thousands of miles must be prepared for the "iron horse" before her cotton-fields and rice-fields can be fairly brought within the range of commerce. India possesses coal, iron, and almost everything else; but she does not produce a good timber-tree for sleepers. But nothing can be better than sal and teak when properly seasoned; but neither of these can now be had in sufficient abundance to satisfy the steadily increasing demand. The pine and fir grow only upon the upper peaks of the mountain ranges; the teak forests, which are distant from Bombay, have been a good deal overworked of late—while the wood is hard to work, and costly. The commonest tree in Western India is the "Babul," a species of acacia (*A. arabica*), with a black trunk and fragrant golden blossoms; but it almost always grows very crooked, and its wood is excessively tough. There are, of course, great forests throughout India, and everywhere may be seen groves of superb mangoes, tamarinds, peepul, jack, silk-cotton, and other trees, besides date and coco-nut palms; but most of these are too valuable, and none of them are suitable for sleepers. Thus, the importation of foreign wood has always been a large element in the cost of railway making in the Peninsula. Thousands of loads of Norway pine have been brought all the way from the Baltic to Bombay, Kurrachee, and even Calcutta, cut into sleepers, and kyanised to keep the white ant away. It has been necessary to pay for this immense sea-transit, because neither stone nor any other material will serve the purpose so well as the solid but slightly elastic beam of fir-wood. Along the Indian lines, bamboo is a good deal employed for telegraph posts, and such native wood as can be obtained is burned up in the furnaces of the locomotives for fuel. But this scarcity of light timber is a serious matter for Indian engineers; and if it really is the case that in the jarrah-tree Australia grows the very thing wanted, it is quite likely that a new source of prosperity is opening for the Australians, and that a steady Indo-Austral commerce may be the result.*

* Has it yet been proved that this wood withstands dry rot and the attacks of white ants better than some of the Indian woods do, such as sal, teak, and deodar?—Ed.

VI. *Miscellaneous Communications.*

1. Dr Richardson referred to the following extract from the *Daily Telegraph*, regarding the failure of certain trees in Paris, and suggested that the failure might arise from gas-pipe leakage infiltrating the soil:—"Much time and money have lately been spent on the Paris trees. The chestnuts, limes, and elms that line the Boulevards and decorate the gardens and parks, are gradually dwindling away under the ravages of an insidious malady. The mould has been turned and re-turned, drained and re-drained; every kind of manure has been tried, and all to no purpose. The trees wither and die by hundreds. A new system of drainage has been tried with the young horse-chestnuts in the Champs Elysées, but it seems very doubtful whether it will succeed. In the Tuileries gardens, although the dead trees are replaced as quickly as possible, gaps are beginning to be visible; and the trees of the Luxembourg are pitiable to see; the planes of the side walks have alone escaped the blight. None of the saplings planted within the last few years in the Champs Elysées have prospered well, and round by the Cirque all the elms, except the old ones, are in a state of decline. On the other hand, the poplars and birches on the banks of the Seine, near the Pont-Neuf, are thriving, and this fact may guide the experiments of those who are studying the causes and effects of the extraordinary disease which is committing such ravages upon the trees of the capital."

2. Mr Anderson, Oxenford Castle, exhibited a remarkable specimen of mushroom, having another growing on the top of it (Plate II. fig. 5). The diameter of the under one was $3\frac{1}{4}$ inches, with a stalk $2\frac{1}{4}$ inches long, the upper one $2\frac{3}{4}$ inches in diameter, with a stalk 2 inches long. Mr Anderson remarks, "that probably some of the spawn must have been less developed than the rest, and having run on the top of the undermost one when in a young state, had taken root, and been supported partly by it and partly by atmospheric moisture; still it is a curious fact that the upper one should be as fully developed as the under." Some years ago Mr Anderson exhibited two curious mush-

rooms united together by their crowns (Plate II. fig. 4), thus causing the stalk of the top one to project upwards.

3. Mr M'Nab exhibited a root of *Pinus Craigana*, from a tree fourteen years old, 8 feet high and 11 inches in circumference at base. It was stated, that out of 245 specimens of the genus Pinus, transplanted during the last two years into the new Pinetum, this was the only one that had shown signs of unhealthiness. On taking the tree out of the ground, it was found that a large swelling had taken place round the lower part of the stem below ground, enveloping the main roots, which were in perfect health. The swelling is 14 inches long and 24 inches in circumference. The plant has not received pot culture.

4. A letter was read from J. B. Webster, Esq., Verner's Bridge, Moy, Ireland, presenting to the Museum three sections of larch stumps, which had continued to increase in diameter for years after the trees had been felled.

5. Miss Raeburn, 21 Pitt Street, sent for exhibition a case of skeletonised leaves artistically mixed with blanched exotic and British ferns. They were prepared and arranged by Mrs Hossack, Silver Street, Aberdeen. This method of preparing ferns seems worthy of attention.

6. Professor Lorimer sent a note regarding the large size of some mushrooms collected in Arran in September 1868. One measured $9\frac{6}{10}$th inches in diameter, and weighed 9 oz.; a second measured $8\frac{9}{10}$th inches in diameter, and weighed $8\frac{1}{2}$ oz.; and a third, $5\frac{8}{10}$th inches in diameter, and weighed 8 oz.

7. A letter was read from William Jameson, surgeon-major, Saharunpore, presenting a large collection of Indian plants, principally from the Punjab, to the University, and specimens of the wood of the following Indian timber trees:—

Acacia Catechu.	Melaleuca Cajeputi.
modesta.	Psidium pyriferum.
Ehretia aspera.	Randia longispina.
Garuga pinnata.	Schleichera trijuga.
Jonesia Asoca.	Trewia nudiflora.
Laurus Cassia.	Trophis aspera.

8. Miss Walker, Drumsheugh, exhibited specimens of

Rhododendron Dalhousianum; also a plant of *Richardia æthiopica*, with a double spathe. (Plate II. figs. 1–3).

9. The Rev. J. F. Leefe presented ten fasiculi of willows; Professor Jameson, Quito, sent specimens of ferns collected on the western slope of Pichincha; Dr John Lowe transmitted a specimen of *Claytonia perfoliata*, collected near Lynn; and Mr John Shaw, a specimen of *Alyssum saxatile*, found naturalised in grass fields near Eyemouth.

Description of Plate II. Figs. 1–3.

Fig. 1 represents the double spathe with a fertile spadix projecting, viewed partly from above.

Fig. 2 gives a side view of the same.

Fig. 3 shows the fertile spadix, with an apparently rudimentary second spadix attached.

Thursday, 10*th June* 1869.—Dr Cleghorn, President, in the Chair.

The following Communications were read:—

I. *Obituary Notices of the late Dr William Seller and of Professor Bertoloni of Bologna.* By Dr Cleghorn.

One of the duties which, by custom, devolves on the President of such a Society as this is to pay a tribute of respect to the memory of those members who have been gathered to their fathers. And first, it is my melancholy duty this evening to notice the loss of a former President, Dr William Seller. Dr Seller was born in Peterhead in 1798, being the only son of a merchant in that town. He was educated in Edinburgh, and was a distinguished student of the University, where he graduated in 1821. A classical scholar of no ordinary rank, a cautious and accurate observer, and a most kindly, genial, and courteous physician, he was much esteemed by his professional brethren, the students, and the general public. He lectured for many years on Materia Medica in the Extra Academic School, and was an Examiner to the Royal College of Physicians and to the University of Edinburgh. He received from the Royal Society of Edinburgh, in 1862, the Makdougall-Brisbane Prize for his admirable memoir of Professor Whytt, published in their

Transactions (vol. xxiii. p. 99); but his great modesty and unwillingness to write explains how so little from his pen remains on record.

In April 1843 he was elected a member of this Society, having been proposed by Mr Brand, and seconded by Professor Goodsir; and in 1857 he was elected to the office of President. He was President of the Royal College of Physicians from 1848–50, and for twenty years he was one of the councillors, discharging also the duties of librarian for a considerable period. He delivered annually a series of lectures on mental diseases under the Morrison endowment in the College of Physicians. A portrait of Dr Seller, by Sir John W. Gordon, adorns the hall of the college. From 1854 to 1856 he was President of the Medico-Chirurgical Society. He edited for some time the "Northern Journal of Medicine," and afterwards he was for many years joint editor of the "Edinburgh Medical Journal."

The following is a list of Dr Seller's writings on botanical and physiological subjects:—

1. Examination of the Views adopted by Liebig on the Nutrition of Plants. Read to Bot. Soc. Feb. 13, 1845. (This paper was published in the "Ed. New Phil. Jour." vol. xxxix. p. 50.)
2. Observations on some Plants obtained from the shores of Davis' Straits. "Trans. Bot. Soc." ii. 215.
3. Notice of a Mass of Fragments of Fossil Stems found in the interior of Trap near Binny Craig, West Lothian. "Proceedings Bot. Soc." July 1856.
4. President's Address to the Botanical Society. "Trans. Bot. Soc." vi. 18.
5. On Vital Agency, with reference to the Correlation of Forces. "Proc. Roy. Soc. Ed." v. 209.
6. Physiology of the Farm in Aid of the Rearing and Feeding of Live Stock," published conjointly with Mr Stephens, author of the "Book of the Farm." 8vo, Edin.

In the professional journals above-mentioned he contributed several papers, as "The Character of Medicine as an Art," "Homœopathy the Last of Modern Delusions."

For three years Dr Seller had been somewhat failing in health, and ascites at last appeared. He passed away on 11th April 1869, aged 71. The College of Physicians surrounded the body while the last rites were being performed.

We have also to record the demise of the celebrated botanist, Antonio Bertoloni, M.D., Professor of Botany at Bologna, who died on the 17th ult., at the very advanced age of 94. On looking through the Proceedings of this Society, I find that the Council proposed the election of this veteran Professor as one of our Foreign Honorary Members on 10th December 1840.

Antonio Bertoloni was born in 1775, at Sarzana. His father was an artillery officer. In 1792 Antonio was sent to the University of Pavia, where he studied under the Professors Giovan Pietro Frank and Scopoli. He had a strong inclination to study mathematics, but these two friends induced him rather to devote his attention to medicine and botany. From that time, under Scopoli's guidance, Antonio began to collect plants in the neighbourhood of Pavia. His herbarium was lost in the sacking of that city by the French; and he himself left Pavia and repaired to Genoa, where, in 1796, he distinguished himself as a student of medicine. From thence he went to Sarzana, and practised medicine for some years. During this period of his life he studied assiduously the plants of his native country, and began to make for himself a name among botanists by the publication of his "Plantæ Genuensis" (1804). In 1811 he removed to Genoa, having been appointed Professor of Physics in the Lyceum, where he had favourable opportunities for studying botany in the beautiful Zerbino gardens of the Marquis Durazzo.

In 1815, by the advice of Professor Gaetano Savi of Pisa, Bertoloni was appointed Professor of Botany in Bologna, and the thought that had been suggested to him by Scopoli while still a student at Pavia, of giving a general flora of Italy, again presented itself. With great trouble and labour he collected, from all parts of the peninsula and of the surrounding islands, dried specimens, forming the richest Italian herbarium which had then been made. The publication of the "Flora Italica" was begun in 1833, and completed in 1854, and was followed by the "Flora Italica Cryptogama." Notwithstanding the labour of such a large work, conducted entirely by himself, and the publication of many memoirs on Italian plants, Bertoloni did not neglect foreign botany, as is shown by his "Miscellania Botanicae," 1842–1851, "Florula Guatimalensis," "Plantæ novæ Asiaticæ," and others, 1864–1865.*

Dr Bertoloni has contributed more to the knowledge of the plants of Italy than any botanist of this century, having been the able collaborateur of Tenore, Gussone, and Parlatore. This distinguished *savant* has published a great number of botanical works and memoirs. Most of his writings are in classical Latin, and of many of them a very small number of copies was printed. His library of classical works was one of the richest made by a private individual. Bertoloni had a wonderful memory, and a fortnight before his death he repeated verses which he had learned in his infancy. He bequeathed the original of his "Flora Italica" to the University of Bologna; to his son, Professor Giuseppe Bertoloni, who succeeded him some years ago in the chair of the University and in the direction of the Botanical Garden, his professional library and herbarium, both Italian and foreign; to his other son, Giacomo, his medical, surgical, and physical books; and to his nephew, Antonio, the classical collection above referred to. A very full list of his publications, amounting to thirty-six in number, will be found in the Index published by the Royal Society of London.

The following, arranged in chronological order, are the best known of his works:—

1. Rariorum Liguriæ Plantarum Decades i.–iii. 1803–10.
2. Plantæ Genuensis. Genoa, 1804.
3. Amœnitates Italicæ. 1819.
4. Description of Italian Saffrons. 1826.
5. Memoir on some Natural Productions of the Gulf of Spezia. 1832.
6. Mantissa Floræ Alpium Apuanarum. 1832.
7. Commentarius de Mandragoris. 1835.
8. Elogio del Professore Ottaviano Targioni-Tozzetti. 1837.
9. Commentarius de itinere Neapolitano æstate anni 1834. 1837.
10. Florula Guatimalensis. 1840.
11. Iter in Apenninum Bononiensem. 1841.
12. Description of a new Species of Sida. 1843.
13. Miscellania Botanica. 1842–46.
14. Flora Italica. 1833–1846.

* Professor F. Parlatore of Florence has published an Eloge of Bertoloni, which supplies most of these facts.

The "Flora Italica" is indispensable in the systematic study of the plants of South Europe. Unfortunately, the Linnean system of classification has been followed; nevertheless, it is the best work for the student of the local vegetation, being well known for the accuracy of its descriptions, the soundness of its criticism, and the amount of research bestowed upon it in a long course of years. The works of Bertoloni on the Apennines were published in the "Novi Commentarii Bononienses," vol. v.

II. *Miscellaneous Communications.*

1. *Rubus deliciosus.*—Professor Balfour exhibited a drawing, executed by Mrs Balfour, along with fresh specimens of *Rubus deliciosus* of Torrey, grown in the garden of William Gorrie, Esq., at Rait Lodge, Trinity. The plant is a native of the Rocky Mountains, and is of a shrubby habit; bears large, light-pink flowers, and a large delicious fruit.

2. *Vegetable Poisoning.*—Dr Lauder Lindsay called attention to several cases of poisoning which had taken place lately in the Isle of Man. The cause had been attributed, by several newspapers, to eating the roots of the Woody nightshade, or Bitter-sweet (*Solanum Dulcamara*). Dr Lindsay, however, doubted that it could be this plant.

3. *Trientalis europæa*, var.—Charles Jenner, Esq., exhibited and presented to the Botanic Garden growing plants of a marked variety of *Trientalis europæa*, found by him in Glen Garry last year. He remarked that the plant principally differed from the common form by having more rounded leaves, the stem very leafy, and the flowers always lateral, thus approaching *Trientalis arctica*. It also flowers earlier than the common form.

4. *Exhibitions.*—Mrs Mooney, Mountmellick, Ireland, exhibited a series of skeleton leaves, tinted in various shades of violet, purple, and pink. Professor Balfour exhibited a collection of dried plants from Palestine, which had been collected and brought home by the Rev. Dr Andrew Thomson. Miss Walker, Drumsheugh, exhibited from Lady Leith Buchanan, a growing plant of *Athyrium Filix-fœmina* var. *Frisellice*, found in a wild state at The Ross, Dumbartonshire.

5. *Presentations.*—William Jameson, Esq., surgeon-major, Saharunpore, presented a collection of dried specimens of Indian forest trees and ferns. Dr Vartan presented dried plants from Nazareth. William Craig, M.B. and C.M., presented growing plants of *Botrychium Lunaria*, which he had collected in a field in Ayrshire, which had been five years under cultivation. J. Couper Johnston, M.B., Melksham, presented specimens of monstrous roses, in which the axis was prolonged beyond the flower, and ended in a cluster of leaves. Mrs Walker-Arnott presented a portrait of the late Dr Burchell.

Mr M'Nab placed on the table a collection of alpine and other plants in flower, including *Meconopsis aculeata* and *Chirita bifolia.*

Thursday, 8th July 1869.—Dr Cleghorn, President, in the Chair.

The following Gentlemen were elected Fellows:—

1. *Resident Fellow.*
William P. Drummond.

2. *Non-Resident Fellow.*
J. Lindsay Stewart, M.D.

The following Communications were read:—

I. *Notes of a Botanical Tour in Ladak or Western Tibet.* By J. L. Stewart, M.D., Conservator of Forests, Punjab.

At the request of my friend Dr Cleghorn, I have put together the following notes of a tour made through considerable parts of Ladak, in August and October 1868, and have now the honour to lay it before the Society. I have to express my regret at the meagreness and incompleteness of these notes in several respects, which depend chiefly on a large portion of my material being at present beyond reach at Kew.

For years I had entertained a hope that I might be able to visit some part of Tibet, which is beyond the British boundary, and in 1868 I obtained permission to visit Ladak or Western Tibet, lying in the territory of H.H. the Maharajah of Kashmir, chiefly in order to get some personal knowledge of its flora, to supplement experience as to great portions of the Himalaya to the south.

Among the most notable of those who had at any time botanised within the Tibetan area were Jacquemont, Vigne, and Dr Thomson, the collections of the last having been very extensive. I kept for the most part free of Dr Thomson's tract (except in Nubra), and a considerable part of the northernmost portion of my route had only been traversed by European officers on sporting or surveying expeditions. Some of the extreme parts had only been visited within two years by Mr Johnson and Dr Cayley, who had both crossed the great range on the hither side of Turkistan. I may note that my own plants were supplemented by a collection of about 175 species made by Dr Cayley in 1867; and I have to premise that, as my specimens have not yet been rigidly identified, many of the botanical names given are dubious or provisional.

The heights of the camps and passes, &c., were taken by the boiling point of water, and may be considered fairly approximate; and the distances are from routes of authority, corrected or supplemented by noting a pedometer, which I constantly carried.

To begin with the tour, then,—from Koolloo, in the Bias basin, where I had for some time been inspecting forests, I, on 21st July 1868, crossed by the Harshar Pass (14,052 feet) into Lahoul, in the Chenab basin, and after traversing considerable tracts on the Chandra and Bhaga, which unite to form the Chenab, and spending at the Moravian mission station of Kyelang two very pleasant and instructive days with the Rev. H. Jaeschke, a most industrious and intelligent botanist, I, on 5th August, entered Ladak by crossing the Baralacha Pass, which here separates British territory, in the basin of the Chenab, from that of Kashmir, in the Indus basin.

The elevation of the pass above the sea is about 16,000 feet, and as the top is rounded or flattish, with some soil, about a dozen flowering herbaceous plants were found on or close to the crest. Hence a road goes eastward to Spiti, another British district, with flora, &c. of a Tibetan type. But our route lay in a north-easterly direction, down one of the longest tributaries of the Zanskar river, which takes its rise from near the pass; and ere I reached my first camp in Ladak, a good many of the ordinary plants of the Lahoul side had disappeared, while a proportion of them still occurred, some to cease entirely within a few days; and Tibetan forms had become more or less common, two of the most characteristic being *Oxytropis macrophylla*, with viscous leaves, and a large, very tough root, afterwards found abundant in many places in Ladak, at from 12,500 to 17,000 feet, and *Biebersteinia odora*, a Rutaceous plant, with viscous leaves, yellow flowers, and a strong scent, frequently got in some numbers in Ladak, but only locally, at from 14,500 to 17,000 feet.

The following are some others of the chief plants got on this march, with some notes of the heights at which they were subsequently found:—A tall Corydalis (one of several Ladak species), rarely got afterwards, at from 14,800 to 16,000 feet; a Viola, at 15,000 feet, not found again; *Geranium Wallichianum*, occasional, at from 14,800 to 16,300 feet; *Potentilla Inglisii*, not uncommon locally, at from 15,000 to 17,000 feet; *Taraxacum officinale*, abundant in many places, from 14,000 to 18,000 feet; *Nepeta discolor*, common in many parts, from 11,500 to 17,000 feet; *N. longibracteata*, often found at 15,000 to 17,800 feet; *Oxyria reniformis*, rare, from 10,500 and at times up to 17,000 feet; Suæda species, common at and above parts from 10,000 to 16,000 feet; several species of Polygonum, the chief being *P. tortuosum*, often found at from 14,000 to 17,000 feet; *Rheum Moorcroftianum*, rare, at 11,500 to 15,500 feet; *Triglochin palustre*, in many places at 10,500 to 16,200 feet; and *Lloydia serotina*, found at 14,000 to 16,300 feet, but not seen after the 8th August. The camp was at Kelung, on a flat green spot by the stream, 7½ miles from the crest of the pass, at an elevation of 14,493 feet.

On the 6th of August, a march of 18 miles in a northerly direction brought me to Rachuk (13,854 feet), on the same stream. *En route* (and several times subsequently) marmots' holes were common, and the animals themselves might be seen for a minute, until they spied the intruders, and dived into their burrows. Two shrubby plants, both used for fuel, occurred—*Lonicera angustifolia*, frequently observed at from 13,000 to 15,300 feet, and the better known *tama*, "Tibetan furze" of travellers, *Caragana pygmæa*, which frequently occurred in quantity in parts of Ladak (except to the north of the Pangong Lake), at from 13,500 to nearly 18,000 feet. The stems of the latter grow to six inches in girth, and afford the best fuel of all these Tibetan desert plants. The following also occurred:—A small *Ranunculus*, with tricuspid leaves, afterwards seen abundantly in many places, at from 11,000 to 16,000 feet; *Dianthus* sp., only got here at 13,800 feet; *Astragalus multiceps*, common in many places from 11,000 to 16,500 feet; a small *Potentilla*, with procumbent leaves, abundant in Ladak from 11,400 to 16,600 feet, and occasionally to 17,800 feet; *Thymus Serpyllum*, only here at 14,000 feet, and on the following day; *Eurotia ceratoides*, abundant in many parts from 12,000 to occasionally 18,000 feet, its thick roots being much used for fuel; *Urtica hyperborea*, which occurs frequently from 14,000 to 17,500 feet, and the young leaves of which are used as a vegetable; and *Allium* sp., with narrow leaves, also used as a vegetable.

The march of 7th August, after a very steep ascent at the beginning, led up to the (southern) Lachalung La (*La* is pass in Tibetan), at the crest of which, among earth, behind and near projecting ridges of rock, about a dozen species of plants were found. Among these the chief were a prickly specimen of *Alsine*, growing in rounded, hassocky clumps (and often mentioned by Dr Thomson); it frequently occurs near the crests of passes from 14,000 up to 18,600 feet; and a small broad-leaved *Arenaria*, common in similar situations to the former, at from 15,000 to 18,600 feet. At this crest also were got an *Isopyrum*, only found once subsequently (on the 8th), at 15,000 feet; a very small *Thalictrum*, got occasionally down to 12,000 feet at Le; a viscous *Lychnis*, found occasionally at from 15,000 to 17,000 feet; *Tanacetum tomentosum*, abundant at many places from 15,500 to 18,000 feet; *Ephedra Gerardiana*, which is common in many places from 11,500 to 16,600 feet; and *Cystopteris fragilis* (the only fern I got in Ladak), and which occurs frequently from 12,000 to 17,500 feet, generally under overhanging rocks, &c.

At some rocks on the ascent, about 15,000 feet, were found an *Aquilegia*, only got once subsequently at 13,000 feet; *Campanula aristata*, only this once; *Dracocephalum heterophyllum*, a very strong-smelling plant, abundant at many places afterwards from 14,000 to 17,500, and occasionally to 18,000 feet; and *Nepeta graveolens*, got here only. A short descent from (southern) Lachalung to camp at Lachalung Sumdo, thirteen miles from Rachuk, lying at 15,788 feet, in a hollow between the former and the higher Lachalung La to the north. At camp I first found a small *Polygonum*, with sagittate leaves, afterwards abundant at many places from 15,000 to 17,500 feet, and the leaves of which are used as a vegetable.

From Lachalung Sumdo a long march of twenty-four miles to Kiangchu ("spring of the wild ass"), by first a steepish ascent of a couple of miles to Lachalung La, at the crest of which, 16,500 feet, some half dozen plants grew, including the *Alsine*.

Most of the rest of the way lay down the valley of a stream, where, about 15,000 feet, were got *Valeriana tenella*, not found again, and *Scrophularia Kotschyi*, afterwards common in many places at from 10,500 to 16,500 feet. For the last five or six miles the road ran along the plain of Kiangchu, about two or three miles wide and eight or ten miles long, at 15,500 feet, and in many places covered with *Caragana*. Water was got by digging holes in a channel which traversed the plain. Near my camp were a number of merchants carrying south borax from Puga, some marches north of this, where much of it is got.

After halting on the 9th August, the march of the 10th was along a valley and across a low water-shed, near which *kiang* (wild asses) were seen, to Rukcham (15,551 feet), lying not far from some tributaries of the Zanskar river, a distance of twenty miles in all. From Kiangchu *Euphorbia Tibetana* occurred, and was found occasionally afterwards from 11,500 to 16,800 feet.

At Rukcham the porters were changed, the twenty-five men who had brought the traps from Kyelang in Lahoul, nine marches, being paid up, and seven or eight *yaks* being engaged to go on to Gia. The march of the 11th August, of sixteen miles, still northerly, in a main valley, with but little water at intervals, brought us to Dimring, 16,182 feet. Here was the summer head-quarters of the tribe of grazing people who furnished our *yaks*, whose villages are far to the south-east; and part of the breadth of the valley was dotted with their small black tents, made of *yaks'* hair.

Near the camp was a good deal of herbaceous vegetation, and here I found for the first time *Artemisia sacrorum*, which was afterwards abundant in many places from 10,500 to 16,500 feet, with a thick root, which is occasionally used for fuel; and *Marrubium lanatum*, at 15,500 feet, afterwards frequently got, at times to 18,300 feet. On the way to Dimring I had, for the first time in Ladak, got *Scopolia præalta*, at 16,000 feet, and it was afterwards frequent locally down to 13,300 feet. It is said to be poisonous to cattle when fresh, and is injurious to man when by mistake used as a vegetable.

From Dimring, on the 12th August, the road ran steep up to the crest of the Taghlang La, which is 17,349 feet. On and near the rocky crest were found some six or seven plants (mostly Cruciferous, as often in such situations), including *Lecanora miniata*, an orange-coloured lichen, found on many passes in Ladak from 15,700 to 18,600 feet. On the descent from the pass a white-flowered variety of *Taraxacum* was common at 17,000 feet, and *Polygonum tortuosum* occurred at 16,000 feet, the highest at which it was found. From 15,500 feet were found *Christolea crassifolia*, abundant in many places in Ladak from 11,800 to 17,000 feet; *Stachys* sp., abundant in many parts down to 11,300 feet in the Indus valley; *Carum*, common in many places down to 11,800 feet; *Pedicularis tubiflora*, almost stemless, with long yellow flowers, and not uncommon in Ladak, down to 11,500 feet.

Near Gia, 14,000 feet, twenty miles in all, barley was cultivated to about 14,500 feet, about the highest at which I saw it, and *Pisum sativum*, at about the same height, where, however, it does not ripen well; but it is commonly cultivated down to 10,500 feet. At Gia were two or three trees of *Populus balsamifera*, nearly the highest at which it was seen; it is not uncommon planted down to 11,000 feet, though not so frequent as *P. pyramidalis* (Lombardy poplar. In some cases the former reaches 8 feet in girth and 70 feet high. Here also were some trees of the common cultivated willow (near *Salix alba*) of Ladak, in many parts of which it is abundant.

Gia was the first permanently inhabited place I had seen since crossing the Bara Lacha. Here there are several considerable villages, with the first of the Tibetan *gonpas* or monasteries, curiously built high on steep rocks over the brawling stream.

On 13th August, by a march of twenty miles still northerly, along the stream which comes from near the Taghlang Pass, I reached Upshi, which lies at 11,841 feet, close to the confluence of that stream with the Indus. In the course of this day's journey a considerable change took place in the flora, the chief members of which may be noted as follows:—*Clematis* occurred in places, climbing over the Myricaria bushes in the stream-bed, and was abundant in many places afterwards, from 10,200 to 15,200 feet; a Rose, like *R. Webbiana*, was in flower, and was common afterwards in places from 11,500 to 13,500 feet; *Myricaria elegans*, the one of the two Ladak sp. which has large leaves and smaller flowers, became common here, and occurred often afterwards in great abundance in the beds of streams, to from 11,800 to 15,500 feet, and occasionally to 16,400 feet, becoming minute and herb-like at the last height,—its wood is often used for fuel; *Galium Aparine*, which occurred afterwards occasionally, from 12,000 to 13,500 feet; *Cirsium arvense*, and *Mulgedium Tartaricum*, both frequent at places from 14,000 down to 11,000 feet; *Convolvulus arvensis*, common in fields, from 11,300 to 13,000 feet; *Lancea Tibetica*, a small plant with pretty blue flowers, was abundant in the turf by the stream, and often found afterwards from 10,500 to as high as 16,000 feet; *Veronica Anagallis*, occasionally from 11,000 to 13,500 feet; *Mentha Royleana*, frequent in wet places, from 11,000 to 12,000 feet; *Nepeta floccosa*, which occurs locally from 11,000 to 13,300 feet; *Perowskia* *abrotanoides* grew in thickets, and occurred afterwards from 10,500 to occasionally 13,000 feet; and *Hippophae rhamnoides* began here in quantity, and in Ladak was often abundant as a shrub of some size, from 10,500 to 15,500 feet, with its thorns excellent as a fence, and its fruit—terribly sour—occasionally eaten. Near Upshi there was a good deal of *Arundo Phragmites*, common in many parts, from 10,500 to 14,000 feet, which is eaten by cattle, and apparently occasionally made into baskets.

Fagopyrum was cultivated from 13,200 feet downwards, and is common in Ladak down to 10,200 feet; and a Sinapis, of which the leaves and oil are used, is frequently cultivated from 13,000 feet downwards. At Upshi were some trees of *Prunus Armeniaca*, with fair fruit; it is cultivated from 12,000 feet downwards. Trees of *Populus pyramidalis* occurred, from 12,500 feet, and lower than this it is very commonly planted in Ladak.

From Upshi to Le the route is somewhat north-westerly, and the march of 14th August brought me to Stagna, at first along uncultivated slopes, then with much cultivation at places, especially near the end. *Lepidium latifolium* was common here, and at many places afterwards, from 10,500 to 14,000 feet. *Tribulus* occurred at the end of the march, and is not unfrequent in this part of Ladak from 10,300 to 12,000 feet; *Panderia pilosa* commenced here, and was frequently seen subsequently from 10,500 to more than 14,000 feet; *Salsola collina*, which occurs from 10,500 to 13,300 feet. Towards Stagna, in low ground, *Iris Kumaonensis* was abundant, and afterwards frequently occurred at 10,200 to 12,000 feet; *Avena fatua*, often abundant in fields, &c., from 10,500 to 11,500 feet; and in canal-cuts, &c., *Potamogeton crispus* was common, and subsequently occurred often at 11,400 to 11,500 feet. Of cultivated plants, *Faba vulgaris* and *Medicago sativa*, both common from 10,500 to 12,000 feet; and *Lathyrus sativa*, from 10,000 to 11,500 feet in Ladak. Along this tract, and in the valley of the Indus generally near this, where irrigation is possible, there are multitudes of *Populus pyramidalis* and *Salix*, both grown for timber.

Stagna is situated on a wide flat near the left bank of the river, with much cultivation of cereals, &c., and has a monastery on a lofty rock.

On the 15th August, a march of seventeen miles, two-thirds of the way along the low ground, and then crossing to the right bank by a bridge, the remainder up a sloping dry tract, brought me to Le, situated at about 12,000 feet above the sea, some miles from the Indus.

On the way, and especially as I traversed the dry slope, *Echinops nivea* and *Caroxylon Griffithii* were common, both of which I only saw in this valley at 11,000 to 12,000 feet. *Potamogeton gramineum* was common in water at 10,500, and occurred afterwards not unfrequently up to 14,400 feet.

Le, the capital of Ladak, is a city of some size, with groves of poplars and willows about it, and is surrounded by a good deal of cultivation. The picturesque appearance of the city, with the temple and palace on the high rock above, have been rendered familiar by the illustrations in various books of travel. A little below the city is a poor fort, garrisoned by a small detachment of the Maharajah's soldiers. The climate is for a part of the year in summer nearly perfect; and the temperature ranged from 52° to 85° in middle of August, and from 44° to 70° at beginning of September. It is but rarely that more than a few drops of rain fall; one fair shower occurred while I was there, and in 1867 a moderate fall brought down some dozen of houses in the city.

I remained four days at Le, and took the opportunity of examining the flora, noting now (and at a subsequent stay of four days in Le) the following species, remarked for the first time here:—*Mathiola odoratissima*, found locally in some quantity, at from 10,200 to 13,300 feet, in the valley of the Indus and in Nubra only; *Sisymbrium Sophia*, only at Le; *Capparis spinosa*, common here at 12,000 to 12,500 feet, and found only in Indus valley and Nubra—in the latter, down to 10,300 feet, and the leaves used as a vegetable, and the fruit said to be eaten; *Stellaria media*, at Le only; *Malva parviflora* and *Lamium amplexicaule*, here, and at 10,800 feet in Nubra; *Nepeta salviæfolia*, here only at 12,400 feet; and a tall *Rumex*, found at damp places, from 10,500 to 13,000 feet, in Indus valley and Nubra;

Cuscuta planiflora occurs, at 10,500 to 11,500 feet in the Indus valley and Nubra, on *Mentha*, *Perowskia*, and *Stachys*. Here a moss was not uncommon, which appears to reach 15,500 feet or more in various parts of Ladak; only once found in fruit at 13,000 feet.

The only two flowers cultivated at Le were a Chrysanthemum and a Tagetes, neither of them very common there, or seen elsewhere in Ladak.

It may be noted that a great part of the fuel used by the well-to-do in Le is drift-wood of *Juniperus excelsa*, brought from the mouth of the Zanskar River, a few miles off.

During the time I was in the capital, a good many Yarkandis came in to trade—very hardy and independent-looking fellows, more so even than the Pathians of our north-west frontier. Their numbers this year were much increased, owing to its being the second season of Dr Cayley, as British agent in Ladak, for watching over the Turkistan trade. It had originally been arranged that I should be up in Le early enough to accompany Dr Cayley across the Karakash Pass, where only Mr Johnson of the Survey had preceded him ; but circumstances had delayed me beyond the season at which he had to cross, and now I could only afford a week or two *towards* the Pass, and on the Changchenmo and north of the Pangong.

So I settled to have first a few days in the Nubra district, across the hills to the north of Le, including part of the basin of the Shayokk and that of the Yarma River, one of the most fertile and prettiest parts of Ladak; and this I fixed on, although Dr Thomson had spent some time in Nubra.

On the 19th August I commenced with a short march of seven miles in a northerly direction from Le, up a large valley to Karamlats, at 15,465 feet, prettily situated on a knoll by a small stream some miles above population and cultivation. On the way, the following additional plants occurred:—*Cicer Soongaricum*, not uncommon in Ladak from 10,600 to 16,000 feet, and of which the grain is eaten ; *Lonicera glauca*, a small shrub, occurring occasionally at 13,000 to 15,000 feet; *Solenanthus* sp., not uncommon at from 13,300 to 16,000 feet ; *Allardia tomentosa*, to

16,500 feet—next day, and once after, at 16,000 feet; *Ligularia arnicoides*, and to 17,000 feet next day, and not common afterwards; and *Waldheimia tridactylites*. The last was got at 16,500 feet on the 20th; it frequently occurred afterwards at great heights, and grew to 18,500 feet, at the extreme north point I reached, being the highest of any flowering plant I know in the Himalaya.

On the 20th August, from Karamlats there was a steady rise, latterly heaped with blocks covered with snow to Laoche La Pass, some three miles from camp. At the blocky and snowy crest, 17,500 feet, no plants were seen. The beautiful, scented *Delphinium Brunonianum*, the blue flowers of which are strung into necklaces, &c., was common on both sides here, as at other passes, about 16,000 feet, and one reached 18,300; *Gentiana nubigena*, with the longest, largest flowers of all I got, was common at places about 17,000 feet, and occurred at a similar height on two passes after this.

A steep descent of 500 feet, over a snow-field covering the mass of blocks, brought me to the Tso ("a lake"), a circular, apparently deep lake, whence the slope lessened, the valley widened, and the path lay along the bank of a stream from the lake. After sixteen miles in all, I reached Khardong, at 13,263 feet, some miles below the first villages and cultivation. The Stachys of the 12th was abundant from 16,000 feet downwards; and from 13,000 a Berberis was common, which afterwards was found down to 11,000 feet, but in this part of Nubra only.

The march of 21st August took me several miles down this stream, to near where it joins the Shayokk, and round and down some steep hills on the left banks of the latter hill, running north-westward to Kartshar, 11½ miles in all, a village picturesquely situated in the lateral glen of a small tributary. Here the lower elevation and increased moisture account for the presence of a good many plants not found in most other parts of Ladak. Amongst these, Dr Thomson got three sp. of Orchidaceæ, of which I found two. Of other plants, *Silene conica*, I got here only; *Vaccaria* here and in the Indus valley, at 11,500 feet; an *Arnebia*, like *A. hispidissima*, which is found in many places in Nubra and to the east, at from 10,500 to 16,000 feet;

Euphrasia officinalis, common in many places in Ladak, from 10,300, and occasionally to 16,300 feet; two species of *Pedicularis*, one of which occurred afterwards to 16,000 feet; *Polygonum Nepalensis*, got in Nubra only, at 10,500 to 11,500 feet. Near Kurtshar there was much Myricaria of both species in the bed of the small stream; and there was first seen *Lycium Ruthenicum*, which was common in young fruit, and found in Nubra only, from 10,200 to occasionally 13,500 feet. Its mawkish, sweet fruit is eaten.

Here, and in some other villages, are some trees of *Pyrus Malus;* but the fruit, which is small and pleasant, only ripens below this. In this village also were some trees of *Juglans regia*—one as much as 10 feet in girth, but short and stunted compared with those in the Himalaya farther south. I only saw it once afterwards in Nubra.

On the 22d August I made fifteen miles down the Shayokk to Diskit, a considerable village, with a monastery on the sloping hill over it, lying, at 10,689 feet, near the left bank of the river, opposite the junction with the latter of the Yarma (sometimes called the Nubra) from the north.

The only novelties of note on the march were *Potentilla Salesovii*, found at Ladak, here only at 10,800 feet, and *Tamarix Gallica*. The latter kind, frequently in fine red flower (darker than that of the plains), grows in some quantity, in parts of the Nubra valley, at 10,200 to 12,000 feet—at one place (26th) to 13,500 feet. It reaches 10 to 15 feet high, and generally is mixed with Myricaria, of which both species were abundant in many parts of the bed of the river, here as much as a mile and a half wide. *Hippophae* also was common in masses, attaining 15 to 16 feet in height.

At Diskit itself, where I halted on the 23d August, grew a tall *Allium*, with long narrow leaves and fine umbels of whitish flowers, the root, leaves, and flowers of which are eaten; and *Juncus bufonius*, which also occurs in the Indus valley, from 10,500 to 11,000 feet.

Populus pyramidalis and *Salix* were not uncommon here, as elsewhere in Nubra, among the cultivated plants of which are *Allium Cepa*, grown under 11,000 feet, and *Cucurbita maxima*, at 10,200 to 10,500 feet only, with *Panicum* *miliaceum* at about the same heights, and turnip up to 11,500 feet. Here also, as in the Indus valley, *Ervum Lens* is grown at 11,400 to 11,500 feet.

On the 24th August I proceeded to Hundirri, twenty miles, lying at 10,604 feet, on the right bank of the Shayokk, still flowing north-westerly. About half-way the river was crossed on a small light raft of spars, supported by inflated goats' skins. *En route*, *Tamarix gallica* was common in and near the bed of the river, with Myricaria; and on the right bank, above Hundirri, a grove of wild *Populus Euphratica* extended nearly a mile in length, at about 10,500 feet. The tree here attains 1½ to 2 feet in girth (one was seen of 5 feet) and 20 in height, and its wood is carried to some distance to be used as fuel. On the way, *Solanum nigrum* was found, the only time in Ladak. Close to Hundirri were a good deal of a *Vincetoxicum*, climbing in bushes, found once afterwards only; and *Colutea arborescens*, in flower and fruit, was common in places here only.

At Hundirri are a good many poplars and willows, with many apricot and other fruit trees, among which are one or two *Elæagnus*, cultivated for its fruit, and reaching 5 or 6 feet in girth, and 25 feet in height. It is quite different in size, aspect, and leaf, &c., from the species which is commonly wild in the Himalaya to the south. It was planted at Unmaru also, a village eleven miles to the north-west, lying on the right bank of the river, at about 10,200 feet, whither I went on 25th August, while my camp halted at Hundirri. At the former, fruit trees were more numerous (and probably become more so further down the river), and included several Juglans.

On the way to Unmaru one specimen of *Orobanche cærulea* was found, the only time in Ladak, though it is frequent in Lahoul. On one of the cairns of stones, with sticks supporting prayers printed on cloth, coloured rags, &c., which are common in Ladak, were placed some pieces of branches of *Juniperus excelsa*, said to be brought from High some distance to the west. I was afterwards told that it grows high on the Yarma also.

From Hundirri, on the 26th August, after proceeding backwards some miles up the right bank of the Shayokk, I crossed, by the Chali Lungpa Pass, to the valley of the

Yarma River. The elevation of the crest was only 15,000 feet above the sea; but a great part of the ascent to it is up a terribly difficult ravine, so much obstructed by rocks and large shrubs, &c., that I cannot conceive how the traps (now carried by men) were got up it, unless their guides were better than mine, and so found a side-path. As it was, they only reached our destination after dark.

In the ravine, or rather rift, to over 13,000 feet, first occurred abundance of *Myricaria*, reaching 15 to 18 inches in girth; *Tamarix Gallica*, *Salix*, and *Hippophae*, with *Populus Euphratica*, more rare. *Arundo Phragmites* and *Perowskia* also are frequent to 13,000 feet. *Ribes leptostachyum*, of which the fruit is eaten, occurred at 12,000, and was found once afterwards in Nubra at 10,800 feet; and *Dracocephalum stamineum* was got here, and once or twice at similar heights in Nubra only.

At the foot of the very steep descent from the pass is the village of Chirasa, with its picturesque monastery on a high rock close by. Some three miles up the right bank of the Yarma, here running south, in the bed of which Myricaria was abundant, and Tamarix common, while near the banks were fine cultivated willows, one or two reaching 9 feet girth and 60 feet in height, brought me to Kuri, 10,231 feet, nineteen miles in all.

On the 27th August, the traps, &c., going straight to where camp was to be, I first went some miles up the river, and crossed it, with some difficulty, on men's shoulders, at a place where there is a great thicket of large Hippophae. Here I examined the warm springs of Churan, where there is a considerable discharge of warm water (temperature, 164° and 170°, that of the air being 71° Fahr.), with some chalybeate and much saline deposit. Then down the left bank of the river to Liakjang, a village at 10,356 feet, lying close to where the Yarma joins the Shayokk, and nearly opposite Diskit. By my route, this is twenty-eight miles from Kuri, a pretty stiff day's work, as the sun was hot.

Close to Liakjang, *Lonicera angustifolia* occurred to 4 feet high in hedges; and not far from it were one or two large trees and several shrubs, *apparently* wild, of a small-leaved *Ulmus* (*U. pumila?*) mentioned by Dr Thomson, agreeing with a species occurring in the Himalaya to the south, and not again seen by me in Ladak. I conceive that this was originally introduced.

Here, for the only time in Ladak, I saw tobacco growing. It was what I believe to be *Nicotiana rustica* (and quite different from the ordinary *N. Tabacum*), which I have now found cultivated in many parts of the Punjab hills and plains. Much of the tobacco consumed in Ladak is brought from Yarkand, and its leaf is said to be the same shape as that of Nubra. Here also I got some fairly good melons (*Cucumis Melo*), which are sparingly grown in Nubra, under 10,500 feet.

Hence I had intended to cross the Shayokk some miles higher (to the south-eastward); but getting word now that the river was still impassable at that place, I was obliged, on the 28th August, to cross here to a point a little above Diskit, and again march to and encamp at Kartshar, where I had been on the 21st. From it, on the 29th August, I made eighteen miles, three-fourths of the distance south-easterly up the left bank of the Shayokk, where was much Myricaria of both species, in the bud; and at one point, in a little hollow, at 12,000 feet, a clump of some dozens of fair-sized *Populus Euphratica*. The remainder of the way was up a considerable slope, and round a hill southward to Digar, eighteen miles in all.

This village lies near a small tributary of the Shayokk, at about 13,000 feet, and is perhaps the highest cultivated ground in this direction, wheat being the only cereal, and its highest point noted by me. Here were a few young planted Salix. On the way to or at Digar no special novelty occurred, except a solitary specimen (fresh) of Lycoperdon, got near the village, and the only one I found in Ladak.

I halted on the 30th August, and on the 31st the way lay up the stream, still to the southward, the valley gradually becoming steeper. *Gentiana nubigena*, and several species of *Saussurea*, were common to 16,500 feet, at which height there was plenty of moisture, with a good many flowering shrubs, and much grass and sedge. But soon the steepness, aridity, and bareness increased, till at last, after a very steep ascent over large blocks (as on the Laoche La of the same range on the 20th), with largish snow-beds near, I reached the Lasghun La Pass, 17,478 feet. As the crest was a narrow rocky ridge, with a good deal of snow, only three or four plants were found, among them being Waldheimia, and a green Lichen only got once afterwards.

By a very steep descent over blocks (as on the 20th), and then south-westerly, in steepish valleys, I, after some miles, reached the open Indus valley, with the Echinops, &c., which had not been found in Nubra; and turning westward, over and among bare low ridges, by-and-by arrived at Le, about twenty miles from Digar.

After a halt of five days at Le, I, on the 5th September, set out, the first part of the journey being south-easterly along the Indus valley on the right bank, passing the villages of She, Thikse, and Stagna, each with picturesque high rocks crowned with monasteries. Along part of this tract there is much population and cultivation, most of the wheat and barley being then reaped. Hippophae was not uncommon low, and Zannichellia occurred in water, with species of Potamogeton, &c. Here I had my first taste of the high winds of Ladak, of which soon after I got ample experience.

Camp was a few miles within the green valley of a small tributary of the Indus, at Kharru, twenty-six miles from Le, at 11,579 feet. Here I halted on the 9th, enjoying the rest and the pleasant temperature (from 45° at sunrise to 73° at highest), and the fine view southward across the Indus valley to the verdant glen, in which stands the monastery of Hemis, one of the largest in Ladak.

On the 7th September, I went twelve miles up the valley, passing early Chimre, with a monastery perched, as usual, on a high rock, the last to be seen for twenty-five days; and, a few miles farther on, leaving behind, at about 13,000 feet, the highest few stunted planted willows. On the way were seen large quantities of turf, cut and piled for fuel, which I have never seen in the Himalayas to the south. *Artemisia parviflora*, a glabrous species, occurred, and is frequently abundant at from 13,200 to occasionally 17,500 feet. *Artemisia sacrorum* was also common, and *Solenanthus* was abundant in leaf for miles, up to 16,000 feet.

Camp was at Zangrul, 15,964 feet, a level spot, with some dry stone walls for shelter, where already many of the plants were drying up from the advance of the season; and here, as generally for some weeks after this, the fuel was chiefly the large thick roots of Eurotia, which is luckily one of the most abundant and wide-spread plants of this part of desert Ladak. *Caragana pygmæa*, already noted, is less widely distributed, and burns away more rapidly. Several odorous species of Artemisia are also used for fuel, as is the hassocky Alsine; but these want body, and none of them are equal to the two first named. From Zangrul, on the 8th September, I started (temperature 30°) for the higher of two passes open to me, and ascending eastward, the latter part being steep, at about five miles from camp, the Ze La was reached. Here, at 17,984 feet, the low temperature (34° at nine A.M.), caused chiefly by the proximity of large snow-fields and biting wind, prevented me from sitting long to enjoy the magnificent view of snowy peaks to the southward. Of the dozen or two of species which reached a considerable height, the most notable were *Delphinium Brunonianum* and *Gentiana nubigena*, to 17,000 feet; *Cystopteris fragilis*, to 17,500 feet; and *Waldheimia*, to 18,000 feet. At the crest I found only Lecanora and another Lichen, and a Moss.

A very steep and rough descent over and among blocks, mostly granitic, brought me to Ke Tso, a pretty, green, clear lake of about half a mile long. After this the road ran down a narrowish valley, gradually getting wider and the scenery tamer, till I reached Tankse, twenty-five miles from Zangrul. This is a small village, but the chief one in this tract, lying at 12,958 feet, with a good deal of flat and cultivation. At 13,500 feet there were one or two poor *Populus balsamifera*, the last for a long time.

On the 9th September, the road from Tankse lay up a widish valley along the stream on the banks of which Tankse is situated; the scenery at first rather picturesque, but gradually tamer, and with great marshy flats, up to Mughlib, nine miles, at 13,300 feet. At this poor, small hamlet, arrangements were made as to provisions for the more distant part of the trip. *Lonicera angustifolia* was occasional from 13,000 feet to the end; and at 13,000 feet an Allium occurred, with very narrow leaves and lilac flowers, which is occasional in Ladak at 10,500 to 14,000 feet, and of which the leaves are eaten.

The march of 10th September was rather an interesting one, the first part of the way lying south-easterly up the valley to the head of the stream, where there were two small, shallow, clear lakes, surrounded by picturesque scenery. *Ranunculus aquatilis* occurred early, as did *Lonicera angustifolia;* and *L. glauca* grew in considerable clumps to the uppermost part near the Sartokh Pass, where Clematis was abundant. From this, 14,800 feet, the slope was easy, and, while descending, light snow fell for about half an hour. Ere long I got my first glimpse of the Pangong Tso, with its great blue bosom everywhere indented by spurs of the lofty mountains round it. With its north-west end full in sight, but without going within a mile or two of the margin, I turned northward, and soon reached Lukung, at 14,127 feet, a very poor, little settlement of Changpas (nomadic shepherds), who come here for grazing in summer, and spend the winter in villages a good way to the south. Toward Lukung, *Glaux maritima* was abundant in saline places, and at it were a dozen or so of small planted Salix, the last for many days.

On the 11th September, leaving at Lukung most of the servants and traps to await orders, I set out towards the north, and passing a few straggling shrubs of *Myricaria elegans*, with abundant Clematis, and leaving behind the last scraggy wild willows, I reached the last village in this direction, Phabrang, at 14,800 feet, where barley was the only crop, the highest at which I have noted it. Here, through the aid of a subordinate government official, met by accident, I was able to make fitter arrangements for provisions to be sent after us than those effected at Mughlib; and here also I picked up a guide, a Bot (as these people call themselves), named Lamba, one of the best and most willing natives with whom I ever had to do, and who accompanied me up to 1st October.

Three or four miles farther north (marmots being seen *en route*), and about eight and a half miles from our start, camp was at Gyanmor, 15,770 feet. This, like other similar places of encampment, was near a supply of water and grazing, the only permanent institution being a few low, dry-stone walls to serve as shelter for passing travellers, and as a nucleus round which clustered the black tents of the Changpas, who bring their flocks hither in summer.

Hence I had intended to go the Changchenmo, a large eastern affluent of the Shayokk River, by a pass with the almost unpronounceable name, Kyapting Kyipting La; but here—and only after the tents were up, &c., so that there would have been much delay in again moving—I was assured that it would be impossible from beyond the pass to get up the river to the place I wished to reach.

Accordingly, on the 12th September, we retraced our detour of the preceding day, and, passing up the sloping side of a wide valley, in a north-easterly direction, with but little vegetation, only a dozen or so of plants in several miles, I at last reached the Marsemik La. This pass crosses the range which divides the Pangong from the Changchenmo watersheds, and though the ascent is long, it is not rough or steep; and even near the crest, 18,641 feet, the slopes being easy with earth among the stones, there was a greater variety and amount of vegetation than at any pass of nearly equal elevation I have ever crossed. Among other plants, *Urtica hyperborea* attained 17,500 feet, *Eurotia* and *Taraxacum* 18,000 feet, the highest at which I found either, and *Waldheimia* reached quite to the top. A good deal of snow lay near, and the temperature was only 46° at two P.M. In such circumstances, with, as often occurred, no large blocks for shelter from the piercing wind, and with, as generally, the poor fuel brought from the last camp, taking the boiling point was not a pleasant task; nor was the view from this pass or ridge a very striking one, so as to tempt me to linger. Near the crest hovered a kind of eagle (one of which I afterwards saw at the very crest of the Parang La, 19,000 feet), and several ravens were flying round. Some of the latter are generally seen about encampments at lower elevations.

From the crest, which was covered with granite blocks, the first part of the descent, with a steep slope among boulders, is not very comfortable; but these difficulties lessened long before I reached the place for camp, Panglung, at 16,040 feet, six or seven miles from the Marsemik

La, and nineteen miles from our starting-point. Here, on the border of a purling little tributary, which joins the larger stream which came from towards the pass, pursuing its course in a grassy valley, I halted on 13th September, temperature ranging from 27° to 52°. At this place there grew about forty species of plants, including ten Graminaceæ and Cyperaceæ, the most notable being a very minute *Gentiana*. *Ephedra* here, as often elsewhere at considerable elevations, was reduced to 1 or 2 inches in height.

On 14th September, the first nine miles of the way from Panglung was down the valley of the stream, still in a northerly direction, to Pamzal, at about 14,500 feet, at its confluence with the Changchenmo, by this time of year become quite a small stream, though flowing in a valley the bottom of which was a mile or two wide. The rest of the way the path ran up the shingly bed of the river, in which at places was a good deal of Myricaria scrub. At last I crossed from left to right bank to camp, which was at Silung Yokma, with some fuel growing about, at nineteen miles from Panglung, and lying at 15,000 feet.

The journey of 15th September, of ten miles in a northerly direction up the valley of a tributary of the Changchenmo, was rather a doubtful one, as none of the men with me had ever been much further up than our starting-place. At four miles up I passed Gokra, where there is a good deal of flattish ground with Myricaria scrub, at the junction of a large stream coming from a wide north-westerly valley, said to abound in wild yak, wild sheep, and antelope. Near this I saw five of the last. Hares were common; and I noticed the first kiang for many days. Hippophae was here, from the altitude, about 15,500 feet, reduced to quite a tiny shrub.

Hence the road was not pleasant up the bed of the stream, often running in a mere cleft between high rocks. At three miles above Gokra was Chonglung, 16,200 feet, on a flat, with much saline efflorescence, with a series of warm springs (122° to 130°) issuing mostly from calcareous excrescences, some of which reached 18 or 20 feet high, with the warm water gushing from some parts of their surfaces, and great icicles hanging from others. *Triglochin* was abundant in pools at the springs.

Some miles further up, after passing some large snow fields in the now wider bed of the stream, camp was at last pitched for the night at Phu, 16,400 feet. Here grass and sedges grew in small patches, only in sufficient quantity for one meal for the yaks, and fuel, of *Eurotia*, was very scarce. Here, again, *Ephedra* was reduced to 2 inches high.

On 16th September (temperature 18°, at 7.30 A.M.) the route lay still north-westerly, the narrowing valley getting more stony and arid, and vegetation more and more scarce. For some time there had been no trace of a path, and our only guides were little piles of two or three stones stuck on end, put up, as is the custom in these desolate parts, by a party which had preceded us by a few days. It consisted of a Yarkandi *vakil* (sub-ambassador), who had been directed with his attendants to take this route to his home *via* the Karakash, across the Kuenlun, to see if it would be a better route for traffic than the very difficult and trying pass at present used, the Karakoram, the road from which comes out on the Yarma in Nubra. This *vakil* had taken with him letters to Khush Begi, the ruler of Yarkand, from an enterprising European gentleman, who, as well as an agent of the Geographical Society, has since gone on to that place (and have now returned safe! November 1869).

Some seven miles from Phu I turned somewhat to the right, north-easterly, up a lateral glen, where the ascent at last became excessively steep; and here, from the elevation, I felt the shortness of breath more trying than on any other occasion, and was compelled to make pauses to try to recover breath every few yards. Neither here nor elsewhere have I ever had the pass-headache, but my guide and other Bots were frequently troubled with it, and used as a palliative to tie a tape tightly round the forehead. The small rill we had till then, had disappeared, and we left behind the last plants—*Tanacetum tomentosum* at 18,000, and *Waldheimia* at 18,500 feet.

At last I reached the crest of what I must call the Benami ("nameless") La, the crest of which, 19,600 feet, is flattish and rounded, very shingly like all the hills near this, and with a good deal of earth in places. None of the mountains within many miles appeared to be more than a few hundred feet above this point. The view to the north was limited by another range, but that to the south was expanded, and included a splendid snow horizon; and as the wind was light, and the temperature 50° (at 1·30), the rest here was very enjoyable.

From the crest our road lay down an easterly valley with a small stream, we being now in the watershed of the Thang o Thang Plains, stretching to the range on the north, across which is the Karakash pass to Turkistan. There was not a blade of vegetation all this part, nor a trace of animal life, except one or two small gnat-like flies. At last, as it became certain that the tired yaks must be late, I halted for the night at a place, about 18,760 feet, some fifteen and a half miles from Phu; there was not a stalk of grass for the yaks, or a single root for fuel, of which only one day's supply had been brought from last camp.

With rather a dreary look-out I halted on the 19th September, and sent off an exploratory party eastward, I and Lamba going in a similar direction, to discover whether a road could be discovered by which to repass to the watershed on the south of the great range, for my time would not now allow of my risking the delays which might result from my diving further into these wilds. Scraps of *Waldheimia* occurred near camp, the highest flowering plant I ever got, and I think the last specimen of it I found, although from the lateness of the season it may have been unidentifiable after this. Besides it, small clumps of the hassocky *Alsine* were the only plants seen on my trip of exploration, which extended about three miles east from camp. Here I reached some 19,000 feet, and from the look of the range to the east, came to the conclusion that the passage to the south was feasible (in which opinion the scouts I had sent out luckily joined).

All the rock seen was of a modified slaty character, and the whole surface of the hills was, as before, covered with small stones. Below the place where I sat, at the extreme point of my trip, to the north-east, lay a widish plain, with the confluence of our stream and another (and so called Gnischu, "two waters"), bounded on the north by another range of hills, over which I had a most striking and extensive prospect of the Thang o Thang Plains, realising the plateau of Central Asia, if it exists anywhere. Humboldt long ago showed it does not exist *beyond* the Kuenlun.

On these plains to the north were many blue expanses with large white flats, being respectively some of the salt-lakes and ice lakes noted by Mr Johnson and Dr Cayley. I returned to camp much pleased with my two hours' work.

As the cold at this camp was about the greatest I had, down to 16° in early morning, and only rising to 47° at highest in the day, I need hardly say I had the greatest difficulty in retaining any caloric in my person, whatever amount of clothing I buried myself in, and the general effects of the cold for some weeks about this time were very severe. All water was, of course, frozen during the night; and I have repeatedly seen the ink remain frozen at midday in a small inkholder carried since morning in a courier's bag slung on my shoulder. The limbs were benumbed, and when the clothes happened to be worn a "raw" was established. The start and early part of the march, as you stumble along with cold and stiff limbs, and beard and moustache clotted with icicles, and the hands thrust well into the pockets, is not particularly lively. I, having a skin idiosyncratically sensitive to the effects of cold, suffered immensely more than nine men out of ten would do, and so may be inclined to exaggerate the discomfort from cold. But latterly my ears and nose, &c., were in a pitiable state; the backs of my hands could only be paralleled in a leper hospital (I have still the white scars of the sores), and the points of the fingers reached such a pitch with chaps that glycerine was powerless, writing difficult, and buttoning a problem and a torture.

On 18th September, as I set out on the route indicated by the explorations of the preceding day, I passed some marks of cooking fires, with tracks of men and baggage animals, indicating, at least, occasional travellers, near the mouth of the second of four considerable valleys which join at Gnischu. Up this we proceeded in a southerly direction for some miles with a moderate slope. Then up a short and very stiff ascent, along the edge of an old snow-field covered with new-fallen snow, which shone like a burnished silver shield, we came out on the flattish top of the same range as we had crossed on the 16th, probably at or close to the Lumkang La of Mr Johnson. The height was 19,632 feet, and there was a more extensive and splendid view over the plains seen to the north than on the previous day; and it was now apparent that many of the mountains beyond them had large snow-fields, so that the snowless tract suggested by Dr Thomson does not exist *there.* Although there was almost no snow here, yet the southerly wind was so terribly bleak and bitter, that I was prevented from sitting long to enjoy the magnificent prospect.

So I proceeded along the top of the range for a mile or two, looking for a valley by which to descend to the southward, and urged to active exertion by the tearing wind from ahead. It is difficult for any one who has not felt such a wind on an open hill-top in desert Ladak to appreciate the violence and pertinacity with which it tries to drive you back, pulls at your clothes, blows off your hat, and seems as if it would wrench the beard from your face.

By-and-by we found and went down a glen descending very steeply to the south-west, where *Tanacetum tomentosum* began at about 17,500 feet; and by this glen, and a wider valley into which it ran, we eventually found a place with grass and fuel at about 17,200 feet. There we encamped, having done about fourteen miles in all—a very good day's work for our starved yaks, with no path any part of the way, and with the hills almost everywhere covered with stones troublesome in walking for man and beast.

On the morning of 19th September (temperature 17° at start, about 7.15 A.M.) after some eight miles down the lower-sloped valley in a south-westerly direction, we came out in the valley of the 15th above Chonglung, and keeping down it, encamped at Kiam on the Changchenmo, a little east from our camp, on the 14th. We had done some nineteen miles, and the elevation here was 15,500 feet. At about 16,000 feet occurred *Artemisia sacrorum,* and at 15,300 feet, *Scopolia*, the highest at which each was found. Some miles before reaching camp I saw a fine specimen of the horns, &c., of the *dūng* or wild *yak* (I had seen one previously), but forgot to annex it. Subsequently the promise of a reward set my guide searching, successfully, for a specimen. Also at various times I got specimens of the skulls of the wild goat, nowhere seen by me on the trip, and of the wild sheep (*nian*), possibly the *Ovis ammon.* Horns of tame and wild animals, but not generally very good specimens, are often placed in numbers on the cairns at crests of passes, and which have been already mentioned.

The first business on the 20th September was to examine the warm springs of Kiam, which had already been described, in a geological paper on part of this tract, by Captain Godwin Austen of the Survey. They are situated on an oozy, grassy, and saline flat, to the south of the river, under slaty hills. The temperature of the air being 42°, that of the springs was 88° and 90°. They are poor compared with those of Chonglung.

Then, the traps going straight, I made a detour by Kiamgo Traggar, a little way up the stream eastward, and afterwards by a wide valley south-easterly, with a magnificent snowy mountain in the distance ahead, I went up to Gnyingri, where the camp was, in a pleasant little green spot by a small stream, at 17,250 feet, eleven miles from Kiam. *En route* lime and granitic blocks were common, but the rock seen *in situ* was clay slate. Vegetation there was very little as yet, with no novelty of moment.

The maximum temperature here was 48°, and on the 21st September, when we started (about 7.45 A.M.), it was at 27°, a great change from what I had been having. The route lay S.S.E. up a wide open valley, with a very moderate slope, the ground being in places riddled with the burrows of Lagomys, which are common in parts of Ladak at from 14,000 to 17,000 feet, this being about the highest at which I observed them; the trivial name, "tailless rat," is tolerably descriptive. Here also I saw five antelopes, and hares were abundant, this probably being about the highest point for the latter.

At four miles from camp was reached the crest of the Kiungang La, 18,070 feet, the temperature at 10 A.M. being 54°. This pass is rounded with a good deal of soil, some red sandstone and conglomerate cropping out; and at or near the top were some twenty species of plants, one or two, *e.g. Alsine*, going a few hundred feet higher. *Urtica hyperborea* and *Artemisia parviflora* were not seen above 17,500 feet, the highest point at which I saw the latter. As there was no great valley stretching directly away from the pass, the view was not a very extensive one. The raven was seen here; the chough and crow do not go quite so high (as a rule, but the former were seen after this at the crest of Parang La, 14,000 feet), and the pigeon with white-barred tail is not generally seen much over 15,000 feet, and apparently not often so far as this from villages.

After a bit of steep descent from the pass, our route was S.S.E. down the moderate slope of the commencement of the Chang Parma, which stretches hence to the south-east end of the Pangong Tso, and is much the longest of its class (wide long valleys) I have seen. Here for some miles I was in Chinese territory, called by the Bots *Machin*, but I missed the stock sensation of a Tibetan journey, viz., being turned by the soldiers who are posted along the Chinese border to warn off intruders. In valleys to the west large snow-fields came down as low as 18,000 feet in places, and from them came a cold westerly wind, bringing a few drops of rain occasionally. In one of these valleys was a wild yak, quietly feeding, the only one I saw, so they would appear not to be *very* common in the country I traversed. About 17,000 feet a small broad flat-bodied lizard appeared. At a wide plain I turned south-westerly down the main valley, where, about 16,500 feet, *Myricaria*, reduced to under 3 inches in height, soon appeared, and was at first puzzling from its herb-like aspect. At 16,200 feet, eleven miles from our starting point, our camp was at Milpal, near which there was a good deal of *Eurotia* for fuel, and sedge and grass for the yaks, as well as water, the small stream having often disappeared in the gravelly bed, again to reappear.

On the 22d September (temperature 22°) I went seventeen miles further down the Chang Parma, here generally about three-quarters of a mile in width. The stream disappeared for a long way here, so that I had to make twelve miles ere water could be got for breakfast. *Glaux* was abundant for some way about 15,500 feet, below which a wild *Salix* grew in clumps to 15 or 16 feet high; *Potentilla Inglisii* was very common in bushes up to 6 or 8 feet in girth; and *Rheum* occurred, after weeks of absence, quite dried up. Towards the end of the march there was some *Myricaria*, reaching 6 or 7 feet in height, and *Lonicera glauca* occurred at the end, where in one corner was abundance of a prostrate *Astragalus*, with a prickly fruit, occasionally found after this in abundance locally down to 13,000 feet. *Christolea crassifolia* was one of the most common plants over all this part of the Chang Parma.

On this day kiang were seen in some numbers, and became common next day. And on this march also two kinds of spiders and one dipterous insect appeared. The common house fly, of different sizes, was seen at places up to 17,000 feet, and one appeared in the milk at the camp (18,500 feet) on the 16th September, but may have been *imported*. The only other animal not already mentioned as seen in the further and higher part of the tour was a small black spider. Butterflies had long disappeared, and no moths had been seen for three weeks, but possibly from the advance of the season only, as a smallish silvery-grey species had been rather common at over 16,000 feet south of Le, in the middle of August. During the whole of the northern part of the tour there were seen no sparrows, magpies, wagtails, or swifts, which are all common in the Indus valley, &c.; nor after the 11th September, near Phabrang, were any marmots observed for weeks.

Ferruginous oozings were common near Shanrai, where our camp was, at 14,800 feet, near the junction of two fine bold precipitous glens, on the west side, with the main valley. It was less the picturesque, however, that induced me to halt here, than the state of the poor yaks, and they only arrived at dark, several of them with suppurating feet, from the stony ground we had been traversing.

The temperature was 26° at starting time on the 23d September, about this time never before 7.30 A.M., being somewhat regulated by the time at which the sun got over the high hills. Determining to finish the Chang Parma and reach the Pangong before night, I proceeded down the south-easterly gently sloping valley, nearly a mile wide in places. Scrubby vegetation was not uncommon, but there was no grass or sedge in quantity for miles. Blocks were numerous, the larger ones often granitic. A larger yellowish lizard and another dipterous insect appeared.

After fifteen miles I got a first sight of the Tso Niak, which is the eastern sweet water portion of the great lake, of which only the western saline part is called Pangong Tso, although the whole is generally named Pangong by Europeans; and I soon entered on the plain of twenty-five or thirty miles area, which lies on the north of the stream that joins the two portions of the lake, and of their two extremities. It lies at about 14,000 feet and a little over, is for the most part sandy, and much burrowed by rats, which are common in many places in Ladak. Many parts of the plain are covered with *Arundo Phragmites. Myricaria* scrub was not uncommon. *Lepidium latifolium* was abundant in places, and *Mulgedium Tataricum* not uncommon.

At Ot, or rather that corner of the great plain so-called which is nearest the outlet of the connecting stream from the eastern part of the lake, our camp was pitched at 13,980 feet, twenty-one miles from Shanrai. The stream was brackish, and turned out to be easily fordable. About this river many wild geese and wild duck, a few dark herons, and a small wader, and ravens, crows, and wagtails were common. Scattered in the clay-beds running through the sand of the plain were multitudes of shells, almost all a Lymnæa and a Planorbis, with one or two of a small doubtful bivalve. Along the steep rocks, on the south side of the stream, "beach marks" of calcareous concretions were common to 50 or 60 feet above the level of the water. These, which continued—and often to greater heights—along the lake so far as I saw it, with other circumstances noted by Captain Austen, show that a gradual but rather rapid diminution of the water of the lake is going on; and, still further back, it would appear at one time to have overflowed at Sartokh Pass (of the 10th September), and run down the Tankse valley, eventually to join the Changchenmo.

The traps were very late in reaching this camp, owing to the fatigued and starved state of the yaks, one of which had died on the way, and two more had to be left behind when I started on the 24th September. Crossing the stream, I passed along its left bank for about three miles to where it falls into the Pangong Tso, and then westerly along the south-western edge to Khabatt, sixteen miles in all. The lake, from its great size and the gigantic mountains around, rising to 4000 or 5000 feet higher, surrounding it closely on all sides, is most impressive, and some of the details are interesting. But these are monotonous and repetitive, consisting of mile after mile of promontories of slaty rock, with granitic blocks alternating with sandy bays, with the same minor features of miles of rows of shells along the beach, varied with myriads of the bodies of a small shrimplike animal, or masses of a dead water-weed (Potamogeton ?) floated down from the sweet-water portion; the only sign of life on the large scale being occasional small herds of kiang. Add to this, that the path was mostly rough and blocky, that herbs there were almost none, the chief vegetation being small patches of *Myricaria* in some of the bays, and that I was somewhat wearied of the desert I had already passed through, and it may be conceived that I had enough of the great lake ere I parted with it.

This parting occurred on the 25th September (temperature of air at starting (7.15 A.M.) 27°, of water of the lake 32°), when I made some nine miles, still westerly, along the shore, the lake at one place apparently diminishing to not more than two or three miles in width; but at Sharma, where we turned off from it, it could not be less than ten or twelve miles broad, and might be much more. In some parts along the lake *Myricaria* was seen up to as much as 7 or 8 feet in girth, by far the largest I saw.

From Sharma, after about six miles S.S.W. up a narrowish valley,—the latter part of the ascent rather stiff,—I reached the rounded flattish crest of the Sharma La. Here, 16,200 feet, the axis of the range appeared to be of granite, as were many of the blocks strewn over the ascent. From this there was an exceedingly stiff descent of a mile in sand with stones, down which, in the face of a strongish wind, it was easier to trot than walk. Here I saw two wild sheep, the only ones noticed on the tour, which, *with* the wind, ran up quite close to me and the guide.

A little further on was a sluggish stream, with abundance of *Potamogeton gramineus*, occasionally found to this height. And after nineteen miles in all, at 14,430 feet, our camp was pitched on the first grassy soft ground of any size we had had for weeks, not far from the considerable village of Chushal, and the first human habitations of any kind seen since Gyanmor on the 12th. Here, and southward for miles, extended a wide, grassy, and occasionally marshy plain, on which large flocks are grazed.

At Chushal I discharged the Bots and *yaks* that had served me so long and so well, and getting porters to replace them, on 20th September, proceeded southward up the shallow broad valley, a continuation of the wide plain. Passing, I believe, not far from the Tso Rul, a small lake south of the Pangong, after fifteen miles, I reached Rizhung Koru, lying in the valley at 14,544 feet. *En route Caragana* reappeared, none having been seen on the northern part of the tour, at 14,400 feet; nor did it again disappear entirely for any length of time up to the time of crossing into Spiti (where also it is common). At the camp *Triglochin* was common in dampish places.

Halting on the 27th, I continued on the 28th September still southerly and up the same valley, and crossed the Tsakki La, 14,850 feet, at six miles, whence, in the same direction, down another wide valley, past a large grazing encampment; and after twenty-two miles in all, having been compelled to come some miles further than I intended, in order to get water, I encamped at Pera, 14,148 feet.

On 29th September, after a few miles south-westerly, over sandy flats, where the basket *Melica* of the Indus valley (apparently) was abundant in places at 13,200 feet, I struck the Indus. Hence, along the right bank, I went, in a westerly direction, to Cha, twenty-two miles in all, lying at 13,175 feet, on an island formed by two of the several channels of the river, here moving slowly along in a widish valley. None of these channels were at this place over knee-deep; but for some weeks before this a skin-raft had been necessary to cross some of them.

On 30th September the remaining channels and flats by the river were soon crossed, and after a very minor pass, I speedily struck the Hanle stream, not far south of where it joins the Indus, and proceeded up its left bank, its valley being for the most part widish, with a very low slope, to Chibra, at 13,603 feet, eighteen miles from our camp at Cha. *Myricaria* was abundant in many parts of the wide bed of the stream and the flats near it, up to and after this; and *Glaux* was profuse in many saline places on this and next day. In this tract very large herds of kiang were often seen, and I repeatedly counted more than one hundred in sight at once.

The journey of twenty-one miles on 1st October, still southerly up the same stream, brought me to Hanle itself, 13,426 feet, with its great monastery perched on the end of a high rocky ridge, and a small village at its base. Round this there are wide grassy plains, with meandering streams, and a little cultivation, barley being the only cereal. Here I visited the monastery, and, without much edification, saw the *doited*-looking prior and brethren sitting among tinsel, coloured rags, and toys, mumbling at their devotions.

Having with difficulty got porters here to relieve those who had come with me from Chushal, and to accompany me to Spiti, I, on 2d October, proceeded westerly across the Hanle Plain, where *Christolea* was one of the chief plants, its split fruit lying in heaps in little hollows. The latter part of the way was up the rough and rocky valley of a small stream, where *Lonicera angustifolia* occurred at 14,400 feet, and vegetation of all kinds was very scarce all along. Camp was at (Eastern) Dongan, twenty miles, at 14,841 feet, very dreary and bare, with but little water or grass.

On 3d October, still up the valley, after turning southward, the ascent getting steeper, and all becoming more arid, and, if possible, barer, till at last, after a very steep bit of ascent, on which were patches of the minute *Myricaria* as high as 17,800 feet, I reached the crest of the Lanak La. On and near the broadish top—18,314 feet—there were a good many plants, but most of them at this season so dried up as to be unidentifiable, or perishable from brittleness. The most notable of them were *Delphinium Brunonianum*, *Marrubium lanatum*, and *Urtica hyperborea*.

After a rapid steep descent, the route sloped more slowly for some miles to the highest water at (Western) Dongan, 14,271 feet, the whole country here and onwards being most sterile and bleak.

On 4th October (Sunday), as the cold was very severe, I left the windy, exposed site at Dongan, and made a short march of seven miles to Taga, at 14,060 feet, where I had a warmer, or at least a more sheltered camp. From both of these places, especially the former, there was a splendid view to the south and south-west, of the magnificent snowy peaks near the Parang La, towards which I was going.

The journey of 5th October, fifteen miles in a westerly direction, was across a pretty extensive plain, here running north and south, and up the narrow valley, in many places a mere ravine, of the Parang River to Nurba Sumdo, on a wider part of the channel, at 14,571 feet. *En route* there was but little vegetation, the most notable being a considerable growth of *Myricaria* and *Hippophae*, about half-way, at 14,500 feet.

From Nurba Sumdo, on the 6th October, we soon turned south-westerly, up the right branch of the river, which comes from towards the Parang La. Up the left branch which joins the former near the north-east, goes the road from the pass to the Great Tsomoiri Lake (and towards the road by which I went northward between Kiangchu and Rukcham). A few *Lonicera angustifolia* occurred on the edge of the channel soon after the start, at 14,600 feet, the only shrub which was seen after this, except *Caragana*, which grew sparingly at our camp at Gnomnak, 15,046 feet, and fourteen miles from Nurba Sumdo.

On the 7th October I made a march of ten miles still up the bed of the stream, now mostly dry, the valley having become narrower, and with but little vegetation of any kind. Camp was at Netik, 15,681 feet, where there was still a good deal of very small *Caragana*.

From Netik, on 8th October, the road southerly was pretty steep and rough, at first along the side of, and the last two miles over, snow covering a great glacier, to the Parang La (pass). This was about six miles from our camp; the elevation is 18,961 feet, and the cold here was terrible. But as I now entered Spiti, which, although the vegetation, &c., is Tibetan in character, cannot be included here, I shall now bring my narrative to a close. And as this paper has already become far too much protracted, I shall omit the remarks I intended to have made on Ladak generally, and travelling in it, the character of the people, their dress, &c., with some notes on kiang, yaks, &c.

I must, however, enter a few general statistics, which I shall make as short as possible. And first, as to the ground gone over. From August 5th, when I crossed the Bara Lacha from Lahoul, to 8th October, when I crossed the Parang La into British territory again in Spiti, were fifty-one days on which there was no complete halt. In that time 837 miles were covered, and seventeen passes, of over 14,000 feet, were crossed (including both terminal ones).

With my Ladak specimens I amalgamated Dr Cayley's, about 175 species, producing a total of 400 species for Ladak. But excluding 13 cultivated plants, and 23 of Dr Cayley's, neither collected nor noted by me, there is a total of 364 species of wild plants for two months' tour there. This will illustrate the comparative poverty of the flora of the country, since I have frequently in the Himalaya, in a tour of shorter duration, and not covering two-thirds of the ground, and with less experience in collecting than I had in Ladak, got more than double the number of species.

Seven of the species being cryptogamous, and three or four of doubtful identity, about 57 Natural Orders of flowering plants were represented in the collection, the following being about the number of specimens in each of the principal Natural Orders :—

Ranunculaceæ, .	17	Primulaceæ, .	9
Cruciferæ, .	30	Gentianaceæ, .	8
Caryophylleæ, .	14	Boragineæ, .	5
Leguminosæ, .	21	Scrophulariaceæ,	11
Rosaceæ, .	17	Labiatæ, . .	21
Crassulaceæ, .	10	Salsolaceæ, .	12
Saxifragaceæ, .	6	Polygonaceæ, .	13
Umbelliferæ, .	10	Gramineæ, .	39
Compositæ, .	51	Cyperaceæ, .	9

In conclusion, I have again to beg that the Society may be lenient with this paper, as much of its incompleteness is owing to the absence of part of my material, and to the haste with which this has been written, in anticipation of the recess.

II. *Notes on the Famine Foods of Marwar.* By Assistant-Surgeon George King, M.B., lately attached to the Marwar Political Agency. Communicated by Professor Dickie, Aberdeen.

The substances resorted to by the very poor, as articles of food in times of famine, are probably pretty much alike in most parts of Northern India. With those used in our own provinces we are, unfortunately, but too familiar, yet as Marwar is a territory of which most Europeans know so little, I have ventured to throw together a few notes on the substitutes for the ordinary cereals which are being used there during the present severe famine. The accompanying specimens of the raw substances, and of the breads prepared from them, were obtained by me in October last, in the districts of Joudhpore and Pallee, from famishing wretches who were then subsisting largely on them.

The Marwarees, in common with the inhabitants of the neighbouring states of Jeysulmere and Bikaneer, are familiar with famine, or at least with scarcity. In all three states the annual rainfall is extremely small. There are no accurate statistics on record, but that of Marwar may be set down at about 3 or 4 inches, which (with the exception of a very uncertain fall of about a quarter or half-inch in the cold weather) is confined to the latter end of July, August, and September. The rain-crops afford the staff of life, for owing to the scarcity of water for irrigation, and its depth* in many cases from the surface, the area of wheat cultivation is very limited, and pulses are grown scarcely at all. Wide tracts of land are hurriedly ploughed after the first shower of the rainy season falls, and *joar* and *bajra* are sown. But even the fate of these crops is very uncertain, for if the scanty rainfall of 3 or 4 inches is not distributed in showers falling at reasonable intervals, they become stunted, and the yield of fodder (in these parts as important as grain) is insufficient for the support of the cattle. The crops having been reaped, these tracts lie quite fallow until next rains, and are almost undistinguishable from the surrounding "jungle," if the term can be applied to such a comparative desert.

The states I have mentioned are essentially pastoral. In Bikaneer, camels are reared in enormous numbers, and in Marwar the wealth of the people lies chiefly in their horned cattle, while in none of the three is sufficient grain grown for the support of its own inhabitants. After the rains a scanty crop of grass springs up, which, with the dry stalks of the *bajra* and *joar*, affords the year's supply of fodder for the cattle. Camels find their chief food all the year round in the leaves and twigs of Zizyphus, Salvadora, Acacia, and other jungle shrubs.

On the first symptoms of a failure of grass, the majority of the horned cattle are driven off under the care of the younger men to seek forage in Malwah or Guzerat, a few bullocks being left to conduct ploughing operations, should

* In Bikaneer, some of the wells are more than 800 feet deep.

showers fall in time to give any hope of a rain crop, and to prepare the soil for the cold weather crop, small as it is. Poorer people who have no cattle, aged and infirm people, and children, do not leave the country until pressure for human food begins to be felt.

Last year, so early as the middle of August, the wiser ryots had their flocks in motion towards Malwah, but as rain so utterly failed, many who put off their departure until a month later, were obliged to remain altogether on account of the weakness of their cattle, the impossibility of finding forage for them on the road, and the difficulty of getting food even for themselves. Not a few who had actually reached Guzerat, having sold their cattle and valuables, and being unable to find employment, returned to Marwar, preferring to die in their homes, if it must come to that, and, like true natives, trusting for something to turn up. But the scarcity is not of food only, but of water also, and many a poor wretch was, I believe, prevented from fleeing the country, from his inability to walk from one well of sweet water to the next, much of the Marwar well water being brackish, and the supplies of superficial water having, of course, been exhausted at an early period of the drought.

With reference to the general subject of scarcity and famine in Rajpootana, the conviction has been forced upon me that these are more common of late years than in times past. This is the confidently expressed opinion of many intelligent old Marwarees with whom I have conversed on the subject. Scarcity is, indeed, now quite a chronic condition in many parts of Marwar. There is no evidence to prove that this rises from increased population. The character of the government of the country during the reign of the present and of the last two or three rajahs, has not been such as to render that a probable solution; besides, it is known that the population of the towns, at any rate, has decreased of late. On the other hand, there is a strong impression among the inhabitants that the cause lies in a diminution of the products of the soil, due to a steadily increasing failure of rain. In the absence of meteorological records the question cannot be settled, but I am inclined to think that this is the explanation.

Much attention has been attracted of late to the reciprocal influence of the vegetation of a district and its rainfall, and the old observation—*that as trees are cut, moisture is lessened*, has been abundantly verified. It is needless to say that in Marwar this principle is unrecognised, and that there is no system of forest conservancy. There does not appear to have been of late any unusual destruction of forest products. For ages the struggle for life in the plains of Marwar has been between men and cattle on the one side, and vegetation on the other. It is an unequal fight, and vegetation is now losing. Nothing is conserved; the few indigenous trees are cut down, and none are planted in their stead. Even shrubs are not spared. Any one who has seen the hedges from 6 to 10 feet high and about as broad, made of dead prickly shrubs, that surround a Marwar village and its fields, can understand what drafts are made on the scanty undergrowth of the jungles for this purpose only. Many more are sacrificed in the preparation of "pala"* as fodder for cattle and camels, as well as for fire-wood. Herbaceous plants fare no better. These are nowhere numerous, but on the first sign of drought their roots are dug up as fodder for cattle, sheep, and camels. By such measures not only is the influence of vegetation, as at once the conservator and attractor of moisture, interfered with, but the hard surface being broken up and loosened by the removal of the roots that bind it into consistency, the naturally light and sandy soil is exposed to the full force of the prevailing west and south-west winds.

The territory of Marwar lies between the Aravalli range of hills on the east, and the desert on the west, and the fertility of any part of it is in direct proportion to its distance from the latter boundary. At the base of the Aravalli lies Godwar, the garden of Western Rajpootana, while on the margin of the desert is situated the barren and inhospitable district of Mullānee. Sandstorms of long duration and great severity are extremely common at certain seasons, and they invariably blow from the west. Much that I saw and heard during a year's residence in Marwar, leads me to believe that the loose sand of the west is

* "Pala" consists of the dried leaves of *Zizyphus*, the commonest jungle shrub in Marwar. To obtain it, the bushes are cut down and the leaves are shaken off the withered branches.

gradually overwhelming the east, and as the process goes on, the reign of barrenness extends eastward.

It would be rash to say that the ruthless destruction of vegetation just described is the sole cause of the alleged increasing frequency of scarcity in Marwar; but it may with safety be admitted that some attention to the conservation of forests (including in the latter term all the vegetable products of waste lands) would be likely to increase the supply of moisture in these regions. Every one knows the difficulty of planting trees in a dry district where the soil has been opened up to the influence of the sun and air, and where all shade has been removed by the cutting of trees.

Dry as Marwar is, however, several species of trees and shrubs could be successfully planted in the rainy season.

Chief among these are the three species of *Acacia*—*arabica*, *leucophlœa*, and *Catechu*—*Salvadora persica*, several species of *Zizyphus*, and *Capparis aphylla*. The two first-mentioned are valuable as timber trees.

Should a railway, as is proposed, be laid down in Rajpootana, the subject will become one of importance to our interests; but without the interference of our Government nothing whatever will be done by the native rulers, whose interests are really most affected.

The chief jungle products being used as food during the present famine in Marwar are as follows:—

1. *Mothee.*—This is the root of *Hymenochaete grossa*, of the natural order *Cyperaceæ*, a tall rush which grows on the margin of tanks. It is not eaten by cattle, but in times of famine the root is eagerly dug up for human food. The fibres and dark cuticle being removed, the solid part of the root is dried, ground, and made into bread, a little flour being sometimes mixed with it. The accompanying specimen of the bread I got from a man who, with his family, was making his dinner of it. Even when freshly made, the bread is dark brown in colour, and has a sour and earthy taste. Roots of other species of rushes besides that named above are also collected under the name of "*Mothee*," but not in any quantity.

2. "*Kejra.*"—The bark of *Acacia leucophlœa*, a tree common in Rajpootana. Bread is made from the ground bark,

with or without the addition of flour. It has an astringent bitter taste, and is far from palatable. On the principle of *experimentum in corpore vili*, I made my sweeper fare on it for a day. The poor man suffered a good deal of griping and discomfort in consequence. I found this to be the usual experience for the first few days that either this or *Mothee* are eaten, but ultimately the stomach gets accustomed to the nauseous food. The young pods of several species of *Acacia* are eaten as vegetables even during times of plenty; and such of their seeds as had ripened were this season ground into a flour, but the quantity available was very small.

3. *Broont* or *Bharoont.*—The seed of *Achyranthes aspera*, a plant common all over the plains of India. When the outer covering of the seed has been removed, as in the specimen which I have forwarded, a wholesome-looking grain remains. The bread made from it is very good, and this is considered the best of all the substitutes for the usual cereals.

4. *Gokhur-Kantee.*—The capsules of *Tribulus lanuginosus*, of the natural order *Zygophyllaceæ*, a decumbent herbaceous plant of wide distribution in India. From the difficulty of collecting it, this does not take a prominent place as a famine food. The unopened capsules are ground down into a rough kind of meal; but from the small proportion which the contained seeds bear to the tough fibrous tissue of the seed-vessel, the bread, of which a specimen is shown, must be indigestible, non-nutritious, and irritating.

5. *Maleecha.*—The seed of a species of grass (probably an *Eleusine*). I have no sample of the bread made from this, neither could I obtain any specimens of the plant itself so as to identify it.

6. *Tilli.*—The refuse of the seeds of *Sesamum orientale*, remaining after the oil has been expressed. This is not made into bread, but is boiled with water into a kind of soup. The specimen exhibited was brought from a bunneah in Joudhpore bazaar, who was selling it to an eager crowd at the rate of seven seers for a Company's rupee. In Marwar this substance is largely stored up by bunneahs against seasons of scarcity. It keeps for many years without further deterioration than a darkening of colour.

7. *Seeds of various Cucurbitaceous Plants.*—Water-melons of great size grow in a semi-wild state in enormous numbers in Bikaneer, and some parts of Marwar, during the rains. The seeds of these, of cucumbers, pumpkins, and melons, are stored up against scarcity. They make a not unpalatable bread.

With the exception of Tilli cake, none of the articles just enumerated can be had to buy. *Mothee* will not keep, but the others are hoarded up in their houses by the poorer people themselves for their own use when the crops fail. These hoards are, however, insignificant, and are soon exhausted during seasons like the present, when in many parts of Marwar no rain whatever has fallen for more than a year.

III. *On the Parasites which affect the Government Timber Plantations in South India.* By Dr Cleghorn.

Dr Cleghorn adverted to the injury done to the plantations of teak in Malabar, and to the Australian plantations on the Neilgherry Hills, by various species of Loranthus and Viscum, which are rapidly propagated, and not easily kept down. The fruit of these loranthaceous plants forms the favourite food of several birds, which deposit the seeds, coated with viscid matter, in the angles of the upper branches. The only remedy is amputation, the affected branches being foreshortened by long-handled chisels. He particularly noticed the occurrence of *Loranthus memecylifolius* on *Acacia melanoxylon* (a tree introduced from Australia), and *L. longifolius* on *Tectona grandis* (teak). He also exhibited a specimen from the University Herbarium, showing a Viscum growing parasitically on a Loranthus.

IV. *Mosses Indigenous to Forfarshire not included in the Flora of Forfarshire.* By the Rev. John Fergusson, New Pitsligo.

The mosses mentioned in this list are new to Forfarshire, and have been gathered principally in Clova, between the dates of Christmas 1866 and Christmas 1868. The great majority of them have been discovered by myself, either in solitary rambles on the mountains, or in company with my much-valued friend, the Rev. Mark L. Anderson of Menmuir, in excursions into the lower lands.

Owing to the many important additions to the number of British mosses made by Dr Stirton and other botanists, through their long-continued and careful investigation of the Bryology of Ben Lawers, that mountain has for some time past been exalted to the dignity of being the best bryological field in Britain. On the other hand, Clova, which, twenty years ago, was its peer, has been allowed recently to suffer a diminution of its glory, simply for the reason that it has not been examined with a tithe of the care which has been bestowed upon Ben Lawers; in fact, it can hardly be said to have been examined at all. The following list, in which we are satisfied the Clova mosses are but indifferently represented, since we have examined only a corner or two of Clova with care, is only an indication of the still unknown treasures of the Benchinnin mountains to be discovered by muscologists of older standing and of more varied experience than two years' study in odd hours, and Forfarshire for a field, have given ourselves. Still, notwithstanding its poverty, the list wrests from Ben Lawers several species hitherto deemed its exclusive property, and contains the names of other species, unknown to Perthshire, new to Britain, and as yet very little known in Europe. It re-establishes the character of Clova, and makes it a dangerous rival to any spot in Britain which may be daring enough to assert a superiority.

Little has been done in the mountainous part of the county, but still less has been accomplished on the coast and in the low-lying inland districts; and much, therefore, may be expected from these quarters, so rich and varied in flowering plants, when they are subjected to a patient and thorough scrutiny.

I need only add that a few of the species are marked doubtful, owing to hesitation on my own part, or to a diversity of opinion regarding them which obtains amongst botanists.

SPHAGNACEÆ.

1 *Sphagnum molluscum,* Bruch. Glenprosen and Clova Hills; common; J. F.

2. *S. rubellum*, Wilson. Glenprosen Hills; J. F.; seems rather rare; J. F.
3. *S. contortum* var. *subsecundum*. Clova; plentiful.
4. *S. contortum* var. *obesum*. Glenprosen, &c.; common.
5. *Archidium phascoides*. Parish of Menmuir; Mr Anderson and J. F. Glenprosen. J. F.
6. *Gymnostomum tenue*. Gannachy and Noran; Mr Anderson and J. F.; plentiful. Kirriemuir and Airlie; plentiful; J. F.
7. *G. rupestre*. Clova and Glenprosen; on rocks, frequent; J. F. Gannachy, &c.; abundant; Mr Anderson and J. F.
8. *Weissia mucronata*. Menmuir; Mr Anderson and J. F. Caterthum; Mr Anderson.

„ *W. verticillata*. Fruit; Auchmithy; Mr Anderson and J. F. Airlie; J. F.

9. *Rhabdoweissia denticulata*. Glenprosen and Clova; frequent; J. F.
10. *Brachyodus trichodes*. Menmuir; but sparingly; Mr Anderson. Clova, at Lochs Wharral and Brandy; very abundant; J. F.
11. *Dicranum rufescens*. Glenprosen; J. F. Menmuir; Mr Anderson; not common.
12. *D. heteromallum* var. *strictum*. Glenprosen Hills; J. F.; very rare.
13. *D. Blyttii*. Stones, boulders, &c., Glenprosen and Clova; not uncommon; J. F.
14. *D. Dickieanum*. Wils. Maskeldie Rocks and Glenprosen Hills, the second and third British stations; J. F.
15. *D. circinatum*, Wils. Clova; J. F. 1867.
16. *D. arcticum*. Clova; in several places; but barren; J. F.
17. *D. longifolium*. Clova, second British station; barren; J. F.
18. *D. albicans*. Reported from Clova by the late Dr Black of Dundee.
19. *Ceratodon cylindricus*. Fields, Glenprosen, Oct. 1867; J. F.; plentiful, but barren.
20. *Dicranodontium longirostre*. Clova, near Loch Esk; barren; J. F.
21. *D. aristatum?* Clova, Glendole, and elsewhere; not uncommon, but barren; J. F.
22. *Campylopus densus*. Glenprosen and Kinnordy; J. F.
23. *C. fragilis*. Glenprosen; abundant, and in fine fruit, 1868; J. F.
24. *C. torfaceus*. Glenprosen, Clova, &c.; plentiful, and in fruit; J. F. Menmuir; fruit; Mr Anderson.
25. *C. setifolius?* Glenphee, Clova; 1868; J. F.
26. *C. alpinus*. Plentiful in Glenprosen, as at Farchil, Kilbo, &c.; Clova, above Rotall; J. F.

27. *C. Schwarzii.* Abundant on rocks at the head of Clova. The Clova specimens of this fine moss are far better than any we have seen; 1867. J. F.
28. *C. brevipilus.* Rare; Glentarrie, Glenprosen; J. F.
29. *Pottia minutula.* Near Arbroath; Mr Anderson. 1868.
„ *Distichium inclinatum.* Clova; rare; J. F.
„ *Didymodon rubellus.* A curious variety, with denticulate leaves, occurs on the Bassies, and other places in Clova.
30. *Didymodon cylindricus.* Glenprosen; in fruit. Clova, 1867; J. F.
31. *D. flexifolius.* Glenprosen; abundant, in fruit. Clova; barren; J. F.
32. *Trichostomum mutabile.* Glenprosen, Clova, &c.; J. F.
33. *T. neglectum*, Wils. MSS. Old chapel, Glenprosen; walls at Cortachy, Carroch, &c.; J. F.
34. *T. tenue*, Br. and Sch. Clova mountains; plentiful, but barren; 1867; J. F.
35. *Tortula revoluta*, Airlie. Wall near Kirriemuir, &c.
36. *T. venialis.* Noran; in fruit; Mr Anderson and J. F. Near Kirriemuir; J. F.
37. *T. lævipila.* Kinnordy, Glenprosen; J. F. Menmuir; Mr Anderson.
38. *T. intermedia.* Near Kirriemuir, rocks by the Carroty; J. F.
39. *T. Mülleri.* Near Kirriemuir; W. Wilson and J. F. Men muir; Mr Anderson.
40. *T. papillosa.* Trees; Noran; Mr Anderson and J. F. Den of Airlie; J. F. Menmuir; Mr Anderson. Kinnordy, &c.; J. F.
41. *Cinclidotus riparius* var. *terrestris.* Kinnordy; J. F.
42. *Encalypta commutata.* Glendole, Clova; J. F.
43. *E. rhaptocarpa.* Glendole, Clova; J. F.
44. *E. streptocarpa.* Common in the county, but barren; J. F., &c.
45. *Grimmia Schultzii.* Clova, on rocks and boulders; plentiful.
46. *G. sudetica*, Schwaegr. Braedownie, Clova; J. F.
47. *G. commutata.* Clova; fruit very scarce; J. F.
48. *Trichostomum ellipticum.* Glenprosen and Clova; frequent; J. F.
49. *Racomitrium protensum.* Clova; rare and barren; J. F.
50. *Orthotrichum tenellum.* Airlie; J. F.
51. *O. fastigiatum ?* Glenprosen; W. Wilson.
52. *O. Lyellii.* Glenprosen, Menmuir, &c.; not rare.
53. *O. rivulare.* Glenprosen; J. F.
54. *O. leiocarpum.* Glenprosen and elsewhere; plentiful; J. F.
55. *O. Bruchii.* Glenprosen, Clova, &c.; plentiful; J. F.
56. *O. Ludwigii.* Clova, in one place plentiful; J. F.

57. *O. phyllanthum.* Common throughout the county.
58. *Zygodon viridissimus.* Kirriemuir, Glenprosen, Noran, Airlie, &c.; fruit rare.
59. *Z. Stirtoni*, Schpr. Near Arbroath; barren; Mr Anderson and J. F. Menmuir; in fruit; Mr Anderson.
„ *Buxbaumia aphylla.* Glenprosen, in woods and on the mountains; plentiful. Glendole, in several places; J. F.
60. *Polytrichum sexangulare.* Caenlochan. Dr Stirton, 1863.
61. *Bryum acuminatum.* Glenprosen Hills, Clova; rare; J. F.
62. *B. polymorphum.* Glenprosen and Clova; frequent; J. F.
63. *B. annotinum.* Fields, Glenprosen, &c.; J. F.
„ *B. Ludwigii.* Clova; fruit in several places.
64. *B. Duvalii.* Glasmheol; Mr Hunt. Clova; Mr Bell, J. F.; barren.
65. *B. lacustre.* Clova, by the side of a stream in Glendole; J. F. 1867.
66. *B. pallescens.* Glenprosen and Cortachy; J. F.
67. *B. intermedium.* Glenprosen; J. F.
68. *Bryum sanguineum.* Glenprosen and Clova, on heaths; common; J. F.
69. *B. atropurpureum.* Glenprosen, Menmuir, coast, &c.; Mr Anderson and J. F.
70. *B. demissum?* Clova; Mr Bell.
71. *B. callophyllum.* Sands of Barrie; Mr Anderson and J. F.
72. *Mnium affine* var. *rugicum.* Near Montrose; Mr Croall.
73. *M. stellare.* Glenprosen, Kirriemuir, &c.; not rare; always barren.
„ *M. cinclidioides.* Clova, Glenprosen, Menmuir, Findhaven Hills, &c.
74. *Cinclidum stygium.* Clova, second British station; not plentiful in Clova; J. F.
75. *Physcomitrium erecitorum.* Glenprosen, Clova, &c.; abundant; J. F. Menmuir; Mr Anderson.
76. *Bartramia calcarea* (var. *major*). Gannachy; Mr Anderson and J. F.
77. *B. seriata*, Mitten. Glenprosen and Clova; plentiful, and in fruit; W. Wilson and J. F., 1867.
„ *Catoscopium nigritum.* Clova; rare; J. F.
78. *Dissodon splachnoides.* Clova; rare; J. F.
79. *Fissidens exilis*, Hedw. Near Forfar; Mr Donn.
80. *Leucodon sciurioides.* Carroty; J. F. Noran, &c.; Mr Anderson and J. F.; barren.
„ *L. morensis.* Clova, in several places; barren; J. F.
81. *Anomodon longifolius.* Airlie. Clova; J. F.; barren.
82. *A. attenuatus.* Airlie, 1868; barren; J. F.
83. *Cylindrothecium Montagnei.* Clova, in several places; barren, and rare; J. F.

84. *Leskea moniliformis.* Clova; very rare apparently; J. F.
85. *L. polycarpa.* Fotheringhame Hill; Thomas Drummond, in "Musci Scotici," in Mr Anderson's possession.
86. *L. subrufa.* Clova; occasionally; J. F.
87. *Hypnum nitens.* Bogs near Forfar; Thomas Drummond, in "Musci Scotici."
88. *H. glareosum.* Glenprosen; J. F. Noran; Mr Anderson and J. F. Clova; J. F.
89. *H. reflexum.* Clova; Mr Don, 1807. Frequent in corries, &c., in Clova, and fruiting freely, 1868; J. F.
90. *H. rivulare.* Glenprosen and Clova; abundant; fruit rare.
91. *H. crassinervum.* Glenprosen; J. F. Norran; Mr Anderson and J. F.
92. *H. Swartzii.* Glenprosen, Kirriemuir, Noran, &c.; not uncommon.
93. *H. Teesdalii.* Kirriemuir; rare; J. F.
94. *H. pumilum.* Airlie; J. F.
„ *H. catenulatum.* Caenlochan; Dr Stirton. Clova; frequent; J. F.
„ *H. atrovirens.* Clova; frequent, and in fruit; J. F.
95. *H. irriguum.* Glenprosen; rare; J. F.
96. *H. confervoides?* Airlie; J. F.
97. *H. chrysophyllum.* Clova, &c.; J. F.
98. *H. dimorphum.* Clova; Dr Stirton, 1863. Glendole, Clova, 1868; J. F.
99. *H. heteropterum.* Glenprosen, Clova, Menmuir, &c.
100. *H. eugyrium.* Glenprosen, Clova, and elsewhere in streams; J. F.
101. *H. arcticum.* Clova; Mr Croall. Glendole; Dr Stirton. Elsewhere in Clova; Messrs Roy, Anderson, and J. F.
102. *H. sarmentosum.* The fruit, which is exceedingly rare, and had not been gathered before more than two or three times, was abundant in Clova and Glenprosen in June 1867; J. F.
103. *H. giganteum.* Glenprosen; Messrs Roy, Bisset, and J. F., in 1866. Fruit in Glenprosen, 1867–68; J. F. Sands of Barrie; Mr Anderson and J. F. Menmuir; Mr Anderson.
104. *H. delicatulum.* Clova; J. F.
„ *H. umbratum.* Thomas Drummond, 1826. W. Wilson, 1836. 1867, J. F.
105. *H. brevirostre.* Glenprosen; J. F.
106. *H. revolvens.* Glenprosen, Clova, Menmuir, &c.
107. *H. exanulatum.* Glenprosen; frequent; J. F.
108. *H. rugosum.* Clova; apparently rare; J. F.
109. *H. hamulosum.* Clova; Thomas Drummond, Dr Walker-Arnott.
110. *H. callichroum.* Glenprosen and Clova; frequent, and in fruit; J. F.

111. *H. resupinatum.* Coast, Mouran Burn, &c.; fruit rare.
112. *H. arcuatum.* Glenprosen, Kinnordy, Oathlaw, Cortachy, &c.; barren; J. F.
113. *H. ochraceum.* Glenprosen and Clova; frequent, and with fruit; J. F.
114. *H. incurvatum?* Glenprosen; on trees, rare; J. F.
„ *H. Muhlenbeckii.* Abundant, and in fruit, in Glenprosen and Clova; J. F.
115. *H. sylvaticum.* Glenprosen, &c.; J. F.
116. *H. elegans.* Glenprosen and Clova; common, but barren.
117. *Neckera pennata.* Very rare. On a beech-tree, Fotheringhame, near Forfar; Thomas Drummond.
118. *Fontinalis squamosa.* Westwater; Mr Anderson. Airlie, Clova; J. F.
119. *F. gracilis.* Glenprosen; Messrs Roy, Bisset, and J. F. Tannadice; Mr Anderson.
120. *Trichostomum flavovirens.* Coast; Mr Anderson.
121. *Tortula Hornschuchiana.* Near Kirriemuir; J. F.
122. *Grimmia ambigua,* Wils. MSS.; *G. robusta,* J. F. MSS. Clova, 1868.
123. *G. Hartmanni.* Clova, in several places; J. F.
124. *G. elatior.* Clova; barren; J. F. 1868.
125. *Fissidens viridulus.* Glenprosen, 1868; J. F.
126. *Hypnum sulcatum.* Clova; J. F.

V. *Notice of Mosses collected in Excursions round Edinburgh in* 1869. By Mr Wm. Bell and Mr Sadler.

The authors exhibited, and presented to the Herbarium, a large named series of mounted specimens of mosses which they had chiefly collected while accompanying Professor Balfour in his class excursions, during summer, to different parts of Scotland. The following are some of the principal species specially referred to, and the districts in which they were gathered:—

1. *Penicuik and Roslin, Edinburghshire, 15th May* 1869.

Bryum carneum, B. cernuum, B. inclinatum.

2. *Kinghorn and Pettycur, Fifeshire, 22d May* 1869.

Anacalypta lanceolata, Didymodon luridus, Grimmia orbicularis, Schistidium maritimum, Tortula lævipila, Trichostomum crispulum, Zygodon Stirtoni.

3. *North Queensferry, Fifeshire, 29th May* 1869.

Bryum torquescens, Grimmia patens, G. trichophylla, Pottia Heimii, Hypnum irriguum, H. palustre *var.*

4. *Dirleton and North Berwick, Haddingtonshire, 5th June* 1869.

Dicranum heteromallum *var.* strictum, Distichium inclinatum, Hypnum chrysophyllum, Mnium serratum, Tortula revoluta, Trichostomum rigidulum, T. tophaceum.

5. *Manuel and Linlithgow, Linlithgowshire, 12th June* 1869.

Cinclidotus fontinaloides, Encalypta streptocarpa, Fissidens viridulus *var.* pusillus, Hypnum aduncum, H. heteropterum, H. lycopodioides *var.* falcatum, H. ochraceum, Orthotrichum rivulare, Ptychomitrium polyphyllum, Schistidium apocarpum *var.* with very obtuse leaves, Zygodon viridissimus.

6. *Denny and Carron Water, Stirlingshire, 19th June* 1869.

Hypnum ruscifolium several *vars.*, H. ochraceum, H. lycopodioides *var.* falcatum, H. prælongum *var.* Stokesii.

7. *Cleghorn and Lanark, Lanarkshire, 26th June* 1869.

Hypnum crassinervum, H. palustre, H. resupinatum, Orthotrichum leiocarpum, O. Lyellii, O. pumulum, O. tenellum, Tortula lævipila, T. Müllerii.

8. *Dollar and Castle Campbell, Kinross-shire, 3d July* 1869.

Andreæa rupestris, Anœtangium compactum, Bryum acuminatum, Encalypta ciliata, Fissidens osmundoides, Grimmia torta, Gymnostomum curvirostrum *var.* pallidisetum, Hypnum fluitans *var.*, H. elegans, H. ochraceum, H. fluviatile, Zygodon lapponicus.

9. *Twizel and Berwick, Berwickshire, 10th July* 1869.

Orthotrichum pallens, Tortula lævipila, T. vinealis *var.* flaccida, Trichostomum tophaceum, Weissia verticillata.

10. *Perth and Methven, Perthshire, 17th July* 1869.

Leucodon sciuroides, Orthotrichum rupestre, Polytrichum juniperinum *var.* strictum.

11. *Glen Dole, Glen Fee, and Loch Brandy, Forfarshire, 23d and 24th July* 1869.

Brachyodes trichodes, Bryum Ludwigii, B. pallens *var.*, Campylopus flexuosus, Dicranum falcatum, D. Starkii, Distichium inclinatum, Grimmia contorta, Hypnum arcticum, H. fluitans *var.*, H. hamulosum *var.* micranthum, H. molle, H. sarmentosum, H. silesiacum? H. trifarium, Leskea subrufa, Mnium cinclidioides, Pterogonium filiforme, Splachnum sphæricum, S. mnioides, Trichostomum glaucescens, Zygodon lapponicus.

12. *Arthur's Seat and Duddingston, Edinburghshire, April and June* 1869.

Bryum carneum, Didymodon luridus, Grimmia anodon (new), G. incanum (new), G. Schultzii, Hypnum cordifolium, H. irriguum, H. polygamum *var.* stagnatum, H. ruscifolium *var.*, H. speciosum, Mnium affine *var.* rugicum, Pottia cavifolia *var.* gracilis, P. Heimii, P. minutula, Tortula intermedia.

VI. *Miscellaneous Communications.*

1. *Carduus carolorum.*—Charles Jenner, Esq., exhibited a growing plant of *Carduus carolorum*, in full flower. This handsome thistle was first discovered by Mr Jenner in 1867, in Ross-shire, and described by him in the ninth volume of the Society's "Transactions." Several plants which he brought from Ross-shire are at present growing luxuriantly (upwards of 5 feet high), and flowering profusely in his garden at Easter Duddingston Lodge.

2. A letter was read from Dr Philip W. Maclagan of Berwick, enclosing specimens of *Linnæa borealis,* and *Goodyera repens*, which had been recently collected by the Rev. Dr Stuart of Chirnside, in Mellerstane Woods, Berwickshire.

3. Mr A. Craig-Christie exhibited, and made some remarks on specimens of a Sagina which he had collected at North Queensferry. Professor Babington, to whom specimens had been sent, thought it might be a form of *S. ciliata;* but it did not agree altogether with the characters of that plant, as it possesses a five divided capsule, while *S. ciliata* has only four divisions. Mr Christie was inclined to consider it a new species between *S. nivalis* and *S. subulata.*

4. Mr Sadler exhibited specimens of *Rosa alpina*, collected near Caribber Castle, Linlithgowshire, in June last. This is the third time that this rose has been met with in Scotland. In 1865, Dr White collected it on Kinnoul Hill, and in 1868, Mr Dawson collected it at Stobhall, in Perthshire.

5. Captain Charles W. Hope, R.N., exhibited and presented to the Museum various articles from the Fiji Islands,

including cloth made from the bark of the paper mulberry; female dress made of a rhizomorphous fungus; stem of *Piper methysticum;* bowl made from a coco-nut; flute which is played by the nose; female hair-combs, made from bamboo; forks made from trees—one exhibited was said to have been used by a chief when eating human flesh.

6. John Cowan, Esq., exhibited specimens of *Azalea procumbens*, *Anemone pulsatilla*, *Primula farinosa*, and *Saxifraga oppositifolia*, sent by his brother, Mr James Cowan, from the Dovrefeld, Norway; and mentioned that on the 6th June there was much snow, and ice 3 feet thick on the lochs in that country.

7. Dr John Lowe, Lynn, Norfolk, presented fruit of *Prunus insititia*, showing the fruit assuming the form of a single-celled pod, not unlike a legume.

8. Mr Halliday exhibited male flowers of *Picea nobilis*, from the Earl of Mansfield's plantations at Scone.

9. Professor Archer presented preserved specimens of nutmeg and mace, gulfweed, and flowers of a Daphne.

10. Mr A. J. Elliot presented a large specimen of *Desmarestia aculeata* from the coast of Argyleshire.

11. Sir Robert Hay, Bart., exhibited a beautiful specimen of *Amaryllis Belladonna*, which flowered in his conservatory at King's Meadows, Peebles, taken from a plant recently received from Africa.

12. Mr M'Nab stated that a plant of the American Aloe, in the Palm-House, had sent up a strong flowering stalk, which, during the month of June, had grown upwards of 10 feet, and was still rapidly increasing.

Appendix to Mr Craig-Christie's Paper on Plants collected in Shetland in 1868 (see pp. 165–170).

Mr Christie being unacquainted with the many additions made to the botany of Shetland since the publication of Edmondston's Flora in 1845, has marked nineteen species and two varieties with an asterisk, indicating that they have been detected for the first time in these islands by himself. Many of these, however, so marked had been previously discovered and recorded by other collectors.

The following, as far as known, are the principal additions made to the flora since Edmondston's day, and the names of the collectors*:—

Draba incana var. *contorta*. Springfields and Muckle Heog, Unst. Tate.
D. incana confusa. Muckle Heog. Tate.
Nasturtium officinale. Sand Lodge. Christie.
Viola palustris. Bressay; Unst; Yell, &c. Tate.
V. Riviniana. Buness; Unst. Tate.
Polygala vulgaris var. *depressa*. Common. Tate.
Sagina nodosa. Tingwall Loch; North Unst. Peach.
Alsine verna. Rona's Hill. Tate.
Alchemilla arvensis. North and south side Balta Voe, Unst; Tingwall. Tate.
Rosa canina var. *Lutetiana*. Tate.
Epilobium alsinifolium. Rona's Hill. Christie.
Myriophyllum alterniflorum. Loch of Cliff and Uyea Sound, Unst; Littlesetter Loch, Burravoe, Yell; Tingwall Loch, Mainland. Tate.
Montia fontana. Throughout the islands. Tate.
„ „ var. *rivularis*. Throughout the islands. Tate.
Bunium flexuosum. Voesgarth, Unst. Tate.
Galium Aparine. Balta Sound, Uyea Sound, and Haroldswick, Unst. Tate.
Valeriana olitoria. Norwick, Unst. Tate.
Gnaphalium sylvaticum. Roadsides about Tingwall. Tate.
Carduus arvensis var. *setosus*. Sandy fields, Nees; North Yell. Tate.
Hieracium crocatum (?) Loch of Cliff and Burrafirth, Unst. Tate.
H. vulgatum. Burrafirth. Tate.
H. floccosum. Rocks, Rona's Voe. Tate.
Lobelia Dortmanna. Littlesetter Loch, Burravoe, Yell; Loch north-west of Rona's Hill; Tingwall Loch. Tate.
Vaccinium Vitis-idæa. Rona's Hill. Christie.
Myosotis repens. Bressay; Haroldswick, &c. Tate.
Veronica scutellata. Marsh behind the manse, Bressay. Tate.
V. agrestis. Tate.
Euphrasia odontites. Unst. Peach, 1864.
Rumex obtusifolius. Unst; Ollaberry. Tate.
Polygonum aviculare var. *littorale*. Shore, Burrafirth. Tate.

* Flora of Shetland Isles. By Ralph Tate, F.G.S. "Journal of Botany," vol. iv. pp. 2–15. Corrections on the Shetland Flora. By H. C. Watson and W. Carruthers. "Journal of Botany," vol. iv. pp. 348-351.

Callitriche hamulata. Bressay; Unst, &c. Tate.
Salix herbacea. Saxaford Hill, Unst; Rona's Hill. Tate.
Listera cordata. Rona's Hill; hills about Lerwick; Scatsta. A. White.
Juncus trifidus. Rona's Hill. Christie.
Luzula multiflora β congesta. Hermaness. Christie.
L. spicata. Rona's Hill. Christie.
Potamogeton polygonifolius. Near manse, Bressay; Skaa, Unst. Peach.
P. perfoliatus. Norwick; Loch of Cliff; Nees; Burravoe; Tingwall Loch. Tate.
P. filiformis. Uyea Sound; Unst; Kirk Loch, North Yell. Tate.
Eleocharis acicularis. Christie.
Carex flava var. *lepidocarpa.* Christie.
C. stellulata. Throughout the islands. Tate.
C. pilulifera. Scarpoe, Unst; Uyea. Tate.
C. panicea. Lerwick; Bressay; Unst; Out-Skerries. Peach.
C. distans. Tate.
Sclerochloa distans. South side of Balta Voe, Unst. Tate.
Catabrosa aquatica var. *minor.* Kirk Loch, Nees; North Yell. Tate.
Festuca duriuscula var. *rubra.* Tate.
Lastrea dilatata. About Lerwick; Bressay; Saxaford, Burrafirth, &c., Unst; Ollaberry. Tate and Peach, 1864.
Asplenium Adiantum-nigrum. Harold's Grave and Muckle Heog, Unst. Tate.
A. viride. Muckle Heog. Tate and Peach.
A. marinum. Sea cave, Burrafirth, Unst. Peach.
Lycopodium clavatum. Peaty heath west of Ollaberry. Tate.
Chara aspera. Tingwall Lochs. Tate.
C. hispida. Loch at Uyea Sound, Unst. Tate.

DONATIONS TO LIBRARY DURING THE SESSION.

Brown (Robert). Das Innere der Vancouver-Insel. 4to.—From the Author.

——— Observations on the Medicinal and Economic Value of the Oulachan. 8vo.—From the Author.

Clos (Prof. le). La Feuille Florale et l'Anthère. 8vo.—From the Author.

De Candolle (Casimir). Théorie de La Feuille. 8vo.—From the Author.

Dickie (Professor). Notes on Mosses collected by James Taylor on the Shores of Davis' Straits. 8vo.—From the Author.

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Inzenga (Professor). On the Cultivation of Sumach (*Rhus coriaria*) in the vicinity of Colli, near Palermo. 8vo.—From Dr Cleghorn.

Keys (I. W. N.). Flora of Devon and Cornwall. Part 3. 8vo. —From the Author.

Martins (Charles). Les Jardins Botaniques de L'Angleterre comparés a ceux de la France. Paris, 1868. 8vo.—From the Author.

Masters (Maxwell T.). The Genus Cochliostema. 4to.—From the Author.

Thielens (A.). Notes Conchyliologiques. 8vo.—From the Author.

——— Note sur le *Myosotis Dumortieri*, espèce inédite. 8vo. —From the Author.

——— Notice sur les *Ibis falcinellus* (Temm.) et *Elanus Melanopterus* (Leach). 8vo.—From the Author.

——— Note sur le *Cytisus decumbens*, Walp., espèce nouvelle pour la Flore de Belgique. 8vo.—From the Author.

——— Notice sur le *Carex lingerina*, Bor., espèce nouvelle pour la Flore Belge. 8vo.—From the Author.

——— Petites Observations sur quelques plantes Critiques. 8vo. —From the Author.

Walker-Arnott (Professor G. A.). Notes on Cocconeis, Nitzschia, and some of the allied Genera of Diatomaceæ. 8vo.—From Mrs Walker-Arnott.

Watson (J. Forbes), M.A., M.D. Index to the Native and Scientific Names of Indian and other Eastern economic Plants and Products. 4to.—From the Author.

Transactions and Proceedings of Learned Societies.

Bonn.—Verhandlungen des Naturhistorischen Vereines der Preussischen Rheinlande und Westphalens. Heft 1, 2 (1867). 8vo.—From the Society.

Boston.—Annual of the Society of Natural History for 1868–69. 8vo.—From the Society.

Condition and Doings of the Society of Natural History, 1868. 8vo.—From the Society.

Memoirs of the Society of Natural History. Vol. I. Part 3. 4to.—From the Society.

Proceedings of the Society of Natural History. Vol. XI. 8vo.—From the Society.

Bremen.—Abhandlungen herausgegeben von Naturwissenschaftlichen Vereine. Band I. Heft 3. 8vo.—From the Society.

Copenhagen.—Botanisti Tidsskrift udgivet at den Botaniske Forening i Kjöbenhavn. Band II. 8vo.—From the Society.

Edinburgh.—Proceedings of the Royal Society for Session 1867–68. 8vo.—From the Society.

Proceedings of the Royal Physical Society for Session 1865–66. 8vo.—From the Society.

Transactions of the Royal Scottish Society of Arts. Vol. VII. Part 6. 8vo.—From the Society.

Transactions of the Scottish Arboricultural Society. Vol. V. Part 1. 8vo.—From the Society.

Glasgow.—Proceedings of the Philosophical Society. Vol. VI. No. 4. 8vo.—From the Society.

Proceedings of the Natural History Society. Vol. I. Part 1. 8vo.—From the Society.

Liverpool.—Proceedings of the Literary and Philosophical Society for Session 1866–67. No. 22. 8vo.—From the Society.

London.—Journal of the Royal Horticultural Society. Vol. II. Part 6. 8vo.—From the Society.

Proceedings of the Royal Horticultural Society. Vol. I. (new series), Nos. 11 and 12. 8vo.—From the Society.

Journal of the Linnean Society (Botany). Nos. 45–51. 8vo. —From the Society.

Lund.—Universitets Ars-skrift för 1866–67. 4to.—From the University.

Manchester.—Memoirs of the Literary and Philosophical Society. Vol. III. 8vo.—From the Society.

Proceedings of the Literary and Philosophical Society. Vols. V. VI. and VII. 8vo.—From the Society.

Melbourne.—Transactions of the Royal Society of Victoria. Vol. VIII. Part 2; Vol. IX. Part 1. 8vo.—From the Society.

Newcastle-on-Tyne.—Natural History Transactions of Northumberland and Durham. Vol. II. 8vo.—From the Tyneside Naturalists' Field Club.

New York.—Annals of the Lyceum of Natural History. Vol. IX. Nos. 1–4. 8vo.—From the Society.

Paris.—Actes du Congres International de Botanique, Août 1867. 8vo.—From the Botanical Society of France.

Bulletin de la Société Botanique de France. Tomes I.–XIV. Tome XV. Nos. 1, 2; Tome XVI. Nos. 1, 2. 8vo.—From the Society.

Washington.—Report of the Commissioner of Agriculture for 1867. 8vo.—From the United States Government.

Report of the Smithsonian Institution for 1867. 8vo.—From the Institution.

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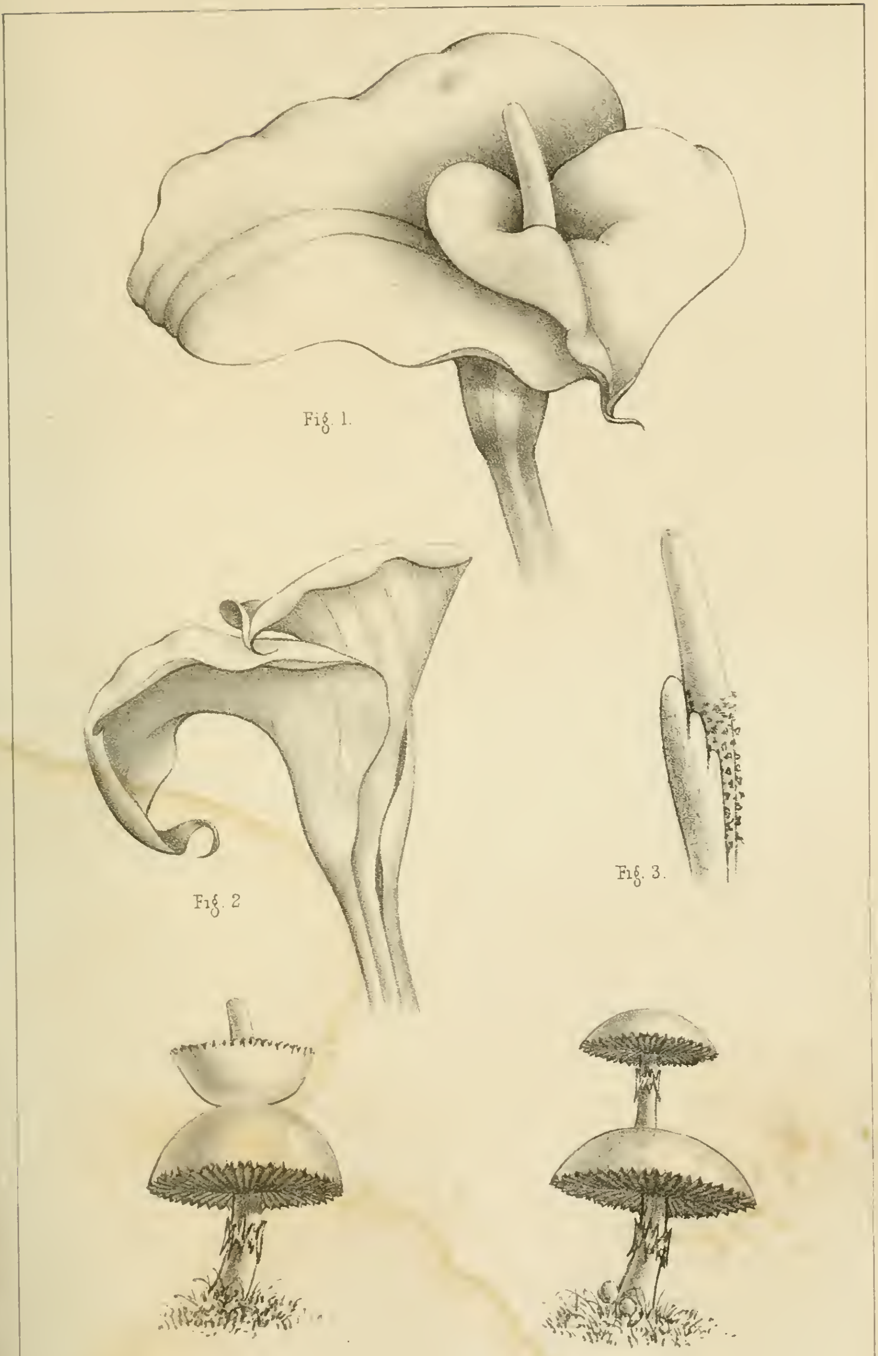
PLATE II



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TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

SESSION XXXIV.

11*th November* 1869.—Dr Cleghorn, President, in the Chair.

The following Gentlemen were elected Resident Fellows:—

Daniel R. Kannemeyer, 25 Rankeillor Street.
R. M. Smith, 7 Bellevue Crescent.

Donations to the Library, Herbarium, and Museum of the Royal Botanic Garden were laid on the table.

The President delivered the following Opening Address:—

In preparing the annual address to this Society which it has fallen upon me, as President, to deliver, I find it difficult (after a long absence in India, and in the retirement of the country where I reside) to trace accurately the progress of botanical research during the past year, and to take up and digest the various publications relating to the vegetable kingdom which have been given to the world since our last annual meeting.

I therefore propose to limit myself to a few remarks on my impressions of the present state of botany in Scotland, as compared with my recollections when I joined the Botanical Society in 1839, and to a brief notice of original works and memoirs, published chiefly in this country and in British India, on the general subject. The impressions received, after long absence, may not accord with your ideas, and I therefore crave your indulgence, as things often appear in a different light to a stranger and to a resident. In the same way I may omit to allude to some points which appear more prominent to you, and which may have altogether escaped my notice. I have prepared a Catalogue Raisonnée of such works as have come under my observation, published during the past twelve months, the divisions of this catalogue being nearly the same as those given in Dr Greville's "Report of the Progress of Botany for 1840," which was a model of what an annual address should be. Here I incidentally remark, that it may in one way be considered advantageous that the President should initiate the session in November by an opening address. On the other hand, there seem strong grounds for recommending that his annual report should embrace an account of the progress of botany from 1st January to 31st December.

About thirty years ago there was in Scotland a goodly number of zealous and industrious botanists, each possessing an extensive general herbarium, who often met at each other's houses for the purpose of comparing specimens and interchanging information. This earnest spirit led, in 1836, to the formation of this Society, which has flourished with fair success for thirty-three years, mainly owing to the continual efforts of the Regius Professor to keep alive an interest in its meetings. Of the twenty-one original members, only nine survive:—*Resident*—J. H. Balfour, M.D.; James M'Nab. *Non-resident*—W. H. Campbell, LL.D., Demerara; Edward Charlton, M.D., Newcastle; Giles Munby, London; Richard Parnell, M.D., Melrose; R. C. Alexander Prior, M.D., London; Nicholas Tyacke, M.D., Chichester; George C. Wallich, M.D., London. And in the surrounding circumstances, also, great changes have befallen the Society. The University Herbarium, which previously contained the collections of Roxburgh, Buchanan, Menzies, &c., has absorbed most of the private collections of the original members, viz., those of Greville, Balfour, W. H. Campbell, P. Neill, G. M'Nab, and others. Large additions have been made by donation and purchase, and there is now a good illustrative herbarium of all the quarters of the globe. It is arranged according to De Candolle's system, and subdivided so as to represent physico-geographical or geographico-botanical sections.

It is remarkable how few general herbaria belonging to private individuals now exist, either in Britain or on the Continent, although we have many collections illustrative of the British flora, and of particular classes of the vegetable kingdom, as ferns, mosses, algæ, diatoms, which require less expense in formation and less space for safe custody. The difficulty of preparing a general herbarium, however, does not apply to Cryptogamic botany.

Scotland is as rich a country in *Cellulares* as any in Europe, and has always been famous for cryptogamic botanists. Of those now at work I may mention prominently one of our oldest members, Professor Dickie of Aberdeen, an accomplished physiologist and algologist, who has contributed the results of many original researches of a high order; and Dr Lauder Lindsay of Perth, an industrious and well-known lichenist. Another of our members, Dr Carrington, is a high authority on the Jungermanniæ; and my predecessor, Mr C. Jenner, is known by his investigations of the uni-cellular algæ.

The difficulty felt by private individuals of forming and preserving general herbaria, renders it of great importance that national museums should exist for the reception of the valuable collections of officers on foreign service; and few things strike me more than the wonderful growth of the museum and herbarium at Kew, where travellers and scientific botanists from all parts of the world take up their quarters for the sole purpose of working in that admirably arranged establishment, the fame of which is so great that in all countries it is looked upon as the grand centre of botanical science. The effects of centralisation which are manifest at Kew are seen in other countries also. In Paris, there is the Jardin des Plantes, presided over by Professor Brongniart; in Florence, Professor Parlatore works in the Orto Botanico; Professor Alphonse De Candolle, at Geneva; in Berlin, Professor A. Braun; in Vienna, Professor Fenzl; and in the Garden at Calcutta, Dr Thomas Anderson has brought the vast Indian Herbarium into excellent order.*

* An annual grant was made in 1861; the general and the Indian Her-

In all these great capitals, government assistance is freely and properly given to centres from which useful influences radiate to the provinces.

But to return to Edinburgh. To render the combined collections of the Edinburgh College and the Botanical Society permanently useful, to make provision for their continual increase, and to place the whole on a footing worthy of our great University, the services of a skilled curator seem alone to be wanting. We may hope, that in these days, when the claims of science to State assistance are acknowledged, this will soon be accorded. While speaking of herbaria, I have to record, with peculiar pleasure, that the Senatus Academicus of Glasgow, aided by the liberality of the citizens, has been enabled to arrange with the trustees of Dr Walker-Arnott's estate for the acquisition and custody of his library and herbarium in the magnificent new College buildings. The conjoint value of these collections is very great; the books contain many notes descriptive of the treasures of the herbarium; and to the student of botany in Glasgow access to these is no small privilege. We rejoice that Dr Walker-Arnott's successor is a man who can, and does appreciate the value of these stores, being himself thoroughly devoted to the science he professes. Dr Dickson has, as you are aware, contributed many valuable papers to our "Transactions."

In reviewing the past, we cannot but connect the flourishing state of botany in Scotland with the influence of Sir William Hooker. During the twenty years of his professorship in Glasgow he published, at his own cost, thirty to forty volumes of original botanical matter, illustrated with 5000 plates by his own pencil. This large amount of scientific hard work produced good fruit, and aided by his kindly and gracious manners, many were attracted to follow the same pursuits. I cannot forget his encouraging words of farewell when I went to India as an assistant-surgeon in 1842, soon after he had settled at Kew. The late Dr Walker-Arnott mentioned to me that it was Sir William Hooker who inspired him and Dr

barium have been all mounted, and placed under a special curator, Mr Kurz, since 1863. A new building for the Herbarium was completed in 1867.

Greville with the love of their favourite science; and my first teacher, Dr Graham, was stirred up in Edinburgh by rivalry with Glasgow.

Another feature in the retrospect is very striking. Two men of science, who possessed a remarkable influence in their day, have passed away, each leaving a valuable legacy in a long series of philosophical journals, published in Edinburgh, and extending over nearly half a century; I mean Sir David Brewster and Professor Jameson. Both of these journals, some years ago, came to an end, without in either case any general index to render their vast stores of learning easily available. Here is work for some industrious student who wishes to render good service to us all. The forthcoming general index of scientific papers to be published by the Royal Society, London, will supply to a certain extent this want; but to those persons possessing Brewster's and Jameson's journals, a separate index would be of great value. In the room of these two well-known periodicals, which occupied the whole field of general science at the time (I allude to thirty years ago), there is now a host of journals devoted to special branches of science. Each circle of investigators has its own mouthpiece. For example, we have "The Chemist," "The Pharmaceutical Journal," "The Naturalist's Note-book," "Zoologist," "Journal of Botany," "Annals of Natural History," "Journal of Microscopical Science," "The Quarterly Journal of Science," "Monthly Journal of Microscopical Science," "Scientific Opinion," "Science Gossip," "Nature," and others.

All who know our esteemed Regius Professor (Dr Balfour) must admire his exemplary devotion to the duties of the class-room, his unrivalled series of diagrams, and his unabated enthusiasm in the field. And I may be permitted to allude to the benefit he confers on many of his former pupils, by his intercourse with them after they enter on distant spheres of duty. I myself am under great obligations to him for regularly transmitting the proceedings of this Society, and for keeping me acquainted, when in India, with much that was occurring in the botanical world at home, of which I would otherwise have remained ignorant. But while under his faithful tuition, there is a much greater number of well-taught students; there are not now so many, in proportion, who follow up the study of Natural History by *individual research.* After reflecting much on this subject, and the probable cause, I believe the reason is, that amongst medical men, for example, the standard of education has risen so high. Twenty years ago, the corporate bodies required a curriculum of three or four years; they require no more time now; but the present examination demands four times the amount of result from those three or four years that it required formerly. In my college days, if a student wanted to take up natural history, he neglected other classes, or employed his class hours in reading up his favourite subject. All this is impossible now; a student to graduate at any university must devote all his time to medicine, surgery, &c., and the less to natural science the better for him. When, however, the young naturalist succeeds in passing the medical examination, he will find the greatest advantage from possessing a degree; if two men, of equal merit in science—one only being a graduate—are candidates for an appointment, the medical man will generally be preferred.

But not only in the medical profession is there a paucity of working naturalists,—from kindred causes the same deficiency of original observers strikes one in all callings. In India this change is particularly noticeable. Among the ranks of the civil service we have no men of the stamp of Sir W. Jones, Colebrook, or Edgeworth, at the present day; Sir Walter Elliot of Wolfelee is the last remaining type of this class; men are all occupied with increased office work and manifold correspondence, and have no leisure to devote to amateur studies. It is to the trained staff of the scientific departments, the geological survey, the trigonometrical survey, exploring expeditions, and forest officers, &c., that we especially look to take fresh steps in science and develope the riches of the empire.

I am more and more convinced that the elements of botany, zoology, and physics should be acquired before the student commences the study of the learned professions; and now that the elementary education of the higher grammar schools is under discussion, it may be possible to arrange that the matriculation examination of our universities should include the elements of the sciences of observation ; something higher than elementary knowledge, of course, is required in a graduate. To produce emulation, there is great need of fellowships, scholarships, and natural history appointments in connection with local museums. At present, there are only the Falconer Memorial Fellowship, for encouraging the study of palæontology and geology, and the Baxter Natural Science Scholarship, open to students of the University of Edinburgh : and for encouraging the study of natural philosophy there is a Neil Arnot Scholarship both in Edinburgh and St Andrews.

Colonial Floras.—The publication by Government of a series of inexpensive 8vo volumes, uniform in type, nomenclature, and arrangement, descriptive of the British Colonial possessions, is a noble work, worthy of the Director of the Royal Gardens, Kew (whose name I was glad to observe yesterday in the *Gazette* as a C.B.), and of the eminent botanists who assist him. Each volume contains not less than 500 pages, with descriptions of not fewer than 1000 plants, and the price varies from 15s. to 20s. Of the proposed series of twelve floras, the following are completed :—

Hong-kong,	1 vol. . .	Bentham.
Australia,	4 vols.* . .	Bentham.
New Zealand,	2 vols. . .	J. D. Hooker.
South Africa,	3 vols. . .	Harvey and Sonder.
Tropical Africa,	1 vol. . .	Oliver.
West Indies,	1 vol. . .	Grisebach.

The value of this series is very great, and it is to be hoped that the whole may ere long be completed. The want of a *Flora Indica* is a great hindrance to the development of the productive resources of that empire. Drs Hooker and Thomson, who commenced this work so well, had unusual advantages for carrying it out, but received no encouragement; ample materials exist at Kew, and there is no doubt that, with the publication of a *Flora Indica*, a new era would open for Indian botany. It is to be hoped that Dr Thomas Anderson, or some other qualified botanist, will soon be in a position to aid in this work, already begun by Drs Hooker and Thomson. In connection with this, I have to notice the publication of Professor

* The fifth volume is nearly ready.

Oliver's "First Book of Indian Botany" (Macmillan & Co.); and an excellent work it is for those desirous of gaining a preliminary knowledge of the botany of India. The natural families are illustrated with excellent figures of typical species by Fitch.

It is further a matter of gratification to find that His Grace the Duke of Argyll, Secretary of State for India, has recently sanctioned the publication of a "Flora Sylvatica," or Forest Guide for Northern India, uniform in size and type with the "Colonial Flora" series. This is to include all the useful trees and shrubs of the North-West Provinces, Punjab, Oudh, and Central Provinces, with concise descriptions and vernacular names, together with all such information regarding their condition in a native state, and under culture, as is obtainable in the present state of our knowledge. The execution of this work has been entrusted to Dr J. L. Stewart, F.L.S., who is eminently qualified to turn the materials to good account. He has established himself at Kew for this purpose. It is of the highest importance for practical purposes, that all the timber trees, especially those reserved by the State, should be well delineated, whether as the only means of correct identification by the departmental officers, or for the purpose of spreading a knowledge of these trees among officers of public works, European settlers, and others. The importance of such illustrations cannot be exaggerated. There are no published drawings in existence showing the character of the Teak, the Sal, the Sissoo, and similar trees, nor are there any accessible to the general public in India, or in England, delineating their foliage, flowers, or fruit. The "Flora Sylvatica" of North India is therefore to be accompanied by a 4to volume of plates, uniform with Dr Wight's invaluable "Icones Plantarum Indiæ Orientalis," and with the "Flora Sylvatica of South India," now being published by Major Beddome, in Madras.

Indian Forest Department.—It may not be out of place here to allude to the openings for young men in the department of public service with which I have had the honour to be long connected. With the greatly extended forest operations which the growing demands of the community and the formation of railways necessitated, the want of trained assistants was much felt, and the Secretary of State for India resolved, in 1866, to send out provisionally a few youths, properly trained, for service in the forests of India, until things are ripe for forming a forest-school in India. The first detachment of assistants, after two years and ten months' education on the Continent, ending with a visit to the forests of Scone and Grantown in Scotland, have sailed for the East; a second party are now in the forests, and a third will undergo the preliminary examination next month. Much has been written in the "Gardeners' Chronicle" and other periodicals with reference to these appointments; and as much misapprehension exists, it seems desirable to give the facts in regard to the object of the present arrangement. In Britain, while arboriculture is conducted with the greatest skill and success, and the finest specimens of ornamental trees and artificial planting may be seen, there is a comparatively small area of wood cultivated as a crop, and that is diminishing rapidly every year; of the wood grown for ornament or game, there is a much greater extent. It is humbling for a Scotchman to confess that there is no school of forestry in this country where the different branches of study can be mastered. It is to be hoped that by the joint action of the Highland Society and the Scottish Arboricultural Society, an organised system of instruction may be set on foot.* In Germany, the system of forest science and management is most elaborate and carefully arranged. The works of Hartig, Burckhardt, &c., all published under Government auspices, show the importance attached to forestry in a country where the population depends principally on wood for fuel. France also has large and well-regulated establishments for the conservancy of State forests. The chief training school is the École Impériale Forestière† at Nancy, in the department of the Meurthe, an excellent institution; in the immediate neighbourhood are very extensive tracts of natural forest, where the different branches of study can be mastered.

* While these pages are in press, a Board of Forest Examiners has been formed in Edinburgh.

† The course of instruction in the French Imperial School of Forestry is fully described by Mr Alfred Pengelly, in the "Quarterly Journal of Science," Jan. 1870, p. 60.

Four youths are now under training in Prussia and four in France, and they are to finish their education by spending some time with a practical forester in Scotland. The experiment being tried is of great importance, and I doubt not such alterations will be made as seem expedient. The object aimed at is to secure the largest amount of theoretical knowledge and practical training combined. It will be admitted that the youths would be imperfectly prepared for their duty in India if they had not an opportunity of seeing the timber slides of the Vosges, the Jura, or the Bavarian Alps, the valuation surveys, economical manufacture of tar and charcoal, and the collection of various articles of forest produce. These details prepare them for the arduous work which lies before them. In Britain, from the force of circumstances, the forests are very small, and the system of management, though sound and suitable on the small scale, is less adapted for the vast forests of India. In this country the scope is so limited, that no gentleman of position thinks of training his son to be a forester. In France and Germany it is otherwise, and Forestry is a regular department of State service.

With regard to the development of the botanical resources of India, I may notice that the Cinchona plantations in Bengal* now cover 1000 acres, and those in Madras† are considerably more extensive. Vigorous efforts are also made to introduce *Cephaelis Ipecacuanha* on the same principle, and, so far as it is possible to obtain a sufficient stock of plants from the botanic gardens and scientific nurseries of Britain, without a special mission to the Organ Mountains, this has been done. Dr Anderson hopes, on his return to India, to take out sixty plants obtained in Europe. This introduction has been forced on Government by the new views in the medical treatment of dysentery, and the greatly increased price of the drug, which now sells at 9s. per lb. Some of the skilled Cinchona gardeners, set free in consequence of the completion of operations, are available for the charge of cotton farms, instituted by Government in various suitable districts.

* 1st Dec. 1869.—Total plants in Darjeeling, 2,248,970, the tallest 13 feet in height.

† 31st March 1869.—The trees planted in 1862 vary from 21 to 24 feet.

Additions to British Flora.—The only addition that seems worthy of notice is that of *Aira uliginosa*, Weihe, in Galway (Mr A. G. More) and North Hants (Mr H. C. Watson), see Seemann's "Journal of Botany," 1869, pp. 266 and 281. There are old Scottish specimens in the British Museum, as noticed by Baker in the "Jour. of Bot." vol. iv. p. 176. Professor Babington has not entered the plant in the last (sixth) edition of his Manual, deeming the evidence of its occurrence insufficient. Professor Balfour laid before us *Hieracium collinum*, Fries, discovered near Selkirk, which may prove to be *H. dubium*, L. Mr J. T. Boswell Syme has found *Allium carinatum*, Linn. Fries (*non* Smith), near Perth, where it had been supposed to be *A. oleraceum;* but the banks of the Tay are a perfect nursery of exotics, four or five American Asters, *Petasites albus*, *Mimulus luteus*, and others, so that the occurrence of a plant there is not sufficient to entitle it to be entered as a native. It might be worth while to examine the other Scotch stations of *Allium oleraceum*, in case of *A. carinatum* occurring—the bright purple flowers and exserted stamens of the latter at once determine it when growing, but dried *Allia* are not easily distinguished.

Messrs Jerdon and Gilbert Stuart have directed attention to the colonies of introduced plants which in like manner have lately appeared on the banks of the Tweed, particularly near Galashiels, where the wool which is brought to the factories is spread out to be bleached, and the seeds attached to it are there sown.

The third edition of "English Botany" has reached the 73d number (*Eriophorum*); ten numbers are required to finish the *Gramineæ*, with which the work will terminate. It is unnecessary for me to speak in praise of the descriptive part of this national work, which has been re-written by Mr Boswell Syme. Dr Hooker has almost completed a "Student's British Flora," a work which will contain a very extended account of British Plants, and will be a valuable pocket companion to the student. It is proposed to follow it by another work, with structural, physiological, and morphological observations on British plants.

Professor Babington of Cambridge has brought out his long expected monograph of the difficult genus *Rubus.*

The descriptions of species are most elaborate, and this eminent botanist has rendered good service to critical students. There is a copious list of localities attached to each species, and a table showing the geographical distribution.

Messrs Trimen and Dyer's Flora of Middlesex is a remarkable book, and the full title expresses accurately what it contains. The introduction gives a succinct account of the topography, physical geography, and present botanical condition of the metropolitan county. There is a sketch of the rise and progress of botany in Middlesex from the time of Turner (1551) till the present day; this contains much new and interesting matter. The existing flora is minutely described and illustrated by a map—the county being divided into seven districts.

Amongst the new elementary works, "Elements of Botany," by Professor Balfour, and "Lessons on Elementary Botany," by Professor Oliver, both for the use of schools, have appeared. The former is intended as a text-book for pupil-teachers and young students, with questions at the end of the chapters; the latter is designed to teach the elements of botany upon Professor Henslow's plan of selected types, and is well illustrated. Messrs W. & A. K. Johnston have published Elementary Physical Atlases, for the use of village schools and similar institutions, at extremely low prices. These are neat and attractive, and the maps are coloured to show geological formations, and the geographic distribution of plants and animals. This enterprising firm has in view the publication of a series of Botanical Diagrams, which will be of great value for the teaching of botany in schools throughout the country.

Physiology.—In the September number of the "Annals of Natural History," Mr Darwin has published additional "Notes on the Fertilization of Orchids," which brings up the literature of the subject to that date. Mr Darwin refers to all the papers bearing upon his work published since it appeared. These papers "contain," he states, "corrections of some serious errors into which I had fallen; and, on the other hand, confirmation of many of my statements." This is a most interesting and instructive contribution to science.

In the same number is a paper "On the leaves of

Coniferæ," by Mr Thomas Meehan of Germanstown, Pennsylvania. He follows up the observations in Professor Dickson's paper on the Phylloid Shoots of *Sciadopitys verticillata* (Procs. of Bot. Cong. 1866, p. 124). The conclusions are—(1.) The true leaves of coniferæ are adnate with the branches; (2.) Adnation is in proportion to vigour in the genus, species, or individual; (3.) Many so called distinct species of Conifers are the same, but in various states of adnation. Carrière has advanced similar views in the Revue Horticole (referred to in Gard. Chron., May 2, 1868). It is somewhat curious that while these gentlemen were considering this point of structure physiologically, Dr Brandis and I had our attention drawn to its practical bearing in Forestry, as may be seen by the following note to a paper on the Pines of the North West Himalaya, which appeared in the "Jour. of the Agri. Hort. Soc. of India," Jan. 1867 (vol. xiv. p. 272).

"Duration of Leaves in Coniferæ.

Picea Webbiana, . . . *Abies Smithiana*, . . .	} 8 to 10 years.
Cedrus Deodara, . . .	5 „
Pinus excelsa, . . .	4 „
longifolia, . . . *Gerardiana*, . .	} 2 to 3 „

"This peculiar character of the foliage indicates the requirements of the different species regarding light and shade. *Picea* and *Abies* thrive in more close and dark forests than *Pinus longifolia* and *Gerardiana*."

Vegetable Teratology.—Dr Maxwell Masters has given in the Ray Society's volume for this year an elaborate and invaluable summary of our knowledge of abnormal development of plants. Many authentic notices of abnormal forms have been most carefully collected, and the volume is illustrated with two hundred figures.

Algology.—The Diatomaceæ have occupied the attention of various observers in this country. Dr Donkin, Rev. J. O'Meara of Dublin, Mr Kitton of Norwich, and others, have recorded supposed new forms, and given additional localities for others previously known. The contents of the Diatomaceæ have been examined under the spectroscope by Professor Smith of America, and found to give the first absorption band in the red, characteristic of ordinary chlorophyll.

Notes on the Diatoms collected in Greenland, by Mr Robert Brown, have been communicated to this Society by Professor Dickie, who also, at another meeting, contributed notes of the few species found among matter brought up from 2000 fathoms in the Atlantic by Capt. Chimmo, R.N. But the most valuable paper in this department is that of Dr John D. Macdonald, R.N., in the Annals of Natural History, "On the Relations of the different parts of the Frustule, and the function of Propagation by Division." Dr G. C. Wallich, after long service in India, has turned his attention, with great zeal and success, to this department of botany. It is very desirable that practised observers, instead of merely giving details of supposed new species, should assume higher ground, and betake themselves to investigations regarding conjugation and subsequent development. The hair-splitting tendency in this, as in other departments, *e.g.*, Lichenology, is one which every true Biologist must deprecate.

Dr H. C. Wood of California has described two Algæ, supposed to be new, viz., *Nostoc calidarium* and *Chroococcus thermophilus*, growing in a hot spring near Benton, in that country, the temperature of which is 160° F.

In the last volume of "Annales des Sciences Naturelles," M. Ripart has written respecting the development of Spores in *Mougeotia genuflexa ;* the stages and results of conjugation are illustrated by excellent figures.

In the June number of the same valuable periodical, there is a very good summary on the nature of the colouring matter of *Fucoideæ*, by M. Millardet. The subject had been previously examined by Cohn, who named the material Phæophyll, and indicated its relation to Chlorophyll. Kraus has described the pigment as composed of Chlorophyll and Phycoxanthine. Arkenary and Rosanoff have also examined this subject. Millardet's observations lead to the conclusion that there are three matters, in some way combined, to which certain marine algæ owe their colour—viz., Chlorophyll, Phycoxanthine, and Phycophæin the two former soluble in alcohol, the latter in water.

An important paper by Professor Dickie on the "Range in Depth of Marine Algæ" was read at the April meeting of this Society, a summary of which is that probably 100 fathoms is the greatest depth at which sea-weeds exist. Even this is doubtful. A single recorded instance of about 80 fathoms in the Irish Channel is mentioned, and a few other cases at 50, 40, &c., are given.

Rabenhorst's "Algen Europas" now exceeds 200 decads. Kutzing's "Tabulæ Phycologicæ" still appear at intervals, and contain excellent figures of Algæ from various parts of the world.

Lichenology.—Various advances have been made in this interesting department of Cryptogamic Botany, and the recent literature has been voluminous. MM. A. Famitzen and J. Boranetsky of St Petersburg, after long investigation, have been led to the conclusion that not only algæ and fungi, but lichens also, are provided with zoospores. Dr Nylander of Paris made, in 1868, some important observations on the Cephalodia of Lichens, which were little known before he drew attention to their importance as furnishing a primary anatomical character. Dr Lauder Lindsay continues his studies on the Microscopical Anatomy of Lichens, and has published elaborate observations on "New Lichenicolous Microscopic Fungi" in "Trans. Roy. Soc. Edin.," vol. xxv. part ii. 1869. His description of this obscure and puzzling group shows much original research, and he intimates the near completion of a memoir on the Spermogonia and Pycnidia of the Lower Lichens. He has also worked out with great care all that is known respecting the lichens of *Greenland*, "Trans. Bot. Soc. Ed.," vol. x. In 1840 only 59 species had been described, but Dr Lindsay enumerates 200 species and 68 varieties. He has also detailed the economical uses of lichens as food for men and animals, and as dyestuff in northern Europe. Dr Lindsay has given in our Transactions (vol. x.) a record of *Experiments* on colour reaction as a specific character in lichens. The results obtained do not support the assertions of Dr Nylander of Paris, and the Rev. Mr Leighton of Shrewsbury, as to the value of the reaction in botanical diagnosis, while reaction is said not to aid the dye manufacturer in determining the value of orchella weed. The Rev. J. Crombie enumerates in the "Journal of Botany" many new lichens found by him in Scotland and England. I have not had an opportunity of seeing the History of Lichenology by Krempelhuter of Munich.

Fossil Botany.—The most important contributions under this head are the series of papers by Mr Carruthers of the Botanical Department, British Museum, printed in the "Geological Magazine," and in the "Transactions of the Royal Microscopical Society." These are enumerated in the catalogue of botanical memoirs published during 1869. Mr Carruthers has paid special attention to fossil fruits and seeds, and his investigations into the Cycads and plants allied to Lycopods and Equisetums are of great value and importance. The Geological Society and the British Association have recognised his services by supplying funds in aid of his researches.

Library.—All great kindred societies (Linnean, Geograpic, Asiatic, &c.) have found the necessity of publishing a classified list, from time to time, of the books and pamphlets which have been acquired by presentation or purchase. A classified catalogue is a great desideratum towards placing our library on a footing in all respects worthy of the University with which we are connected. I doubt not members of the Society would expend both time and money in contributing to so important an object, in the belief that public aid would not be withheld, if required; and I am confident that the publication of such a catalogue *raisonnée*, showing both our possessions and deficiencies, would lead to their supply. It will be remembered that in the infancy of the Society we received some valuable legacies of books, which are enumerated in the first three annual reports.

List of Members.—At the commencement of this year, so far as we know, the members of our Society were as follows:—Resident fellows, 96; non-resident, 265; Lady members, 11; foreign and corresponding, 181; associates, 28,—total, 581. Of the Fellows more than half reside in Scotland, about 140 in England, 14 in Ireland, 20 in India, 5 in America, and 2 in the West Indies. During the year, 10 resident and 2 non-resident members have joined the Society. The Society has to record, during the past year, the loss of—

Dr W. Seller, F.R.S.E., formerly President.
Antonio Bertoloni, Bologna, } Honorary Members.
Carl F. P. von Martius, Munich, } Honorary Members.
Adelbert Schnizlein, Erlangen, Foreign Member.
W. S. Turnbull, Hunting Tower, Non-resident.
A. J. Macfarlan, M.D., at one time Curator.
W. Brand, W.S., Auditor.

Special notices of Dr Seller, and the distinguished honorary and foreign members, have already appeared in our Transactions, pp. 30 and 202.

At a very recent date we have had to lament the loss of our auditor, Mr Brand, in whom the Society has been deprived of the services of one who has contributed in no small degree to its prosperity, and whose place it will not be easy to fill. Mr Brand's singularly methodic arrangement of details, his clear perception, and his early taste for natural history, were remarkable. I would have said more, but Professor Balfour proposes to give a short biographical notice of Mr Brand. The Council have this evening recorded their sense of the loss we have sustained.

A Catalogue of Botanical Works and Memoirs, published chiefly in Great Britain during the year 1869.

STRUCTURE.

Bennett, A. W.—On the Structure and Affinities of *Parnassia palustris*. Jour. Lin. Soc. xi. 24.

Dickson, Alex.—On the Development of the Flower of *Pinguicula vulgaris*, with Remarks on the Embryo of *P. vulgaris*, &c. Trans. Roy. Soc. Edin. xxv. 639. 1869.

Duncan, Mr.—Note on the Stamens of *Saxifragæ*. Jour. Lin. Soc. xi. 31.

Meehan, Thomas.—On the Leaves of Coniferæ. Ann. Nat. History, 4th series, iv. 213.

PHYSIOLOGY.

Bidard, M.—Structure of the Flower of *Gramineæ*, the Functions of the Organs, and the Phenomena of Fecundation. Ann. Nat. Hist. 4th ser. iv. 134.

Darwin, C.—Notes on the Fertilisation of Orchids. Ann. Nat. Hist. iv. 141.

Miquel, F. A. W.—On the Sexual Organs of the *Cycadaceæ*. Jour. of Bot. vol. vii. 64, 93.

DESCRIPTIVE AND CRITICAL.

Balfour, J. H.—Description of *Hieracium collinum* of Fries. Trans. Bot. Soc. Edin. vol. x. 17.

Braun, A., and C. Bouche.—Revision of the Genus *Sanguisorba*. Jour. of Bot. vii. 202.

Briggs, T. R. Archer.—Notes respecting Plymouth Plants. Jour. of Bot. vii. 33, 317.

Crombie, Rev. J.—New British Lichens. Jour. of Bot. vii. 48, 105, 232.

Dickie, George.—Notice of *Grimmia contorta* of Schimper. Trans. Bot. Soc. Edin. vol. x. 19.

Gray, Asa.—Characters of a new Genus, consisting of two Species of Parasitic *Gentianeæ*. Jour. Linn. Soc. vol. xi. 22.

Gulliver, George.—Notes on *Lemnaceæ*, and on the Discovery of the Raphidian Character in Systematic Botany. Jour. of Bot. vii. 9.

Hance, H. F.—On the Genus *Arthrostylis*. Jour. of Bot. vii. 63.

—— De Nova *Rhamni* Specie. Jour. of Bot. vii. 114.

—— On *Delima*. Jour. of Bot. vii. 115.

—— On the *Phœnix* of the Hong-Kong Flora. Jour. of Bot. vii. 15.

—— On *Habenaria Miersiana*, Ch. Jour. of Bot. vii. 161.

—— On *Panicum Mandshuricum*, Max. Jour. of Bot. vii. 41.

—— On *Capparis magna* of Loureiro. Jour. of Bot. vii. 41.

—— On *Thesium decurrens*, Bl. Jour. of Bot. vii. 42.

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On the motion of Professor Balfour, a vote of thanks was cordially given to Dr Cleghorn for his address.

The following Communications were read:—

1. *Obituary Notice of William Brand, Esq.* By Professor Balfour.

We have this year to lament the death of our Auditor, William Brand, Esq., W.S., one of the original members of the Society. The following is a list of those who met at my house, 15 Dundas Street, Edinburgh, on 8th February 1836, to constitute the Botanical Society:—

R. C. Alexander (now Prior).	Gilbert M'Nab.
J. H. Balfour.	James M'Nab.
William Brand.	Giles Munby.
W. H. Campbell.	Richard Parnell.
Edward Charlton.	Nicolas Tyacke.
Edward Forbes.	George C. Wallich.

He was the first Treasurer, and had continued ever since its formation to take a warm interest in its affairs. He was born in 1807, at Blackhouse, in the parish of Peterhead. His early education was at the parish school there, first under the Rev. William Donald, and thereafter under the Rev. John Imray, both subsequently parish ministers in the district. After leaving school, he was apprenticed to Messrs Robertson & Gray, writers in Peterhead, who were factors for the Merchant Maiden Hospital of Edinburgh, and had a large general business. After leaving their office, he went to Edinburgh about the year 1829, and entered the office of Messrs Scott, Finlay, & Balderston, W.S., and there served another apprenticeship. He entered the legal classes in the University. While prosecuting his legal studies, he took a great interest in botanical pursuits, and attended the lectures of Professor Graham in the years 1830–31. He became devotedly attached to botany, and joined the Professor in excursions to various parts of the country, especially in the Highlands of Scotland, with the flora of which he became thoroughly acquainted. He was one of a zealous band of botanical students, who added much to the flora of Scotland, and who made large collections for distribution. The Herbarium of the Botanical Society was much enriched by their labours, and British botanists were largely supplied with specimens for their herbaria. Our Proceedings show the enormous labour which Mr Brand and others underwent in distributing specimens at the first formation of the Society.

Mr Brand was a person of great energy and vigour, a shrewd and intelligent observer, an excellent and fearless cragsman, capable of enduring great fatigue, and of accommodating himself to all the discomforts which might happen during excursions. His happy and cheerful disposition rendered him a most pleasant companion; whatever occurred, he was never out of temper, but on all occasions was a true peace-maker.

Having completed his legal education, he entered the Society of Writers to the Signet in 1834. He afterwards became a partner in the firm of Messrs Scott and Balderston. He was a most valuable man of business, and his reputation in this respect led to his election in 1846 to the office of Secretary to the Union Bank of Scotland, a situation which he filled with great acceptance until his death. Mr Brand was elected Treasurer of the Botanical Society 17th March 1836, and for many years he performed most faithfully the duties of the office. He made several communications to the Society during its early years. In January 1838, Mr Brand laid before the Botanical Society a scheme for the publication of a work under the Society's direction, intended to give a general but comprehensive view of the whole range of botanical science, both as respects its natural and civil history, and commencing with the earliest period in each department (See 3rd Report Bot. Soc. Proceed. Appendix, p. 121). In July 1838, he read a paper on the mode of arranging the Society's

Herbarium, and forming a catalogue of it. In December of the same year, he read a communication on the statistics of British botany, intended to illustrate the plan proposed to be adopted in the formation of the Botanical Society's British Herbarium; he there stated that 30,000 specimens were required to illustrate properly the flora of the British Islands in the Herbarium. In July 1839, he gave an explanation of his proposed scheme for the arrangement of the Society's General Herbarium. All these papers were illustrated by maps, and by printed tabular forms, pointing out the mode of forming various botanical districts, both in Great Britain and over the world. These tables, although printed, were never published; but they have always appeared to me to be worthy of the attention of students of geographical botany. In January 1840, he read a paper on the advantages of systematic arrangement in the formation of natural history collections in general. Mr Brand made a large collection of British plants, and formed a good herbarium. He discovered several rare and new plants in Scotland, notices of which he gave from time to time to the Botanical Society. During a trip to Clova with Dr Graham in August 1831, he discovered *Astragalus alpinus* on the famous cliff in Glen Dole. During the autumn of 1837, along with Dr Greville and myself, he made an excursion to the Highlands for three or four weeks, during which we visited Glen Isla, Clova, and Braemar. The specimens dried during the excursion amounted to upwards of 18,000, nearly all of which were given to the Botanical Society for the purpose of distribution. Mr Brand became Secretary of the Botanical Society Club, which met annually to commemorate the first meeting of those who set the Society on foot. The original members of the club amounted to twelve; the number was afterwards increased to twenty-one. Mr Brand regularly attended the meetings, and kept a record of the proceedings. The last which he attended was held at Dr Lowe's, Balgreen, in June 1869. On that occasion Mr Brand complained of illness, which he seems never to have got rid of. He will be much missed at these social gatherings. After the illness in June and July, he became so much better as to be able to visit his relations at Peterhead. But on his return home he had an attack of gastric derangement and fever, which proved too much for a constitution already exhausted and undermined by continuous and arduous attention to professional duties. He gradually became weaker until his death, on 15th October 1869.

Mr Andrew Murray, Aberdeen, to whom I am indebted for a notice of Mr Brand's early history, writes as follows:—"My acquaintance with Mr Brand began as soon as my nurse was able to carry me a few hundred yards beyond the door, and a more intimate and unbroken friendship never existed. We went our daily walks together to school, and separation in after life, in following out different walks in the profession, led to a frequent correspondence, and our meetings were always as those of brothers. One of Mr Brand's school-fellows was the late Rev. John Milne of Perth. Many, with myself, have reason to regret his loss, as that of a friend whose counsel and judgment were highly valued, and never withheld when he was appealed to."

A friend contributes the following remarks:—"Mr Brand's singular capacity for arrangement, his clear apprehension, his 'single eye,' made the intercourse of business with him easy and pleasant. To those who required advice or assistance, his unfailing courtesy rendered him always accessible; and so universally was he respected and trusted, that in many cases of doubt Mr Brand's opinion was held to settle them. While engaged in the weary business of the world, its cares never destroyed or soiled his free and buoyant temper, leaving him ready to enter into the frolics of the young, or to share the sorrows of the afflicted. In affairs connected with the improvement of Edinburgh and its philanthropic institutions, Mr Brand took a lively interest, as an instance of which it may be mentioned that the removal of the Infirmary to a better site occupied his thoughts many years ago, and formed the subject of a letter which he addressed to the newspapers. His tastes led him in early life to the study of botany and arboriculture, in the pursuit of which he became associated with many whose youthful friendships continued to solace him to the end. Mr Brand was a warm and earnest member of the Episcopal Church of Scotland,

and to all measures designed to promote its efficiency, he contributed not only of his means, but of his counsel and experience. With sympathies so wide, Mr Brand became a centre to a large circle of friends, and an object of general affection and trust, insomuch that his removal has by many of his friends been mourned as keenly as if the light of their own households had been quenched."

Mr Brand was married in 1848, and he leaves a widow, a son, and two daughters to mourn over his departure.

II. *On Equations to the Curved Outlines of the Leaves of Plants.* By Mr William Mitchell. (Plate III.)

Some time ago I suggested a method of approximating the mean curves of leaves of plants,* intending to follow it up by a series of measurements, but more pressing matters came in the way. During last summer, however, I resumed the subject in my leisure hours, and thought I might try if anything could be made of the *true outline*, instead of the mean curve.

Knowing something about the difficulties of measuring leaves, all I proposed was to find formulas to express the curves of their outlines so closely that the calculated values should not differ from those measured, more than the proportional measurements of several leaves of the same plant differ among themselves, by reason of their ordinary variations. Having succeeded, to some extent, by the special application of a formula much used for the interpolation of terms wanting in a series, I would now crave leave to state my mode of procedure, and present a short list of results.

Selecting a characteristic and well-developed leaf of any plant, I carefully trace its outline, when placed on cardboard or stout paper; but when both sides appear to be equally developed, one-half the outline is sufficient. On this copy all the measurements are made.

The point corresponding to the base of the midrib of the leaf is fixed on for the pole, or origin of measurement, and from it lines are drawn to the outline, making equal angles with each other.

* See Transactions of the Botanical Society, Edinburgh, vol. vi. p. 232.

These lines are then measured by a scale divided on the edge into tenths of an inch, and as the first line, or radius vector, is the longest, we have a descending series of terms from which to construct a formula for the curve in question.

Now, if R represent any radius vector, θ any angle corresponding to it, and m the angle between each pair of measured radii, then the curve of *one-half* the leaf will be represented by

$$\mathrm{R} = a + b\frac{\theta}{m} + c\left(\frac{\theta}{m}\right)^2 + d\left(\frac{\theta}{m}\right)^3 + \&\text{c.}$$

Here a is given, being the length of the midrib, which is the first radius corresponding to R_0 or $\theta = 0°$, and as three variable terms of the above formula give a sufficiently good approximation, the constants, b, c, d, are easily found. I shall, however, give the rule for determining four, namely, b, c, d, e, and it is very simple. Thus—

$$e = \frac{\mathrm{D}_4}{24}, \quad d = \frac{2\mathrm{D}_3 - 3\mathrm{D}_4}{12},$$

$$c = \frac{12\mathrm{D}_2 - 12\mathrm{D}_3 + 11\mathrm{D}_4}{24},$$

and $b = \mathrm{D} - c - d - e$, where D, D_2, D_3, D_4 are the 1st, 2d, 3d, and 4th first differences of those equi-distant terms of the series chosen for constructing the formula for a given leaf. Let the leaf of the common dock (*Rumex obtusifolius*) be taken as an example. The specimen before me measures 47, 38, 30, 23, 18, 15, 12, 11, 10, 9, 8, 7, 5, 2, 0, when taken at every 10°, and measured in tenths of an inch. If now I should take $m = 10°$, the formula sought would consist of too many terms, but, after a few trials, I find that a fair approximation is given by putting $m = 40°$, and the corresponding terms of the series are 47, 18, 10, 5, which, being treated according to the rule just given, we have—

$$\mathrm{R} = 47 - 45{\cdot}5\frac{\theta}{40} + 19{\cdot}5\left(\frac{\theta}{40}\right)^2 - 3\left(\frac{\theta}{40}\right)^3.$$

In this formula, putting $\theta = 0°, 10°, 20°, 30°$, &c., successively, $\frac{\theta}{40}$ becomes 0, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, &c., and calculating the foregoing series, we find 47, 37, 29, 22·7, 18, 14·8, 12·5, 11, 10, 9, 8·4, 7, 5, 2, 0. Here the approximation is not so close as it might be made, but is within the limits I have chosen; for, taking another leaf of the same plant, and measuring its corresponding radii, I find them to be 47, 40, 32, 24, 19, 15, 13, 11, 10, 9, 8, 7, 5, 0, the length of the midrib happening to be the same as in the former case. Other leaves give similar small variations, and hence I consider my formula a fair expression for the curve of the dock leaf.

A leaf of *Laurustinus* measured in the same way, and taking $m = 20$, gives for its equation—

$$R = 34 - 17{\cdot}17\,\frac{\theta}{20} + 3{\cdot}5\left(\frac{\theta}{20}\right)^2 - 0{\cdot}3\left(\frac{\theta}{20}\right)^3,$$

and the radii for angles of 10° are 34, 26·2, 20, 15, 11, 7·23, 5, 2·6, 0·2, 0, being nearly figure for figure with those actually measured, which are 34, 26, 20, 15, 11, 7, 5, 2, 0.

For other examples, I refer to the list previously mentioned.

In constructing the curve by the given equation, one-half the leaf only is produced by giving consecutive values to θ, but the other half may be readily set off on the other side of the midrib, with the same radii correspondingly applied.

All this applies only to simple undivided leaves, but by a little modification in the measurements, may be adapted to the more regularly divided, and to compound leaves. Thus, in the case of the divided leaf of the Maple (*Acer Pseudo-Platanus*), the radiating vein, or axis of each lobe, may be considered as the midrib of a single leaf, and a formula found for three out of the five. The intersections of these curves will then produce the outline of the simple divided leaf, when set off on five axes, making the normal angle of 45° with each other. This angle often varies a few degrees, but 45° seems to be the rule.

Equations to the leaves of plants may be put in the more simple and elegant form, $R = ae^{-b\theta}$—a form of which a gentleman kindly reminded me, after he had seen the first part of this paper. The expansion of $ae^{-b\theta}$ being a series of the same form as the series I have employed, we may apply the formula thus:—Let a denote the length of the midrib, e the base of the Napierian logarithms, $= 2{\cdot}71828$, and if r represent any radius corresponding to a particular value of the angle θ, b may be found from the equation—

$$b\theta = \frac{\log \frac{a}{r}}{\log e}.$$

For example, the leaf of the Dock (*Rumex obtusifolius*) gives $b = 0{\cdot}0226$, when $\theta = 20°$; hence

$$\mathrm{R} = 47\, e^{-0{\cdot}0226\theta}$$

is the equation to the leaf. For practical use the formula is—

$$\log. \mathrm{R} = \log a - \log e \times b\theta.$$

Similarly, the equations to the leaves of

Laurustinus is . . $\mathrm{R} = 34\, e^{-0{\cdot}027\theta}$,
Elder Tree (*S. nigra*), $\mathrm{R} = 53\, e^{-0{\cdot}026\theta}$,
Portugal Laurel, . $\mathrm{R} = 42\, e^{-0{\cdot}028\theta}$,
Privet, ... $\mathrm{R} = 23{\cdot}5\, e^{-0{\cdot}0385\theta}$,

and

Urtica dioica, . . $\mathrm{R} = 33\, e^{-0{\cdot}0186\theta}$.

When the approximation does not come sufficiently close by this method, we can make it as near as we please, by taking successive values of $b\theta$, and forming a few terms of a series, in the manner already described. Thus we find—

Laurus nobilis, . $\mathrm{R} = 53\, e^{-(0{\cdot}0138 + 0{\cdot}000635\theta)\theta}$.
Gean Tree, . . $\mathrm{R} = 31\, e^{-(0{\cdot}01055 + 0{\cdot}00033\theta)\theta}$.
Lombardy Poplar, $\mathrm{R} = 25\, e^{-(0{\cdot}04967 - 0{\cdot}001815\theta + 0{\cdot}000018518\theta^2)\theta}$.

Most leaves that I have measured do not require an expression so long as this last, but in no case is the calculation difficult.

Since the length of the midrib, or a, affects only the *size* of the leaf, we may write a in the formulas instead of particular numbers. For instance, it is sufficient to express the equation to any leaflet of the ash tree by—

$$\mathrm{R} = ae^{-(0\cdot 02124 + 001030\theta)\theta};$$

and in this way the equations to the lobes of divided leaves show their relations more clearly. Thus the leaf of *Rubus nutkanus* gives—

$$\mathrm{R} = ae^{-0\cdot 01879\theta}, \text{ at } 0^\circ,$$

$$\mathrm{R} = \left(a - \frac{a}{5}\right) e^{-0\cdot 0168\theta}, \text{ at } 55^\circ,$$

$$\mathrm{R} = \left(a - \frac{a}{3}\right) e^{-0\cdot 0168\theta}, \text{ at } 110^\circ,$$

$$\mathrm{R} = \left(a - \frac{a}{2}\right) e^{-0\cdot 023\theta}, \text{ at } 150^\circ.$$

Here we observe that the differences of the lengths of the middle veins of the lobes seem to follow the law of the plant series, 1, 2, 3, 5, 8, &c., as they do in other cases I have before me. Then the values of b, being nearly equal, we may take their average $= 0\cdot 01879$, and make use of one equation instead of four, as—

$$\mathrm{R} = ae^{-0\cdot 01879\theta},$$

applying

$$\left(a - \frac{a}{5}\right), \qquad \left(a - \frac{a}{3}\right), \qquad \left(a - \frac{a}{2}\right),$$

instead of a for the other lobes. The normal angle may perhaps be taken $= 55^\circ$. In the specimen I have selected for measurement a is 45 tenths of an inch.

By means of these formulas other properties of the curves of leaves may be deduced, but I must leave them for future leisure. In conclusion, it may be added that the figures illustrative of this paper are all constructed according to the formulas here given.

LIST OF EQUATIONS TO THE CURVED OUTLINES OF LEAVES OF THE FOLLOWING PLANTS:—

1st, *Simple Leaves not divided deeply at the Apex or Margin.*

Portugal Laurel, $R = 42 - 23{\cdot}589 \frac{\theta}{20} + 6{\cdot}5 \left(\frac{\theta}{20}\right)^2 - 0{\cdot}91 \left(\frac{\theta}{20}\right)^3.$

Gean Tree, $R = 31 - 8{\cdot}16 \frac{\theta}{20} - \left(\frac{\theta}{20}\right)^2 + 0{\cdot}16 \left(\frac{\theta}{20}\right)^3.$

Beech, . $R = 27 - 9 \frac{\theta}{30} - 1{\cdot}5 \left(\frac{\theta}{30}\right)^2 + 0{\cdot}5 \left(\frac{\theta}{30}\right)^3.$

Birch, . $R = 20 - 7{\cdot}1 \frac{\theta}{10} + 2{\cdot}5 \left(\frac{\theta}{10}\right)^2 - 0{\cdot}3 \left(\frac{\theta}{10}\right)^3.$

Laurustinus, $R = 34 - 17{\cdot}17 \frac{\theta}{20} + 3{\cdot}5 \left(\frac{\theta}{20}\right)^2 - 0{\cdot}3 \left(\frac{\theta}{20}\right)^3.$

Salix caprea, $R = 48 - 21 \frac{\theta}{20} + 4 \left(\frac{\theta}{20}\right)^2 - 0{\cdot}6 \left(\frac{\theta}{20}\right)^3.$

Rumex obtusifolius, $R = 47 - 45{\cdot}5 \frac{\theta}{40} + 19{\cdot}5 \left(\frac{\theta}{40}\right)^2 - 3 \left(\frac{\theta}{40}\right)^3.$

Lilac (*Syringa vulgaris*), $R = 43 - 22{\cdot}34 \frac{\theta}{30} + 7{\cdot}51 \left(\frac{\theta}{30}\right)^2 - 1{\cdot}17 \left(\frac{\theta}{30}\right)^3.$

Lime Tree, $R = 35 - 9{\cdot}1 \frac{\theta}{40} - 0{\cdot}5 \left(\frac{\theta}{40}\right)^2.$

Do., unequally-sided, $R = 36 - 7{\cdot}5 \frac{\theta}{40} - 3 \left(\frac{\theta}{40}\right)^2 + 0{\cdot}5 \left(\frac{\theta}{40}\right)^3,$

right side leaf.

$$R = 36 - 18{\cdot}6 \frac{\theta}{40} + 5{\cdot}5 \left(\frac{\theta}{40}\right)^2 - 0{\cdot}83 \left(\frac{\theta}{40}\right)^3,$$

left side.

Populus nigra, $R = 30 - 15{\cdot}5 \frac{\theta}{20} + 6{\cdot}5 \left(\frac{\theta}{20}\right)^2 - \left(\frac{\theta}{20}\right)^3.$

2d, *Single Leaves divided at Apex or Margin.*

Ivy, . . $$R = 29 - 10{\cdot}3\frac{\theta}{10} + 4\left(\frac{\theta}{10}\right)^2 - 0{\cdot}6\left(\frac{\theta}{10}\right)^3,$$
lobe 1st, at 0°.

$$R = 22 - 7{\cdot}5\frac{\theta}{10} + 3\left(\frac{\theta}{10}\right)^2 - 0{\cdot}5\left(\frac{\theta}{10}\right)^3,$$
lobe 2d, at 85°.

$$R = 15 - 6{\cdot}6\frac{\theta}{10} + 2\left(\frac{\theta}{10}\right)^2 - 0{\cdot}3\left(\frac{\theta}{10}\right)^3,$$
lobe 3d, at 130°.

Maple, . $$R = 46 - 10\frac{\theta}{10} + 2\left(\frac{\theta}{10}\right)^2,$$ lobe 1st.

$$R = 43 - 13{\cdot}5\frac{\theta}{10} + 2\left(\frac{\theta}{10}\right)^2 + 0{\cdot}5\left(\frac{\theta}{10}\right)^3,$$
lobes 2d and 5th.

$$R = 30 - 15\frac{\theta}{10} + 6\left(\frac{\theta}{10}\right)^2 - \left(\frac{\theta}{10}\right)^3,$$
lobes 3d and 4th.

Normal angle between lobes is 45°.

Ladies' Mantle,

$$R = 15 - 2\frac{\theta}{20}$$

$$R = 14 - 2\frac{\theta}{10}$$

$$R = 13 - 2\frac{\theta}{10}$$

$$R = 11 - 2\frac{\theta}{10}$$

The angle between the lobes is 45°.

Compound Leaf.

Horse Chestnut, $$R = 69 - 15{\cdot}5\frac{\theta}{10} + 15{\cdot}5\left(\frac{\theta}{10}\right)^2 - 6\left(\frac{\theta}{10}\right)^3,$$
1st or terminal leaflet.

$$R = 64 - 20\frac{\theta}{10} + 18\left(\frac{\theta}{10}\right)^2 - 6\left(\frac{\theta}{10}\right)^3,$$
2d and 7th leaflets.

Horse Chestnut, *continued.*

$$R = 60 - 15{\cdot}5\,\frac{\theta}{10} + 13{\cdot}5\left(\frac{\theta}{10}\right)^2 - 5\left(\frac{\theta}{10}\right)^3.$$

3d and 6th leaflets.

$$R = 48 - 14{\cdot}16\,\frac{\theta}{10} + 9\left(\frac{\theta}{10}\right)^2 - 283\left(\frac{\theta}{10}\right)^3,$$

4th leaflet.

$$R = 31 - 13{\cdot}6\,\frac{\theta}{10} + 6\left(\frac{\theta}{10}\right)^2 - 1{\cdot}3\left(\frac{\theta}{10}\right)^3,$$

5th leaflet.

Explanation of Plate III.

Fig. 1. This figure is constructed, as all the others, from the formulas corresponding to them in the list given at the end of my paper, but the general formulas are given here. Thus for *R. obtusifolius* —

$$R = a\,e^{-0{\cdot}0226\theta}.$$

Fig. 2. $R = ae^{-(0{\cdot}02 + 0\,0006\theta)\theta}$.

Fig. 3. $R = ae^{-0{\cdot}027\theta}$.

Fig. 4. $R = ae^{-(0{\cdot}05 - 0{\cdot}018\theta + 0{\cdot}000018\theta^2)\theta}$,

but constructed from

$$R = 25 - 9{\cdot}327\frac{\theta}{20} + 1{\cdot}16\left(\frac{\theta}{20}\right)^2 + 1{\cdot}583\left(\frac{\theta}{20}\right)^3 - 0{\cdot}416\left(\frac{\theta}{0}\right)^4.$$

Fig. 5. $R = ae^{-(0{\cdot}011 + 0{\cdot}00024\theta)\theta}$.

Fig. 6. $R = ae^{-0{\cdot}01355\theta}$.

Fig. 7. $R = ae^{-(0{\cdot}02124 + 0{\cdot}00103\theta)\theta}$.

Fig. 8. $R = ae^{-0{\cdot}012\theta}$ for one side.

$R = ae^{-0{\cdot}015\theta}$ for the other.

Fig. 9. $R = ae^{-0{\cdot}02\theta}$ for terminal lobe.

The same equation serves for the other lobes, by substituting

$$\left(a - \frac{a}{13}\right) \text{ and } \left(a - \frac{a}{3}\right) \text{ respectively for } a.$$

In the figure, the angle between the lobes is 45°, but is often variable in nature.

Fig. 10. $R = ae^{-0{\cdot}02\theta}$ for terminal lobe. For the other two put

$$\left(a - \frac{a}{3}\right) \text{ and } \left(a - \frac{a}{2}\right) \text{ respectively.}$$

The angle between the lobes is very variable, but the normal angle seems to be 60°.

The radii drawn in the figures indicate the mode of measurement.

III. *Supplementary Notes on the Lichen-Flora of Greenland.* By W. Lauder Lindsay, M.D., F.R.S.E., F.L.S.

Since the publication of my catalogue of the Lichens of Greenland in the last Part of the Society's Transactions,* my friend Robert Brown, F.R.G.S., has pointed out to me, that in the said catalogue I have omitted all reference to a list of the lichens of Greenland, published in 1830 by the Chevalier Sir Charles Louis Giesecké of Dublin; † and Mr Brown has further done me the favour of making and sending me a copy of the said list, adding to it a short biography of Giesecké, which is both of use and interest as bearing on the circumstances of all his collections of Greenland plants, including the lichens. My omission arose from my ignorance, at the time, of the existence of such a list, and my too implicit trust in Th. Fries' "Lichenes Arctoi" as a compendium of all lists of Greenland Lichens up to 1860.‡ But, inasmuch as my catalogue cannot be considered complete without reference to, or incorporation of, so prominent a list as that of Giesecké, and in so far, further, as it appears desirable to render my catalogue as complete as may be up to the present date, § I now hasten to supply my omission by quoting Giesecké's list, adding my own comments thereto—comments which are mainly directed to an attempt to discover the *modern synonymy* of his species. Apart altogether from the subject of Greenland and its lichen-flora, Giesecké's list enables me to indicate the comparatively little value that can be attached to the earlier lists of lichen-species belonging to the Pre-Microscope era of Lichenology, especially where the name of the authority for, or nomenclator of, the said species is not given; as well as the extreme, and sometimes insuperable, difficulty of ascertaining their modern synonyms or equivalents.

* Vol. x. (1869), p. 32.

† In an article on "Greenland," in "Brewster's Edinburgh Encyclopædia," vol. x. (1830), pp. 495–6.

‡ *Vide* page 32 of my former paper.

§ Personal inquiries made quite recently (in October 1869) in Denmark, by Mr Brown, show that the Catalogue in question is the only separate list extant of the Lichens of Greenland.

I am indebted to Mr Brown for the following information regarding Giesecké—his Greenland collections, and his list of Greenland lichens. "He was born in 1761, at Augsburg, and after a rather adventurous life, studied under Werner, and settled down at Vienna as a dealer in minerals. Eventually entering the service of Denmark, he repaired to Greenland, and made large collections of minerals and minor ones of plants. Afraid of his collection being captured (for we were then at war with Demark), he went over the ground a second time, and made a duplicate set. His fears were realised, for the vessel containing his first collection was captured by the English cruisers, and the collection sold for a mere trifle at Leith. It was bought by Mr Thomas Allan, who found in it Sodalite, Allanite, Cryolite, &c. In the meantime, Giesecké, who had been delayed, by communication being temporarily cut off with Greenland, arrived in Leith; and with great good nature assisted in arranging his confused collection, which was of immense extent. I have been informed by Dr Hoff, assistant in the Mineralogical Museum of Copenhagen, who has himself visited Greenland, that though Allan supplied out of Giesecké's cabinet many of the mineralogical collections of the day, yet he always understood that Giesecké purchased back from Allan a great portion of his own collection. Following the Duke of Marlborough's maxim of 'quartering himself on the enemy," he settled down as Professor of Mineralogy to the Royal Dublin Society, where he remained till his death, in March 1833. The old energy had, however, evaporated by that time, and beyond a few papers on mineralogy and geography,* and the article referred to,† he published nothing. He left a voluminous journal, which is now in Copenhagen, and a copy in Dublin (written in German). But his collections, in a chaos of non-assortment, are still lying in Dublin. . . . . . His collection was so rich in duplicates, that sub-collections from him are in the British Museum, and Copenhagen and other museums; but most of his plants are in the British Museum, or (I believe) in the Museum of the University of Dublin, or

* Trans. Roy. Soc. Edin., vol. ix. p. 263; Appendix to Scoresby's "Voyage to Greenland," &c.

† *Vide* foot-note, † page 284.

the Royal Dublin Society. . . . . . He was a knight-commander of Dannebrog; hence the knightly prefix by which he was known." His list of Greenland plants contains, says Mr Brown, a number of errors. "Giesecké must then have been a man nearly seventy, and as he was latterly in bad health, and always rather lazy, the errors may be understood." The *species* in his list of Greenland lichens, Mr Brown adds, "appear to have been determined by Dr Taylor of Dublin,* though it is not so expressly stated."

Giesecké's List of Greenland Lichens, with their (approximate, probable, or) *modern Synonymy.*

1. *Lecidea sanguinaria.*† Doubtless of Linnæus and subsequent authors. Does not occur in Greenland, according to Th. Fries (Lich. Arctoi, p. 223).
2. *L. fusco-lutea.* Doubtless of Acharius, Schærer, and Hooker = *Lopadium*, Mudd, Brit. Lich., p. 190, and *Lecanora*, Dicks., of my catalogue.
3. *L. pustulata.* Probably *Umbilicaria pustulata*, Hffm., which, however, does not occur in Arctic countries, according to Th. Fries (L. Arct., p. 168). Most likely the plant so named is *U. Pennsylvanica*, Hffm., of my catalogue.
4. *Lepraria botryoides.* Doubtless of Acharius; English Botany, p. 41, t. 1973‡ = *L. viridis*, T. and B.; a *Protophyte* of the genus *Protococcus* (= *P. viridis*, Kütz., Hepp No. 233, = *Chlorococcum vulgare*, Grev., in Kew Herbarium).
5. *L. Iolithus.* Doubtless also of Acharius; Engl. Bot. p. 42, t. 1978; another *Protophyte* of the genus *Protococcus*.
6. *Gyrophora hyperborea* = *Lichen proboscideus*, L. Either *Umbilicaria hyperborea*, Ach., or *U. proboscidea*, L., of my catalogue. They are given as separate species by Mudd, Brit. Lich., pp. 117 and 118.
7. *G. erosa.* No doubt *Umbil. erosa*, Web., of my catalogue.
8. *G. cylindrica.* No doubt *Umbil. cylindrica*, L., of my catalogue.
9. *G. hirsuta.* No doubt *Umbil. hirsuta*, Ach., of my catalogue.

* Author of vol. ii. of the "Flora Hibernica," which includes the Musci, Hepaticæ, *and Lichens*.

† These names are given as published by Giesecké, and copied by Brown. It will be observed that in no case is the author of the specific name mentioned!

‡ All quotations from the "English Botany" of Smith and Sowerby are from the *second* edition (1844), vols. x. and xi.

10. *Endocarpon tephroides.* No doubt of Acharius = *Dermatocarpon cinereum*, Pers., and *Endocarpon cinereum*, Mudd, Brit. Lich., p. 268. Does not occur in Greenland, according to Th. Fries (L. Arct., p. 256).
11. *Isidium defraudans.* Probably of Acharius = *Lecanora poliophæa*, Ach. and Whlnb. Does not occur in Greenland, according to Th. Fries (L. Arct., p. 114).
12. *Urceolaria calcarea.* No doubt *Lecanora calcarea*, L., of my catalogue.
13. *Parmelia tartarea.* No doubt *Lecanora tartarea*, L., of my list.
14. *P. candelaria.* Probably *Physcia candelaria*, Ach., which, however, is not at all mentioned in Th. Fries' "Lich. Arctoi."
15. *P. brunnea.* No doubt *Pannaria brunnea*, Sw., of my list.
16. *P. subfusca.* No doubt *Lecanora subfusca*, L., of my list.
17. *P. gelida.* No doubt *Squamaria gelida*, L., of my list.
18. *P. stellaris.* No doubt *Physcia stellaris*, L., of my list.
19. *P. saxatilis.* Doubtless of Linnæus and subsequent authors in my list.
20. *P. omphalodes.* Doubtless of Linnæus, a variety of the foregoing in my list.
21. *P. parietina.* Doubtless of Linnæus, which, however, is not at all mentioned in Th. Fries' "Lich. Arctoi."
22. *P. fraxinea.* Doubtless of Linnæus; a variety of *Ramalina calicaris*, L. Does not occur in Greenland, according to Th. Fries (L. Arct., p. 32).
23. *P. farinacea.* Doubtless of Linnæus; also a variety of *R. calicaris*; but not occurring in Greenland, according to Th. Fries (L. Arct., p. 32).
24. *P. jubata.* No doubt of Linnæus; *Alectoria jubata*, L., of my list.
25. *P. capillaris.* No such lichen is mentioned in any lichenological work in my library. It cannot refer to *Ephebe pubescens*, *Parmelia lanata*, or *Alectoria jubata*, each of which is separately mentioned. I cannot even *guess* at its proper modern synonymy!
26. *P. nigrescens.* Doubtless *Collema nigrescens*, L., which does not, however, occur in Greenland, according to Th. Fries (L. Arct., p. 281).
27. *P. ciliaris.* No doubt *Physcia ciliaris*, L., which, however, is not at all mentioned in Th. Fries' "Lich. Arctoi."
28. *P. ochroleuca.* No doubt *Alectoria ochroleuca*, Ehrh., of my catalogue.
29. *Peltidea horizontalis.** No doubt *Peltigera** *horizontalis*, L.,

* There is great confusion created by the use of the generic terms *Peltidea* and *Peltigera*. Hitherto they have been used *synonymously*. But Nylander

which, however, does not occur in Greenland, according to Th. Fries (L. Arct., p. 47).

30. *P. venosa.** No doubt of Linnæus and my list.
31. *P. resupinata.* May be *Nephroma resupinatum* of Hooker, Taylor, and Leighton, which = *N. lævigatum*, Ach., of Mudd's "Brit. Lich.," p. 81; or *N. resupinatum*, Ach., which = *N. tomentosum*, Hffm., of Nylander's "Synopsis," p. 319. There is great confusion in the synonymy of *N. lævigatum*, Ach., and *N. tomentosum*, Hffm., if they are really separate species. *N. tomentosum* does not occur in Greenland, according to Th. Fries (L. Arct., p. 41); while *N. lævigatum* appears = his *N. papyraceum*, Hffm., which occurs in my catalogue.
32. *P. canina.* Doubtless *Peltigera canina*, Hffm., of my list.
33. *P. saccata.* No doubt *Solorina saccata*, L., of my list.
34. *P. crocea.* No doubt *Solorina crocea*, L., of my list.
35. *Cetraria Islandica.* No doubt of Linnæus and my list.
36. *C. Groenlandica* (vars. *nigra* and *viridis*). May be *Lichen Groenlandicus* of the "Flora Danica," t. 466, which = *Nephroma arcticum*, L., of my list.
37. *C. nivalis.* No doubt of Linnæus and my list.
38. *C. pulmonaria.*† No doubt *Sticta pulmonaria*, L.,† which does not occur in Greenland, according to Th. Fries (L. Arct., p. 49).
39. *C. juniperina.* No doubt of Linnæus and my list.
40. *Cornicularia lanata.* No doubt *Parmelia lanata*, L., of my list.
41. *C. tristis.* No doubt *Parmelia tristis*, Web., which, however, does not occur in Greenland, according to Th. Fries (L. Arct., p. 30).
42. *C. pubescens.* No doubt *Ephebe pubescens*, L., of my list.
43. *Stereocaulon paschale.* No doubt of Linnæus and my list.
44. *S. globulare.* May be *Lichen globularis*, Retz., which = *Calicium furfuraceum*, L., of my list.

employs them to distinguish *separate genera*—the first established specially for *P. venosa* and *aphthosa:* the second including all the other British species. In a letter to me, of date February 1866, Nylander writes—"Si vous avez, dans le travail que vous vous proposez, à nommer le *Peltigera venosa*, il faudrait l'appeler *Peltidea venosa*, Ach., car je le rapporte maintenant ainsi que l'*aphthosa* au genre *Peltidea*, qui diffère par ses gonidies (qui rendent leur thalle à l'état humide d'un beau *vert*) des *Peltigera*, dont le thalle à l'état humide devient *foncé*." In his "Synopsis" and other works, moreover, he uses the term *Peltigerei* for the tribe, and *Peltidei* for the subtribe!

† Much confusion is created by the use of the specific names *pulmonaria* and *pulmonacea*, which are synonymous. One of them ought to be abolished. *Pulmonaria* has the claim of priority, having been used by Linnæus, Hoffmann, Schærer, and others; while Nylander, in his "Synopsis," adopts Acharius's name, *pulmonacea*.

45. *Bæomices cocciferus.* Doubtless *Cladonia coccifera*, L., which is = variety of *C. cornucopioides*, L., of my list.
46. *B. pyxidatus.* No doubt *Cl. pyxidata*, L., of my list.
47. *B. cornucopioides.* Doubtless *Cl. cornucopioides* of Linnæus and my list.
48. *B. fimbriatus.* Doubtless *Cl. fimbriata* of Hoffmann and my list.
49. *B. gracilis.* Doubtless *Cl. gracilis* of Linnæus and my list.
50. *B. digitatus.* Doubtless *Cl. digitata*, L., and my list.
51. *B. radiatus.** Probably *Lichen radiatus,* Schreb. (Engl. Bot. t. 2288), which = *Cl. radiata*, Ach., of the "Flora Hibernica," and = a variety of *Cl. fimbriata*, Hffm., of my list.
52. *B. cristatus.* Doubtless *Cl. cristata*, Hffm., which = *Cl. degenerans*, Flk., of my list.
53. *B. foliaceus.* Probably *Lichen foliaceus*, Huds., which = *Cl. alcicornis*, Flk., of my list. The latter is not mentioned at all in Th. Fries' "Lich. Arctoi."
54. *B. rangiferinus.* No doubt *Cl. rangiferina*, L., of my list.
55. *B. uncialis.* No doubt *Cl. uncialis*, L., of my list.
56. *B. subulatus.* No doubt *Cl. subulata*, L., which is = variety of *Cl. furcata*, Schreb., of my list.
57. *B. fragilis* (= *coralloides fragile*, Hffm.) No doubt *Sphærophoron fragile*, L., of my list.

An analysis of the foregoing list of Giesecké's, and its modern synonymy, brings out the following peculiarities:—

I. In one case at least, *Parmelia capillaris*, the modern synonymy is indeterminable.†

II. In four cases this synonymy is doubtfully determinable, viz., in

Gyrophora hyperborea.	*Cetraria* Groenlandica.
Peltidea resupinata.	*Stereocaulon* globulare.

III. At least two species are *Algæ* or *Protophyta*, belonging to the genus *Protococcus*, or some of its allies or subdivisions,—viz., the two supposed species of the now obsolete genus *Lepraria*.

IV. One species is an obvious error, according to Th. Fries' "Lich. Arctoi," viz.:—

Lecidea pustulata.

* This lichen is enumerated *twice*, probably by an overlook either of printer or author.

† A similar apparently indeterminable species is *Cladonia glacialis* of Brown's "Florula Discoana" (Trans. Botan. Soc. of Edin., vol. ix. p. 443). It is, however, I am informed by him, a misprint for *Cladonia gracilis*, L.

V. Four other species do not occur in the wide range of Th. Fries' "Lichenes Arctoi," which includes the whole of Northern Scandinavia and Russia (Nordland, Finmark, Lapland, and the Samoyede country), Iceland, Greenland, and the Spitzbergen group of islands, viz.:—

Parmelia candelaria.
ciliaris.
Parmelia parietina.
Bœomices foliaceus.

VI. Others, though met with in some parts of the region of Th. Fries' "Lich. Arctoi," do not, according to him, occur in Greenland, viz.:—

Lecidea sanguinaria.
Endocarpon tephroides.
Isidium defraudans.
Parmelia fraxinea.
farinacea.
Parmelia nigrescens.
Peltidea horizontalis.
Cetraria pulmonaria.
Cornicularia tristis.

The last two classes may be regarded either as errors of Giesecké and Taylor, or as omissions of Th. Fries, who does not, like myself, appear to have been acquainted with Giesecké's list, seeing that the list in question is nowhere mentioned in his "Lichenes Arctoi." There are reasons both for and against adding the species in question to my catalogue. The arguments *for* such addition are that we are bound to believe—till the contrary can be proved—that they were collected by Giesecké, and properly determined by Taylor, while they have been inadvertently omitted both by Th. Fries and myself. The arguments, on the other hand, that lead to hesitancy in incorporating such lichens in the Greenland flora are, that they have been omitted by Th. Fries—an accurate and laborious lichenologist—experienced in the use of the microscope, and presumably well acquainted with all authentic collections or lists of Greenland Lichens up to the date of publication of his "Lich. Arctoi" (1860); and that all lists of lichens drawn up without microscopical examination are, as a rule, little trustworthy.* The latter objection, however, does not hold good as regards species that are easily determinable by the naked eye, such as *Physcia ciliaris*, *P. parietina*, *Cladonia alcicornis*, *Ramalina calicaris*, *Peltigera horizontalis*, *Sticta*

* This proposition has already been sufficiently illustrated in my former paper by the analyses of the lists of James (p. 34), and of Hooker and Brown (pp. 47, 49, 51).

pulmonaria, or *Parmelia tristis*. Even if we add to my catalogue the omissions of Th. Fries and myself recorded by Giesecké and Taylor, the total number is increased only by thirteen species and varieties—the aggregate amounting to 281 species, including varieties.

VII. The remainder of Giesecké's lichens, consisting of thirty-six species and varieties, have already been recorded in my catalogue.

The total number of lichens collected and recorded by Giesecké is only fifty-seven, while the number enumerated in my catalogue was 268, or nearly five times as many. The difference between these figures may be held as representing the progress that has taken place in the collection and determination of the lichens of Greenland during the last forty years.

Referring to my comparison of the Lichen-Floras of Greenland and Iceland,* Mr Brown very naturally objects that the two countries or islands are not properly comparable. "The whole *interior* of Greenland," says he, "so far as known, is overlaid with an immense glacial cap. . . . . The *east* coast is almost entirely *un*explored and, on account of ice, unexplorable; and the interior a frozen icy waste. . . . . You may almost take it for granted that all the lichen collections made in Greenland were made not far from the sea-level," and I may add on the *west* coast, and even within a limited area of *it*. Of all this I am fully aware, and I have not attempted to institute any rigid comparison either between the countries in question or their flora. But I believe the extent to which *Iceland* also is desert, and *un*explored, or unexplorable, is not sufficiently borne in mind. An intelligent American traveller, who visited the greater part of Iceland in 1853, thus writes on this point:† "If you look on Gunnlaugsson's large map of Iceland—a map made from surveys, and extending over Iceland for twelve years—it will be seen that the green or agricultural portion is not more than one-third of it, and about one-half of the remainder . . . . is a pink colour, indicating the growth of heath; and the balance is *snowy*

* In my former paper, pp. 39 and 52.

† "Nordurfari; or, Rambles in Iceland," by Pliny Miles. London, 1854, p. 158.

mountains, sandy deserts, and black and barren lava." The glaciers of Greenland are in Iceland replaced, to a great extent at least, either by lava or volcanic sand, forming deserts which, if we may credit the testimony of travellers, are devoid even of cryptogamic vegetation.* This sand, which includes pumice and ash, is sometimes one or two feet thick on the plains, and even four to six feet in the mountain valleys. "The melancholy appearance of these districts has occasioned them to be called by the natives *Hraun* or *Hröin*,—a word meaning ruin or annihilation."† In 1861 the then vice-president of the Alpine Club (Wm. Longman) published "Suggestions for the *Exploration* of Iceland," accompanied with a tinted map, showing the districts yet *un*explored, and the area occupied by jökuls‡ (glacier or ice-covered mountains). The combined area occupied by lava, volcanic sand, snow, and ice, is nearly one-half of the whole island !§

Again, Mr Brown, in some degree, objects to the spelling of the names of localities in Greenland, given at page 32 of my catalogue. The truth is, however, that the utmost diversity prevails among travellers and writers regarding the spelling of Esquimo names, and even of the word Esquimo or Eskimo itself (=Esquimaux, &c.) The names in question were all cited from Th. Fries' "Lichenes Arctoi," and he doubtless copied the orthography of Danish botanists. I have therefore preferred to give his orthography unchanged. Whether it is right or wrong, according to current opinion, is of no consequence to the subject or object I have presently in view,—the lichens of Greenland as a country. Neither are the precise latitude and

* Compare what I have said on this head at page 36 of my former paper.

† Edinburgh Cabinet Library volume on "Iceland, Greenland, and the Faroe Islands." Edin., 1840. P. 359.

‡ The unexplored—and perhaps unexplorable—area of the Vatna or Klofa jökul alone amounts to about 400 square miles ! (*Vide* Edin. Cab. Lib. vol., foot-note * p. 41). Of the whole area of 38,000 square miles, it has been calculated that not above one-eighth is occupied, the remainder (= 33,000 square miles) consisting of jökuls, or of plains and valleys desolated by lava or other volcanic *ejecta*. It is to be observed, however, that the estimates of the *barren* area given by different authors differ remarkably—depending, no doubt, mainly on their different ideas of *barrenness !*

§ *Vide* a definition of the term in my paper on the *Kötlugja volcano*, Iceland. "Edinburgh New Philosophical Journal," January 1861, p. 3.

longitude material for present purposes. While, therefore, I am indebted to my friend Mr Brown for the trouble he has taken to set me right in various matters of detail, the matters in question do not appear—as not bearing directly on our present subject—to require further notice here.*

My catalogue contains a few trivial typographical errors, of which it may suffice to point out that an asterisk should have been prefixed to the following species, indicating that they occurred in Mr Brown's collection :—

Lecidea Friesiana and contigua.
Verrucaria tartaricola.
Lecanora tartarea *v.* vermicularia.

Lecanora leucorœa is erroneously entered twice, the second time under *Lecidea*.

IV. *Dr Gray's Arrangement of the Hepaticœ.* By Benj. Carrington, M.D.

"Seemann's Journal of Botany" (1865) contained an article of great interest by Mr Carruthers, claiming priority for the classification of the Hepaticæ proposed in "Gray's Natural Arrangement of British Plants" (1821).

The fate of this work—the first attempt to apply the natural system to British plants—was most unfortunate. Few copies appear to have been sold, and virtually it fell still-born from the press, and has been overlooked alike by British and foreign botanists.

Yet it deserved a different fate. The introductory chapters are especially good—containing a lucid epitome of botanical history, a chronological list of authors and

* Thus he points out that—(1.) There are several places of the same name in different parts of Greenland, *e.g.*, Upernivik, Amitoarsuk, Isortok. (2.) There is a small patch of Cretaceous strata on the shores of the Waigat. (3.) Crantz's "History of Greenland" is a translation from the German of the original work published in 1769. (4.) Hölboll, as well as Rink and Wormskiold, made lichen collections in Greenland. (5.) Several of the places mentioned by Th. Fries—such as Kukiarsuk—are unknown to, or are not mentioned by, Rink in his "Grönland Geographisk og Statistik." (6.) Other names are synonyms, *e.g.*, Sydostbugten (= Anglicé "South-East Bay)," which is merely the southern portion of Disco Bay. (7.) Upernivik is the most northern Danish "Colonie"—in lat. 72° 48′. (8.) Sir James Clarke Ross *did* visit Spitzbergen when a lieutenant with Parry.

their works, and a copious glossary of botanical terms. This portion of the work was compiled by Mr S. F. Gray, whose name alone appears on the title page. But we are indebted for the systematic and descriptive portions to his son, Dr J. E. Gray, the now celebrated Director of the Zoological Department of the British Museum.

The cryptogamic plants occupy 550 closely-printed pages of the first volume. But our remarks must be limited to a consideration of the new genera of Hepaticæ proposed by Dr Gray.

In our day, when men of science are supposed to be liberal, and truthful, and charitable in their dealings with each other, it seems incredible that a costly and laborious work should have been sacrificed to the prejudices of a botanical clique.

And yet such was the truth. Gray's book was looked upon as "coming from Salisbury, who was full of all kinds of crochets, and had during many years made himself as unpleasant as possible to Robert Brown, Sir J. E. Smith, and other members of the Linnean Society." The following illustration of these quarrels I quote from the letter of a friend:*—"I came upon another instance the other day. Salisbury published a plate and proper description of a Tiliaceous plant, under the name of *Hookeria*. *After* this Smith described the same plant as *Brodiœa*, and named a genus of mosses *Hookeria!*"

Another story is told by De Candolle. During a friendly interval, Sir J. E. Smith dedicated a genus of plants to Salisbury, and the latter returned the compliment. But the truce was of short duration; they fell out again, and each wrote an urgent request to De Candolle that he would suppress these genera. This he declined to do, replying "that the genera were good ones, and he should make it a point to retain them, inasmuch as the compliment, in either case, was so well deserved!"

We must not forget that those were times of great political excitement. The year 1821, when Gray's work appeared, was the year of Napoleon's death; and the legacy of debt, and suffering, and wrong, bequeathed by a generation of warfare, was not soon to be forgotten.

* J. G. Baker, Esq., F.L.S.

This feeling extended even to scientific truths, and the natural system, which was conceived in the stormy epoch of the French Revolution, was looked upon as a product of Atheism and Jacobinism—stamped with the mark of the Beast.

Fortunately, these prejudices are now forgotten, and Mr Carruthers deserves the thanks of English botanists for enabling them to rectify an act of injustice.

If we are unable to accept many of these genera, it is simply because they had been pre-occupied by earlier botanists.

Fifty years ago priority of nomenclature was a matter of much less consideration than in our time. Thus, about the time when Gray's work appeared, two other botanists published arrangements of the Hepaticæ—Raddi (1820), and Dumortier (1822). Singularly enough, each seems to have been ignorant of the work of the other. Subsequent writers have shown scarcely more regard for the labours of their predecessors, so that the genus Jungermannia, which Hooker (1816) left intact—a little oasis unknown to synonyms—is now obscured and defaced by them past recognition.

Dr Gottsche (*Hedwigia*, 1866, pp. 11–14) not unnaturally objects to the proposed changes, on the ground that the nomenclature of *Nees ab Esenbeck*, and the *Synopsis Hepaticarum*, has now been accepted for more than thirty years, and ought not to be disturbed, because an earlier arrangement is disinterred from some obscure publication. But a work published in two thick octavo volumes, and by an author still living, cannot be called obscure. Nor do we think that, upon reconsideration, Dr Gottsche will oppose the modified restitution we now advocate.

Already Professor Lindberg has restored the genus *Pallavicinia* in place of *Blyttia.*

Another objection has been offered to Dr Gray's nomenclature ; we allude to the masculine terminology of the genera, which renders them rough and uncouth to our ears, accustomed to the softer feminine. Who, for example, would substitute Hookerius for Hookeria, or Linneus for Linnea?

In the following list the new genera proposed by Gray are first quoted; secondly, the equivalent terms now in use; and, lastly, the works of writers on general botany who have anticipated Gray's names. While engaged on this list, I have been greatly indebted to critical remarks contained in letters from Professor Lindberg, of Helsingfors, one of the most gifted students of the cryptogamia of our time:—

Staurophora (1821)	= *Lunularia.* Micheli, 1729!
Cyathophora .	= *Preissia.* Corda, 1829. (*Cyathophorum*, a genus of mosses, P. Beauv. Prod. pp. 33–52, 1805!)
Stozzius . .	= *Reboulia* et *Fegatella.* Raddi, 1818.
(*Reboulia*	= *Asterella.* P. Beauv. Lam. Exc. Meth. Bot. 1810!)
Maurocenius .	= *Fossombronia.* Raddi, 1820!
Pandulphinius .	= *Lejeunia.* Libert. 1820!
Cavendishia .	= *Porella* (Dill.), L. 1741! = *Madotheca.* Dumort. 1822.
Scalius . .	= *Haplomitrium.* N. ab E. 1833. (*Scalia.* Sims, Synantheræ, Bot. Mag. xxiv. 1806!)
Cesius . .	= *Gymnomitrium.* Corda, 1828. (*Cæsia*, R. Br. Prod. Fl. N. Holl. Liliaceæ, 1810!)
*Herbertus .	= *Sendtnera.* Endl. 1842 = *Schisma.* Dumort. 1822. (Herbertia, Swert. Liliaceæ, 1829.)
*Pallavicinus .	= *Blyttia.* Endl. 1840.
Kantia . .	= *Calypogeia.* Raddi, 1820!
Lippius . .	= *Sarcogyna.* Dumort, 1822. (*Lippia*, Houst. (Verbenaceæ), L. Syst. Nat. 1735!)
*Marchesinius .	= *Phragmicoma.* Dumort. 1822. (Is there any valid distinction between this and *Lejeunia?*)
*Martinellius .	= (now divided into *Radula.* Dumort. 1822. *Scapania* et *Plagischila*, 1831.) Candollea, Raddi, 1820—but preoccupied by Laberellardi for a genus of Dilleniaceæ, 1806!
*Mylius . .	= *Jung. polyanthus, Chiloscyphus Corda, Jung. cuneifolia!* and *J. Taylori*, placed by Mitten in *Leioscyphus*, Fl. Nov. Zeal., 1847. Mylius must replace the latter genus.
? Nardius . .	= *Alicularia.* Corda, 1830 (= *Mesophylla*, Dum. Com. 1823!) et *Sarcoscyphus*, Corda, 1830. Too much like *Nardus*, L. Syst. Nat. n. 75, Gramineæ, 1735! Otherwise it might be adopted with advantage, since *Alicularia* bears the same relation to *Sarcoscyphus*, which the round-leaved Junger-

		manniæ bear to the emarginate ones. Again, the distinction between *Sarcoscyphus* and *Gymnomitrium* is quite arbitrary.
*Bazzanius	.	= *Mastigobryum.* Syn. Hep. 1844.
Papa	. .	= *Pellia.* Raddi, 1820!
Riccardius	.	= *Aneura.* Dumort. 1823. (*Richardia*, Houst. Lam. G. Pl. 1737! (Rubiaceæ)—*Richardsonia,* Kunth = (*Richardia*, L.) Ann. Mus. Par. lv. p. 439; Pat. Browne, Nov. Gen. Anur. iii. p. 350, 1818.)
Herverus	. .	= *Metzgeria.* Raddi, 1820!
Salviatus	. .	= *Frullania.* Raddi, 1820!

So that of the twenty-one genera introduced by Dr Gray, the following alone can be retained:—*Herbertia* = Sendtneria; *Pallavicina* = Blyttia; *Marchesinia* = Phragmicoma; *Bazzania* = Mastigobryum; *Martinellia* = Radula; (perhaps) *Nardia* = Alicularia and Sarcoscyphus; and *Mylius* = *Leioscyphus*, Mitt.

IV. *Miscellaneous Communications.*

Professor Dickson, Glasgow, made some remarks regarding the formation of the fruit of *Hippophea rhamnoides*, and exhibited preserved specimens. He stated that Mr Sadler and he had paid a visit to Tynninghame last month, where they found the plant fruiting in the greatest profusion on the shore. Dr Dickson also exhibited a flower of *Tropæolum* (Indian cress) having two spurs.

Mr Gorrie exhibited cones of *Picea cephalonica* and *Cupressus Lambertiana*, produced at St Fort, Fifeshire.

Duncan Forbes, Esq., presented cones of *Picea cephalonica*, taken from a tree at Culloden House, 15 feet 8 inches high.

Mr Fowler, gardener, Castle Kennedy, sent cones of *Picea Pindrow*, *P. Webbiana*, and *Abies orientalis*, produced there.

Mr Bisset presented cones of *Picea cephalonica*, produced at Moncrieffe, Perthshire.

Mr M'Nab exhibited cones of *Picea Nordmanniana*, from the Cambridge Botanic Garden.

Professor Christison presented the fruit of a species of

Strophanthus, which yields an arrow poison used by the African natives on the Shire.

Donations to the Herbarium were announced from Mrs Millar, plants from the Cape of Good Hope; Dr James Cox, Australian plants; Mr D. L. Beckingsale, rare English plants; Mr Sim, plants naturalised on the banks of Tay; Rev. Thos. Bell, specimens of *Drosera longifolia*, collected on Benhar Moor, near Whitburn.

9th December 1869.—Sir WALTER ELLIOT, President, in the Chair.

The following Gentlemen were elected Office-Bearers for 1869–70:—

President.

Sir WALTER ELLIOT, K.S.I.

Vice-Presidents.

ALEXANDER BUCHAN.
CHARLES JENNER.
HUGH CLEGHORN, M.D.
ROBERT BROWN.

Council.

JAMES M'NAB.
Professor ARCHER.
WILLIAM GORRIE.
Professor DICKSON.
THOS. A. G. BALFOUR, M.D.
JOHN BALLANTYNE, Jun.
ROBERT SCOT-SKIRVING.
IS. ANDERSON-HENRY.
THOMAS HARDIE, M.D.
JOHN RUSSELL.

Honorary Secretary,	Professor BALFOUR.
Honorary Curator,	The PROFESSOR OF BOTANY.
Foreign Secretary,	Professor MACLAGAN.
Treasurer,	PATRICK NEILL FRASER.
Auditor,	GEORGE TODD.
Artist,	NEIL STEWART.
Vice-Secretary and Curator,	JOHN SADLER.

Local Secretaries.

WILLIAM CARRUTHERS, British Museum, London, W.C.
ALEXANDER DICKSON, M.D., Professor of Botany, Glasgow.
GEORGE DICKIE, M.D., Professor of Botany, Aberdeen.
PHILIP W. MACLAGAN, M.D., Berwick.
CHARLES C. BABINGTON, Professor of Botany, Cambridge.
THOMAS SHAPTER, M.D., Exeter.
JAMES GILCHRIST, M.D., Dumfries.
WILLIAM KEDDIE, 5 India Street, Glasgow.

JOSEPH DICKSON, M.D., St Helier's, Jersey.
BENJAMIN CARRINGTON, M.D., Eccles, Manchester.
WILLIAM ALEX. STABLES, Cawdor Castle, Nairn.
EDWARD CHARLTON, M.D., Newcastle.
JOHN LOWE, M.D., King's Lynn, Norfolk.
F. BUCHANAN WHITE, M.D., Perth.
Rev. W. A. LEIGHTON, Shrewsbury, Shropshire.

JOHN KIRK, M.D., Zanzibar, Africa.
FERDINAND VON MUELLER, M.D., Ph.D., Melbourne, Australia.
THOMAS ANDERSON, M.D., Calcutta.
W. H. CAMPBELL, LL.D., Georgetown, Demerara.
ALEXANDER HUNTER, M.D., Madras.
GEORGE LAWSON, LL.D., Ph.D., Dalhousie College, Nova Scotia.
R. J. SHUTTLEWORTH, Berne, Switzerland.

The Treasurer submitted a report on the state of accounts for the past session, and on the present financial condition of the Society.

The following Gentlemen were elected Fellows of the Society :—

1. *Foreign Honorary Fellows.*

CARL NAEGELI, Ph.D., Professor of Botany, Munich.
N. PRINGSHEIM, Ph.D., Professor of Botany, Jena.
CARL KOCH, Ph.D., Professor of Botany, Berlin.

2. *Resident Fellows.*

JAMES COX, Clement's Park, Dundee.
JOHN GAIR, Falkirk.
ALEXANDER ROBERTSON, 29 Dick Place.
JOHN S. COWAN, 20 Cumberland Street.
JOHN EDWARD SHAW, 4 Bellevue Terrace.
DAVID MITCHELL, Nursery and Seedsman.

3. *Non-Resident Fellows.*

J. F. DUTHIE, Sutton Court, Pensford, Bristol.
W. A. T. DICK, Keith House, East Lothian.

4. *Foreign and Corresponding Members.*

JULIUS SACHS, Ph.D., Professor of Botany, Freiburg.
H. N. BOLANDER, Botanist to the Geological Survey of California.
DON GUILLIERMO JAMESON, San Juan, formerly Professor of Botany, Quito.
A. S. ÖERSTED, Professor of Botany, University of Copenhagen.

The following Member has been struck off the List of Fellows for Non-Payment of Subscriptions :—

JOHN S. MACBETH, M.A., M.B., C.M., Ewell, Surrey.

Donations to the Library, Herbarium, and Museum were announced.

The following Communications were read:—

I. *On the Structure of a Lignite from the Old Red Sandstone.* By W. R. M'Nab, M.D. Edinburgh.

I am indebted to Mrs Miller for the opportunity of examing the sections of the Old Red Sandstone lignite from Cromarty, the description of which I now wish to lay before you. On the four slides are preserved six sections, two transverse, two longitudinal, and two tangential. These sections are described and figured in Mr Miller's works; but although the slides were examined by the late Mr Nicol, as well as by Mr Miller, their peculiar characters seem to have been entirely overlooked. It is in the longitudinal section, parallel to the medullary rays, that the peculiar punctated markings to which I wish to direct attention are observable. Mr Nicol failed to detect these punctations, and therefore could not give any opinion as to the nature of the wood, while Mr Miller described what he called "stipled" markings. The transverse and tangential sections are quite correctly described and figured by Mr Miller. Judging from the figures in Mr Miller's works, the sections must all have been examined with a low power, and it is only by the use of a power of more than 200 diameters that the peculiar structure can be easily made out. The specimen from which the slices were cut is now in the Edinburgh Museum of Science and Art, in Mr Miller's collection. It consists of a nodule about 6 inches by 4, with a black band in the centre. There can be no doubt whatever that the specimen is from the Old Red Sandstone, as Mr Miller describes scales of certain Old Red Sandstone fish occurring in the same nodule. The nodule was collected by the late Mr Miller himself at Cromarty, and is described in several of his books.

The transverse section exhibits no trace of annual rings, but the structure agrees with that of the Coniferæ, in there being no large openings, all the cells being of very nearly the same size. As the stem has been greatly compressed the cells are more or less flattened. The longitudinal sections exhibit at certain parts peculiar punctated discs. The external disc is slightly oval, closely resembling the circular discs of the ordinary conifers, but the central dot is replaced by an elliptical opening, exactly the same as the peculiar central markings found in the punctated tissue of the Cycadaceæ. The long axis of the central opening corresponds to the long axis of the external disc. These markings are $\frac{6}{6000}$ by $\frac{3}{6000}$, external diameter; the central elliptical opening being nearly $\frac{4}{6000}$ long, and $\frac{1}{6000}$ broad. They seem to be smaller than the ordinary coniferous punctations, and, as in the sections, they are only to be seen with great clearness in one place, it is not to be wondered at that they had escaped observation. The tangential section shows the medullary rays cut across. In the transverse section, the medullary rays can also be seen very clearly.

There can be no doubt whatever that the specimen is from the Old Red Sandstone formation; and from an examination of a large series of lignites from the north of Scotland, in the collection of Mr C. W. Peach, they do not seem to be uncommon in that formation. All the specimens examined present the same external characters as the lignite found by Mr Miller. The microscopical structure of the other lignites has not yet been made out; but as Mr Peach has very kindly given me fragments of the lignites in his collection, I hope to be able to examine and describe their microscopic structure at some future time. A considerable quantity of bituminous matter obscures, to a certain extent, some of the structure, but not enough to prevent the structure being satisfactorily made out.

What are the relations of this lignite from the Old Red Sandstone? The discs are cycadaceous, but the structure of the rest of the stem precludes the idea of their stem being cycadaceous. The transverse section shows a very much closer relationship to the Coniferæ; but, as far as I know, all the Coniferæ, with the exception of Salisburia, have circular dots in the punctated tissue. The peculiar form of the punctated markings indicates also a rather close resemblance to scalariform tissue—an almost intermediate step between scalariform tissue and true punctated tissue.

The presence of medullary rays, the uniform size of the cells, as seen on transverse section, and the presence of punctations, although they are peculiar, seem all to point to a close relation to the Coniferæ. As I cannot refer the lignite to the carboniferous genera, Dadoxylon or Dictyoxylon, it seems possible that it will have to be referred to a new genus; if so, I would venture to suggest the name of *Palæopitys Millerii*, for the Old Red Sandstone lignite now described. The relation of the markings found in the lignite to those of Salisburia is of peculiar interest. The Salisburia is known to have leaves very closely resembling those of certain ferns. May it not turn out that some of the so-called fern-like leaves from the older formations should be referred to plants resembling the Salisburia of the present day?

Murchison* states that plants from the Old Red Sandstone of Caithness, examined by Professor Quekett, exhibited a true coniferous structure, allied to Araucaria. The lignites from Caithness, examined by Quekett, are therefore quite distinct from the lignite of Cromarty, discovered by Mr Miller.

II. *Histological Notes.* By W. R. M'Nab, M.D. Edinburgh.

1. *On the Structure of the Adventitious Roots of the Portugal Laurel.*

In the month of October of last year, many of the branches of the Portugal Laurels, in the grounds of the Crichton Royal Institution, Dumfries, became covered with patches of adventitious roots. These adventitious roots were submitted to a careful microscopic examination, and were found to present the usual histological characters of true roots. They arise in patches, more or less large, from the branches, but not in any regular order, their position on the branch not giving any clue to their relative age. The bark was always ruptured and pushed aside by the rootlets, showing that they have a deep-seated and not a superficial origin. Sections made in various directions showed that the roots are in direct relation to the cambium layer; and, in certain

* Siluria, third ed., pp. 290, 291.

sections, the medullary rays could be traced for some distance into the adventitious root. All the cells of the medullary rays in the neighbourhood of the rootlet were filled up with small rounded starch granules, which gave the characteristic blue reaction with iodo-chloride of zinc solution. The apex of the root was covered with the mass of loose cells common to ordinary roots, and forming a slightly developed pileorhiza. When sections were placed in carmine solution, the active cells at the growing point became, as usual, brightly coloured. One section was left, by mistake, for a long time in the carmine solution; this, when taken out and carefully washed, showed a coloured matrix, in which the apparently loose cells were immersed. These cells, although apparently loose, can be always removed with the section from slide to slide. It is thus probable that the cells, instead of being loose as described, are more or less immersed in a gelatinous matrix, probably due to the degeneration of the primary cell-wall. I have not been able to get the same appearance again, as the rootlets were all destroyed before the above observation was made. The appearance was certainly not due to some of the colouring matter remaining between the cells, as every attempt was made to remove it without success. The only difference between these adventitious and true roots is in their position and irregular mode of growth. In their growing by addition to the growing point, and in histological characters, they are undistinguishable from true roots. Root hairs were also produced in abundance by the epidermis.

2. *On Intercellular Substance and Cuticle.*

At the meeting of the Botanical Society held last January, I communicated a paper on the staining of certain vegetable tissues. In it I took occasion to remark that the cuticle covering the external parts of plants could be readily stained with carmine, the so-called intercellular substance remaining colourless. During the year these experiments have been frequently repeated, and always with the same result, namely, that while the cuticle was quickly and deeply stained with carmine, the intercellular substance remained colourless. Careful observation of the growth of cells in the young roots of the white mustard, *Phalaris canariensis*, and the garden pea and bean, have led to the conclusion that the so-called intercellular substance is in reality the original or primary cell-wall—that as growth goes on, this primary cell-wall becomes thickened by the addition of numerous more or less marked layers on the inside. In the stems of many plants it requires some care to be able to demonstrate that the cell-wall and thickening layers are separate. In the layer of cells of the epidermis, on which the cuticle rests, the outer surface is in general greatly thickened, while the inner part of the cells are only thickened at the angles at which the other cells join. This thickening at the angles is often so great that the cell appears almost filled up, or the thickening appears as a continuous layer. In the epidermal and subepidermal cells of the ivy the thickening is so great, that without careful examination the thickening might be considered continuous. On the more or less thickened external surface the cuticle rests, and may be considered as thickening occurring outside the cell-wall. We have many examples of this thickening outside a cell-wall, the covering being analogous to a cuticular layer; as in the extine and intine of the pollen grain,—the intine representing the primary cell-wall, the extine the cuticular layer. The intine is the more important part, because the extine may be very thin or wanting, as in the pollen of Zostera. The outer covering of many spores, the exosporium, is also another example of a cuticular layer on a single cell. The so-called intercellular substance, as seen in sea-weeds, &c., seems to be a degenerated and gelatinous condition of the cell-wall, and of an entirely different character from that of the cuticle. From all the observations I have made, I think we must reject the statements of Wiegand, Schacht, and others, regarding the identity of intercellular substance and cuticle as untenable.

III. *Notice of* Hieracium stoloniflorum, *Waldst. and Kit.;* H. glomeratum, *Fr.;* and H. præaltum, *Vill., as occurring in the Neighbourhood of Edinburgh.* By Professor BALFOUR.

Of late years the following species of *Hieracium* have been gathered near Edinburgh:—

1. *Hieracium stoloniflorum* of Waldstein and Kitaibel. This plant is found in the meadows and pastures of Eastern and Northern Europe, chiefly in mountainous districts. Stations are given for the plant in Russia, Poland, Hungary, Bohemia, Silesia, and Sweden. In Norway the plant is met with only near Christiania; and Fries, in his "Monograph of Hieracium," says that it may possibly occur in the northern parts of Britain. It was found by myself and Mr Sadler in large quantity, on the banks of the railway between Warriston and Meadowbank, near Edinburgh, on 16th October 1869. It is probable that it has been introduced in the first instance, although now it seems to be in a natural habitat.

It belongs to the section Pilosellæ. Fries thinks that it is the *H. dubium* of Hudson, and refers to Withering's Arrangement, iii. p. 684; Smith, Brit. Flor. p. 828; English Bot. figure 2332.

The specific characters are,—Rhizomate repente stolonifero, foliis obovatis obtusis utrinque setosis intense viridibus, subtus floccis canis raris adspersis, scapo primario submonophyllo racemoso-corymboso oligocephalo, sæpe ramo arcuato-adscendente aucto, capitulis erectis ventricosis basi truncatis, defloratis depressis, squamis concoloribus acutis, ligulis radiantibus subtus subvittatis.

The rhizome is creeping and stoloniferous; scape erect, usually single, naked or with a single solitary leaf, bearing long white hairs, mixed with very short glandular ones; leaves collected into a rosette at the base, more or less obovate or obovate-oblong, attenuated below; very short soft setæ; capitula solitary, sometimes 2–4 or more, with alternate distant peduncles; scales acuminate; ligulate flowers yellow, the marginal ones having purple spots below.

2. *Hieracium glomeratum,* Fries. This species was found also on the railway embankments at Edinburgh, between Scotland Street and Trinity, by John Maclaren, in June 1869. The species is common in Eastern, Middle, and Northern Europe, extending to Upsal.

The characters, as given by Fries, are,—Pallide viride. subglaucescens, pilis brevissimis mollibus adspersum, caule sparsifolio cano-floccoso, apice cymoso corymbosove, foliis lineari-lanceolatis acutis cano-floccosis, radicalibus elongatis, pedunculis glomeratis cano-floccosis involucrisque ex ovata basi oblongis, defloratis conico-ventricosis, glanduloso-pilosis, squamis acutis.

Root oblique; stolons either awanting or cord-like; stem erect, somewhat hairy, covered with floccose hairs, intermixed with shorter hairs, black at the base and glanduliferous at the apex, with two or three scattered leaflets; leaves in a rosette at the base, elongated and narrow, commonly linear-lanceolate and acuminate, sparsely covered with hoary stellate flocci; cauline leaves remote; inflorescence more or less conglomerate; cymes of hairy capitula; interior scales (phyllaries) acute; ligulate flowers and style yellow; achenes blackish, shorter than the whitish pappus.

3. *Hieracium prœaltum,* Vill. This species was gathered several years ago in woods at Culross, by Dr Kirk. It is a plant of Middle and Eastern Europe. It is also found near Christiania.

Its characters, as given by Fries, are—Glaucescens, setoso hispidum glabratumve, sæpe flagelliferum, caule simplici stricto 1–3 folio, foliis lineari-lanceolatis subtus denudatis, primariis obtusis, corymbo denso cano-floccoso, pedunculis defloratis strictis, capitulis subnudis virentibus ovato-cylindricis, squamis obtusiusculis carina hispidis, margine pallidis.

It is *H. cymosum*, Leers; *H. florentinum*, Spreng; *H. Auricula*, Willd.

Root is præmorse and oblique; flagella sometimes present, at other times wanting; plant having a glaucous hue, often with a floccose covering, but without glandular hairs; stem simple, straight, with 1–3 leaves; infloresence corymbose with few or many capitula; leaves lanceolate, attenuated towards the base; hairs of the capitulum short, usually non-glandular; involucre with an ovate-oblong base, small, slightly flocculose; flowers and styles yellow.

IV. *Notes on the Propagation of the Ipecacuan Plant* (Cephaelis Ipecacuanha). By Mr M'Nab. (Plate IV.)

In August 1869 I had a conversation with Dr Anderson, Director of the Botanic Garden, Calcutta, relative to the growth, habit, and propagation of the Ipecacuan plant.

He was anxious to procure as many specimens as possible from the British and foreign nurseries and gardens, to send to India, for the purpose of establishing them in that country. The Ipecacuan plant has always been exceedingly scarce in British collections, and, owing to its peculiar habit of growth, is likely to remain so. The conversation referred to induced me to turn my attention to the mode of propagating this plant, which for years had remained much in the same condition, making little or no progress.

St Hilaire, in his "Plantes Usuelles des Brasiliens," gives the following information regarding the wild state:—"It is found inhabiting the moist and shady forests of various parts of Brazil, especially in the provinces of Pernambuco, Minas Geraes, Bahia, and Rio Janeiro, its growth extending as far south as Lat. 22°; on the islands of Parahyba and the banks of two rivers called Pomba and Xipota it is particularly abundant."

It was first introduced into the British gardens in 1830, but through what source does not seem to be recorded. It is a plant of remarkably slow growth; the largest specimen now in the Botanic Garden at Edinburgh is scarcely one foot in height, although more than thirty years of age, and has three leading shoots, each four inches in length. The method hitherto adopted of propagating the Cephaelis (as far as I am aware) is by cuttings, but of these not more than one or two can be got at a time, and at long intervals. Cuttings root freely when inserted in white sand. If placed in bottom heat, and kept somewhat moist, five or six weeks will be amply sufficient to produce roots After the cuttings are sufficiently strong, they should be potted in a mixture of fine loam and sand. On account of this comparatively slow method of propagating, the Cephaelis will probably remain scarce.

The roots, or rather rhizomes, of the Cephaelis are peculiarly annulated (Pl. IV. fig. 2). A few of them were taken from one of the plants in the Botanic Garden during the month of August 1869, and after being cut into transverse sections of different lengths, were inserted in a horizontal position over the surface of a pot prepared with drainage and white sand. This pot was placed under a hand-glass in a warm propagating bed, and kept moist. A few weeks afterwards the root-cuttings began to swell, and showed signs of budding, chiefly on the edge of the upper cut surface, as in Pl. IV. fig. 3. In most cases only one bud was developed, but in some instances two or more were produced. When several growing points are observed, the root can be cut through, so as to form independent plants. In every case the leaf buds are first developed and nourished by the sap in the fleshy portion of the root. As the buds begin to elongate, some fine filmy roots are protruded from the under surface. Young plants so produced are now growing freely in the garden, the largest being 3½ inches high, with five small leaves, and young fibrous roots about 1½ inch long (Pl. IV. figs. 4, 5). In order to meet the demand which in all likelihood will be made on nurserymen for plants of the Cephaelis, it is well to know how it can be propagated independently of cuttings, and at the same time without injury to the parent plant.

Understanding that the Government intend to introduce the cultivation of this plant into India, I would suggest that no time should be lost in securing a quantity of the Ipecacuan plants for the purpose of making a fair start. I have explained from experiments how this plant can be increased by means of root-division; but as this will be a slow process, on account of the few established plants in the country to work upon, it is desirable that immediate steps should be taken to procure a quantity of plants or roots (rhizomes) from the native habitats in Brazil, and thus enable cultivators to get a stock to propagate from. For this purpose I beg to offer a few observations on the introduction and extension of the Ipecacuan plant. Various ways may be suggested for this end. The first, and perhaps the most expensive method, would be to have the plants brought home in Wardian cases, and on their arrival in this country, or in India, they could be subjected to root propagation. If the tops come home alive, they also could be placed in positions to secure a new growth of leaves and roots. But a cheaper, and perhaps the safest, method of procuring plants, would be to collect a quantity of the fresh roots or rhizomes from their native soil, and after sealing the cut extremities, to place them longitudinally in a close-fitted packing-box made of wood (not less than one inch thick), having a layer of fresh sphagnum moss placed between each layer of roots. If the moss is firmly packed, it ought to keep the roots in a plump and perfect state for many months, or until such time as they reach their destination. If white sphagnum moss cannot readily be obtained, moss of any kind moistened, and the excess of moisture thoroughly squeezed out, will perhaps answer the purpose as well. If moss cannot be procured, heavy soil, taken six or eight inches under the surface, with the natural moisture in it, may be used, although not so suitable as sphagnum.

Rose bushes have been sent from this country to Australia, packed entirely in layers of sphagnum moss, and have reached their destination in safety. Some years ago I packed a quantity of roots of herbaceous plants in sphagnum, in the backwoods of Canada, during the month of August, and unpacked them in Edinburgh in January, all perfectly fresh; and I have also brought home many species of American tree seeds in sphagnum moss, in a state fit for growing, while samples of the same seeds, brought home in canvas and paper bags, were incapable of germination. From my knowledge of the preservative powers of fresh sphagnum moss, and the nature of the woody roots of the Ipecacuan plant, I have no hesitation in saying, that roots, or rooted stems (the plants being previously divested of their foliage), might be sent home alive in the manner described. It is a curious fact, that some variety of sphagnum moss is found in almost every quarter of the globe. A few weeks ago some plants of Anæctochilus, packed in sphagnum at Singapore, reached this country in good condition, thus showing the wonderful preservative powers of the moss.

When the young Ipecacuan plants intended for India are of sufficient size, they ought to be hardened in a moderately cool plant-house for some weeks, to enable them better to stand the transit. After being sufficiently matured, they may be planted in a Wardian case, where they should remain a few weeks to settle before being sent out. However, this method of packing for transmission abroad is not always desirable, except in the case of very strong specimens. With the exception of a few old ones, the age of the majority to be sent out will not average over eight or ten months. Such young plants could hardly survive in a case constructed on the Wardian principle, and the young roots could not hold the soil together; besides, Wardian cases are liable to be upset, and the roots injured and lost.

Judging from the size and nature of the plants likely to be available, it will be preferable to send them all in pots. The case for such plants to be divided into wooden compartments like a bottle basket (fig. A), each compartment being made to contain only one pot (fig B). The pots to be enve-

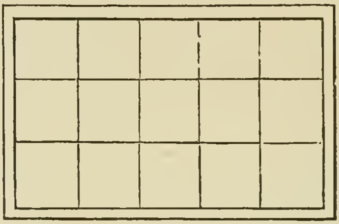


Fig. A.

loped in sphagnum moss, having some light clean pieces carefully placed on the surface of each, and afterwards tied round and kept down with very fine galvanised iron wire, as bast matting or hemp cord, generally employed for such purposes is apt to mould with the damp and injure the young plants. The bottom of the case should be perforated with six or eight holes half an inch in diameter, to carry off any superfluous moisture. The plants, before being tied up, ought to be watered and well drained before the sphagnum covering is put round them, and so arranged in the case that the tallest shall be in the centre row. The bottom of the case should be covered with sphagnum, so that each pot will rest securely on it, and if necessary, some fine wire can be taken over the surface of the rack to keep the pots from moving. By the method of packing here suggested, the cases will be lighter than the ordinary earth ones, and more easily moved. A little fresh water now and then poured over the moss will be sufficient to keep the earth in the pots in proper condition. Such sphagnum prepared cases could be glazed, wired, and covered with tarpaulin in the way adopted for Wardian cases. Instead of glass, I would recommend strong white cotton cloth tightly stretched, and tacked over properly constructed frames, hinged at the bottom, and made to lock or open at pleasure (fig. B). A sprinkling of fresh water over the cotton covering several times during the transit, ought to keep the plants in good condition till they reach their destination, without pouring it over the moss, as is necessary in glazed cases.

The cotton-covered cases could be made of different sizes, to hold twelve, fifteen, or eighteen pots. The pots placed in each case should be of a uniform size, say 3 or 4 inches outside diameter. We shall suppose a plant case constructed to hold fifteen plants, and each pot 4 inches in diameter, This ought to be 26 inches long, and 16 inches wide (inside measure), made of wood one-inch thick, the sides to be eight inches deep, and the

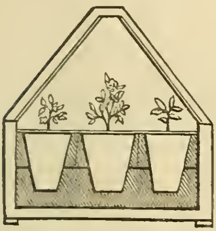


Fig. B.

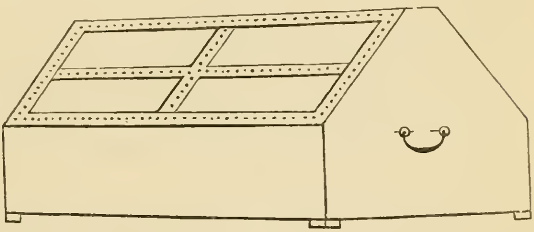


Fig. C.

height need not be more than 18 or 20 inches. The ends to be wholly of wood, so constructed as to receive the framed cotton covering, and to be provided with iron handles. The rack to contain the pots should be made of wood $\frac{3}{4}$ of an inch thick, and 3 inches deep, so secured as to be 4 inches above the bottom of the case, thus allowing the moss to be uniform over all the under surface; by being so, it will be less liable to become dry, than if each compartment were filled separate. If properly done at first with clean moist sphagnum, it will be found that the occasional moistening of the cotton cloth, either by rain or artificial watering, will be found sufficient to keep the plants in good condition till they reach their destination.

It will be necessary, when the cases arrive at their journey's end, to admit light and air very cautiously. In the event of a glass covering, air ought to be introduced gradually, but with a cotton covering, less care is required, as no matter how strong, it always admits a certain amount of ventilation.

If the plants arrive in good condition, they should be planted at first in an open, free, and fibrous soil, with a slight mixture of sand, and properly shaded and protected. In such a mixture, the fleshy roots will develope themselves better than in soil of a heavy compact or clay nature; which, however, may suit them after they are sufficiently matured.

If the tops of any of the plants should decay during the transit, the pots and soil should be preserved, as it is likely that fresh tops will be produced, from the fleshy portion of root under the surface.

Explanation of Plate IV.

Fig. 1. Ipecacuan Plant in flower.
,, 2. Annulated Root or Rhizome, cut from a pot-grown plant.
,, 3. Cut portion of a Rhizome, showing the growth at one month old.
,, 4. Cut portion of a Rhizome, showing the growth at two months old.
,, 5. Cut portion of a Rhizome, showing the growth at four months old.

V. *Notes on the "Dogwood" of Powder Manufacturers.* By Mr M'Nab.

In a letter Mr George E. Frere, Roydon Hall, Diss, remarks—

"Are you aware that the wood which is called 'dogwood' at the gunpowder works, and used in the manufacture of the finer kinds of powder for small arms and fowling-pieces, is not *Cornus sanguinea*, but *Rhamnus Frangula*, and that the main supply of it is imported into this country from Belgium and Prussia? This last mentioned circumstance makes me think the *R. Frangula* ought to be more frequently cultivated in England, for it is quite out of character that the nation should be dependent on foreigners for the supply of an important material of defence. Failing to procure plants from the English nurseries, I looked into the catalogues of the Edinburgh nurserymen, and I find the Messrs Lawson quote it amongst ornamental trees and shrubs, at 1s. to 3s. 6d. each; while Reids, of Aberdeen, do not mention it at all. Of course, there is no planting it by the acre at Lawson's price.

"If you have any means, by labelling the *Rhamnus Frangula* in the Edinburgh Botanic Garden, or otherwise, of informing the public that it is the dogwood of gunpowder makers, you will be doing a decided benefit; and perhaps nurserymen may then turn their attention to its cultivation for coppice wood."

The notice by Mr Frere on the use of the *Rhamnus Frangula*, or alder buckthorn, as it is called, in the manufacture of the finer kinds of gunpowder, is not new, having been already noticed by several old authors. It is, however, an important subject, and one worthy of the attention both of nurserymen and arboriculturists. This species of buckthorn is a tree resembling in habit some plants of the common white hawthorn. It is of easy cultivation, both in light and heavy soils, and by a little attention could soon be got in large quantities. It produces abundance of fruit, which ripens freely in favourable seasons. It could easily be cultivated in hedge-rows, or used to form hedges, as it bears cutting in remarkably well. It could also be planted with great advantage on many railway embankments, both in England and Scotland; with a little care after planting it would succeed well. In such places it would sustain no injury from engine sparks.

The subject of using charcoal-producing plants for gunpowder purposes is an important one, and the Highland and Arboricultural Societies should bring it prominently before the public in their prize lists, in order that it may be fully investigated.

The genus Rhamnus embraces about twenty-six species and varieties, and all are probably suited for gunpowder charcoal. A few of the species are sub-tropical, some are natives of North America, others of Spain, Switzerland, and the south of Europe; while *Rhamnus Frangula* and *R. catharticus*, although Continental species, are likewise considered natives of Britain.

Dr F. Buchanan White has recently discovered *Rhamnus Frangula* in the parish of Contin, Ross-shire; he states—"The plants (of whose number I cannot, owing to the dense growth of other bushes, speak with certainty) were well-established bushes, about 4 feet in height, flowering and fruiting freely, and growing in a marshy ground. Their associates were all native plants—alder, willow, birch, sweet gale, common heather," &c. This circumstance shows that there is no limit in Britain to its cultivation, if parties feel inclined to grow it for profit.

It is not improbable that many other genera of shrubby plants are capable of producing a fine quality of charcoal as well as the common alder, the alder-buckthorn, and dogwood, all now in use. Experiments could be made on the following British woods (if they have not already been tried): the sea buckthorn, common maple, white hawthorn, rowan tree, bladder-nut, spindle-tree, barberry, guelder-rose, wayfaring-tree; also the hazel, birch, hornbeam, sloe, furze, broom, or even the ivy, which, in many districts, is injuring our forest trees to a great extent, likewise several exotic shrubs and trees, now largely cultivated in this country.

Experiments could also be made with dried roots of many of our forest trees. After felling, such roots are generally left in the ground to rot, and are often very troublesome. If any, or all, could be turned to account for producing a useful charcoal, it would hold out an inducement to remove them from the ground, which could then be used for planting, or for agricultural purposes.

The high price which the wood and branches of *Rhamnus Frangula* bring in the British market—L.10 to L.14 a ton—is certainly an inducement for landholders to turn their attention to the cultivation of the alder-buckthorn, dogwood, or any other trees and shrubs found best calculated for producing the finer kinds of charcoal. The dry buckthorn branches are sent from the Continent in the form of compressed faggots, and peeled, previous to being charred.

Since the above was written, I have received, through the kindness of Mr P. S. Robertson, a sample of the gunpowder-wood from the Roslin Mills, with the following letter from Messrs Hay, Merricks, & Co.:—" We have pleasure in sending you a sample of the dogwood we use here in the manufacture of gunpowder. The sample sent is of English growth, in the county of Sussex, and the price varies from L.10 to L.14 per ton, according to quality. We require all peeled and packed into bundles of 100 pieces in each. The wood is cut generally in May and June."

The specimen sent from the Roslin Mills was subjected to a microscopic examination, along with recent woods of buckthorn and dogwood, and turns out to be the true alder-buckthorn (*Rhamnus Frangula*). It can readily be distinguished, both in the fresh and dried state, from the dogwood (*Cornus sanguinea*), by turning yellow immediately on being moistened, which is not the case with dogwood. If dogwood is really a charcoal-producing shrub, no plant could be so easily grown, as cuttings can be got in quantity. They will soon strike root, and grow as freely as a red or black currant.

The misnomer of dogwood for alder-buckthorn ought to be corrected by all powder manufacturers, as it is apt to lead to unpleasant consequences, by parties growing and supplying the true dogwood, and afterwards finding the produce refused by manufacturers as not the dogwood required by them.

VI. *Notice of* Ruscus aculeatus. By Mr M'Nab.

Mr M'Nab exhibited a specimen of *Ruscus aculeatus*, or butcher's broom, covered with rich crimson berries, sent by George E. Frere, Esq., of Roydon Hall, Diss, with the following letter :—

"Some years ago I found this plant in a state of ripe fructification. It is brought every Christmas into the market at Brighton, for the decoration of houses at that season. I had never seen before, in any other part of England, more than one, or, at most, two berries in any one clump of the plant, and I wished very much to get it to fruit in profusion at this place.

"I was reminded that the plant was diœcious, and I found friends to supply me with female plants. Soon after I received them it was suggested to me that my plants might possibly not have been hitherto barren, because they were of the male sex, but for want of impregnating agencies. I saw, a day or two since, an article in 'Nature,' by A. W. Bennett, who calls attention to the fact, that the normal time of flowering of the plant is almost the depth of winter, when the number of insects that can assist in its fertilisation is certainly very small. Mr Bennett also remarks on the incorrectness of the periods generally given in the Text-Books of Botany for the flowering of each species. Hooker, in his 'British Flora,' and Sowerby, in his original edition of 'English Botany,' give March and April for the flowering of this plant."

Mr M'Nab mentioned that, although several large clumps of the butcher's broom exist in various parts of the Botanic Garden, he had never seen ripe fruit on any of them. All the plants but one have a dark green colour, all are very compact, and are now covered (8th December 1869) with rudimentary fruit buds, but no male flowers have yet been obtained. The one above alluded to, a tall light green variety, has a few incipient scales on the side of the leaf. This may be the male plant, but as it is not growing beside what is undoubtedly the female plants, no seeds could be perfected. The specimen sent by Mr Frere, although containing numerous ripe berries, has also a number of apparent rudimentary fruit buds for next year, similar to those now seen on the plants in the Garden. It is difficult to say at what stage the impregnation of the ovule takes place. The plant is recorded as diœcious, and flowers during March and April, and possibly this is the time when the male blossoms expand. It will be interesting to ascertain whether these rudimentary fruit buds, now covering the plants, remain as they are till the month of March, when the male flowers expand.

Two specimens of Ruscus, one called *R. aculeatus,* and the other *R. aculeatus rotundifolius,* have just been received from the nursery gardens of Messrs P. Lawson & Son. The former is identical with the one cultivated here, and is also covered with rudimentary female flowers. The specimen called *R. aculeatus rotundifolius* is also covered with buds; but after a careful microscopic examination, all turn out to be male buds, while the specimen sent from England by Mr Frere has male buds and ripe fruit on the same branch. From the state of the male buds on both plants alluded to, it seems impossible that these male flowers can have the stamens sufficiently developed before March or April.

VII. *Note on* Carex paniculata. By Mr M'Nab.

The Royal Botanic Garden has recently been presented with three plants of *Carex paniculata*, sent by Mr Archibald Gorrie, forester to the Earl of Leicester, Holkham Hall, Norfolk. The plants measure, from the base of the roots to the extreme points of the leaves, 8 feet 6 inches, independent of what must have been cut off in the lifting. They have been growing in deep rich soil, as 3 feet of the lower portion of each has been bared of the peat; the part remaining is filled up with a mass of longitudinal roots or fibres, each nearly half an inch round.

The circumference of the upper root portion of the largest plant is 5 feet 3 inches, from which a large crown of leaves proceeds. One of the plants has an upright stem above the peat, 1 foot 9 inches long, and 3 feet 6 inches in circumference, composed of the dead portions of the leaves; from the top of this pseudo-stem the large tuft of leaves is growing. The stem of this plant between the leaves and the peat has the lower base of the fallen leaves quite short and brown, appearing as if they had been destroyed by fire.

It is impossible to calculate the age of these gigantic sedges; but, judging from the quantity of decayed leaves round the base of each plant, and the way the peat seems to grow or rise round them, they must be at least a century old. Very few fruit spikes were observed, and of those found, the heads were comparatively small, the largest not more than 2½ inches long. Some idea may be formed of the size and weight of these plants from the fact that it required three men to lift each of them.

Mr Gorrie writes—"We have some taller and heavier plants than any of those sent. I observe they grow strongest when the roots get into the water. I am told, when foxes abound, they are very fond of lying on the top of the Carex tussocks, and basking in the sun. This gigantic Carex is very common on sodden peaty soils in Norfolk. I have also seen it at the Duke of Grafton's, and at other places in Suffolk, likewise near Bury St Edmunds."

VIII. *Note on* Pinus Benthamiana. By Mr M'Nab.

Mr C. W. Peach, of Haddington Place, Edinburgh, exhibited a large cone, ripened at Overton, Orton, Peterboro', from Mr Charles Bodger, under the name of *Pinus macrocarpa*. This cone is 6½ inches long, and 14 inches in circumference. Mr Bodger writes—"The tree stands in the centre of my garden. It bore three drooping cones, in 1868, on the main stem, where that season's wood shot from; no signs since of any more. It has made two shoots from branches since the cones were taken off, one each season. There are twenty-three spreads of branches from the main stem. I believe it has been planted where it now stands for twenty-two or twenty-three years. The tree is 34 feet in height, and 23 feet across the branches. The circumference of the stem at the surface of the ground is 4 feet."

Pinus macrocarpa is by many considered as synonymous with *Pinus Coulteri* and *P. Sabiniana*. The cone sent by Mr Peach agrees with the description of *Pinus Benthamiana*, of Hartweg, which we have never seen in cone. Numerous plants are cultivated throughout the country, raised from cones, introduced about eight years ago, under the name of *Pinus Benthamiana*. The cones were 4½ inches long, and 7 inches in circumference. The habit of the plants, and the size and arrangement of the leaves of many of them, resemble the true *P. Benthamiana*. It is not improbable that all will turn out to be *Pinus ponderosa*, or a variety of it. In all cases a few cones ought to be sent home with seeds for identification.

IX. *Miscellaneous Communications.*

1. Major Peploe exhibited and presented a cone of *Pinus Sabiniana*, produced this season at Garnston.

2. Mr Gorrie, forester to the Earl of Leicester, exhibited and presented cones of *Cupressus Goveniana*, and male and female cones of *Araucaria imbricata*, produced at Holkham Hall, Norfolk. Mr Gorrie also exhibited a section of a stem, showing a graft between *Quercus Æsculus* and the common oak, the former being the graft. The graft had increased to 23 inches in circumference, while the attachment

was very limited. When blown down during a recent gale it was found that the stems had only adhered to each other by a small portion of the wood and bark.

3. Mr C. W. Peach exhibited a collection of Shetland plants, a twin apple, and *Leontodon Taraxacum* with double heads of flowers and leafy appendages on the flowering stalks.

4. Professor Dickson exhibited, under the microscope, preparations of the drupe of *Viburnum Lantana*, and made some remarks regarding its structure.

5. Professor Balfour exhibited photographs of Indian forest scenery, including palms, banyans, &c., sent by Professor Stephen Coull Mackenzie, Calcutta.

6. Mrs Wright presented a specimen of *Lythrum flexuosum*, which had been gathered in the woods at Hallston, Shropshire.

7. Mr A. Craig-Christie exhibited a specimen of a species of Agrimonia, which he thought was *A. odorata*, collected by the waterfall in Glen Easdale, Arran; and also a specimen of a Hypericum from Birk Glen, Arran, which was considered a variety of *H. Androsæmum*.

8. Messrs Hay, Merricks, & Co., of the Roslin Powder Mills, presented a bundle of the so-called "dogwood" (*Rhamnus Frangula*), used by them in the manufacture of gunpowder.

13th January 1870.—Robert Brown, Vice-President, in the Chair.

The following Gentlemen were elected Fellows of the Society:—

1. *As Resident Fellows.*

John Leitch.
John Methven.

2. *As a Foreign Member.*

Dr George August Pritzel, Custos of the Library, Berlin.

3. *As an Associate.*

Charles William Peach, A.L.S.

Professor Balfour referred to the death of Miss Jane Farquharson, a Lady Associate of the Society. Her father was Thomas Farquharson of Howden, in West Lothian, a retired surgeon of the E.I.C.S., and her mother was Elizabeth Macleod, daughter of Donald Macleod of Geanies, in Ross-shire, and sheriff of that county. She was born at Howden on 18th February 1802, and died on 24th December last. She lived with her parents at Howden, and afterwards at Charlesfield, in the same neighbourhood, then at Inveresk, till her father's death, about 1830, since which she resided in Edinburgh. She was kind and generous, and had a love for everything good and beautiful. She was elected a Lady Associate of the Society on 12th May 1842.

The following Communications were read:—

I. *Note on the Embryo of* Ruscus aculeatus. By Professor Dickson.

Dr Dickson made some remarks on the embryo of this plant, which he had examined from fruits sent to the Botanic Garden by Mr Frere, of Roydon Hall, Norfolk. The embryos were remarkable for their great variability in size, general form, and more particularly in the orifice of the cotyledon. Regarding the last point, the majority of the specimens exhibited the lips of the cotyledonary orifice as approximated, thus forming a "slit," this being evidently the normal arrangement, and corresponding to the ordinary type of cotyledonary orifice in Monocotyledons. In some cases the lips of the orifice were seen to gape in a remarkable manner. In these embryos the plumule is almost always small, rudimentary, and pretty deeply sunk in the cavity of the cotyledon; but in one case Dr Dickson observed it to be very much enlarged, completely filling up the cotyledonary cavity, and appearing externally between the lips of the cotyledon. Dr Dickson's observations were illustrated by specimens under the microscope and by drawings.

II. *Notice of Plants collected in Spitzbergen and Nova Zembla in the Summer of* 1869. By WILLIAM LIVESAY, Esq.

The arctic plants which I lay upon the table this evening are specimens from a collection made last summer during a yachting excursion to the Polar Seas, in which I accompanied J. Lamont, Esq., F.G.S., of Knockdow, Argyleshire; one of the chief objects of the expedition being to explore the unknown lands around Spitzbergen, and to ascertain the existence of a so-called Polar Basin.

The "Diana" left the Clyde on 15th April, and dropped anchor off Tromsö, North Norway, on 5th May. The only vegetation which greeted us here at this early season consisted of such small patches of scanty verdure as were beginning to be reclaimed from the winter's snow by the daily increasing heat of the level rays of the sun. In justice, too, to Scandinavian taste and energy, I must not omit to mention the gay collections of plants which the inhabitants are in the habit of crowding into their southern windows. All else in this district, and in fact throughout the five hundred miles of coast we had steamed along, presented but a weary waste of monotonous white, with scarcely a suspicion of tree or shrub. At one island, however, Majerö (the northern point of which is known as the North Cape), where I had an opportunity of going ashore, *Saxifraga oppositifolia* occurred in flower, whortle-berries still adhered to their stems, and some species of Lastrea and Athyrium nestled in the crannies of the cliffs.

We called in at Vardöhuus, on the confines of Russia, on 14th May, and ten days later, were off the island of Kolgeuv, further eastward on the north coast of Russia.

It was not till 13th June that we landed at North Goose Cape, on the west coast of Novaja Semlja, in lat. 72° 15′ north, long. 52° 30′ east. This part of the country consists of undulating plains, rising farther inland to hills of considerable height; these undulations being intersected in every direction by frozen streams, with occasional lakes. On the low ground the snow was gradually disappearing in the lengthening days of sunlight, and revealed here and there strips and oases of vegetation. This consisted, at the time of our visit, only of the sodden leaves, stems, and seed-vessels of the previous year's growth, characterised by the usual alpine abundance of saxifrages, and large quantities of macerated grass and carices, while every available space between the higher forms of vegetable life was filled up with mosses and lichens. The following were some of the species collected:—

Racomitrium lanuginosum.
Pogonatum urnigerum.
Bryum nutans.
Cetraria islandica.
    cucullata.
Peltigera aphthosa.
Solorina crocea.
Lecanora tartarea.
Cladonia furcata.
    deformis.
Umbilicaria cylindrica.

The budding twigs of a species of dwarf Salix were noticed in great quantity, and some of the Saxifrages seemed to be the first to answer the summons of summer.

Most of the other plants seen here were gathered in more mature condition, later in the season, at Spitzbergen; though, as will readily be imagined from the more southerly position of Novaja Semlja, the flora is more varied, and altogether of a higher type, than that of the former place.

It was a matter for regret that the shortness of our stay at Novaja Semlja, and the earliness of the season, did not permit my making any further botanical researches in this interesting country; for if, as others have pointed out, the floras of Spitzbergen and Greenland, with their many points of resemblance to each other, exhibit a close connection with the vegetation of Northern Europe on the one hand, and with that of Northern America on the other, there is a great probability that an examination of Novaja Semlja plants would, at least, form a very important rivet in the chain binding these two continents together—a chain already made up of a series of very interesting links. Judging from the general aspect of such clearings, as one could form an opinion from, I should think that, in the height of summer, this district must present the appearance of rich and luxuriant verdure, affording grazing, as it does, for the immense herds of rein-deer which have to lay up their winter stock of fat on these plains.

Having left Novaja Semlja, on the 25th of June we first sighted the bold cliffs forming the South Cape of Spitzbergen, but it was the 11th of July before I was able to add anything to my collection. At Cloven Cliff, Norway Islands, in lat. 79° 53′ north, long. 11° 30′ east (the most northerly point attained by the yacht), the following specimens were gathered:—

Polytrichum commune.
Pogonatum urnigerum.
Bryum crudum.
  nutans.
  Wahlenbergii.
Cetraria aculeata.
  nivalis.
Dactylina arctica.
Parmelia lanata.
Physcia elegans.
  obscura.
Lecanora badia.
Lecanora gibbosa.
Umbilicaria arctica.
  erosa.
Sphærophoron coralloides.
Cladonia fimbriata.
  pleurota.
Lecidea candida.
  contigua *var.*
  flavicunda.
  petræa.
Jungermannia setiformis.
  nemorosa.

Ranunculus hyperboreus was found in great luxuriance, and *R. nivalis* in marshy ground. *Papaver nudicaule*, *Cochlearia fenestrata*, and *Salix herbacea*, occurred where the soil was deeper. The leaves of the two latter plants supply the principal food of the brent goose, which frequents and breeds among these islands.

The most favourable opportunity which presented for examining the botany of Spitzbergen was afforded by a detention of four days in Ice Fjord. The climate of this part of the island has by all explorers been considered the most mild and temperate in the whole country; "the Madeira of Spitzbergen," it might not inaptly be termed. A large inland sea, of some hundreds of square miles in extent, stretches its arms of water, tempered by the Gulf Stream at its point of greatest influence, towards the glaciers and frozen mountains of the interior. The widely-hollowed valleys sheltered from the winds, which in other places blow like a whirlwind of keen knives from the glaciers, are fully exposed to the warming rays of the sun, which does not set for four months, and are watered by the copious streams which issue from the melting snows above. Under such favourable circumstances, the difference between the shores of this calm sea and the rugged cliff coast outside, where glacier and storm, sea and cliff, iceberg and breaker are ever meeting, can be readily imagined. The emotions awakened by a sudden change from the frozen seas to a ramble on shore, were enhanced by the interest which every plant under foot possessed for the botanist, and the reflection that one might stroll and collect for miles among rocks and ravines where no human being had yet trod. The level ground near the water was chiefly occupied by the golden tufts of *Potentilla nivea*, by *Dryas octopetala*, the brilliant purple petals of *Saxifraga oppositifolia*, by *S. cæspitosa*, *S. hyperborea*, *Stellaria humifusa*, and *Silene acaulis.* On the drier ground were found *Arenaria norvegica*, *Cerastium alpinum*, and *Stellaria Edwardsi.* In some places, where the soil appeared almost too poor to sustain any growth, the eye was dazzled by fields of *Papaver nudicaule.* On the slopes formed by the debris of the cliffs, which had disintegrated to form a very fair soil, the ground was even more closely clad in a variegated robe. In such localities I found *Saxifraga cernua*, *Lychnis apetala*, *Polygonum viviparum*, *Cassiope tetragona*, three species of *Draba*, *Pedicularis hirsuta*, and *Oxyria reniformis;* associated with these were tufts of *Poa arctica*, *Poa annua*, and *Hierochloe pauciflora.* On these and other grasses the rein-deer, which frequent the valleys in great numbers, feed greedily, though, where herbage is so scanty, it may naturally be conceived that these animals can ill afford to be epicures, and are not particular as to what they eat, provided it be not one of the three constituents of the country—rock, ice, and snow. It was in a long deer chase, up one of these valleys, that I came upon that gayest of arctic flowers, *Polemonium cæruleum;* but although I carefully searched on several occasions, I was able to obtain only half a dozen specimens, which occurred close together, almost buried in a luxuriant patch of grass. In one of the marshes which are generally found where a valley opens on the sea, *Carex rigida*, *Alopecurus alpinus*, and other plants, peculiar to such habitats, and named in the completed list, were collected.

On 27th July, I was able to get a few additional species from King's Bay, some hundred miles north of Ice Fjord. It was the second visit we paid to this bay. On the former occasion, a month previously, everything was completely snowed up; and where before there was but a flat expanse of snow, now, on landing, one trod on a carpet of verdure, some square miles in extent, level as a bowling green, composed of the most exquisite and harmonious varieties of colour and shade,—the blue petals and leaves of *Mertensia maritima* contrasting with the gay Saxifrages, Potentillas, and the naturally arranged bouquets of *Stellaria norvegica.*

Later in the season, during August, we visited Stor Fjord, the great arm of sea which separates East from West Spitzbergen. South Cape is said to divide two distinct climates; and this fact could not be better illustrated by the coarse winds and storms experienced on the east, compared with the genial calms of the west, than by the contrast of the flora of the two islands. So desolate was the former district, that, though often ashore, I was unable to find any new species not obtained in the west, and many found in Ice Fjord were absent here. Still, that there is abundance of a coarse vegetation, is manifest from the number of rein-deer which feed on the east side of the fjord. These animals graze principally on the low land close to the shore, but in the course of our explorations, more particularly in Walter Thymen's Straits, we met with large fertile table-lands, at the height of several hundred feet above the sea-level, and I have no doubt that a diligent worker in these so-to-speak high alps, with leisure and opportunity, might obtain some very interesting and remunerative results. The low shores of some of the bays are strewn with vast quantities of drift-wood of every size and shape, mostly consisting of the whole trunks of coniferous trees, in various stages of water and weather wearing. The origin of such accumulations has not failed to excite the interest and speculation of most voyagers to Spitzbergen, and has given rise to various theories, in some of which I need hardly state the inevitable Gulf Stream figures conspicuously. Without going into all the arguments for and against the several solutions to the difficulty, I think we may consider that the bulk of the evidence points to the continent of Siberia as the source of the timber. That it ever grew *in situ* will hardly be advocated by any one who has personally examined the shores of Spitzbergen. As a fact of curious interest in connection with the Gulf Stream, it may be mentioned, that Torrel, in 1861, at Shoal Point, met with a bean of *Entada gigantilobium*, which must have come from the Gulf of Mexico.

At Half-Moon Island, lat. 77° 17′ north, long. 23° 50′

east, I obtained specimens of the red and green snow plant, which have been placed under the microscope for inspection. It has, I believe, been thought that the species *Protococcus nivalis* and *P. viridis* are merely different stages in the growth of the same individual. This theory was by no means confirmed by the circumstances in which I observed the plants growing. The two were never found associated in the same patch of snow, nor was it possible to trace any intermediate forms in the passage from the simple cells of *Protococcus nivalis* to the jointed segments of *P. viridis.*

The last *terra firma* we landed on was the bare trap and broken basaltic columns of that cluster of rocks known as the Thousand Isles. Where anything green presented, it was carefully treasured, but I was only able to collect one or two cryptogams, including *Hypnum sarmentosum*, *Weissia* sp., *Cetraria aculeata*, *Cornicularia bicolor*, and *C. divergens.*

On 5th September we sailed for Norway, and a week later arrived among the most northern islands, to find the whole face of the country changed from the hopeless garb of winter, in which we had left it a few months before, to rich birch plantations and fertile meadows; the gush of green after the eternal snow, and the life around seemed to indicate that nature, no less than the thrifty peasantry, was anxious to make hay while the sun shone.

I fear what I have said conveys but a very imperfect idea of the wealth of the flora to be met with in Spitzbergen. M. Fries and M. Malmgren, who accompanied the Swedish expedition to Spitzbergen, had most extensive opportunities of examining the flora, and they each have published the results of their research.*

In conclusion, I take this opportunity of thanking Mr Sadler for his kindness in naming the specimens, many of which were entirely new to me.

[The author laid on the table a complete list of the plants collected, as drawn up by Mr Sadler, and presented specimens of the plants to the University Herbarium.]

Mr Buchan, in making some remarks on Mr Livesay's

* Tillägg till Spitsbergens Fanerogam.—Flora of Th. M. Fries. 1869, pp. 23, 8vo. Bihaug till om den Svenska expeditionen till Spitsbergen, 1864. af A. J. Malmgren. Stockholm, 1868, pp. 21, 8vo.

paper, said that the large quantities of drift-wood referred to by the author as having been seen in many of the bays of Spitzbergen, had probably been brought there from America by the Gulf Stream.

Mr Robert Brown also made some remarks on the paper. He did not concur with Mr Buchan in considering the masses of timber drifted on to the shore of Spitzbergen, as being due to the Gulf-stream, and therefore coming from the American coast across the Atlantic. On the contrary, he stated that little timber is ever met with in the course of the Gulf-stream, nor are there any great rivers on the Atlantic sea-board which are subject to great overflows such as would bring timber down into the current of that stream. Most of the wood which Mr Brown and other observers had examined was coniferous in structure, and though it was impossible to determine the genus or species, the trunks being all denuded of bark and worn, yet he considered there could be but little doubt that they came from the mouths of the great Russian and Siberian rivers. Some of these rivers rise in the spring by the melting of snow twenty and thirty feet above their ordinary level, undermining their banks and sweeping the great rafts of timber out to sea. Some of this is also carried out frozen in the large pieces of ice. The drift from the Kara Sea carries out immense quantities of this timber, which piles on the coast of Spitzbergen. The current then flows westward, but is deflected by the Greenland coast, and then flows south at the rate of thirteen knots an hour to Cape Farewell. Here the breadth of the current, according to the observations of the Danish Admiral Irminger, may be considered at 100 miles from land, decreasing as it goes north until it is lost about the southern end of Disco Bay, where it is met by the north current which flows down Davis Strait. The force of the two may be said to meet near Rifkol, and to this cause Mr Brown considered the banks there due,—just as the Newfoundland banks are made by the meeting of a portion of the Gulf-stream with the current down the coast from Davis Strait. This "Cape stream" which flows down the east coast of Greenland, doubles Cape Farewell, and then ends about Disco Island, not only brings round great streams of ice—the "Cape Ice" of navigators—who, in order to avoid it when entering Davis

Strait, keep well off to the westward,—but also much driftwood, which is piled up on some of the islands in Disco Bay. Further north it is uncommon, and in the far north is almost unknown. On the western shores of Davis Strait driftwood, for the same cause, is equally rare. Mr Brown could scarcely give in his adhesion to the ingenious hypothesis recently promulgated by Mr Findlay, viz.:—that the Gulf-stream ends about the banks of Newfoundland, and that the stream which is known under that name in the north is only the water drifted over by the continuance of westerly winds. The Gulf-stream, doubtless, extends far into the Arctic Sea, carrying up tropical seeds and Pernambuco and Campeachy woods on to the coast of Iceland and Spitzbergen.

It was, in all likelihood, owing to some north-westerly offshoot of this that the log of mahogany was drifted on to the coast of Greenland many years ago, out of which the Danish Governor, at one of the west coast settlements, made his dining table. Irminger has also shown that it is to the northern prolongation of this Gulf-stream that the harbours of Norway and south and west coast of Iceland are free from ice. If not, the ice would penetrate more frequently from the Arctic Sea on Iceland, and cut into the sea between Iceland and Shetland. Thus it is rare for any ice to impinge on Iceland; the Greenland ice only coming on the Icelandic coast on an average seven or eight times in a century, producing famine by destroying the crops, by the lowering of the temperature, and bringing troops of polar bears and foxes, but also abundant drift timber. It was to the accidental presence of this Greenland ice that the earlier discoverers named the island "Iceland," the name being as great a misnomer as Greenland—the one country having little ice except what comes from Greenland, and the climate being in reality rather better than some portions of the Norwegian mainland; while the other owes its only claim to greenness to the fertile imagination of Erik Rauthi and his "house carles," the first visitors. When Iceland was discovered in 861, it was clothed with wood from the shores to the very tops of the mountains; but this timber (probably only bushes) has long ago disappeared from the island, as also from Caithness, Orkney, Shetland, and Faroe. The connection of this with some revolution in temperature is a subject of deep interest, but one not easily understood.

Mr Brown concluded his remarks with an account of the Phyto-geographical relations of the Nova Zemblan and Spitzbergen Floras, giving in reference to the one country a summary of the researches of Von Baer, Spörer, and other observers; and for the other a *resumé* of the labours of the three Swedish expeditions, which have for some years past been exploring, in a most complete manner, with staffs of accomplished naturalists, the Spitzbergen Archipelago. He considered that though Mr Lamont had, owing to causes over which he had no control, partially failed in his original project, yet that great credit was due to him for his pluck and public spirit, and to his companions, Messrs Livesay and Smith, for their efforts to add to our knowledge of the scientific history of a region already so well examined under more favourable circumstances.

III. *Notice of Botanical Excursions during the Summer of* 1869. By Professor Balfour.

Dr Balfour stated that during last summer he made several botanical trips with his pupils, the results of which seemed not unworthy of notice.

On 12th June, a party numbering eighty-six visited Manuel, Woodcockdale, Carribber Glen and Castle, Bowden-hill, Cockleroy, and Linlithgow. Among the plants collected were the following:—

Trollius europæus.
Aquilegia vulgaris.
Berberis vulgaris.
Chelidonium majus.
Geranium nodosum.
     sanguineum.
Rosa alpina (near Carribber Castle, in quantity).
Polemonium cœruleum.
Lysimachia thyrsiflora (in the Union Canal).
Anacharis Alsinastrum (in Manuel Pond).
Habenaria chlorantha.
Neottia Nidus-avis.
Allium Schœnoprasum.
Equisetum umbrosum.
Botrychium Lunaria.
Ophioglossum vulgatum.

On 19th June a party of sixty visited Denny, where they met Dr Peter White, who conducted them up the banks of the Carron as far as the Hermitage. The following plants were met with:—

Trollius europæus.
Meconopsis cambrica.
Viola lutea and canina.
Cardamine amara.
Fragaria elatior.
Rubus saxatilis.
Sedum anglicum and villosum.
Sempervivum tectorum.
Carum Carui.
Carduus heterophyllus.
Mimulus luteus.
Gymnadenia albida and Conopsea.
Habenaria bifolia and chlorantha.
Listera ovata.
Orchis maculata and latifolia.
Polypodium Dryopteris and Phegopteris.
Lastrea Oreopteris.
Cystopteris fragilis.
Botrychium Lunaria.

On 26th June a party of ninety-four proceeded to Cleghorn, and walked along the banks of the Mouse as far as Cartland Crags, dividing then into two parties—one of which visited Stonebyres, and the other Corra Linn. Professor Dickson, from Glasgow, with fifteen of his pupils, accompanied the party during the day. The following were some of the plants gathered :—

Trollius europæus.
Aquilegia vulgaris.
Hesperis matronalis.
Geranium sylvaticum and lucidum.
Trifolium medium and striatum.
Vicia Orobus.
Fragaria elatior.
Rubus saxatilis.
Carum Carui.
Viburnum Opulus.
Carduus heterophyllus.
Galium boreale.
Jasione montana.
Vinca minor.
Polemonium cœruleum.
Populus tremula.
Gymnadenia Conopsea.
Habenaria chlorantha.
Equisetum hyemale.
Tortula Mulleri.

On 3d July a party, consisting of fifty, proceeded by Stirling to Dollar, where they breakfasted. They were conducted by Dr Strachan and his son, and Mr Westwood, through the Castle Campbell Glen, and thence to the Ochils. The principal plants collected were :—

Stellaria nemorum.
Ornithopus perpusillus.
Epilobium alsinifolium.
Saxifraga stellaris and hypnoides.
Smyrnium Olusatrum.
Solidago Virgaurea.
Vaccinium Vitis Idæa.
Myosotis palustris.
Gymnadenia Conopsea and albida.
Habenaria chlorantha.
Eriophorum latifolium.
Carex rigida.
Equisetum umbrosum.
Cryptogramma crispa.
Scolopendrium vulgare.
Hymenophyllum Wilsoni.

On 10th July a party of fifty went to Kelso, and breakfasted. They were met by Dr Douglas, Dr Paxton, and Mr Boyd, and proceeded by train to Twizel. There they crossed the Tweed, and were conducted by Mr Milne Home's gardener through the grounds of Milnegraden. They then proceeded along the banks of the Tweed to Ladykirk, where they were handsomely entertained in the mansion of Mr Robertson, M.P. His gardener, Mr Scott, conducted them through the grounds. They then went to Norham, visited the castle, and walked by the banks of the Tweed to Paxton House, having crossed the Tweed a second time below the suspension bridge. Mr Milne Home kindly entertained the party, and accompanied them through his grounds, thence they proceeded to Berwick in time for the express train to Edinburgh. Among the more interesting plants collected may be noted :—

Thalictrum flexuosum.
Ranunculus arvensis.
Nasturtium palustre and sylvestre.
Cerastium arvense.
Medicago maculata and denticulata.
Œnanthe crocata.
Scabiosa columbaria.
Lactuca virosa.
Silybum Marianum.
Echium vulgare.
Mentha viridis.
Ballota ruderalis.
Epipactis latifolia.
Serrafalcus racemosus.

On 17th July an excursion was undertaken to Perth and Dunkeld. A party of thirty-four went by early train, and breakfasted at the Perth Station. There they were met by Dr Lauder Lindsay, Dr Bramwell, Rev. Mr Lowe, Mr Dawson, Mr Sim, and others. They crossed the Tay by the railway bridge to Barnhill Toll, and after examining the north bank of the river, returned to Perth by the Witch Quarry and Bridge End. They then proceeded to Dunkeld, and examined the Birnam Glen and Rumbling Bridge, under the direction of Mr Sadler. The following plants were collected :—

Chelidonium majus.
Hesperis matronalis.
Armoracia rusticana.
Iberis amara.
Lepidium Smithii.
Saponaria officinalis.
Cerastium arvense.
Malva moschata.
Hypericum humifusum.
Geranium pyrenaicum.
Radiola millegrana.
Genista anglica.
Trifolium scabrum.
Spiræa salicifolia.

Sanguisorba canadensis.
Poterium Sanguisorba.
Potentilla hirta.
 argentea.
Sedum album.
Saxifraga aizoides.
Astrantia major.
Cicuta virosa.
Œnanthe crocata.
Galium boreale.
Aster (several species).
Campanula Rapunculoides.
Vaccinium Oxycoccus.
Linaria repens.
Mimulus luteus.
Lamium maculatum.
Galeopsis versicolor.
Polygonum viviparum.
Listera cordata.
Scheuchzeria palustris.
Lastrea spinulosa.

The last two were collected by some of the party who visited Methven Bog.

On Thursday, 22d July, at 1.15 P.M., a party of twenty-four proceeded, by Perth and Forfar, to Kirriemuir, and thence to Clova, which was reached about 10 P.M. The party were comfortably accommodated at the Ogilvy Arms Hotel, kept by Mr James Alexander. It consisted of Professor Balfour, Dr J. L. Stewart, Rev. R. C. Colvin, Messrs Sadler, Leitch, Ivory, Church, Scott, Watters, Brown, Cruaux, Craig, Tait, Harris, Irvine, Simson, Mawson, Morrison, Wright, Allman, Aitken, Hayman, Craig-Christie, and Bell. On Friday, 23d July, they proceeded to Glen Dole and Glen Fee, and some went to Little Gilrannoch and the White Water. Next day (Saturday) the party visited Loch Brandy and the mountains above it, returning to Kirriemuir in time for the 5 P.M. train, and reaching Edinburgh about 11 P.M.

In Glen Dole the plants collected were:—

Thalictrum alpinum.
Trollius europæus.
Draba incana.
Cochlearia alpina.
Silene acaulis.
Sagina saxatilis.
Cerastium alpinum.
Astragalus alpinus.
Vicia sylvatica.
Alchemilla alpina.
Sibbaldia procumbens.
Rubus Chamæmorus.
Dryas octopetala.
Epilobium angustifolium, alpinum, and alsinifolium.
Sedum Rhodiola.
Saxifraga stellaris, aizoides, hypnoides *var.* platypetala, and oppositifolia.
Cornus suecica.
Linnæa borealis.
Mulgedium alpinum.
Hieracium alpinum, holosericeum, nigrescens, and boreale.
Saussurea alpina.

Erigeron alpinus.
Gnaphalium supinum.
Antennaria hyperborea.
Vaccinium Oxycoccus, uliginosum, and Vitis Idæa.
Arctostaphylos Uva-ursi.
Pyrola rotundifolia, media, and secunda.
Veronica saxatilis, alpina, and humifusa.
Mentha velutina.
Calamintha Clinopodium.
Trientalis europæa.
Oxyria reniformis.
Polygonum viviparum.
Empetrum nigrum.
Salix Lapponum, venulosa, lanata, Myrsinites, reticulata, and herbacea.
Habenaria viridis.
Listera cordata.
Malaxis paludosa (near Acharn).
Tofieldia palustris.
Juncus triglumis and trifidus.
Carex atrata, rigida, aquatilis, vaginata, capillaris, and stictocarpa.
Aira alpina.
Poa alpina and Balfourii.
Polypodium alpestre.
Polystichum Lonchitis.
Cystopteris dentata.
Asplenium viride.
Lycopodium annotinum; besides many species of mosses and lichens.

In Glen Fee, *Oxytropis campestris,* in flower; *Woodsia hyperborea, Chara flexilis.*

In Loch Brandy, *Subularia aquatica, Lobelia Dortmanni, Sparganium natans,* and *Isoetes lacustris.* On the face of the rocks above the loch, *Potentilla maculata,* and many other alpine plants; and on their summit, *Azalea procumbens, Salix herbacea,* &c.

The party who visited Little Gilrannoch gathered *Lychnis alpina, Armeria maritima* var. *alpina, Plantago maritima* var. *alpina, Cochlearia officinalis* var. *alpina.*

Near the Clova Hotel were picked *Linum usitatissimum, Meum athamanticum, Antennaria margaritacea, Rumex aquaticus, Sparganium natans,* &c.

In the course of the two days a large number of the rarer alpine plants of Scotland was thus gathered.

IV. *On the Botany of the Dominion of Canada and adjacent parts of British America* (Part I., Ranunculaceæ). By Prof. Lawson, Dalhousie College, Halifax, Nova Scotia.

In this paper the author gives the general characters of the natural order Ranunculaceæ, the characters of the different genera embraced in the order, their synonymy, and their distribution through all the provinces, as well as in other countries. Several plants that have been described as Canadian, are shown to have been so recorded through mistake, and many unsettled points are suggested for investigation. Of *Clematis*, he says, there are two species, one local and the other general in its distribution, viz., *C. virginiana*, which grows around the rifle range at Bedford, and also at Windsor, Nova Scotia. It extends to Lake Winnipeg, Isle Verte being its limit north-eastwardly. *Pulsatilla* is confined to the north-west, whence numerous specimens have been received from Governor M'Tavish. The common form of the species, named *P. Nuttalliana*, is now known to be identical with *P. Wolfgangiana* of the Russian botanists, which is itself a variety of the European *P. patens.* Two forms from the north-west are described, one of which does not accord with Regel's *Wolfgangiana. Anemone dichotoma* is shown to be the proper name for the plant hitherto known as *A. pennsylvanica.* Of *A. nemorosa*, the windflower of English forests, four varieties are described as inhabiting the dominion—one a small northern form, and another found at Belleville by Mr Macoun. *A. Richardsonia* has been received only from the Hudson's Bay territories. *A. Hepatica* is shown to be essentially an Ontarian and New England plant, although found to extend into Nova Scotia, having been gathered at Windsor by Professor How. *A. acutiloba* is restricted to a more northern range. *A. narcissiflora* is not known to exist within British America, although it occurs in the United States in the Rocky Mountains. *A. parviflora* is a north-western plant, picked also at Gaspe, by Dr Bell of Montreal, and on Anticosti, and is found to have usually five, not six petals, as described. *A. multifida* has not yet been collected in Canada, except on the Gulf shore and in the north-west, but will probably reward some diligent searcher in Ontario. *A. pennsylvanica* has a wide and southern range. *A. cylindrica*, a sand-hill plant, is confined to Central and Western Ontario.

Syndesmon anemonoides is a curious little plant, a link between the windflowers and meadow rues, but has only been found in two localities, although in the adjoining States it is not rare. Its Canadian *habitats* are St David's and Hamilton.

Thalictrum Cornuti is a stately plant, with large masses of snowy white blossoms, rendering it conspicuous along the Sackville River, and on the meadows at Beaver Bank, and is of general distribution throughout the dominion. *T. purpurascens*, differing in its sessile stem-leaves, greenish flowers, and drooping anthers, is to be looked for in dry situations. Its record as Lower Canadian is, however, a mistake, and possibly it does not reach so far north as the St Lawrence. *T. dioicum* has a wide range, but there are two distinct forms about Kingston which require further investigation—one growing near Kingston Mills and the other at the Penitentiary. *T. alpinum*, an Arctic European plant, is confined with us to Anticosti and Newfoundland. It is general within the Arctic circle, and runs down the Rocky Mountains to low latitudes, as Arctic plants are apt to do. *T. clavatum* is a York Factory plant, remarkable for its pod-like stipitate carpels, without furrows, but with embossed veins.

Of *Ranunculus*, eighteen species are described, and one excluded. *R. repens* is the most common, as a weed, but rare as an indigenous plant, in which character it grows near Toronto. *R. bulbosus* has been frequently reported as Canadian, but the evidence is doubtful. *R. ovalis*, *R. brevicaulis*, and *R. cardiophyllus* are referred to *R. rhomboideus*. *R. auricomus* does not belong to the flora, and *R. affinis*, here considered as a variety of it, is confined to the Arctic Sea and the North-West Hudson's Bay Territories. Of *R. abortivus*, two varieties (*pratensis* and *sylvaticus*) are described. *R. nivalis* was found by Dr Rae at Repulse Bay, and the specimens agree with *R. sulphureus* of Solander. *R. Cymbalaria* is a sea-shore plant. The numerous varieties of *R. multifidus* and *R. aquatilis* still require careful comparison in the living state with European forms. *R. digitatus* is a Rocky Mountain plant, approaching *R. Ficaria* of Europe. *Trollius laxus* has not been recently found in Canada. *Aquilegia canadensis* presents two forms, and abounds in Ontario, but becomes scarce eastward and northward. It will probably be found in Annapolis, if anywhere in Nova Scotia. *A. brevistyla* is quite western, and does not come so far east as to enter the province of Ontario. *A. vulgaris*, on the other hand, is confined to Nova Scotia, but is only an introduced plant, one of the wild flowers of England, brought, many years ago, by the Duke of Kent, and now widely spread through the woods and along railway banks and roadsides. *Delphinium exaltatum* is from the Youcon and Clear Water River, although in the States its distribution is decidedly southern. *D. azureum* is also from the Youcon. *D. Consolida*, an introduced European plant, is found at Prescott, and *D. Ajacis*, an excluded species, is not permanently naturalised. *Aconitum delphinifolium* is kept distinct from *A. Napellus*, of which Dr Regel describes no fewer than forty varieties and forms, all named and classified. *A. semigaleatum*, not previously noticed as American, is considered a distinct variety of *A. delphinifolium ;* the specimens of both are from Governor M'Tavish. *A. Napellus* is a naturalised plant. *Cimicifuga* is confined to Cayuga, in the extreme south-west of Canada, where it was found by Dr Philip W. Maclagan. *Actæa rubra* is widely spread throughout the whole dominion, but *A. alba* is south-western. *Hydrastis canadensis* is confined to Ontario, and *Adonis* is excluded, as the specimens sent to Hooker from Labrador, thirty or forty years ago, had no doubt sprung from seeds dropped there by accident, and the plant has not been heard of or seen since.

V. *Notice of Sicana odorifera*, Naudin (*Cucurbita odorifera*), Velloso, Flor. Flum. By Senhor JOAQUIM CORREA DE MELLO, Camprinas, Province of St Paulo, Brazil. Communicated by DANIEL HANBURY, Esq.

The fruits of this plant (*Cucurbita odorifera*, Velloso, Flor. Flum), as well as the plant itself, are commonly known by the name of Coroá or Curuá. Their odour is very agreeable, and excites a longing to eat them. The taste is sweet, and at first not unpleasant, but it soon nauseates, and to me is intolerable. Notwithstanding this, there are some persons, but not many, who eat them. The fruits may be kept for four or five months without decaying, and I therefore send them without preparation, hoping they may arrive in good condition. I have never seen *Sicana odorifera* truly wild, but always in cultivation, and I am uncertain in what province of Brazil it is indigenous.

There are two plants of it in my garden, with stems about an inch in diameter, which are seedlings of last year, and which this year have flowered and borne fruit, and are still growing. A neighbour of mine, who also cultivates this plant, informs me that it lasts for many years. The description of *Sicana* as "herba annua gracilis" . . . given in the "Genera Plantarum" of Bentham and Hooker (i. 429), is not, therefore, very correct, at least for the plant as seen in this province.

A specimen of the fruit was exhibited and presented to the Museum.

VI. *Hints for Collecting Cryptogamia.* By Professor Dickie.

Mosses and *Lichens* grow on the ground or on trunks of trees, and on rocks; many of the former are found also in streams and marshes; shady damp places are generally most productive of both. Specimens of such require little preparation for carriage; spread them out to dry in the *shade*, and afterwards pack loosely in paper, they can be finally prepared any time after; or they may be dried at once under pressure, between absorbent paper, like flowering plants. Many Lichens on trees and rocks are mere crusts of different colours, and can alone be got by slicing a piece of bark or chipping the rock.

Sea-Weeds are of various colours—olive, red, purple, or green. They may be found between tide-marks attached to rocks and stones, or rooting in sand, &c. Those in deeper water are got by dredging, and many are cast up after storms. Small kinds grow on the larger, and some, being like fleshy crusts, on stones, shells, &c., must be pared off by means of a knife.

The more delicate kinds, after gentle washing, may be floated in a vessel of fresh water, upon thick writing or drawing paper, then gently lift out paper and plant together, allow some time to drip, then place on the sea-weed clean linen or cotton cloth, and on it a sheet of absorbent paper, and submit to moderate pressure,—many adhere to paper but not to cloth,—then change the cloth and absorbent paper till the specimens are dry. Large coarser kinds may be dried in the same way as land plants, or are to be spread out in the *shade*, taking care to prevent contact of rain or fresh water of any kind. When sufficiently dry, tie them loosely in any kind of wrapping paper. Those preserved in this rough way may be expanded and floated out in water at any time afterwards. A few specimens of each of the more delicate algæ ought to be dried on mica or glass. A note of date and locality ought to be attached to every species.

Fresh water algæ may be prepared in the same way, or are better preserved in a fluid composed of 3 parts alcohol, 2 parts water, 1 part glycerine, well mixed.

VII. *Miscellaneous Communications.*

1. *Flowering of Eranthis and Leucojum.*—The following

Fig. 1.—Eranthis.

note was read from Dr W. R. M'Nab:—"I send a diagram showing the dates of flowering of *Eranthis hyemalis* (fig. 1) and *Leucojum vernum* (fig. 2), in the Royal Botanic Garden, Edinburgh, for twenty years. In 1850, they flowered within four days of each other; in 1851, within five days, but one month earlier than 1850 ; in 1852, *Eranthis* was fifteen days later, while *Leucojum* was one month ; in 1853, *Eranthis* was one day behind 1852, while *Leucojum* was one month (21st February to 21st March) ; in 1854, *Eranthis*

Fig. 2.—Leucojum.

was a few days earlier, while *Leucojum* was more than a month earlier ; in 1855, both very late, but within a day of each other; 1861, 1862, 1863, and 1864, are peculiar; in 1863, *Leucojum* flowered before *Eranthis;* while in 1864, *Eranthis* was in flower on 1st January, much earlier than in 1863, *Leucojum* being three days later; in the other years they flowered pretty closely. The differences in the year 1860 are much less than in 1850."

The accompanying woodcuts of Dr M'Nab's diagrams, for which we are indebted to the kindness of Dr Masters, editor of the "Gardeners' Chronicle," show the range of flowering of the plant referred to by Dr M'Nab. The left-hand column in the diagrams is divided into spaces corresponding to a week's interval in each case; the upper column of figures shows the respective years from 1850–69 inclusive. For 1859 there is no record.

In the case of the *Ribes sanguineum* (fig. 3), raised from a cutting derived from the original plant of Douglas, the earliest date at which flowers were observed was in 1869, March 1; the latest in 1855, April 19.

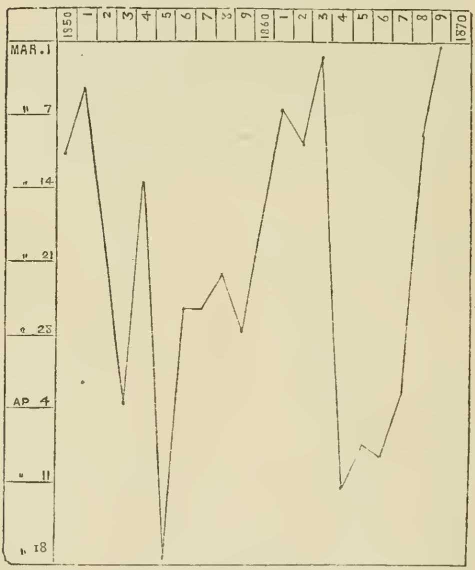


Fig. 3.—Ribes.

Mr M'Nab stated, that owing to the frost being still in the ground, none of the spring flowers were at this date (13 Jan.) in bloom.

2. *Ruscus aculeatus.*—Mr M'Nab stated that Mr Frere, Roydon Hall, Diss, had recently sent to the Botanic Garden a plant of the *Ruscus aculeatus* in flower and fruit. In a letter accompanying the plants, Mr Frere remarks:—Sowerby said of *Ruscus*, in 1799, "the root is perennial,

the plant itself is biennial, and for one winter evergreen." And Bentham writes :—" Stems said to be biennial, though apparently shrubby." It is possible that the flowers one year may be female; the next year male. On the question of sex, I find Linnæus (" Genera Plantarum ") writes :— " Species datur floribus hermaphroditis," &c. And Irvine, " Introduction to Botany," London, Nelson & Son, 1858, pp. 307, 308, gives as generic character :—" Flowers lateral, monœcious or diœcious;" and as specific character, " Flowers diœcious by abortion." Professor Balfour remarked that he and Mr Sadler had lately examined the flowers of *Ruscus* very carefully, and had found male and female flowers on the same plant, and male flowers alone on other plants.

3. *Cones of Abies.*—Mr Wm. Gorrie exhibited and presented branches and cones of (1.) *Abies rubra*, taken from a group of trees growing on the railway banks, near Tynehead Station, in Midlothian, at an altitude of about 800 feet. The trees have been about fifteen years planted, and are from 12 to 18 feet high. (2.) *Abies rubra*, from a group of trees growing in drained and improved ground, which must once have been marshy, in Dunmore Park, near Stirling, not 50 feet above high-water mark, seemingly about the same age as the last, and from 15 to 20 feet in height. (3.) *Abies alba*, from near Tynehead Station. (4.) *Abies nigra*, from Dunmore Park.

Mr Gorrie remarked that *Abies rubra*, the red spruce fir, or Newfoundland red pine, is found in Nova Scotia, some parts of Lower Canada, and northward to Hudson's Bay, but is not included in Dr Asa Gray's flora of the northern United States. It is said to be a taller and finer timber tree than either of its allies—the black and white American spruces, from which it further differs in being entirely devoid of that glaucous green by which the leaves of these two are distinguished. It is, in fact, exactly like the common Norway spruce in the colour both of its foliage and young branches, but differs from it in its thinner and more slender growth, shorter leaves, and much smaller cones. From this close resemblance in colour of the *Abies rubra* and *A. excelsa*, Americans call the latter the red spruce of Europe. Like the *A. alba*, the *A. rubra* drops its cones in the course of the first winter and succeeding spring, while those of *A. nigra* are retained on the tree for two or more years. Like its two American associates, *A. alba* and *A. nigra*, *A. rubra* seems to delight in moist soils containing a proportion of peat, and moist upland climates. Those now growing at Tynehead were reared from seeds gathered in Newfoundland, and a portion of the plants which were planted on good, dry, heavy soil, within from two to three miles, and at half the altitude, dwindled away after the first few years, till they entirely perished. The trees at Dunmore are no doubt growing at a low altitude, but they are sheltered by a high wooded bank on the south, and are on a damp bottom. Mr Andrew Murray, a distinguished member of the Botanical Society, and recognised authority on Coniferæ, has ignored the existence of *Abies rubra*, but he has probably never seen it growing, as although long introduced, it is still scarce in Britain.

Presentations.—The Rev. A. Williamson exhibited and presented numerous specimens of fruits, seeds, &c., brought by him from China. Messrs J. & J. Cunningham presented coco-nuts, which had sprouted during the voyage to this country. Mr George H. H. Dewolf presented a collection of dried plants from Nova Scotia. Mr Mawson presented specimens of *Asplenium alternifolium* and *A. septentrionale*, collected by him in August last, in Cumberland. Mr Archibald Jerdon presented a specimen of *Bupleurum aristatum*, found by Mr Borthwick growing in a field near Melrose.

10*th February* 1870.—Sir WALTER ELLIOT, K.S.I., President, in the Chair.

The following Gentlemen were duly elected Fellows of the Society:—

1. *As a Resident Fellow.*

JOHN M. BRAMWELL.

2. *As a Non-Resident Fellow.*

CHARLES WILLIAM COWAN, younger of Logan House.

The following Communications were read:—

I. *Remarks on the Flora of Shetland.* By Mr ALEX. CRAIG-CHRISTIE.

II. *Account of Botanical Excursions in the Island of Arran during August and September* 1869. By Professor BALFOUR.*

On Wednesday, 4th August, our botanical party left Edinburgh, and proceeded to Glasgow in time for the "Hero" steamboat, which arrived at Lamlash, in Arran, at two P.M. The evening was spent in dredging in Lamlash Bay, and in visiting St Molio's Cave in Holy Island.

Thursday, 5th August.—This day our walk extended from Lamlash to Brodick and Corrie, chiefly along the shore. From Corrie we returned by the steamboat. The salt marshes and sandstone rocks supplied a considerable number of interesting plants, among which were the following:—

Sinapis monensis.
Mertensia maritima.
Aster Tripolium.
Suæda maritima.
Salicornia herbacea.
Sagina maritima, a peculiar form of *Fucus vesiculosus*, called *evesiculosus*, in saline, grassy turf, near Brodick.
Samolus Valerandi.
Œnanthe Lachenalii.
Helosciadium repens.
Haloscias scoticum.
Erythræa linarifolia.
Lycopus europæus.
Pinguicula lusitanica.
Anagallis arvensis.
tenella.
Lastrea æmula, in fine condition on moist, shady rocks.
Hymenophyllum Wilsoni.
Tunbridgense.
Osmunda regalis.
Œnanthe crocata.
Rubus saxatilis.
Triticum junceum.
acutum.

* Prof. Balfour's Trip to Arran in 1857 is recorded, Bot. Soc. Tr. vi. 3.—[EDS.]

Also, near Lamlash, *Ligustrum vulgare*, and *Lathyrus latifolius*, in the vicinity of gardens. On the cottages at Corrie, abundance of *Corydalis claviculata.*

On the 6th August we went by the early steamboat to Invercloy, breakfasted at Macdonald's Inn, and then ascended Goatfell. The day was sunny and warm, and the rocks were very dry. At the milldam, we observed the junction of clay-slate and granite. Vegetation was parched, and very few alpine plants were seen, the principal being *Alchemilla alpina*, *Saxifraga stellaris*, *Festuca vivipara*, *Salix herbacea*, *Lycopodium Selago.* There were scarcely any plants of interest gathered. The mountains on this occasion seemed more unproductive than usual, owing to the dryness of the season.

The 7th of August was wet and stormy, and our botanical walk was arrested.

On 9th of August, we went to the southern part of the island, and walked along it to Benan Head, Kilmorie, and Kildonan, and then returned by Whiting Bay to Lamlash.

Among the plants gathered were the following:—

Carlina vulgaris.
Pinguicula lusitanica.
Solanum Dulcamara.
Scirpus Savii.
maritimus.
Lathyrus sylvestris.
Pulicaria dysenterica.
Convolvulus sepium.
Rubus discolor.
Hypericum Androsæmum.
Hypericum dubium.
Atriplex Babingtonii.
arenaria.
Asplenium marinum, abundant in the crevices of the rocks.
Polystichum angulare.
Scolopendrium vulgare.
Equisetum maximum.

Near some of the houses about Kilmorie we saw abundance of *Lavatera arborea*, probably introduced from Ailsa Craig, and *Hypericum hircinum*, a plant which I once found in quantity in Ireland, near Cork.

August 10th, we went to Loch Ranza, gathering only some of the ordinary plants by the way. We then ascended by the side of the stream, coming from Loch-na-Davie up Gleann Easan Bidrach. The road is difficult, and in some places dangerous, more especially at the first part of the ascent from Loch Ranza. We wandered along the banks of the stream in order to get, if possible, specimens of *Pyrus fennica.* We were fortunate in getting many good specimens in fruit, and as this is the only Scotch station for the plant, we felt that we had some reward for our labours. Leaving the stream, we turned to the left and proceeded in a south-easterly direction across the hills until we joined the Loch Ranza road, a few miles north from Corrie. Among the other plants gathered may be noticed—*Rhynchospora alba*, *Drosera anglica*, and *Carex pauciflora.* We took up our quarters at the Inn at Corrie, and returned next day to Lamlash.

August 12th, a small party went by conveyance to Black Waterfoot, Drumadoon, and King's Cove. The day was fine, and the sea view was beautiful and extensive. The porphyritic basaltic rocks at Drumadoon are very fine, rising to a height of 80 feet, and covered thickly with the grey lichen *Ramalina scopulorum.* The ivy climbs upon them in all directions, and many common plants, such as *Lastrea Filix-mas*, *Pteris aquilina*, *Rumex obtusifolius*, *Teucrium Scordonia*, *Lychnis dioica*, and species of Rubi, are very luxuriant. On the sands near the point, we collected abundance of *Convolvulus Soldanella*, *Eryngium maritimum*, *Sinapis monensis*, *Triticum junceum*, *T. acutum*, *Scutellaria galericulata*, and a form of *Viola sylvatica*, sending very long roots into the sand. At King's Cove, we found *Asplenium marinum*, *Scolopendrium vulgare*, and *Osmunda regalis.* We examined the sandstone cave connected with the history of Robert Bruce.

August 13th, the botanical party broke up, to enable some of them to attend the meeting of the British Association at Exeter; Dr Dickson taking with him to Glasgow fresh plants of *Zostera marina*, with the view of trying to cultivate them in the Botanic Garden.

On 3d September, a party, consisting of Dr Dickson, Dr Thomas Balfour, and myself, along with some members of my family, went by conveyance to Corrie, and proceeded from thence along the shore by the Cock of Arran to Loch Ranza. We had a laborious and difficult walk, especially among the masses of conglomerate rocks which cover the shore on the north-eastern and northern part of the island. Passing the lower part of Glen Sannox, we proceeded by the shore, to the Fallen Rocks, and thence to

Laggan, where we examined the trap rocks, in which Mr Wunsch had found specimens of fossil plants. A man named Hamilton, who lives in a small cottage there, kindly supplied us (as directed by Mr Wunsch) with hammers and crowbars, which we required to procure specimens of the fossils. We succeeded in getting excellent examples, and these, when sliced and rubbed down, exhibit very evident structure under the microscope. The plants are obviously those of the coal measures, Sigillaria, Stigmaria, &c. On the northern part of the shore walking is by no means easy. *Lithospermum officinale* occurs on the rocks, and *Osmunda regalis* in considerable quantity. The ferns, however, in Arran are gathered in vast numbers, and nearly all the accessible specimens of the rarer species are taken away in the vicinity of the places frequented by visitors. We saw on several occasions boys and women carrying large quantities of ferns taken up by the roots, with the view of making a profit by the sale of them.

On reaching Loch Ranza, where our conveyance was to meet us, we found that the driver (a peculiar man in many respects) had despaired of our coming, and had quietly taken his departure home, about 6.30 P.M. Our dilemma was great. The inn was occupied by a party from Glasgow, and there was no conveyance to be had. After sundry consultations and vain attempts to get a car, we were constrained to walk on to Corrie, a distance of about ten miles. Considering that there were ladies in the party, this was rather a severe trial of strength. We persevered, however, and about 11 P.M., reached Mrs Morrison's hospitable inn, where a good cup of tea and comfortable beds made us soon forget all our hardships.

Next morning, our friend the driver made his appearance and told us that, thinking we must have gone some other way, he left Loch Ranza and went to Lamlash. Finding that we were not at our lodgings, he returned to Corrie early next morning, in order to carry us home. Before returning, we visited Glen Sannox, and gathered specimens of sulphate of barytes.

September 13th. Hiring a boat, our party rowed to Whiting Bay, and encountered a severe storm, which drove us on shore near King's Cross, and gave us a thorough drenching with sea water. After getting our boats hauled up we walked to Whiting Bay, gathering on the road *Eryngium maritimum*, *Hypericum dubium*, *Polygonum Raii*, *Œnanthe crocata*, *Œ. Lachenalii*, and other plants. We then proceeded beyond the village of Whiting Bay to Glen Easdale (or Ashdale), a fine wooded glen. After visiting an old man, aged 100, who resides at the foot of it, we walked along the banks of the stream, and found the passage most troublesome. The trees grow down to the water edge, and in many places so close as to prevent passage. We gathered a number of ferns in the most shady places. *Lastrea Filix-mas*, *L. Oreopteris*, *L. dilatata*, *L. æmula*, *Athyrium Filix-fœmina*, *Polypodium Dryopteris*, *P. Phegopteris*, *P. vulgare*, *Polystichum aculeatum*, *Scolopendrium vulgare*, *Hymenophyllum Wilsoni*. In this glen, Mr Craig-Christie gathered, on another occasion, what he considered to be *Agrimonia odorata*.

After a long and fatiguing walk, we reached the waterfall at the head of the glen, and had a fine view of it from the bottom of the rocks over which the water is precipitated. On our return to King's Cross we succeeded in launching our boats, although the wind was still strong and the waves high. After rowing for an hour or two, we found it impossible to advance with all our efforts, and we had to run the boats ashore, haul them up for the night, and make the best of our way on foot, reaching home between ten and eleven at night, and thankful that we had escaped the perils of the deep. Our boats were rowed back next morning at 6 P.M., during a lull of the storm.

One of our trips seems to be specially worthy of record, on account of the adventures which marked it. On the morning of Friday, 17th September, a party of eight, consisting of myself, Messrs Robert, James, and Alexander Finlay, two of my sons, and two young ladies, proceeded by the early boat to Invercloy, with the view of visiting Glen Sannox and returning by Glen Rosa. The day was not promising, and rain came on very heavily. In spite of this we proceeded along the shore towards Corrie, gathering abundance of good ferns and other plants, chiefly with the view of supplying the Edinburgh Botanic Garden. Long before reaching Corrie we were thoroughly drenched, and we surprised my friend the Rev. Lewis Irving, who was residing in a cottage within a couple of miles of Corrie, by presenting ourselves in a wretched plight at his cottage door. The weather was so bad that we had resolved to return, and after getting under the shelter of some of the sandstone rocks, and finishing our lunch at the early hour of 9 A.M., we were about to sound a retreat, when a slight symptom of clearance appeared in the south, and the rain abated. On then we went to Corrie, and as the sun's rays enlightened our path for a time, our spirits revived. At Corrie we got the benefit of a kitchen fire to dry part of our habiliments, and after replenishing our stock of viands, we started for Glen Sannox. At the foot of the glen we examined an old churchyard, enclosed within good walls, with an iron gate, but no church near. Our attention was specially called to the profuse flowering of some fine Fuchsias. I took specimens of all the trees and shrubs growing in the churchyard, viz., *Thuja chinensis*, *T. occidentalis*, *Juniperus communis*, *J. Sabina*, *Cupressus sempervirens*, *Taxus baccata*, *Quercus Robur*, *Betula alba*, *Hedera Helix*, *Buxus sempervirens*, *Laurus nobilis*, *Fraxinus excelsior*, *Cotoneaster microphylla*, *Ilex Aquifolium*, *Arbutus Unedo*, *Fuchsia** with a stem 22 inches in circumference, *Prunus lusitanica*, and *P. spinosa*.

Passing the old locality of the barytes quarry, we entered Glen Sannox, and had a long and toilsome walk among the heather. The day became dull, and thick mist covered the tops of the mountains, but we persevered. In place of ascending by the usual route for the summit of Goat Fell, we visited a corry on the right hand under Caistael Abhail, where we gathered some alpine plants, such as *Saxifraga stellaris*, *Alchemilla alpina*, *Thalictrum alpinum*, and *Lycopodium Selago*.

The ascent was difficult, and on reaching the top we congratulated ourselves on the prospect of at once descending into Glen Rosa. The mist prevented us from seeing the top of Goatfell. Without much consideration, we descended by a rocky declivity into a valley through which a fine stream ran, with beautiful waterfalls of a most

* Probably the original *Fuchsia coccinea*, Bot. Mag. t. 97.—[EDS.]

picturesque character—the rocks being precipitous, and the ravines very deep. *Asplenium viride* was seen in several places. The day had kept fair for some time, although the mist was coming lower on the hills and the ground below us was very wet. After proceeding for a mile or so on our route, it was obvious that we had got into the wrong glen, and we saw before us a long stretch of a valley as desolate as possibly could be, with a large stream running through it. The banks of the stream are very marshy. In some places a pole more than six feet long could scarcely reach the bottom, and caution was required lest we should be immersed in a quagmire.

We now suspected that we had got into the Iorsa Valley, and we were subsequently confirmed in this opinion when we came upon the Lake of Iorsa. The weather now assumed a threatening aspect. Rain descended in torrents without intermission, and we were all thoroughly drenched. The bad plight in which we now were, the uncertainty as to the extent of the journey still to be accomplished, and the approach of darkness, all tended to cause considerable alarm, especially in my own mind, as the conductor of the party—two of whom were young ladies, and two young boys of about twelve and fourteen. They all, however, kept up their spirits well, and I tried to conceal my anxiety and alarm for fear of dispiriting them. The remainder of our Corrie lunch was now consumed, and we had no idea when we would get another meal. The weary valley seemed never to show any termination, and not a house or human being was to be seen. On turning a part of the valley we saw in the distance a little opening in the sky, and we sent a scout up the hill in order to ascertain if the sea could be observed in the distance. The ascertaining of this would, we hoped, help us to determine our position. He came down with the pleasing intelligence that he saw a bay stretching out some miles off. This announcement added new vigour to our efforts. The sudden appearance of a small herd of red deer helped also to give us some excitement, and we watched their movements with interest. The waters from the hills all round came down in torrents, and in some places it was very difficult to cross them. In the course of two hours the rain had swollen them to an enormous extent. As the evening was closing in, we thought we could discern something like a house in the distance, but there was no light to assist in its detection. The very hope of this being a human habitation cheered us; but ere long we were brought to a halt. A stream which came down on our right hand, *i.e.*, on the north side of our path, and which was afterwards found to proceed from Beinn Bharrain, was so deep and impetuous as to forbid our progress. One of our party tried to pass, but failed. We saw no alternative but to follow the stream down to its junction with the Iorsa, which, although swollen, was not rushing in such a tumultuous manner as its tributary. One of the more adventurous of the party ventured into the river and found that he could stem the current, and the depth was about 3½ or 4 feet. By good management we all got across in a condition not easily described, and anything but comfortable. Our road was still very rough; and, moreover, darkness had set in, as it was now 8 P.M.. We groped our way, and kept well together in case of accident. At length we found a stile over which we passed, and came to a wooden bridge which spanned the Iorsa near its embouchure. Crossing this we met a young man, the first person we had seen from the time we left Glen Sannox. On asking particulars we found that we were at Dugarry, that there was a shooting box of the Duke of Hamilton close to us, several cottages, and a farm house, but that no inn could be met with nearer than Imachar, three miles off. On stating our condition, the young man said we had better come to the farm. His offer was most joyfully accepted, and in the course of a quarter of an hour we reached the farm house of John Craig and his family. We were most hospitably cared for. Mrs Craig was in anxiety at the time as to the safety of a son who had been out on the hills in the storm of the afternoon, and had not made his appearance. But notwithstanding this, she ministered to our comfort in every way, by supplying all the means necessary for our comfort in the shape of fire, clothes, and food. The dress supplied to the members of the party was of a varied and anomalous character. Some of the articles were too wide, while others were too short. Still we all contrived to put ourselves into such a respectable condition as to appear comfortably at the tea table, each scanning his neighbour's garments with no small interest and amusement. While enjoying Mrs Craig's hospitality at tea we had the pleasure of hearing that her son had arrived in safety. The accommodation for sleeping was furnished, as far as could be done, and after the fatigues of the day we enjoyed our rest.

On the morning of the 18th we had an ample breakfast provided, and parted from our kind friends with many thanks for their attention. The day was rather stormy, but rain did not come on till late in the afternoon, so that we had an opportunity of examining completely the rocks on the shore between Dugarry and King's Cove. We gathered a great number of excellent ferns. *Scolopendrium vulgare* and *Asplenium marinum* were in profusion; also *Hypericum Androsæmum*, *Mertensia maritima*, *Eryngium maritimum*, *Daucus Carota* var. *littoralis*, *Polygonum Raii*, *Convolvulus Soldanella*, *Scutellaria galericulata*, *Hypericum dubium*. On the shore, north from Dugarry, and near Imachar, *Crambe maritima* is found. We were anxious to examine the so-called "standing stones" in the neighbourhood, and, in obedience to directions, we crossed the fields but found that we were stopped by the swollen Mauchrie river, which could only be crossed by walking up to the middle in water. Our transit was effected by two of the gentlemen sacrificing themselves for the benefit of the rest, and carrying us over on their backs. This difficulty over, we proceeded to the stones, which are in every respect remarkable.

There are numerous monolithic circles in Arran. The most remarkable is that at Tormore, which we visited on the eastern part of the river Mauchrie. It has been examined by Headrick, Macarthur, and Dr Bryce.* Mr Macarthur traced eight circles more or less complete, consisting of four to fourteen columns of rude unhewn sandstone. The stones measure from 3 to 18 feet in height,

* See Headrick's Arran; Macarthur on the Antiquities of Arran; Macarthur on Rude, Unsculptured Monoliths and Ancient Fortifications of the Island of Arran: Edin. New Phil. Jour. (new series), vol. ix. p. 59; Dr Bryce on Excavations in Arran in 1861; Proc. Antiq. Soc. Edin. vol. iv. p. 499.

with an average circumference of 8 feet. The diameter of the circles ranges from 15 to 20 feet; one of the largest embraces an inner circle of eight stones and an outer circle of fourteen, one of which is perforated with a small hole. Besides the sandstone blocks, there are three large granite masses. Six of the circles at Tormore are tolerably perfect, and one is very incomplete. Two have only a single stone now standing. Our party measured some of the stones; one was above 15 feet high above the ground, some were from 3 to 4 feet broad, and many 2 feet thick.

Dr Bryce made excavations at Tormore in 1861, and has given an account of them in the "Proceedings of the Antiquarian Society of Edinburgh," vol. iv. p. 499. Some of the stones are sunk at least six feet into the ground. The weight of the largest one was estimated at ten tons. Dr Bryce, during the excavations, found cists, flint implements, urns, skulls and other bones of man and animals, and a bronze pin, apparently part of a brooch. These are figured in the Antiquarian Society's volume. Dr Bryce thinks that these circles were places of sepulture. Besides these stone circles, there are separate monoliths in various parts of Arran. In Brodick Bay there is a large one, 14 feet high, by the roadside, and another in an adjoining field. Similar stones are seen on the banks of the Sliddery and of the Kirkmichael rivers, also at Sannox and Glen Iorsa.

Having lunched in the vicinity, we proceeded to the Shiskin road, which leads from Blackwater Foot to Lamlash, gathering on the way *Potamogeton polygonifolius*, and many of the common Arran plants. We reached Lamlash between five and six in the evening, to the great relief of our friends, from whom we had parted the day before with the intention of only spending one day on the trip. A photograph of the party, taken at Lamlash, concluded the day's work.

Excursions were subsequently made to Holy Island, the caves of which are very interesting, and the cliffs covered in many places with *Asplenium marinum;* to Corriegills, where *Pinguicula lusitanica, Scirpus Savii, Erythræa Centaurium* (red and white), *Carex lævigata, Asplenium marinum, Cotyledon Umbilicus, Hydrocotyle vulgaris, Anagallis tenella, Schœnus nigricans, Juncus maritimus, Eupatorium canna* *binum*, &c., were gathered. Another trip was to Glen Benlister, near Lamlash, where *Hymenophyllum Wilsoni* grows in large quantity, and *Asplenium viride* also occurs sparingly. The station for the latter has been sadly robbed of late.

On 22d September, a final trip was made to Glen Cloy, a fine mountain valley and corrie near Brodick. The hills are well worthy of examination. The rocks are covered with ferns, such as *Lastrea æmula*, *Hymenophyllum Wilsoni* and *tunbridgense*, *Asplenium viride*, *Polypodium Phegopteris* and *Dryopteris*, *Scolopendrium vulgare*. *Sedum Rhodiola* is also abundant.

The neighbourhood of Lamlash is rich in species of Rubi. Professor Babington and I visited Arran some years ago, and gathered the following brambles:—

Rubus Idæus, *L.*
plicatus, *W.* and *N.*
affinis, *W.* and *N.*
Lindleianus, *Lees.*
incurvatus? *Bab.*
discolor, *W.* and *N.*
carpinifolius? *W.* and *N.*
Rubus macrophyllus, *Weihe*, and its *vars.* umbrosus and amplificatus.
mucronulatus, *Bor.*
Kohleri *var.* pallidus.
corylifolius *var.* conjungens and purpureus.
saxatilis, *L.*

I have thus given details of excursions which, although not so productive as our alpine trips to Clova, Braemar, and Ben Lawers, yet presented us with many interesting species characteristic of the western parts of Scotland. The excursions will not soon be forgotten, associated as they were with adventures of no ordinary interest to those who took part in them.

III. *Sketch of the Botany of Lord Howe's Island.* By Charles Moore, Esq., Director of the Botanic Garden, Sydney.

This island is situated in S. lat. 31° 31′, and E. long. 159° 5′ (or about 300 miles east of Port Macquarie, the nearest part of our coast), is seven miles in length, by about an average of one mile in breadth, and is said to contain 3220 acres, of which it is calculated that more than 2000 are capable of cultivation. Of volcanic origin, the soil generally is of a rich character, that in the lower or flatter parts extremely so, being of a dark unctuous loamy nature, largely impregnated with humus, overlying a deep bed of yellow clay. It is only land of this description that is now cultivated; that on the more elevated places being of a lighter kind, its principal components consisting of decomposed porphyritic and calcareous rock, and more affected by atmospheric influences than the former. On this account, much of it formerly under cultivation is now left untilled, the demand for produce having of late years greatly failed. These as well as some abandoned clearances on the flats are now almost wholly occupied by two grasses which are common about Sydney, *Cynodon dactylon* and *Sporobolus elongatus*, called by our colonists respectively "Couch" (the *Doob* of India), and "Tufty-grass," the former growing most luxuriantly, and forming a superabundance of food for the horses and cattle now upon the island. On the sides of the two highest mountains, each nearly 3000 feet high, which terminate abruptly the south-eastern point of the island, the soil is for the most part composed of decomposed basaltic rock, strong and stiff, and suitable for the growth of many plants valuable to man, yet the surface is so covered with loose stones, varying in size from huge boulders to small pebbles, that it would be difficult if not impossible to clear it.

Every part of the island is covered with a dense vegetation, the undergrowth being kept comparatively clear by pigs and goats, which are allowed to roam at large. These crop off the lower branches of the trees, and in too many instances, it is feared, have destroyed the smaller kinds of plants altogether. The absence of undergrowth, and the very remarkable scarcity of Ferns and Orchids, in the lowest and richest parts of the island, would indicate a dryness of climate which is not the case, as a drought of any great continuance is seldom or never experienced here, rain being said to be frequent and abundant at all seasons. While the want of undergrowth may be accounted for by the action of the pigs and goats, yet the rarity of the classes of plants referred to cannot be so readily explained. Thus, in the rich low flats, extending upwards of three miles, where the trees were the thickest and most lofty, only one orchid —*Dendrobium gracilicaule*, Muel.—and five or six kinds of ferns, were all that were observed, and these sparingly.

At the end of this flat ground towards the east, in gullies near the base of the mountains, and up to their very summit, ferns increase in number, both as regards genera and species. The presence among these of *Trichomanes* and *Hymenophyllum* would dissipate the notion of a very dry atmosphere, and prove at least a greater abundance of moisture in proximity to the mountains than occurs elsewhere. A second and smaller species of *Dendrobium* was gathered at a rather high elevation. This, with the former, and a species of *Sarcochilus* found sparingly upon trees growing on the hilly sides, at the other end of the island, were the only representatives of the family of Orchidaceæ noticed. One of the most remarkable features of the vegetation is the prevalence of Palms, of which there are four species, all of which appear to be as yet undescribed. Two of these, called by the settlers, respectively, "Thatch Palm," and "Curly-leaved Palm," and both sometimes "Cabbage Palms," are very general, and most abundant. They reach to a height of at least 1000 feet on the side of Mount Lidgbird, at which point their place is supplied by another very distinct species, of a noble appearance, called the "Umbrella Palm," from its compact, gracefully drooping, arched, dome-like, pinnate fronds. The zone of this plant is of limited extent, as it does not reach within some hundreds of feet of the top of the mountain, where a dwarf species, not more than 6 feet high, also with pinnate fronds, and altogether different from any of the others, occurs in large quantities. In appearance and character, the two first-mentioned species closely resemble each other; both grow to about the same height, the highest observed being about 35 feet, and both have pinnate fronds, from 6 to 8 feet in length. The spadix of both is simple and drooping; and that of the "curly-leaved" species being nearly twice as long as that designated "Thatch Palm,"—a term applied to it because of the fronds being employed for covering the roofs of houses. They are otherwise readily distinguished from each other, even to the ordinary observer, by the pinnæ of the former slightly converging upwards, while those of the latter droop; and by the straight and more robust stem of the latter, the former being more slender, of a darker colour, and usually slightly bent in the middle. In habit these palms resemble those of the genus *Areca*, but their carpological characters would indicate that they belong to the genus *Kentia* of Blume, which is not surprising, as all the palms of New Caledonia (eight species) are referable to this genus; but until fully developed flowers of all the kinds are obtained, the genus or genera to which they may belong cannot with certainty be determined. From the very imperfect specimens procured of the "Umbrella Palm," it has been impossible for me to refer it to any known genus. Of this no flowers were seen, but its large reddish-coloured fruit (the size of a pigeon's egg), borne upon a branching spadix, is unlike that of any other palm as yet found in this quarter of the world. The small species, which only grows on the tops of the mountains, has also a branching spadix. This plant was not seen by me in a growing state, but the specimens obtained would represent it as of a dwarf rigid habit, with pinnate fronds not more than from 2 to 3 feet in length.

The *Pandanus*, or "Screw Pine," of which there appears to be two species, marks the vegetation in a peculiar manner, wherever it occurs. One species, known to the settlers as the "Tent Tree," *Pandanus Forsteri*, Moore, grows plentifully in some parts of the flats, but is more general on the mountain sides, increasing in number as they ascend, and attaining to an elevation of at least 2000 feet. This often grows to a height of over 30 feet, the lower half of which is usually constituted of spreading stem-like roots, which proceed from the main stem at various heights, and as the earlier roots perish, in a manner almost corresponding with the production of those from above, a clear space is thus left beneath, the plant being supported by these root-props, having a tent-like appearance. The most remarkable plant, however, upon the island is a species of *Ficus*, and the only one of the genus found there. Along the whole extent of the flat and richest ground, on the south-west side, this noble tree grows in large numbers—very rarely in exposed situations—but marks distinctly an inner zone of vegetation, being protected on every side by belts of trees of various descriptions. It possesses to an extraordinary degree the branch-rooting characteristics of the famous "Banyan" of India, *Ficus indica*. From its high wide-spreading branches, adventitious roots are produced, which descend to the ground, then rapidly enlarge, and become in the course of time huge stems; drawing nourishment from the earth for the support and increase of the parent branch, which, as it extends, produces similar root-stems; the tree by this means covering a very large space of ground. In some instances the original stem had perished altogether, the branches becoming separate trees, each with numerous root-stems, and forming by the whole a beautiful amphitheatre of considerable dimensions. This interesting tree appears to be new, and confined to the island; its column-like stems suggesting the specific name *columnaris*, proposed to be given to it. In character it is allied to *Ficus macrophylla* of this colony, but the smaller size of the fruit and foliage, and its numerous root-stems, at once distinguished it from that species.

The trees of most frequent occurrence throughout the island were *Hibiscus Patersonii*, *Myoporum acuminatum*, Br., called "juniper," and *Ochrosia elliptica*, all most abundant near the coast, and forming for the most part the outer or most exposed belt, the latter being, it is supposed, the "manchineel" mentioned by Lieutenant Ball, the discoverer of the island. These and a species of *Acronychia*, *Hemicyclia australasica*, Muel., the latter remarkable for its bright-coloured foliage and red-coloured fruit, *Olea paniculata*, *Achras costata*, *Pisonia Brunoniana*, *Baloghia lucida*, and a species of *Tetranthera*—the latter appeared to yield the largest useful timber—constitute at least three-fourths of the tree vegetation. Climbing plants were represented by *Marsdenia rostrata*, *Stephania hernandiæfolia*, *Smilax latifolia*, *Flagellaria indica*, *Ipomœa palmata*, *I. pes-capræ*, *Tecoma australis*, and *Canavalia obtusifolia*. Among the more rare and interesting plants, special mention may be made of a magnificient species of *Dracophyllum* discovered by one of our party—R. D. Fitzgerald, Esq., of the Survey Office—in a valley between the two highest mountains, called Erskine Valley. This magnificent species (perhaps the finest of the genus) being new, will henceforth bear the name of its discoverer, *Dracophyllum Fitzgeraldii*, who describes it as "a tree between 40 and 50 feet high, with a trunk at least two feet in diameter. It produced the leaves in tufts at the ends of the branches, and panicles of flowers of a reddish white colour, from nine inches to a foot long, springing from the centre of the tufts. Altogether it had a strange appearance, growing in a rambling way, the small branches forking like a *Pandanus*, the whole tree having the semblance of producing young pine-apple plants." It is allied to some species indigenous to New Caledonia and New Zealand, but quite distinct from any of these. A beautiful species of *Randia* (*R. macrophylla*, Moore), with large bright-shining foliage and stipules, was met with in several parts of the island. No flowers of this were seen, but the foliage alone will be sufficient to entitle it to a place in our gardens. A singular plant of the Mistletoe kind, *Viscum opuntioides* of Forster, found also on Norfolk Island, was observed growing in considerable quantities, but only upon two kinds of trees, *Hemicyclia* and *Elæodendron.* Every tree attacked by this curious parasite, which confined itself to the ends of the top branches, either presented evident signs of decay, or appeared to be dying from its effects altogether. No other Loranthaceous or parasitical plant of any kind was noticed. A most offensive-smelling plant—a new species of *Coprosma* (*C. putrida*, Moore and Muel.)—was met with both on the high and low grounds. It is called by the settlers "Stink-plant,"—a most appropriate name, as the smell which is emitted from its bruised leaves or broken branches is perfectly abominable. Were it not for this peculiarity it would be a shrub worthy of cultivation, having a rather pretty habit of growth.

A large Iridaceous plant, termed the "Wedding-flower," was found sparingly in two or three situations. Of this seed vessels only were obtained, but the flowers were described as being very beautiful. The leaves were upwards of six feet long, and from two to three inches in breadth. In appearance it resembles a large species of *Moræa*, but will probably prove to be a new genus.

At the mouth of a creek or small rivulet, near the base of Mount Gower, *Ægiceras fragrans* was observed for the first and only time, although it is said that this or some other kind of mangrove grows where another rivulet enters the sea. Along the coast on the northern side, *Crinum pedunculatum*, *Juncus maritimus*, *Rhagodia Billardieri*, *Senecio insularis*, *Mesembryanthemum æquilaterale*, *Ipomœa* *pes-càpræ* and *Canavalia obtusifolia*, occupied for the most part the sandy ridges raised by the wind from the beach. Curiously enough, on this the warmest side of the island, the trees and shrubby plants appeared to suffer more from exposure to the sea than they did on the opposite or southern side. There especially, *Hibiscus Patersonii*, *Ochrosia elliptica*, and *Myoporum acuminatum*, which, as has been before observed, constitute the principal part of the outer belt of tree vegetation, grew to be both good-sized and well-formed, whilst here they were reduced to a low-sized and nearly impenetrable scrub, the more so as they were usually intermixed with *Guilandina Bonducella*, a sub-climbing prickly shrub. In some parts of the interior, *Verbena bonariensis*, *Ricinus communis*, *Solanum laciniatum*, *Sonchus oleraceus*, and other smaller kinds, evidently foreigners to the soil, had, from neglect, taken almost entire possession of fine tracts of cleared ground, and had become, in other parts, very troublesome weeds.

Two interesting arborescent ferns (species of *Alsophila*), which are considered to be new, were observed in a small valley near the base of Mount Gower, growing in company with *Alsophila excelsa*, Br. Both of these are allied to *Alsophila australis*, Br., but of a more slender habit. In the same locality with these, *Trichomanes meifolium*, *var. Bauerianum*, grew plentifully. Another fine species of *Trichomanes*, as well as *Lomaria capensis* and *Hymenophyllum Tunbridgense*, were brought from the top of the mountain by one of the settlers, who stated that they all grew there in the greatest profusion, as well as a large and beautiful moss, more than a foot in height—a species of *Spiridens*. Among ferns it is not a little remarkable that the genus *Adiantum* was missing, although indigenous to all the countries with which the island is surrounded.

The position of the island, which may be regarded as Australian, being only 300 miles from our coast, and more than 500 from Norfolk Island (the next nearest land), with New Caledonia still further to the north and New Zealand to the south, would lead to the expectation of a somewhat different flora from this. Myrtaceæ and Leguminosæ, which prevail to a great extent on the coast districts of this colony, have here but few representatives: the former of these by two species, each of different genera—one an arborescent *Leptospermum*, of which only a single tree was found, high up on the side of Mount Lidgbird; the other a shrubby *Melaleuca*, inhabiting rocky, exposed situations, near the coast, on the south-western side. The last, locally called "Kilmogue," is used as a substitute for tea, and said to be a pleasant and exhilarating beverage. The Leguminous plants were also single species of distinct genera, and more indicative of other countries than of Australia. Proteaceæ, a family as abundant as the two last with us, is wholly wanting, although it has representatives both in New Caledonia and in New Zealand, of which countries the Cinchonaceous plants found here are also typical. Taken as a whole, the plants are perhaps more nearly allied to those of Norfolk Island than of any other country.*

IV. *Botanical Notes from Naples.* By Professor Allman.

In a letter to Professor Balfour, dated Naples, 28th January 1870, Professor Allman says:—"It is now about five weeks since we reached Naples. I have not been so successful as I had hoped in the exploration of the Neapolitan fauna. Some good work, however, I have done. I have gone over the ground of some of the old naturalists, and have found several new species, besides turning up some of the old ones, which had not been noticed since the time of Cavolini. I am putting up some interesting things for the Museum.

"You have no idea of the wretchedness of the weather here. Were it not that every one is agreed in calling this a most exceptional year, the fine climate of Italy must be regarded as a delusion. At this moment Vesuvius and the surrounding hills are covered with black-streaked dirty-looking snow, which in the course of twenty-four hours will probably have all disappeared, to be renewed in a day or two again; while a bitter penetrating north-east wind—the 'tramontana,' as they call it—is cutting its way through and through one, and making us long for our honest bracing Edinburgh winter, which lays no claim to climatal amenities.

* We do not give the list of plants observed by Mr Moore, as he proposes to prepare a more detailed account of the Flora of this interesting Island.—[Eds.]

And yet there is, after all, something very wonderful in these Neapolitan winters, something which gives them a special charm, and while we shiver in the cold, delights us with the aspect of summer which surrounds us. The ilexes and stone pines, and other evergreens, are in such profusion, that were it not for the great extent of country occupied by vineyards, dreary enough at this season of the year, we should scarcely miss the foliage of the deciduous trees. In the villas the oranges are growing in the open ground, where they attain the size of some of our largest evergreens, and are now laden with their ripe fruit. Camellias nearly as large grow equally without protection, and are flowering as freely as in our conservatories. *Schinus Molle* is in every garden, with its drooping branches and beautiful racemes of red fruit; and there are gigantic magnolias, and bays, and oleanders, and eucalyptuses. Australian mimosas are now in full flower, and casuarinas are carrying their cones, and in the male tree every pendant branch is continued into a long moniliform group of flowers. *Araucaria brasiliensis* is also in abundant fruit, and *Araucaria excelsa* is here a magnificent tree, attaining a height of 70 feet, and with its whorls of branches perfect from root to summit. Then there are date palms, with a height from 40 to 60 feet, with their heavy clusters of golden fruit, which, however, rarely ripens, and *Chamærops humilis* with stems of from 4 to 15 feet in height. On every rock and cliff in the suburbs, and round every village, and everywhere along the dusty roads, are agaves and opuntias and trailing mesembryanthemums, as common as furze bushes and brambles are with us.

"But it is the indigenous flora after all which, in my opinion, gives a special and peculiar charm to the Mediterranean vegetation, and possesses an interest beyond that of all the introduced plants, however beautiful. It is on the coast road between Vietri, a small town south of Naples, and Amalfi, that we have the native flora in perfection ; for, though still rather early in the year for its full development, the hill sides are clothed with arbutus, and arborescent heath, and myrtle, and cistuses and rosemary, wherever the native vegetation is not displaced by terraces of lemons, and oranges, and olives. The smilax clings whenever it can get support; the woods are filled with purple crocuses, and the broad leaves of the cyclamen give promise of a carpet of flowers somewhat later; the little Italian Arum is in blossom in every shady nook, and wherever there is a moist rock the beautiful fronds of the *Adiantum Capillus-veneris* form a tapestry of exquisite verdure. Those who have seen only the flora of Northern and Central Europe can have no conception of the wonderful richness and beauty of the vegetation of the warmer temperate zone."

Professor Allman adds:—"I paid a visit the other day to Mrs Somerville, on her ninetieth birthday. She is a charming old lady; her senses, with the exception of slight failure in her hearing, are still perfect; she can thread her needle without spectacles, and is in full intellectual vigour. She is engaged with a second edition of her work on 'Molecular Science.'"

V. *Report on the Open-Air Vegetation in the Royal Botanic Garden.* By Mr M'Nab.

It has been my practice for the last twenty years to lay before the Botanical Society, at the February meeting, a notice of the spring plants then in flower. Frequently the list has been large. Last February meeting (1869), twenty-four species were noticed as being in bloom. This year, however, I can only record the flowering of the *Tussilago fragrans* on the 18th January, and the snowdrop (*Galanthus nivalis*) partially on the 2d of February. During the winter, the hellebores have been flowering profusely, while the *Primula vulgaris* var. *Gentiana acaulis*, and wallflowers have produced blooms more or less throughout the winter, and cannot therefore be recorded amongst the true spring flowering plants. Up to this time we have experienced a good deal of frost. On nineteen mornings since 1st January, the thermometer has been below the freezing point, the six lowest temperatures being on the 11th, 22d, 24th, 27th, and 30th January, also on the 10th of February, the thermometer falling respectively to 25°, 25°, 26°, 17°, 20°, and 21°; while the six highest morning temperatures during the same period were on the 7th and 8th of January, also on the 1st, 3d, 5th, and 7th of February, being respectively 38°, 38°, 36°, 36°, 37°, and 39°. It was not till the 4th of February that the frost entirely disappeared out of the ground; since then the rush of spring vegetation has been considerable, and if it receives no material check, a number of the spring flowering bulbs will be in flower immediately.

VI. *Presentations and Exhibitions.*

1. Dr Daniel Wright exhibited and presented specimens of a caterpillar with a fungus grown out of the anterior part of its body. The species is frequently met with in this condition in the north of Nepaul. He also presented a specimen of a kind of peat lately discovered in Nepaul, and now being largely used for fuel there.

2. Rev. Dr Andrew Thomson presented specimens of plants which he had collected in Palestine during his recent visit there.

3. Professor Balfour exhibited an alpen-stock, upwards of 6 feet long, made of orange wood from Mentone; also a collection of dried specimens of the foliage of the trees growing along Sir Walter Scott's favourite walk at Ashestiel, a name probably derived from the trees of ash and tiel (*Tilia*, lime tree or *Linden*) which grow there; Professor Balfour also exhibited, under the microscope, sections of fossil plants collected by him near Laggan, in Arran.

4. Mr Oswald Brodie presented a large collection of grasses from Ceylon.

5. Mr J. B. Webster, forester, presented a twig of *Wellingtonia gigantea* bearing ten cones, from the plantation of Sir William Verner, Bart., Churchill, Verner's Bridge, Moy, Ireland.

10*th March* 1870.—Sir WALTER ELLIOT, President, in the Chair.

The following Gentlemen were duly elected Members of the Society:—

1. *As a Resident Fellow.*
A. OSWALD BRODIE.

2. *As a Non-Resident Fellow.*
ROBERT W. FOSS, M.B. and C.M., Stockton-on-Tees.

3. *As a Foreign Member.*
Senhor ADOLPHE ERNST, President of the Natural History Society of Caracas.

The following motion, proposed by Dr Cleghorn, was adopted:—"That all papers intended for publication be submitted to the Council, who shall decide as to the propriety of printing in full or in abstract, and that a Sub-Committee be appointed to revise the proofs."

Professor Balfour noticed the death of Professor Franz Xavier Unger, M.D., which took place suddenly at Gratz, on 13th February. He was one of the twenty-five Foreign Honorary Members of the Society.

Mr Sadler noticed the death of Dr Alexander Carroll Maingay, who joined the Society on 8th February 1855. He was very fond of cryptogamic botany; and while prosecuting his medical studies in Edinburgh, from 1854 to 1858, he assisted in re-arranging the large collection of Algæ in the University Herbarium. He read several papers to this Society; and on taking the degree of M.D., in 1858, he obtained a gold medal for his thesis, entitled "A Monograph of the British Parmeliaceæ," which was beautifully illustrated by several hundred drawings and specimens, and contained much original matter. On leaving Edinburgh he joined the Bengal army, and while serving in the last Chinese war, made a large collection of the plants of North China. He acted as colonial surgeon, Malacca, and in 1868 published "Notes on the Tapioca Plant (*Manihot utilissima*), as cultivated in the Malay Peninsula." (Jour. A. H. Soc. N. S. I. 184.) Ultimately he became superintendent of the jail in Rangoon, where he was killed in attempting to quell a mutiny amongst the convicts on 15th November 1869. Before his death he was engaged in investigating the flora of Burmah.

The following Communications were read:—

I. *On the Formation of a Museum of Vegetable Materia Medica.* By WILLIAM CRAIG, M.B. and C.M.

The author referred particularly to the formation of a complete Materia Medica Museum for the use of students. While admitting the great value of the Materia Medica collection in the University, which was now regularly consulted by students, and also the importance of the Herbarium of Medicinal and Economical Plants at the Royal Botanic Garden, which was open to the public, he thought that it would be well if the Society would assist in forming a museum to illustrate completely the British Pharmacopœia, by means of herbarium and laboratory specimens. In conclusion, he gave some illustrations of the mode in which such a museum might be formed.

II. *On the Fructification of* Griffithsia corallina, *with a Notice of the other Algæ found in Shetland, not mentioned in Edmonston's Flora.* By C. W. PEACH, A.L.S.

The author stated, that when dredging with Mr J. Gwyn Jeffreys, in 1864, off the Shetland Islands, he noticed, in a collection of Algæ made by one of Mr Jeffreys' daughters, at the West Voe Out-Skerries, some fine specimens of *Griffithsia corallina* in fruit, and as Miss Jeffreys kindly supplied him with as many specimens as he required, and as they were quite fresh, he placed some in sea-water under the microscope. On examining the whorls of tetraspores, he observed a circular opening at the lower part of the joint immediately over these masses. The edge of the opening was quite smooth, not in the least ragged as if ruptured; this opening he found constant over all the whorls of tetraspores he examined. He also noticed that the granular matter in the joints escaped through these openings on the whorls of tetraspores; and although these latter retained all their brilliant colour, the joints became literally colourless. He also found favellæ on some of the specimens, but not both kinds on the same fronds. He had not time to examine the favellæ carefully. He observed another thing on some of the specimens, of which he finds no mention in any of Harvey's works. On the lower part of the main stems were lateral pointed branches of some length—not jointed. The centres were filled with a dark pigment, which continued into the pulp mass in the main stem; they were placed one on each joint alternately. He further stated, that although he kept a good look out for algæ when dredging in deep water, three species only were got—*Desmarestia viridis*, a Polysiphonia, and a Nitophyllum; these were got in the Inner Haaf, at a depth of 40 fathoms. They were very fresh, retained all their brilliant colours, but not attached to anything. He took them from amongst the contents of the dredge. After expressing regret for the early death of Mr Edmonston, he spoke highly of his labours, and then stated that, as the object of the dredging was connected with the fauna, the flora was neglected, except by Miss Jeffreys, and he regretted he could not give a list of the algæ collected by her; and added that he gathered only fourteen species, out of which, probably, nine are additions to Mr Edmonston's list. Three of the others were got in new localities. He further stated that any one giving time and attention would no doubt reap a rich harvest in Shetland, the opportunities of getting from island to island being so much greater now, as there is a steamer trading amongst them from Lerwick weekly. Sketches of portions of the Griffithsia, with the openings in the joint and tetraspores, and of portions with the lateral appendages, as well as specimens of all the algæ collected, were exhibited.

III. *On Two New British Hepaticæ.* By Benjamin Carrington, M.D.

Nardia sphacelata (Gies.) Carr.—Primary shoots creeping, stoloniferous, branches erect, flexuose, leaves remote, vertically patent, obcordate, sub-complicate, erect and sheathing at the base, apex emarginate, lobes patent, obtuse, incurved, sinus acute.

Jung. sphacelata (Gieseke. Lind. Syn. Hep. p. 76, t. i. fig. 13); *Sarcoscyphus sphacelatus*, Nees ab E.; *Marsupia sphacelata*, Dum. Syll.

Collected by Mr G. E. Hunt of Manchester, at Loch Kandor, and Ben Mac Dhui, July 1868.

Shoots 2·4″ long by $\frac{1}{16}$″ broad; flexuose, very slender, simple, or vaguely ramose, stoloniferous at the base; *rootlets* scattered at the bases of the leaves; rare, except on the creeping stems. Colour olive-green, the apices of the leaves and stems sphacelate; whole plant of a dirty olive-brown when dry.

Leaves alternate, distant, *patent from an erect, tumid, sheathing base;* very concave, cordate to ob-cordate, bilobed, lobes equal, rounded, obtuse; sinus narrow, reflexed at the base, equal to about one-third of the length of the leaf; anterior margin repand, and sometimes reflexed. Texture of the leaves thin and tender, not shining, shrinking when dry. Areolæ minute discrete, the limits of the cells well marked, walls delicate, trigones distinct, interior of the cells sub-pellucid. Apical cells $\frac{1}{1750}$″ to $\frac{1}{1166}$″, basal $\frac{1}{750}$″ long, and $\frac{1}{1166}$″ broad.

N. sphacelata is an important addition to our list of Hepaticæ, and not easily confounded with its allies. The remarkably long and slender stems, and distant sheathing leaves, reflexed at the apex, and the colour, will usually serve for its identification.

In slender forms of *Nardia emarginata*, Ehrh. (Gray), the leaves are of a more cartilaginous texture, somewhat polished and scarcely altered when dry, and the leaf cells are larger and the reticulation "guttulate." The stems, too, are stouter and shorter, and the leaves more crowded and bluntly lobed. From *N. Funckii* it may be always known by the smaller size, the more rigid approximate leaves, and acute lobes of that species; from *Jung. inflata*, which it resembles in colour and texture, by the oblique insertion of the leaves, which are frequently plane, and narrowed at the base, and not at all sheathing, and by the inflated perianths.

At first I felt some doubt as to the identity of our species with Gieseke's *Jung. sphacelata*, misled by specimens distributed under that name in Rabenhorst's "Hepat. Eur. Ex." No. 137; from Dr Hepp, but which really belong to *Nardia Funckii.* Through the kindness of my friend Professor Lindberg, I have received recently a portion of the original tuft collected by Gieseke, which agrees in all respects with the Loch Kandor plant. The perigonial leaves of *N. sphacelata* are more erect and gibbous at the base, with shorter inflexed lobes, and enclose two oval antheridia. I have not yet met with the perfect involucre, but in one or two cases the leaves at the base of innovant shoots still enclosed undeveloped archegonia, and differed from the rest in their larger size, and their division into three lingulate repand lobes. Some of the old archegones were undergoing metamorphosis into innovations, whilst in others the change was complete.

I have ventured to reinstate Gray's genus *Nardius* ("Nat. Arrang. of Brit. Plants," 1821) to include *Sarcoscyphus*, and *Alicularia*, Corda, which only differ as the bidentate Jungermanniæ do from the entire-leaved ones.

Adelanthus Carringtoni, Balfour.—Primary stems rhizomatous, creeping; shoots erect, laterally compressed, recurved at the apex. Leaves of firm texture, secund, obliquely subreniform, approximate, very concave, vertically appressed, sub-lævigate; margins of the opposite leaves meeting; anterior margin very narrow and decurrent; posterior abruptly rounded; areolation "*guttulate*."

Jung. compressa, Hook.; Dr Greville's Herb.; *Alicularia viridis;* Dr Stirton's MSS.

This fine species was first recognised as distinct by Dr Stirton, who collected it on Ben Lawers, July 1866, and Ben Voirlich, 1869. It appears to be not unfrequent in the Scottish Highlands. I have received specimens labelled *J. compressa* from rocks above Loch Avon, August 1830, by the late Dr Greville; Mr A. Croall found it in the same locality, July 1856; and Mr C. Howie at Loch Maree, Ross-shire, July 1867. It prefers boggy places, either growing alone, or forming loose tufts with other species, *e.g.*, *J. Doniana*, *J. orcadensis*, &c.

Stems 2″ to 4″ high, by a line in breadth, slender, flexuose, of a brownish colour, destitute of rootlets, except on the creeping portion; mostly simple; the branches, when present, arising from the ventral aspect; sometimes innovant at the apex, which is more or less falcate. Leaves of nearly uniform size, except at the base of the stem, where they are smaller and more distant, about $\frac{1}{20}''$ in diameter, obliquely orbicular or reniform, entire, or very rarely truncate; convex externally, margins inflexed, posterior lobe projecting considerably beyond the stem, abruptly rounded, the anterior very narrow and decurrent; colour pale olive or stramineous, texture firm, sub-levigate, scarcely altered when dry.

Areolation "dotted"—that is to say, the true outlines of the cells are obscured, and what is in truth the cell-cavity is mistaken for the cell. If, however, a leaf be boiled in liquor potassæ, and a few drops of iodide of zinc solution added, the true outlines will appear, as a clear narrow band, surrounding the six-sided cells. Each angle of the cell is occupied by a triangular body, the "trigonum interstitiale" of authors, which is a deposit of cellulose *within*, not outside the cell, and, like the outer walls, uncoloured by the iodide of zinc; whereas the six-lobed "membrana secundaria," enclosing the processes (pori) of the primordial utricle of Mohl, is coloured violet by the solution.

The cell-structure alone will serve to distinguish *A. Carringtoni* from *Nardia compressa*, in which the limits of the cell are well marked without preparation, and the trigones inconspicuous. The leaves, too, in that species are nearly plane, appressed to each other, and gradually enlarging to the apex of the stem; their texture is more tender and delicate; the colour a pale translucent green, often tinged with purple, and they project equally on each side of the stem, and, from their succulent texture, shrink more when dry. The immersed terminal involucre when present will at once distinguish the species.

Adelanthus occlusus (*Alicularia occlusa*, H. f. and T.), described again as *Plagiochila ansata*, is about a third of the size of our plant, with the leaves rounder, less convex and decurrent, of firmer texture, olive brown, whilst the stem is black and polished. The leaf-cells are also much smaller, sub-quadrate, opaque, radiating in regular lines from base to apex, where they are smallest. This species bears a close resemblance to *Nardia* (*Alic.*) *compressa*, so that it was referred by Dr Taylor to the same genus. And yet, among the Campbell Island specimens, collected by Dr Hooker, I have met with two perianths, sessile on the rhizomatous shoots, which agree in character with the fructification of *A. decipiens*. Guided by this indication, I refer the new species to *Adelanthus*, Mitt. rather than to *Nardia*, Gray.

Plag. Magellanica, Ldg., seems also to belong to the entire-leaved section of *Adelanthus*, and may be known by its narrower secund deflexed leaves, which are closely imbricated, and not at all convex.

With his accustomed partiality for condensing, Mr Mitten, in his paper on Adelanthus, "Jour. Lin. Soc." No. 28, April 1864, quotes *Plag. sphalera* and *P. unciformis*, Hook. f. and T., as synonyms of *Adel. Magellanicus*. To my eyes, the three seem as distinct as the majority of Hepaticæ. With equal discrimination, he clubs together *Adel. falcatus*, Hook, "Musc. Ex." t. 89, in which the leaves are crenulate-dentate, and the involucre rough, with minute papillæ, and *A. occlusus*, H. f. and T., "Cryp. Ant." t. 62, f. 8, in which the involucre is smooth and sub-cyathiform, and the leaves entire.

After such an example, is it too much to ask an arrest of judgment before Taylor's species, cancelled in the *Fl. Novæ Zelandiæ*, and *Flora Tasmanica*, are consigned to oblivion? In one genus only, *Lophocolea*, we find *twenty* species, figured by Hook. f. and Taylor, reduced to *five;* nor are the rejected ones mentioned even as varieties.

IV. *On the occurrence of* Luzula arcuata *and* Buxbaumia indusiata *in Inverness-shire.* By Dr Buchanan White.

I had the pleasure of finding a new station last summer for the somewhat local *Luzula arcuata* (Hook.). This is upon Mamsoul, a high mountain in Glen Affrick, Inverness-shire. In the Transactions of this Society for 1868, the Rev. James Farquharson, of Selkirk, gives an interesting sketch of the mountain ranges of this district, and expresses his sanguine opinion of their productiveness. This, I am sorry to say, is not borne out by my experience of Mamsoul, the highest mountain of the district, which did not yield me any notable Phanerogam, except the above-mentioned Luzula. Indeed, the common alpine plants were by no means fully represented, either by number of species or specimens. The probable reason of this is, that all the numerous precipices are very dry, with the sole exception (as far as I saw) of the one producing *Luzula arcuata*. This plant occurred at an altitude of about 3000 feet, and not very far below the summit. The exact locality is the precipice to the west of and overhanging Loch-an-Ouan. On the peak of Mamsoul grew *Cerastium trigynum* in tolerable abundance, and near the summit the rare Cryptogams, *Cladonia vermicularis* and *Solorina crocea.* Near Loch-an-Ouan, I found a few patches of what appears to be *Polypodium alpestre.* Notwithstanding my bad fortune on Mamsoul, I think that the whole of the mountain ranges in this district are worthy of a thorough search, as it has proved very productive entomologically, several new and many rare species being the reward of my investigations. Other noteworthy plants occurring, there were—*Cornus suecica*, *Arctostaphylos alpina*, and *Betula nana*, common in many places; *Tofieldia palustris*, on the hills on the south side of Strathglass; *Nuphar pumila*, in Glen Cannich; *Subularia aquatica* and *Isoetes lacustris*, very dwarfed, in a stony lake, at an elevation of about 2000 feet on Ben Hearag, and of a larger size in pools beside the river Beauly. On an island in this river, and on its banks, a large, dark, blue-flowered Lupin (a species common in old gardens) is thoroughly naturalised. I may remark that *Plantago serpentina* was abundant along the roadsides throughout Glen Affrick, and that *Silene maritima* grew beside the river, and *Armeria maritima* var. *duriuscula* at a high altitude on Mamsoul. I was fortunate enough to find three capsules of the rare moss, *Buxbaumia indusiata*, growing in a little ravine on the side of Ben Hearag, in Strathglass, at an elevation of about 900 feet. These specimens agree exactly with specimens from Aberdeenshire (kindly sent me by Professor Dickie), except that they were not growing on rotten wood, but on soil composed of decaying leaves, small twigs, &c. I believe this moss has hitherto been only found (in Britain) in Ross-shire and Aberdeenshire.

V. *On recent Additions to the Flora of Canada.* By Mr Sadler.

Mr Sadler enumerated the flowering plants, ferns, and mosses, which had been recorded as added to the flora of Canada, during the last two years, by Mr Macoun, Mr D. A. Watt, and others. He particularly noticed the species belonging to the British flora—including *Cystopteris montana*, *Lastrea Filix-mas*, *Lobelia Dortmanna*, *Littorella lacustris*, eight species of Potamogeton, and eighteen species of mosses. *Cystopteris montana* was found in some abundance by Mr Macoun, in July 1869, on one of the northern bays of Lake Superior. *Lastrea Filix-mas*, one of our commonest ferns, was gathered in a single spot, by Mrs Roy, of Royston Park, Owen Sound, near her residence. *Littorella lacustris*, a plant common enough in many of our Scotch lakes and streams, was collected, for the first time in America, by Mr Macoun, on an island in Gulf Lake.

Mr Sadler exhibited specimens of *Cystopteris montana* from Glen Lyon, in Perthshire, where he had met with it in three different places, in August last, and remarked that, although it was recorded as being found in low woods in America, in this country it always occurs on moist, turfy, exposed cliffs.

VI. *Report on the Open-Air Vegetation at the Royal Botanic Garden.* By Mr M'Nab.

At the meeting of the Botanical Society, held on 10th February, I gave a brief report on the state of the open air vegetation in the Botanic Garden. Since that period we have experienced a continuance of cold weather, the ground being more or less covered with snow, or hardened with frost. The six lowest morning temperatures since 10th February were on the mornings of 13th, 22d, 25th, 26th, and 27th February, also on 6th March, being respectively 26°, 26°, 15°, 26°, 20°, and 27°; and the six highest morning temperatures during the same period were on the 16th, 17th, and 21st February, also on 1st, 2d, and 3d of March, being respectively 34°, 34°, 33°, 43°, 34°, and 34°. This low range of temperatures has retarded vegetation considerably. The snowdrops are much in the same state as they were at end of January last year. At this date I can only give the names of ten species of spring plants in bloom, independently of the two formerly noticed; while at the March meeting last year no less than forty-three species were recorded. This list included *Ribes sanguineum*, Erythronium, Narcissus, Mandragora, Corydalis, Hyoscyamus, &c. The number this March is only twelve, including those noticed at the January and February meeting.

	Date of Flowering 1870.	Date of Flowering 1869.
Corylus Avellana, . .	Feb. 18	Jan. 14
Nordmannia cordifolia, . .	Feb. 19	Jan. 21
Eranthis hyemalis, . .	Feb. 20	Jan. 16
Jasminum nudiflorum, . .	Feb. 20	Jan. 13
Garrya elliptica, . . .	Feb. 24	Jan. 14
Crocus Susianus, . . .	Mar. 1	Jan. 22
Leucojum vernum, . .	Mar. 2	Jan. 17
Crocus vernus and *vars.*, .	Mar. 3	Jan. 13
Galanthus plicatus, . .	Mar. 4	Jan. 26
Hepatica triloba, . . .	Mar. 5	Jan. 23

VII. *Miscellaneous Communications.*

1. Professor Dickson, Glasgow, demonstrated some of the stages in the development of the embryo of *Zostera marina*. He also exhibited specimens of the embryos of some Gramineæ. He stated that the study of the embryo of *Zostera* had convinced him (as it appears to have done every one who has studied it) that Jussieu's interpretation of the parts of the grass-embryo is correct, viz., that the *scutellum* is nothing more than a remarkable expansion of the tigellus; while the cotyledon is to be found in the structure immediately investing the plumule, and perforated by a small slit-like orifice. Among the specimens of *Zostera* exhibited was an embryo-sac extracted entire, showing the pointed micropylar and conically invaginated chalazal extremities, and containing a young embryo (at a stage shortly after the appearance of the cotyledon) with its unicellular pyriform suspensor.

2. Miss Beaver, of Coniston, sent a list of the rarer plants found near Clapham, in Yorkshire, by Miss Marriner.

3. Mr M'Nab exhibited a head of female flowers of Pandanus, produced in the palm-house at the Botanic Garden. He stated that the Pandanus had produced female heads of flowers for several years, but never more than two at a time. This year nine heads have been developed. They are all globular at first, and elongate as they advance towards maturity. Mr M'Nab also exhibited a portion of the

spadix of the *Arenga saccharifera*, now flowering in the palm-house at Edinburgh. This palm is now 68 feet in height, and has three large flower-spikes near the summit.

4. Mr Sadler exhibited and presented a specimen of Guarana which he had received from Dr Lea Richardson. It is obtained from the seeds of *Paullinia sorbilis*, one of the Sapindaceæ, a tree found growing abundantly in some parts of the Great Amazon Valley. The fruit, when ripe, is roasted, and the seeds taken out and powdered. The powder is then mixed with water and made into a thick paste, which is moulded into cakes or round rolls, and dried in the sun. It possesses a bitter principle, identical with theine, and is reported to be stomachic, and febrifuge. In Brazil it is regarded as a cure for dysentery and many diseases. According to Dr Stenhouse, Guarana is the richest known source of theine. It also contains a colouring matter, analogous to the tannin in Cinchona bark, as well as fatty matter which, like the fat of chocolate, does not appear to become rancid by keeping. According to the price paid by Dr Richardson for the specimen presented, Guarana sells in the market of this country at 6s. an ounce.

5. Sir William Jardine, Bart., presented specimens of the fruit of a variety of *Solanum Melongena* (L.), obtained in the Covent Garden Market, where it is sold for making sauce.

6. Don Guilliermo Jameson, San Juan, presented a large collection of dried plants from the Andes; and Mr Mawson presented dried specimens of plants from Cumberland, to the University Herbarium.

14*th April* 1870.—Sir Walter Elliot, President, in the Chair.

The following Communications were read:

I. *On the Flowering and Fruiting of* Aucuba japonica. By Mr P. S. Robertson.

The author had observed that recently introduced female plants from Japan (grown in a cool pit) came into flower in January and February, while the male plants, grown in the same circumstances, never came into flower till the middle of March. Yet he had every year obtained a crop of young plants from the seed, although the female flowers were quite shrivelled before the male ones expanded. He found that the common spotted variety, long grown in this country, does not flower till May or June, although grown in the pit or house with the others, and begins to expand its flowers when the males are getting past; yet it also never fails to produce a crop of fruit with perfect seeds. He thought that the pollen must lodge for some time in the scales of the unopened flower-buds, or must reach the pistils before the flowers are expanded; but how to account for the fertilising of the early flowering varieties he was at a loss. This year he has forced on the flowering of the male plants by placing them in strong heat, and has all the varieties of the male and female plants in full flower at very nearly the same time, and accordingly he anticipates a much larger produce of fruit than in former years, when they were left to the ordinary course. He exhibited a branch bearing fruit with perfect seed; yet when that plant came into flower, there had not been a male plant in the house where it grew for fully a month previously.

Mr Sadler stated that he had been informed by the Messrs Lawson that when there was a great lapse of time between the flowering of male and female Aucuba plants, they frequently collected the pollen and kept it wrapped in paper until such time as the female flowers were ready for fertilisation, when it was applied to the stigmas, and thus secured invariably a crop of fruit with perfect seeds. By grafting the male plant on the female, the two kinds of flowers might expand nearly at the same time.

II. *Remarks on* Grimmia pruinosa (*Wilson's MSS.*) By Mr William Bell.

The specimens of the moss now exhibited, collected in April 1869 on Arthur Seat, have been carefully examined both by Mr Sadler and myself; and I have come to the conclusion that it is very different from any Grimmia described and figured in the "Bryologia Britannica." Sometime since, on turning over the species of Grimmia in Dr Greville's collection—now in the University Herbarium—specimens were observed which careful inspection showed to be identical with the moss above mentioned. Dr Greville's specimen is now exhibited, and those acquainted with Mr Wilson's handwriting will at once perceive that the critical note and description attached are his. He calls it *Schistidium confertum* var. *incanum*. It will be observed that the locality in which it was collected is the King's Park, and the date of collecting 1847. Thinking it strange that Mr Wilson should have omitted all mention in the Bryologia of such a well-marked variety, I wrote to him on the subject, and in his reply he informed me that Dr Greville sent him specimens of a moss in 1856, the same as the one he had just received from me, and that it is *Grimmia pruinosa* (Wilson's MSS.), named from specimens sent by Mr Howie from Largo Law, 1864. The fact of Mr Wilson not having seen Dr Greville's specimen till 1856, sufficiently explains why no mention is made of it in the Bryologia. It is now fourteen years since the specimens were first seen by Mr Wilson; but twenty-three years since *Grimmia pruinosa* (Wilson's MSS.) was discovered by Dr Greville.

Mr Wilson seems as yet undecided whether the moss just spoken of, or the one known to the generality of British Muscologists as *Schistidium* (*Grimmia*) *confertum*, be the typical *G. conferta*—a question which no one is more competent to decide than himself.

If the genus Schistidium is to be retained, both *Grimmia anodon* and *G. pruinosa* will naturally fall into it, rather than into Grimmia as it now stands. If the genus Schistidium be abolished (which perhaps would be of advantage), then under the heading of *capsules sessile*, *peristome perfect*, first in order might come *Grimmia maritima*—next, *G. apocarpa*—next, *G. pruinosa*—and next, *G. conferta*, which seems to have a less perfectly developed peristome than any of the preceding. Then, under *peristome entirely awanting*, *G. anodon*, which, although its capsules are sessile, has more characters in common with Grimmia proper than with any of the foregoing.

III. *Remarks on* Boehmeria nivea (Urtica nivea of *Linnæus*). By Mr Sadler.

Mr Sadler exhibited raw and prepared fibres of Boehmeria, as well as articles of dress manufactured from it, and drawings and specimens of the plant. He stated that it was a plant which was attracting a good deal of attention at the present moment, both in this country and abroad, from the fact that the Government had lately offered an award of L.5000 for the invention of a machine capable of separating the fibre from the bark and stem in an inexpensive manner; the working expenses of the prepared fibre not to exceed L.15 per ton, and to be of such quality as to realise not less than L.50 per ton in the English market. The offer of this premium was issued from the India Office in February last, and one year given to competitors; but Mr S. saw in the newspapers about three weeks ago that a gentleman in Bombay was stated to have invented a machine such as was required. This statement, even if verified, should not however have the effect of preventing intending competitors from sending in their inventions.

Mr Sadler went on to describe *Boehmeria nivea* as a herbaceous plant, belonging to the natural order Urticaceæ, and indigenous to South-Eastern Asia. He referred to the other fibre-yielding plants belonging to the same natural order, and exhibited a scarf manufactured from the fibre of the common nettle (*Urtica dioica*), which he described as a fine and soft, but not lasting fibre. The Boehmeria is known as "Rheea," "Ramie," "Ma," or "Chu-ma," "Chinese grass," and "Chinese nettle." Several notices of the plant have recently appeared, and Mr Sadler particularly noticed a paper by George King, M.B., published in the "Journal of the Agricultural and Horticultural Society of India," vol. i., part 4, and a full description of the plant, and mode of preparing its fibre, as given by Dr Royle in his "Fibrous Plants of India." Dr King states that naturally twice, but under cultivation three, four, or even five times a year, according to climate and soil, a fresh set of stems shoots up from the root. The proper time to cut the old twigs for their fibre is when they begin to become brown at their bases. In the Government Gardens at Deyrah Dhoon, where the object aimed at has been the propagation of the plant, and not the extraction of its fibre, the stems have hitherto been cut down only twice a year. If, however, it was well watered and manured, three crops (as is the case in China) might be obtained. In the moist climate of Assam four or five crops may be secured. The plant is hardy, and thrives well in parts of India differing much in climate and other physical conditions, such as Assam, Bengal, the North-West Provinces, and the Kangra valley in the Punjab. It has also been introduced with success in the Madras Presidency. In Deyrah Dhoon some old plants throw up shoots from 8 to 10 feet high, 6 feet being the common height. An 8-feet shoot, if carefully manipulated, will yield a fibre 6 feet long.

Dr King next notices the limit of its growth, and the soil and climate best suited for it. In speaking of its propagation and cultivation, he states that the plant is monœcious, and that seed is uncertain in localities where the insects are not indigenous by which fecundation is probably for the most part accomplished. In districts where Boehmeria has been introduced, propagation has therefore been conducted not by seed, but by cuttings, and by the division of the roots of old plants. Scarcely one of the cuttings ever fails to strike. The cost of cultivation, and the probable produce per acre, are next considered by the author. Major Hannay estimates the expense at L.14 per ton, and reports that Rheea can be produced and sold with profit at as cheap a rate as Russian hemp. Dr Royle, however, states that this must be a mistake, and that L.28 were meant. Captain Jenkins puts down the cost at L.28 per ton, while Captain Dalton states that the lowest price at which it is likely to be procurable by purchase from the cultivator is 6 annas a seer, or about L.48 per ton. Dr King notices further the process of separating the fibre from the plant, and its cleaning and bleaching, and concludes by relating some experiments which have been made in the manufacture of the fibre, and points out the chances of its success in a commercial point of view.

IV. *Memorandum on Ipecacuanha.* By Clements R. Markham, Esq. Communicated by Dr Cleghorn.

The native tribes of Brazil have always known the efficacy of the little root of the best sort of Ipecacuanha in various diseases. The common native name is Poaya de mato and Cipo. In the province of Minas Geraes it is called Ipecacuanha. The meaning of this name is uncertain, but it is composed of Guarani words.

Professor Brotero, of Coimbra, first described the plant (which he called *Callicocca Ipecacuanha*), from specimens brought from Brazil by Bernardo Gomez. His description is published in vol. vi., p. 137, of the "Transactions of the Linnean Society for 1801," and the paper is illustrated by a drawing of two stems, with the leaves, from one root.

The great French chemist Pelletier discovered the active principle in the root in 1817, which he called emetine; and in 1818 M. Richard again described the plant, calling it *Cephaëlis Ipecacuanha*, a name which has been generally adopted.

The *Cephaëlis Ipecacuanha* is met with in Brazil from about latitude 8° to 22° S., in the forests of the Serra do Espinhaço, or mountains extending from the capitania of Bahia, through the province of Minas Geraes, to the northern part of Sao Paolo. The forests in Minas Geraes are divided into four classes:—The Matos Virgens, or virgin tropical forests; the Catingas, or woods composed of smaller deciduous trees; the Carrascos, at still greater heights, consisting of shrubs; and the Capoeiras, or scrub growth on land once cultivated. The Matos Virgens clothe the eastern slopes of the Serra do Espinhaço and the Organ Mountains. To the westward of the Serra do Espinhaço, in Minas Geraes, the country is flatter, consisting of pasture land and much Catinga forest; and still further west is the Sertão, or desert country in the basin of the San Francisco and its affluents. The Ipecacuanha is found, I believe, both in the Matos Virgens and the Catinga, in moist shady situations.

Cephaëlis Ipecacuanha is a little shrub, consisting of a perennial root (or rhizome), three to six inches long, and a short stem with a few leaves at the end.

The root is bent and contorted, having a knotty appearance like a number of rings of unequal size strung on a thread, of a pale brown colour when fresh.

The stem is creeping at the base, then erect and rising five to nine inches. After the first year or two the stem throws out crooked knotty runners, which take root irregularly at the knots and produce new stems.

There are four to eight leaves at the end of the stem. They are almost sessile, oblong-ovate, opposite and entire, three or four inches long by one or two broad, rough and deep green above, pale and finely pubescent beneath. The petioles at the base of the pairs of leaves are short and hairy, and there are a pair of interpetiolar stipules deeply cleft into segments.

The flowers are aggregated into a solitary head, a little drooping, set on a round, downy stalk, terminating the stem. The green bracts are pubescent, entire, and sessile. The florets sessile, and fifteen to twenty-four in number. Calyx five-toothed and very short. Corolla synpetalous, white, and five-lobed. Anthers enclosed; stigma, bifid and usually exserted; stamens, five.

The berry is obovate oblong, and crowned with the remains of the calyx. Soft and fleshy, being reddish purple at first, and becoming black and wrinkled. It has two smooth oval seeds.

The Ipecacuanha roots are gathered at all seasons, but more frequently from January to March, by the negroes in the neighbouring estates, and also by the Coroado Indians in Minas Geraes. They cut the roots from the stems, dry them in the sun, and pack them in bundles. The berries are ripe in May. The bundles of roots are disposed of to traders, who bring them down to the coast, and they are shipped from Rio and Bahia in bales, bags, barrels, and *serons* (hides.) It is called Annulated Ipecacuanha in commerce.

Koster, who wrote in 1817, tells us that the Ipecacuanha plant is easily cultivated. He had himself made the experiment, but he adds that it requires shade, or at least that it must not be completely exposed to the sun.

V. *Report on the Open-air Vegetation at the Royal Botanic Garden.* By Mr M'Nab.

Since the last meeting of the Botanical Society (March 10) the temperature has been somewhat variable. On nineteen mornings the thermometer has been below the freezing point, the lowest being on the 12th, 13th, 14th, 23d, 27th, and 28th of March, falling respectively to 24°, 25°, 23°, 27°, 24°, and 27°, while the six highest temperatures were on the mornings of 16th and 31st March, also 1st, 8th, 12th, and 14th of April, standing respectively at 40°, 40°, 41°, 40°, 47°, and 49°. Having more sunshine during the past month than during the previous markings of this year, vegetation in consequence has made considerable progress, although still behind last year, as exemplified by the following register. In the forest and ornamental tree departments, the foliage is still very backward, even more so than it has been at this date for many years.

	Date of Flowering, 1870.	Date of Flowering, 1869.
Tussilago nivea, ...	March 14	Feb. 26
Symplocarpus fœtidus, . .	„ 18	„ 11
Populus tremula, . . .	„ 18	Jan. 21
Nuttallia cerasiformis, . .	„ 20	Feb. 7
Sisyrinchium grandiflorum, . .	„ 23	„ 1
Andromeda floribunda, . .	„ 23	Jan. 17
Narcissus pumilus, ...	„ 24	Feb. 28
Sisyrinchium grandiflorum album,	„ 25	„ 20
Scilla bifolia, blue, . . .	„ 25	„ 3
bifolia major, . . .	„ 25	„ 21
Narcissus minimus, . . .	„ 26	„ 20
Daphne Mezereum, . . .	„ 27	Jan. 29
Scilla bifolia alba, . . .	„ 27	Feb. 21
sibirica, ...	„ 28	March 2
bifolia rubra, . . .	„ 28	„ 8
Corydalis cava, ...	„ 28	„ 4
Muscari botryoides, . . .	„ 30	Feb. 28
Puschkinia scilloides, . . .	April 1	„ 29
Gagea lutea, ...	„ 2	March 5
Erythronium Dens canis, . .	„ 2	„ 6
Rhododendron nobleanum, . .	„ 2	Jan. 16
Aubrietia grandiflora, . . .	„ 2	Feb. 10

	Date of Flowering, 1870.	Date of Flowering, 1869.
Orobus vernus, ...	April 3	Jan. 25
Mandragora vernalis, ...	„ 3	March 2
Draba aizoides, ...	„ 4	„ 11
Cydonia japonica, . . .	„ 4	Jan. 30
Triteleia uniflora, . . .	„ 5	March 28
Ribes sanguineum—first flower seen open on standard plant,	„ 6	„ 1
Adonis vernalis, . . .	„ 8	„ 18
Muscari botryoides alba, . .	„ 8	„ 5
Mahonia Aquifolium, . . .	„ 8	Jan. 30
Hyoscyamus Scopolia, . .	„ 9	„ 19
Omphalodes verna, ...	„ 9	„ 10
Symphytum caucasicum, . .	„ 10	„ 10
Hyoscyamus orientalis, . .	„ 11	March 10
Pulsatilla vernalis, ...	„ 11	April 6
Muscari racemosum, ...	„ 12	March 25
Anemone nemorosa, ...	„ 12	April 3
Pulmonaria virginica, ...	„ 12	„ 1
Narcissus moschatus, ...	„ 13	March 16
Carex montana, ...	„ 14	April 1
Primula nivalis, ...	„ 14	—

VI. *Remarks on the Embryos of the White Water Lily* (Nymphæa alba), *and the Date Palm* (Phœnix dactylifera). By Professor Dickson.

Regarding the embryo of Nymphæa, Dr Dickson stated that he had nothing new to bring forward, and would merely exhibit preparations showing the different parts of the seed, viz., integuments, perisperm, endosperm (vitellus), and dicotyledonous embryo, with rudimentary radicle and well-developed plumule, exhibiting two leaves, an older and a younger one.

Regarding the embryo of the date, Dr Dickson remarked that, so far as he had seen, the representations of it in books were very erroneous—the slit of the cotyledon being indicated in one representation by a *transverse* cleft or fissure near its upper part, in another by a *longitudinal* slit near its upper part. Dr Dickson found that the slit of the cotyledon is longitudinal, and is always situated near its base. In shape the embryo is pretty definite, and may be described generally as conical. The cone, however, is compressed laterally, and is somewhat curved towards its apex,—in fact, resembling a short somewhat flattened horn. The position of this conical body is definite as regards the mesial plane of the seed—its long axis being nearly horizontal, the compression lateral, and the curvature such that the concavity is towards the apex, the convexity towards the base of the seed. The position of the slit, however, is very variable. Though always longitudinal and situated near the base of the cotyledon, it may be either on the concave, on the convex, or on one of the lateral aspects. In fact, the slit may occur on any portion of the circumference near the base. This variability is noteworthy, since it would appear that the position of the cotyledon or cotyledons is, as a rule, constant as regards the mesial plane of the seed.* It is to be presumed that the condition in Phœnix depends on the developing embryo lying sometimes in one way, sometimes in another, in a cavity of a definite shape, which it ultimately fills and moulds itself to. It is, of course, to be understood that the embryo here is usually unsymmetrical, *i.e.*, its morphological mesial plane usually does not coincide with the mathematical mesial plane of the conical body. Dr Dickson hopes at a future period to extend his observations, and to publish some analyses of the embryo.

VII. *Miscellaneous Communications.*

1. Professor Balfour communicated a letter which he had received from Dr Gambleton Daunt, dated San Paulo, Brazil, 19th November 1869. Mr Daunt says—" I enclose you some seeds of the *Herva de Lagarto*, or Lizard plant, whose leaves the lizard (a large variety) masticates and eats during or after its combats with venomous snakes. The people of the country say that it is an antidote to all serpent poison; and a Saxon apothecary here avers, that when engaged in a natural history commission in the island of Santa Catharina, by order of the Dresden government, he was bitten by a serpent, and saved his life by swallowing the juice of the leaves of this plant, and applying the

* Hofmeister, Handbuch der Physiol. Botanik, Allgemeine Morphologie der Gewächse, pp. 620, 621.

pulp of the leaves to the wound. The seeds should be planted in the greenhouse, not in the hothouse. Senhor Correa de Mello of this place succeeded in rearing a specimen of the (Physostigma) Calabar ordeal bean plant, which flowered and then died.

2. In a letter to Professor Balfour, dated Mentone, 28th March 1870, Professor Allman says—"Spring is rapidly advancing among the Mentone valleys. It would be worth coming here at this season if it were for nothing else than to see the peach trees in flower—all standard trees, covering the country like orchards in Devonshire, and filling every glade upon the hillside, not already occupied by the bright green lemon and orange, with a marvellous flush of blossom. The woods are filled with the anemones, blue and scarlet, and the very air is fragrant with the sweet violet. I think the most remarkable plant here is an arborescent Euphorbia, which covers the most arid rocks, but which is singularly limited to a small district along the coast."

3. Mr Peach exhibited a stone which he had detached from a rock near Stromness in August 1856, on which were clearly printed figures of *Desmarestia aculeata* and *D. viridis.* The sea-weeds had been thrown up and spread on the rocks by the flowing tide, and had been printed before the next return had again covered them; and thus time was given for the process before the remains of the printing weed was washed away. He saw a great quantity, both of the weeds and pictures, which covered wide spaces of rocks. They were mostly Desmarestias. The specimen presented before printing was covered by Ralfsia, which formed a nice dark ground, and contrasted beautifully with light-coloured figures left by the Desmarestias; and although the slab had been in his possession fourteen years, and not varnished or protected in any way, the impression is as fresh as ever. He had observed rocks in some parts of Caithness covered with printed delineations of sea-weeds. He thought that this process was interesting to geologists, as it threw much light on similar plant-markings often seen in newly-quarried rocks, even so low down as the Old Red Sandstone and Silurian, and showed how they might have been formed.

4. Mr Adam White, who had lately paid a visit to Ben Ledi, in Perthshire, gave some account of the spring vegetation on that mountain, and noticed particularly some of the rare mosses he had observed.

5. A letter was read from Mr Frere Hall, Diss, transmitting specimens of eight different "dogwoods" from the Government powder works at Waltham Abbey, for examination. Mr Sadler stated that he had examined these woods and found them all to be *Rhamnus Frangula*. A nurseryman in Edinburgh had lately received a large quantity of the plants of *Cornus mascula* as the gunpowder "dogwood." He was not aware, however, that the wood of this species was ever used for powder-charcoal, and thought that the plants must have been sent by mistake. The wood of Rhamnus was easily distinguished from that of Cornus, from its becoming yellow when moistened, and having coloured medullary rays and alternate branches.

6. Mr A. Oswald Brodie exhibited drawings of the foliage, flowers, and fruit of a species of Adansonia which he found growing at Putlam, in Ceylon, in 1847. The tree was of a great size, and was blown down in 1860.

7. Professor Balfour exhibited a specimen of wood covered with beautiful delineations from impressions of native ferns, executed by Miss Tulloch, and sent by Mr Westren.

8. Mr Frere presented a bundle of what watchmakers call "pegs," or "pegwood," used for cleaning the pivot holes of watches. The wood is remarkably free from silex, and makes good crayons for artists, when charred. It is probably a species of Cornus, and is imported from the Continent.

9. Mr D. A. Watt, Montreal, presented specimens of *Cystopteris montana* and *Botrychium Lunaria*, from Lake Superior.

10. Mr James Cox, Clement Park, Dundee, exhibited and presented a stem of *Corchorus capsularis* (Jute plant), measuring upwards of 11 feet in length.

12th May 1870.—Sir Walter Elliot, President, in the Chair.

Professor Balfour noticed the death of Sir J. Y. Simpson, Bart., who joined the Society in April 1852, and had ever since continued to take an interest in their proceedings. He proposed that the Society should record their sense of the loss they had sustained, and that a letter of condolence be sent to Lady Simpson, which was unanimously agreed to.

Excerpt from the Minutes of the Botanical Society of Edinburgh, 12th May 1870.

The Botanical Society desire to record their great regret at the loss they have sustained by the death of Sir James Y. Simpson, Bart., who joined the Society on 8th April 1852, and continued ever since to take an interest in their proceedings.

While occupying a highly distinguished place as a physician, and as an original discoverer in medical science, and engaged in the arduous duties of an anxious profession, he exhibited a sympathy with observers in all departments of science; and he strongly advocated the study of the natural history sciences as a part of general education.

Many of the members of the Botanical Society look back with a melancholy pleasure to the intercourse which they had with Sir James, and they feel that the blank which his unexpected death has occasioned, cannot be easily filled up.

The Society desire to express their condolence with his widow and family in their sad bereavement.

Donations to the Museum, Herbarium, and Library were announced.

The following Communications were read:—

I. *Botanical Notes of a Journey through Spain and Portugal.* By T. C. Archer, Esq.

It is not intended by these notes to give any strictly scientific or even novel information, but rather to shew by the number of interesting objects observed in a railway journey how much our favourite science may be made to add to its pleasure, or rather to beguile its tedium ; for a railway journey through these countries is usually very slow indeed.

I started from Bordeaux after an early breakfast, and in the course of three hours was passing through the district of the Landes. No part of the journey afforded me greater pleasure, for special circumstances have made me take a peculiar interest in this remarkable district. I made the acquaintance of M. Leopold Javal in the Exhibition of 1862, and then learned that in his youth the Landes were a desert of shifting sands ; but owing solely to his foresight and industrious spirit, the whole district has become one of remarkable fertility, and probably no part of the soil of France is more remunerative to the cultivator. The wonderful change was wrought by M. Javal in this manner :—About sixty years ago (he is now over eighty-five years) he purchased a very large tract of this desert, and having found that the seaside pine—*Pinus maritima* of the French arboriculturists—(the *Pinus pinaster* of botanists) would thrive well in sand containing a small amount of salt, he established in a suitable spot extensive nurseries, and raised a vast number of this pine from seed. When about two or three feet high, he planted them out in lines across the desert, taking care to place them in the direction of the prevailing winds. These lines, or rather broad belts, of young trees were placed about 300 yards apart, and, where most exposed, were protected by hurdles made of reeds. When fairly established, these belts were intersected by others planted at right angles, and at such distances as to include about four acres of space in each division. As the young trees grew up they formed perfect screens, which soon prevented the sands enclosed from blowing, and the spaces were sown in wet weather during the summer with cruciferous seeds, as rape and other quickgrowing species, so that they soon covered the ground with verdure, some of which as rapidly died away, and helped to form a vegetable mould by the decomposition of the dead plants—some seeded and furnished material for further work of the same kind. In a couple of years, grass and clover were tried, generally with success ; after one or two light crops the plough turned the remainder under, and made way for other crops. By such methods these spaces of sand became very fertile, and crops of all kinds of cereals, including maize, buckwheat, tobacco, potatoes, and other roots, pumpkins, melons, and other gourds, and now very largely in some parts even vines, have been successfully raised. In the meantime, the pine trees grew apace, and as they were thinned out, oaks, cork trees, mulberry trees, poplars, willows, and other useful timber trees, were put in, and throve well under the protection of the pines. The pines were tapped for turpentine, large distilleries were established, and now supply France with enormous quantities of spirit of turpentine, resin, tar, and pitch. Thousands of people are employed in this trade, and the collectors of the fresh turpentine, who go by the name of *Terebintieres*, live in villages prettily placed amongst the plantations, and they could be seen busily at work amongst the trees as we passed along. Either the carelessness of the workers or the sparks from the engines occasionally cause vast fires amongst the inflammable pine trees, and one which we saw had left a track of more than three miles of charred stems, giving a hideous aspect to the landscape.

The *Terebintiere*, by means of a curved axe, cuts out a portion of the bark and wood ; he then fixes a piece of bent zinc, so as to form a spout, at the lower extremity of the cut, and under this suspends a small earthenware pot by means of a nail ; into this pot the turpentine drops as it exudes from the incision made in the tree, the pots are removed when full and replaced by others. I passed through 108 kilometres of such cultivation, and thus had an opportunity of seeing in actual operation those processes by which M. Javal and others subsequently have fertilized and rendered productive some hundreds of square miles of what was the worst desert in Europe ; and of understanding more satisfactorily the large series of the interesting products of the Landes which were presented by M. Javal to the Museum of Science and Art. Entering Spain by Irun, the grand mountain scenery, on the one hand, and the beautiful broad open views of the Bay of Biscay, calm, with a heavenly blue, as if it had never raged and hurled to destruction the brave men who trusted themselves on its treacherous bosom, so completely occupied my attention that I had no opportunity of noticing the plants on the railway sides. Losing sight of the sea at St Sebastian, where we stayed nearly an hour, we passed on through a beautiful country, highly cultivated, but with most of the crops gathered in, until nightfall, which brought us to Vittoria, and at midnight I reached Burgos. The next morning I examined the details of its glorious Gothic cathedral; but in the afternoon I walked outside the walls and around about half of the town, hoping to see something of the plants or the neighbourhood; but in this I was disappointed, for so scorched up was every kind of vegetation, except the avenues of white poplar which here and there formed a rather dismal shade, that it could not have been more complete had a fire passed over the land, from the plain on which the city stands, to the summits of the hills surrounding it. The river Arlanzon, which passes by the town, has a broad bed, but so dry was it that the small stream which was still flowing, was often lost amongst the pebbles, and nowhere formed any serious obstacle to the pedestrian. I thought I might find some damp patches supporting vegetation, but not so. I did not find a green blade of grass. From Burgos to Madrid is a night journey; but the morning broke upon us as we were winding through the wild passes of the Sierra Guadarra, and I saw for the first time the oak forests of Spain, with their detached trees, beautiful in shape, but sombre in aspect, from their dense dark evergreen foliage, which at first sight made me think they were olives. Whenever we passed any peasants' habitations, immense droves of large black swine were seen feeding on the fallen acorns, proving by their well-fed appearance that the crop was abundant.

Madrid and its suburbs were nearly as bare of vegetation as Burgos. The roads leading out of the city are planted with rows of *Gleditschia*, I believe the species *latisiliqua*, the large brown pods of which seemed to overpower the dull green foliage of the tree, and give anything but a pleasing aspect to the roads. The bare hills all around give the idea of their having been just thrown up by railway navvies, no spot of green relieving their clay-coloured sides. The Prado, a magnificent drive and promenade on the south side of the city, is the only place where the visitor finds any variety of vegetation. This attraction of Madrid is well planted and carefully watered, so that it almost equals, and in some respects surpasses, the Champs Elysees of Paris, but the trees are chiefly *Gleditschia*, *Cercis Australis*, *Robinia Pseud-acacia* var. *umbraculifera*, which last is the favourite tree for ornamental purposes, and bears the scorching sun well if freely watered. In order to meet this requirement, the root of each tree is daily supplied by a system of covered drains, usually built of brick, in such public walks as the Prado.

The Botanic Gardens of Madrid are rarely mentioned by travellers, and I was told they were rarely visited. This is a great mistake, for they are full of interest; they were once under Cavanilles, and still bear in every part traces of his skill and scientific abilities. Every botanist should certainly visit them. In looking through gardens in Spain and similar countries, those who come from genial climates like our own have to make great allowances; in order to protect a few plants from the scorching rays of the sun, many others which can bear it have to be planted as a protection; hence it is impossible to preserve a careful systematic arrangement. Then, again, our carefully raked and level beds are impossible, for every large plant must have the earth raised around it, to form a receptacle for water, large quantities of which have to be frequently supplied. But notwithstanding this and many more difficulties, the Madrid Gardens are a credit to the director and to the country. At the time I walked through, about two o'clock in the afternoon, the thermometer, in the shade, was standing at 39 Cent. or a trifle over 102 Fahrenheit, so that most of the plants were hanging their heads, and looking flaccid. Great bushes, however, of the beautiful Barbadoes pride, *Poinciana pulcherrima*, blazed away in all their splendour, and at a distance gave the idea of fireworks. Hedges of *Plumbago capensis*, covered with its charming pale blue blossoms, and growing with more luxuriance than our privet hedges, were common. The walls of some buildings, forming one of the boundaries of the gardens, were covered with a glorious sheet of lovely rose-colour, which proved to be the *Bougainvillea spectabilis*, much coveted by English gardeners, but rarely seen in bloom in this country. The date palm, and a few others were growing in the borders, and fine collections of *Cacti*, and other succulent plants were placed in *sheltered* spots.

When I left Madrid it was again night, and the following morning found me going over the plains of La Mancha. The country was undulating, occasionally hilly, or rather rocky and wild; but whether hill or plain, all was alike arid and parched. Sometimes, however, a land spring, or a small rivulet, revealed the nature of the otherwise parched up plants, which consisted of a low brushwood, chiefly various species of *Cistus*, amongst which I afterwards found the following:—*Cistus albidus*, *C. crispus*, *C. salvifolius*, *C. monspeliensis*, *C. populifolius*, *C. laurifolius*, and *C. ladaniferus*, the last abundant. On the embankments, bright green bush-like plants of *Euphorbia rupicola* were frequent, and reminded me of tufts of samphire on rocks. During the forenoon, all the country had the same aspect—rocky, covered with Cistus bushes, and uncultivated. Much of it seemed only capable of supporting game, amongst which is the wild boar, for we passed a hunt in full cry, and the poor brute ran for some little distance alongside the railroad, seeking the slight shelter of the Cistus bushes. The progress of the train soon distanced the boar, and we could only imagine its fate. Here and there on the rocky declivities were small enclosures made of rough stones, in which sportsmen hide themselves, and fire through loopholes at the unsuspectiog game; and we were informed that these "shootings" are exceedingly profitable.

At half-past ten in the morning we were at Almaden, the centre of the quicksilver mines, where I intended stopping till the following day; but finding, on inquiry, that all the mines were closed, in consequence of the heat of the weather, I spent the three-quarters of an hour during which the train remains there to get breakfast, in getting a hasty look at the place. Immense rocky masses, as large, or larger, than Salisbury Craigs, rose all around, and the adit openings of the mines were very conspicuous in their almost perpendicular sides.

A beautiful effect was given to these cliffs by some lichens or algæ of a bright canary yellow, passing occasionally into a yellowish green colour, covering large portions of their rocky sides; they were too far off to ascertain exactly what they were, which I much regret, as the effect produced was altogether new to me.

We were now in the province of Estremadura, and soon found the rocks give place to vast undulating plains, the herbage, scorched by the burning sun, was of a dark-brown colour; the brushwood of Cistus became scarce; but where the hills were highest, forest trees abounded, chiefly the oaks, *Quercus Gramuntia*, and *Q. Esculus*, and chestnuts (*Castanea vesca*), amongst which numerous herds of black or brown swine, consisting of hundreds of individuals each, were feeding. During the afternoon, we also passed two wandering flocks of merino sheep, with picturesquely dressed shepherds; those flocks appeared to consist of some thousands each; and it seemed wonderful how they could gather sufficient food on plains where not a green blade of grass was to be seen. At Merida we stayed a short time, and here the river Guadiana, which is crossed by a bridge, rather altered the aspect of the country, and in many parts its banks were covered with crops of various kinds; pumpkins and melons were lying in great profusion; plots of tomatos glowing with their scarlet fruit; maize stripped of its leaves stood ripening its cobs; and various kinds of sorghum and millet, bearing heavy crops, seemed ready for gathering in. The town is picturesquely situated; but our attention was principally attracted by the ruins of the ancient Roman buildings, as the aqueduct, Forum, bridge, the circus, and wall, of great extent, which, as they are scattered all around the railway station, are easily seen by the passengers.

Leaving Merida we passed through a highly cultivated country, consisting of an extensive plain or vega, watered by the Guadiana, and its tributaries running down from the not distant Sierra de las Viboras; but from the plains the crops were all removed, and nothing was seen to interest the passer-by but a few cranes on the margins of the streams, watching their chances of a fish-supper. At the small village of Montijo we saw a beautiful garden in the highest state of cultivation, surrounding the mansion in which resides the family of the late Empress of the French, and in which she was born; but it was too far distant from the railway to distinguish the species of the various climbers in flower which covered the veranda, and rose in festoons above the low boundary walls. *Bougainvillea spectabilis* was, however, too prominent to leave any doubt about its presence, forming, as it did, a roseate curtain of several yards width. The garden hedges, too, were conspicuous from their being formed of the delicate pale sapphire blue *Plumbago capensis*, which all through the Peninsula is a favourite hedge plant for gardens.

Before sunset we reached Badajos. The station commands the fortified city, and from it we had a beautiful view, the Guadiana flowing between it and us, but spanned by a magnificent granite bridge of 28 arches. During the half hour we remained here, I wandered around the station, looking for anything of interest; but the sun had done its work so effectually that vegetation seemed entirely destroyed, with one remarkable exception, and that was *Euphorbia rupicola*, which was abundant, and by its bright green colour and luxuriant growth formed a striking contrast to the arid land on which it grew. On the dried up pasture-lands and stubble-fields the dead flower-stalks of *Asphodelus ramosus* were numerous, and by no means improved their appearance. Throughout the Peninsula, as also Southern Italy, this plant is extraordinarily abundant, and in the latter country the tubers have lately been employed for making alcohol; and there is no doubt that both it and the corms of *Colchicum autumnale*, so amazingly abundant in most parts of Europe, but especially in Southern Germany, might be profitably used for this purpose, and thus in time remove a cause of exhaustion from the soil of the meadows and corn-fields, which at present is serious.

Night soon closed upon us, after leaving Badajos, and passing the Portuguese lines, which, like a series of sentry boxes, stretch right and left as far as the eye can reach. After journeying two nights and a day the traveller is not in an observant mood, and I must confess that some hours of daylight were lost, so that I was almost in Lisbon before I was aware of it.

We arrived there in time for breakfast, and after that refreshment and a bath, proceeded to view the beautiful city. Leaving our most comfortable quarters—Durand's Hotel—in three minutes we were in the Largo do Camoes, in which, for the first time, I recognised the extraordinary beauty of the tree *Schinus Molle.* The largo or square is not very large; in its centre is a beautiful group of statuary, surmounted by a single figure of the poet Camoens; around the square is a single row of the beautiful Schinus, or pepper tree, as it is called, from the powerful pepper odour of the leaves. At the time I saw them their fine feathery foliage was exquisitely green, and contrasted beautifully with the profusion of pendulous clusters of coral-like berries, resembling in form bunches of grapes, but in size the berries are more like currants; some of the clusters were nearly a foot long. I had seen hundreds of these trees in Southern Italy, but never in their true beauty as I found them here. The public gardens in Lisbon are numerous, and beautifully planted, chiefly with tropical and sub-tropical plants, as bananas, callas, marantas, date palms, dracænas, azaleas, caladiums, aloes, cacti, and many others; the trees planted for shelter and shade are *Celtis occidentalis*, which is as common as our elm, *Broussonetia papyrifera*, *Schinus Molle*, *Gleditschia triacanthus*, *Ceratonia Siliqua*, *Cercis Siliquastrum*, *Pittosporum undulatum*, and *P. coriaceum*, &c. In the Passieo Publico, or principal promenade of the city, there are two magnificent trees of *Araucaria excelsa*, rising full sixty feet high, with lower branches sweeping the ground. There are two botanic gardens in Lisbon. As I saw nothing in the smaller one, attached to the Hospital of Sao Jose, which I did not see in the extensive one by the Ajuda Palace, I shall confine my observations entirely to the latter.

The Ajuda Botanic Gardens occupy the slope of a considerable hill, and have a south-westerly aspect. They are formed of terraces rising one above another, and reached by broad shady paths and flights of stone steps. The lower one is rather an arboretum than a general garden, although the fountains contain collections of aquatics; and many other plants requiring shade, are placed without much order under the trees. The latter are chiefly *Celtis occidentalis*, planted so as to form radiating avenues, and grown as a hedge-plant to enclose small spaces in which various economic plants are reared. Many varieties of orange and lemon trees are scattered about; but the great glory of this lower garden is two gigantic date palms, not less than forty feet high, from which were hanging huge bunches of golden-brown fruit, apparently ripe, but in reality not so, for they do not ripen their fruit in Lisbon. I will now give a list of the plants noticed in the upper gardens, in flower or fruit, attempting no classification, but giving them in the order in which they presented themselves.

Duranta Plumieri var. *flore albo* (from India), with white flowers, and very beautiful clusters of yellow berries in great profusion.

Lantana trifolia,
lavandulacea, and
nivea.

Grewia occidentalis, with handsome purple flowers.

Anona Cherimolia, ten feet high—it ripens its fruit here.

Entelea arborescens, with ripe fruit.

Styrax officinale, twenty feet high.

Pistacia Lentiscus.

Persea foetens, a large tree, covered with fruit shaped like acorns.
indica, *regia*, } also large trees.

Dracæna Draco, two remarkable specimens; one six yards in circumference, the other no less than thirty yards, and laden with clusters of fruit. The latter is now supposed to be the largest known plant of this species.

Artozia capensis, an elegant evergreen from the Cape of Good Hope, covered with bloom.

Schinus Areira, from Brazil.

Solanum verbascifolium, a very large bush, covered with fruit.

Cordia Martinicensis.

Ilex paraguensis.

Grevillea robusta, with stem three feet in girth, and twenty feet high.

Pittosporum Tobira, in fruit green.

Pittosporum coriaceum, } fruit ripe, orange colour.
undulatum, }

The last two grow very large, and their beautiful berries render them exceedingly ornamental.

Celastrus lucida.

Zizyphus vulgaris, laden with fruit.

Viburnum Tinus, of large size, but presenting a remarkable appearance, from its great profusion of fruit, of a metallic purple colour, looking, in the glowing sunlight, like some peculiar kind of bronze.

Gomphocarpus fruticosus.

Aralia papyrifera.

japonica.

guatemala.

Aloe plicatus, enormous plants; one rose about ten feet high, and had more than twenty woody branches, springing from the thick dwarf trunk. The whole plant was about ten feet diameter.

Chamærops humilis, with ten feet of clear stem.

Schottia speciosa, a small tree in full bloom, forming a beautiful object.

Buddlea Lindleyana, common about the shrubberies.

Opuntia Ficus-indica, one huge plant, growing twelve feet high, the lowest part of the main stem having a girth of four feet.

Leonotis Leonurus, a fruticose labiate, with pretty orange flowers, was common in the pastures.

Eugenia Michelii—The Pitangueria.

Paliurus australis.

Vitex Agnus-castus.

Clerodendron fragrans, a fine large shrub in flower.

Acacia Farnesiana, small trees covered with their deliciously-scented flowers.

Aleurites moluccensis.

Erythrina secundiflora, clumsy-looking trees, covered with fine scarlet flowers. They were about twelve feet high, and about three feet in girth, but very naked, having more flowers than leaves, their ash-coloured gouty-looking stems being all exposed.

The shaded thermometer in the gardens at noon was standing at 101° Fahrenheit. Had it been a little less my list would have been much longer; but the plants were flagging, and so was I. Cintra "the beautiful" is about eighteen miles from Lisbon, and during a drive to that place, I noticed a few interesting plants, chiefly growing in the Quintas, or estates in the suburbs of Lisbon.

In most of the gardens bananas were plentiful, with ripe fruit. *Mandevillea suaveolens* festooned the verandahs. *Plumbago capensis* was the common garden hedge. *Passiflora kermesina* covered many house fronts, and hung clustering from the balconies. Two or three species of Erythrina threw up their masses of scarlet flowers above the garden wall, and in the plantations fine trees of the Goa cedar, *Cupressus lusitanica*, perfumed the air with their aromatic odour. When we came to the open country, the parched fields offered little chance of botanizing; still some curious plants occurred at intervals, *Cnicus pungens* (?) in flower, and here and there *Colchicum autumnale;* everywhere over the fields the dead stalks of *Asphodelus ramosus.* On the banks occasionally, *Asparagus horridus*, *A. acutifolius*, and *A. albus*, *Mentha Pulegium*, and *Euphorbia rubicola.*

In the gardens of the Pena, on the heights of Cintra, *Cephalotaxus Fortuni* reaches a height of forty feet, and about the same height were fine specimens of *Araucaria Bidwillii*, *A. excelsa*, *A. Cunninghamii*, and *A. Cookii.* A plantation of camellias give a beautiful appearance to a large portion of the hill-side, offering a delightful contrast to its rocky peaks by the bright glossy green of their beautiful foliage; under their shade, and scattered amongst the surrounding forest trees, were hundreds of gigantic Hydrangeas covered with flowers.

Emerging from the gardens to the moor leading to the cork-convent, we travelled on donkeys over an extensive moor covered with stinted myrtle plants, closely resembling the Myrica of our moorlands, except that it was in full bloom, and its delicious odour, as we crushed it, was unmistakable. In some of the surrounding Quintas, ancient cork trees formed conspicuous objects, and were indeed magnificent adjuncts to the landscape, a recent author thus speaks of them:—

> "His giant Cork-trees, centuries of time
> Have hallowed, and all gnarled, and silvered o'er
> With age, yet spread they wide their beauties hoar,
> Brave, stalwart, and heart-whole, they do divide
> With two great cedars tall, which still abide
> Since the olden time, the honours of the wood,
> All waving peaceful there, one loving brotherhood."

From Lisbon I passed by sea to Gibraltar, thence to

Tangier and Cadiz. As I have made a separate list of the plants noticed on the rock, I will now allude to what I saw in Morocco. The city of Tangier is situated on the steep western bank of the bay, and, being a walled city, presents nothing within its walls to attract the eye of the botanist. We unfortunately arrived half-an-hour after sunset in a violent storm, and as the gates were closed for more than an hour after we anchored, the Moors turned a deaf ear to the incessant screeching of our steam whistle, whilst all the time our small steamer threatened to part with her anchor. This she eventually did after we left her. At last two large boats, manned by noisy Moors, who seemed to be endeavouring to shout down the roaring storm, took us off from the steamer, and making for the rolling crest of surf, dashed boldly through it, much to our discomfort, and immediately we were in shallow water, surrounded by a host of half-naked, but powerful men, who carried us on their backs to the shore.

In the morning before breakfast, we went out of the city by the gate called Bab-el-Sok, to the market place or Sok outside the town. Here I hoped to see the country produce well displayed, as it was the great market day, but there was little of vegetable produce, except a few piles of beautiful tomatoes, prickly-pears, brinjals (*Solanum Melongena*), and melons. Small bundles of various kinds of fodder were being consumed by the numerous camels which were lying on the sandy plain. Smiths, carpenters, saddlers, and others, were plying their vocations, and cooking establishments on a small scale were ministering to the wants of the numerous sellers and purchasers, who seemed to carry on the business of the market in the sleepiest style imaginable. From the market we passed into the country, which, for miles, consisted of sand-hills, with the rocks occasionally peeping through, and the vegetation all of one character—agaves and opuntias everywhere, the latter of monstrous size, almost approaching to trees. The agaves were less luxuriant, being often cropped by the camels and mules; myriads of the small palm, *Chamærops humilis*, forming hummocks every two or three yards. These, with a few dwarf bushes of *Ceratonia Siliqua*, *Pistacia atlantica* formed almost all the vegetation left by the burning sun.

Near the sea, however, were extensive patches of the great reed, *Arundo Donax*, which serves many useful purposes of the inhabitants. One was especially interesting. The Jewish population, which amounts to about a-third of the whole, were celebrating the feast of tabernacles, and in the patio or courtyard of every one of their houses was a pretty square erection of these beautiful green reeds, nicely wattled, and with the long green leaves left on, and always looking fresh as if watered. In these tabernacles they spend some part of each day. We spent the evening in one, at a merry-making in celebration of a betrothal, and listened to monotonous music, and saw strange dances, so utterly different to anything European, that we were much charmed by the novelty of the scene and its accessories.

A few days after I landed at Cadiz, and after a brief sojourn, started inland for Seville, stopping on the way at Xeres, the centre of the great wine district, which gives its name to our favourite Spanish wine. Nothing of botanical interest met the eye in this part of the journey, which is 95 English miles; about 12 miles of the commencement was through the wonderful salines or salt-marshes of La Isla de Leon, where salt is made by evaporation, on a scale which is truly surprising; the white pyramidal heaps of this material, often 30 feet high, were so numerous as to give the idea, as we passed rapidly along, of a vast tent-covered plain, and the mind naturally reverted to the days when the flower of the Spanish army embarked from this same spot on the Galleons of the Armada, which was intended to enslave our own little island.

We arrived at Xeres at nightfall, and could see nothing of the vegetation except a few towering date-palms, and the vine-clad hills just visible in the last rays of the setting sun. We called for sherry of course, and found it execrable; so bad indeed that it made us long for a sixpenny glass at Mugby Junction, and determined as to be champions in future for that much abused liquid. After an hour's stay in the capital of Sherry-land, a time only sufficient to recover from the one glass, we proceeded in perfect darkness to Seville, which we reached at about half-past nine o'clock; and after the tiresome examinations at the station, we packed ourselves in an omnibus of small dimensions, and with one or two breaks-down, reached our hotel in the town, situated in a magnificent square, the Plaza Nueva de la Constitucion, a name with which it had been newly designated. It is a perfect grove of magnificent orange trees, and at the time of our arrival was a scene of splendid gaiety; a superb band playing, and senhoras in the gayest festa-attire, for it was Sunday evening, were promenading and perfuming the air with the profusion of jasmine flowers worn in their raven-traces; but we had scarcely been ten minutes in our balcony, looking down on the beautiful scene, before an alarm of a revolutionary rising made the promenaders and band fly in all directions in dire confusion.

Early in the morning we were moving, and visited the Alcazar, the most beautiful of Moorish palaces. Its garden is a marvel of beauty; but our time, and the rapidly rising sun, forbade more than a passing glance at it. The most striking thing I noticed was the celebrated orange tree, of vast dimensions, and said to be 600 years old. Its stem is split into several, and it covers the ground space of a good sized oak. In the court-yards were magnificent groups of bananas, laden with ripe fruit, and indicating that they grew almost spontaneously. We next went through most of the public gardens and along the Alameda, but there was little variety in the vegetation—avenues of the tiresome Gleditschias, *Celtis Australis*, and similar trees, overgrown beds of *Mirabilis Jalapa* of every colour, and many plants, sadly in want of proper culture, were all that met the eye; and an early morning's work was brought to a close at 11 A.M. by finding ourselves on the Prado de San Sebastian, in presence of a vast crowd of 20,000 or 30,000 people, and some 5000 military, with a goodly array of artillery, met for the purpose of witnessing the execution of a horrible murderer by the garrotte—a terrible scene on a terrible spot, for it was on the same square on which formerly was placed the Quemadera, or fire-place of the Holy Inquisition, where, first and last, its officers, from honest convictions that they were serving God, destroyed 34,612 persons by the most cruel of all conceivable tortures. Our next stage was from Seville to Cordova, a pleasant journey through a country of vast corn-fields and vineyards, with many olive gardens. The dwarf palm was in wonderful profusion, and occasionally, where the level plain was cut through by ravines of no great depth, the hollows were well filled with shrubs, amongst which the oleander, covered with flowers, was the most conspicuous. Near the small towns and villages, the pomegranate orchards gave a lovely appearance, far surpassing the most beautiful of our fruit orchards.

At Cordova, in the Court of Oranges of the old Moorish Mosque, now the Cathedral, the splendid avenues of orange trees, all of them centuries old, and two stupendous date trees, were a most interesting sight. The lines of orange trees in the court corresponded with the lines of pillars, 1096 in number, in the interior.

From Cordova to Granada the scenery is often very grand and beautiful, notwithstanding the enormous extent of olive grounds, which are not lively looking trees; but in this district the traveller is interested in noticing the admirable culture which the olives receive, and the extent of the plantations through which the train flies for many hours in succession; and he here begins to understand how the enormous quantities of oil found in commerce are produced; the trees were heavily laden with the fruit, then closely resembling our acorns in size and colour, but when ripe they are of a rich purple colour, not unlike damsons, and the pulp is very oily. The harvest, I was told, took place in December. At a place called Bobadilla, a small branch line took us to Antiquerra, whence the diligence carried us by night to Granada. Of course we saw nothing on our journey; but had too many unpleasant intimations that we were going over mountain moors, by roads which scarcely deserve the name; and Granada itself offered nothing new except the beautiful avenues of elm trees which overshadow the roads up the Alhambra hill; these have an especial interest, for they were planted under the directions of the Duke of Wellington, and were all sent out from England. They have thriven wonderfully, and are evidently at home in the cool air of the Sierra Nevada. On our return to Bobadilla, the train conveyed us through scenery of extraordinary beauty, commencing with the magnificent pass Guadalhorce, winding through stupendous ravines, crossing from precipice to precipice, by bridges which seemed in the distance to be aerial, gliding through numerous tunnels, we seemed to have left the cultivated country for a world of bare rocks and mountain sides, unclothed with any kind of vegetation; but after five or six miles of this, we emerged into the open, and found ourselves in the glorious plains of Andalusia, the aspect of which was delightful in the extreme; for even the best portions of La Mancha and Estremadura, and even Granada, were so arid and brown that but little real beauty could be discovered in the scenery. Here, however, was a paradise of verdure, wide-spread orange groves, vineyards, olive plantations, vegetable gardens, orchards of pomegranates, the trees bending under the weight of their beautiful fruit, green fields, watered by numerous streams, and, as we approached Malaga, numerous villages, chiefly made up of elegant villa residences and beautiful gardens, the country residences of rich merchants, all glowing with sunshine under a cloudless sky, with the mirror-like surface of the Mediterranean forming the horizon line. This was the last portion I saw of the vegetation of Spain, the rest of my journey being along the coast by steamer, the political troubles preventing any stay at the various towns on our way to Marseilles.

II. *Botanical Notes on the Garden of Montserrat, Portugal.* By T. C. Archer, Esq.

Montserrat is the name of one of the most famous Quintas in Portugal. It lies on the north-east of the lofty granitic Serra, on which Cintra stands, and on the summit of which is placed the beautiful palacio of Dom Ferdinando —formerly the Jeromymite, or Pena Convent. Montserrat was at one time the property of Mr Beckford; but now belongs to Mr Cook of Richmond in Surrey (Viscount Cook of Portugal), and has been by him brought into its present state of perfection. His gardener, Mr Burt, an Englishman, commenced and has completed the work.

Although it is impossible to conceive a garden more tasteful and beautiful in every respect, its chief merit is not horticultural, but botanical; for it contains within its wide extent a greater variety of *rare trees* and *shrubs*, *succulent* *plants*, *palms*, *ferns*, &c., than any garden in Europe, except Kew; but, again, it surpasses that garden in the fact that, whereas all the choicest treasures of the latter are closely packed together under glass-roofs, the whole of the plants at Montserrat have no other covering than the azure sky above.

Situated in a lovely little valley at the base of the Serra, and sheltered by its steep and rocky sides, it knows no frost, and basks in sunshine, only varied by the warm rains of a short winter. It is well watered by numerous springs from its rocky barriers, and is thus in the most favourable condition for the growth of plants which luxuriate in heat and moisture; whilst its soil, formed of the decomposed igneous rocks, and an accumulation of vegetable mould, is so rich that plants grow with a rapidity and luxuriance which is truly marvellous.

Dr Cargill, an accomplishod botanist, and a poet of no mean talents, has hovered around this spot for several years, and as a personal friend of the proprietor, takes the utmost interest in it, he has lately published a poem, called "Fairy-life and Fairy-land," in which he has given an almost botanic description of its beauties. From this I shall occasionally borrow some descriptions, when my own language fails me; and in so doing I shall show that the botanist can use poetry as well as the prosy language generally employed.

In company with Dr Cargill, I rode down to Montserrat from the myrtle-covered moors of the Serra, and we left our animals at the gates. These animals were not Arab-barbs, so I have not specially described them. However, it was a relief to leave them and get into the verdant gardens, which we entered through fine broad iron gates, and found ourselves in a spacious carriage-drive, sheltered by magnificent trees of *Cupressus lusitanica*, perfuming the air with their balsamic odour, the underwood being the Common and Balearic Box, and enormous bushes of the Mediterranean Heath, and others. After walking some distance, we came to a spot where a side-walk branched off to the left. This my poetical friend has called Puck's Corner, and with much justice, for in the angle thus formed there stands a remarkable vegetable phenomenon, a double tree! It consists of a Plane-tree and a Cork-tree whose stems have, for some feet above the ground, grown so completely together that they appear to spring from one root. My friend's language will best describe them:

> " How rare this nook where they do flourish free :
> 'Puck's Corner,' called of playful Fays, since when
> That artful spirit planted there that Tree
> Incongruous, strange, since welded there, there be
> Two trees in one—puzzle to gardening men !
> Plane-tree and Cork in sworn hostility ;
> For with averted looks they climb on high,
> And yet their bases intertwiningly
> Mix in eternal union ! Cunning spell,
> Of pleasant Puck, whose wit at times will tell,
> In sly Tree-language, tales political
> And social of Man's life, in symbols all,
> Shadowing with humour quaint some ills his lot befall ! "

At this point the residence, or, as it is truly called, the Palacio comes in sight by the appearance of a round Moorish-looking tower, with a spacious gravel circle in front, surrounded with grand old oaks and plane-trees, and having in its centre a beautiful fountain. Through the open door-way, by a Moorish corridor, is seen the opposite extremity of the building; but my business is with the garden, and not with the Palacio. I must, however, mention, that it stands on a slight elevation which, like a promontory, juts into the valley, out of which the garden is formed, and hence the lawn slopes in front of the house downwards, and then rises up the steep sides of the Serra. A magnificent terrace extends along the whole front of the palacio, and it is formed by a high wall, built on the steep slope of the lawn, and surmounted by a handsome balustrade, little, however, of which can be seen for the profusion of beautiful climbers, which cover the wall and intertwine with the balusters, so as to form a floral drapery of exceeding loveliness. Amongst these climbers, chief in beauty, was *Tacsonia ignea*, a plant which, as far as I have been able to ascertain, is not found in our gardens. Its flowers are of the same bright colour as our Tom-Thumb geraniums, and the effect of thousands of them, thickly scattered over the thick drapery of dark green foliage, was beautiful in the extreme. Next came *Bougainvillea spectabilis*, with its myriad of rosy-pink involucred flowers covering a space of many square yards; and near it, in still wilder profusion, *Tecoma grandiflora,* with its lovely dark orange-coloured clusters of trumpet-shaped flowers. *Tecoma stans* and *T. radicans* were almost as showy, and the exquisite *Ipomœa Learii* drapes the whole summit of the wall with its great bells of deepest azure.

On the lawn, placed with the nicest taste as separate specimens, were the following plants:—

Araucaria Bidwillii, 20 feet high, and having a circumference of about 30 feet; *A. Cunninghamii*, 50 feet high, and one called *A. glauca*, probably a variety of the last; *A. Cookii*, and three splendid trees of *A. excelsa*, which have grown 60 feet in 18 years; *Pinus patula*, *P. montezuma*, *P. palustris*, *P. Coulteri*, and *P. taurica; Abies insignis*, only 9 years old, but 50 feet in height; *Cupressus torulosa*, 30 feet high by about 80 feet in circumference; *C. Knightii*, or *elegans*, and *C. funebris*, about 18 feet high; *C. excelsa*, 20 feet high, spreading out on the lawn to a circumference of 90 feet; and of equal size was *C. macrocarpa*, which had only been planted 9 years. A beautiful specimen of *Thuiopsis dolabrata* was 6 feet in height, but widely spread at the base; and near it a fine plant of *Juniperus japonica.*

The Eucalypti grow like willows in these gardens. The stem of *E. fasciata* measured 3 feet in circumference 5 feet from the ground. Two others, of which I could not ascertain the species, were respectively about 50 and 80 feet high; the stem of the former measured 4 feet round. They flower and fruit abundantly, and are thus spoken of by the poet botanist:—

> "Across our little river springeth steep
> Yon mossy lower lawn;—great wealth of trees,
> And shrubs coniferous, deck its lengthening sweep,
> And two great giant gum-trees load the breeze
> With their full-blossomed fragrance." . . .

On the western side of the upper lawn is a sight which no botanist can view without intensity of pleasure; it is a large grove of palms, on the borders of which are magnifisent specimens of *Cycas revoluta*, and *C. circinalis*, the former with two immense cones of ripe fruit. The palms are chiefly *Areca sapida*, *Latania borbonica*, *Seaforthia* *elegans*, *Chamærops Fortuni* and *Martiana*, each about forty-five feet high. *Corypha australis*, *Sabal Blackburniana*, and the date palm ; one specimen of this last at Puck's corner, is of gigantic size, and is the only one, I believe, in Europe, which really ripens its fruit. It is supposed to be some centuries old, and formerly grew at Cascaes, a place twelve miles distant, whence it was removed by Mr Burt, the gardener at Montserrat, across the intervening Serra with great difficulty. Its leaves were tied up, and its roots protected, and twenty-four oxen worked for a whole week to bring it to the paradise in which it now so proudly flourishes. Thus speaks our poet friend of it :—

"Regard this giant Palm ; translated, too,
Yet full of life, his birthplace far Cascaes,
Where centuries he had stood ; the stranger's view—
Now charms he here by his so stately guise ;
His stem of massive girth, from it do rise
What lofty fronds that spread themselves in air,
Then droop recurving, most supremely fair,
Casting a conqueror's look on all around,
Shrub, flower, or ferny gem, that clothes th' enchanted ground."

The stem of this prince of palms is seven feet six inches in girth, and the height not less than thirty feet,—the beautiful crown of leaves being at least ten feet more.

Passing by an immense display of roses and rhododendrons, as belonging to the domain of horticulture rather than of botany, although amongst the latter were most of the Himalayan species, as well as their hybrids. The most striking sight meets the eye after leaving the palm grove. Dr Cargill thus describes it:—

"Lo ! Mexico,
Rock-strewn, in front of thee ! what colours glow
On his hot surface ! All that Cactus gives,
Of indescribable painting, gorgeous lives
On his steep slope, and Aloe's flaming head
Shoots darting upwards from his rocky bed,
And Yucca's thousand chalices of snow
Hang bending o'er those broken depths below,
Outpouring all their sweets on fragrant Mexico."

This part of the garden is well called Mexico, the contrast it offers to the luxuriance of the other parts of the ground is most striking, the bare rocks of which it is composed glow in the burning sun with a dry heat which almost seem to forbid vegetation, but this suits the Cacteæ, the Agaves, and other succulent plants admirably, and they are there seen in such profusion and luxuriance as cannot be imagined by those who have only known them in cultivation under glass.

Cereus peruviana stood twelve feet high. *Fourcroya gigantea* well merited its specific name, for we measured some of its leaves and found them twelve inches broad. There was a singularly beautiful Agave, called *A. cubensis* var. *coccinea*, which was entirely new to me.

Passing over a small bridge on to the southern lawn, we passed a plantation of climbing roses, and the lawn surrounding them was pretty thickly sprinkled with plants of the *Orobanche tuberosa.* At the eastern extremity of the walk at the top of this lawn, and cut out of the rocks which overshadow it, is a recess in which a building formerly stood.* Its three roofless compartments, as Dr Cargill calls them, are not strictly so, for they were almost covered in with thickly intertwined stems and foliage of *Tacsonia mollissima*, from which depended a profusion of its golden egg-shaped fruits just in perfection, and about to be sent to the princely proprietor's table, at his house on Richmond Hill, where their rich but delicate flavour would meet with appreciative taste.

Proceeding onwards, we came to a ravine in the mountain side up which our path led, and here a new delight awaited me. I seemed to have left the garden grounds, and to have reached a bit of pure nature untouched by the hand of man. But it was not so, for here Mr Burt's skill had most cunningly displayed itself. The gully was narrow and deep, the only pathway up it, on the right, was interrupted with fallen rocks, and trees of various kinds festooned with wild climbing plants; but the left side, and part of the right, presented such a scene as only could be found in Australia or some of the Polynesian islands, for here were noble tree ferns, *Dicksonia antarctica*, eight and ten feet high, *Cyathea Smithii*, *C. medullaris*, of which a

* This is the old ruined chapel of "Our Lady of Montserrat," where miracles of healing were believed to have been wrought.

last year's seedling was four feet high, *Lomaria Chilensis*, *L. longifolia*, &c., and the whole of the bank was covered like a brake, but with such choice ferns as we only see in our best collections.

Reaching the top of this "fern-tree gully," we found ourselves on a platform of rock in front of a mighty waterfall, tearing down the face of the rock into a large reservoir on a level with our standing-place. In its basin grew abundantly *Papyrus antiquorum*, *Cyperus elegans*, *Calla Æthiopica*, and other aquatics. The overflow of this reservoir was through a broad shallow channel in the platform on which we stood, whence it fell into another basin about twenty feet lower down, forming a beautiful cascade, after which it rushed down through the mid-channel of the "fern-tree gully," supplying the ferns with abundant moisture.

Departing by the "Fairies' Walk," as our poet calls it, a promenade shut in with rocks, grey with thickly spread lichens, and shaded by immense cork trees, and a wilderness of rhododendrons, we soon reached the lodge, and thus finished a day of great pleasure.

In the foregoing notice of the garden of Montserrat, which even Emperors may envy the fortunate and liberal owner, I have said nothing of the plants in the parterres, for they are too numerous to mention, but on referring to my notes, I find that *Begonia Rex* stands in the borders all the year round, whilst amongst other shrubs *Metrosideros latifolium*, *Eugenia robusta*, *E. australis*, *Anthocercis ovata* and *Stadmannia australis* formed most ornamental objects, and were from fifteen to twenty feet high, and plants of *Dracæna australis* were twenty-five feet, adding much to the beauty of the scene. Some of the acacias, especially *A. dealbata*, are large timber trees. In February and March, I am told, when the golden tapestries of the acacias are all out at once, they scent the air with their delicious odour, and cover the lawn with golden showers of dropping flowers.

III. *Botanical Notes taken on the Rock of Gibraltar.* By T. C. Archer, Esq.

Few spots on the globe have had their fauna and flora more thoroughly investigated than this Rock. For scarcely a regiment is sent there which does not possess some officers with scientific tastes, and a garrison-life makes them only too glad of such an opportunity of beguiling the time. Besides which, an eminent member of this Society, the late Dr Kelaart, has written a systematic history of all the plants found on this remarkable locality. I therefore only record those plants which specially attracted my attention. The list is not a long one. It contains some introduced plants which were to me peculiarly interesting. The names are entered as they were observed in the garden :—

Asphodelus ramosus, the dried flower stalks all over the uncultivated slopes of the western side.
Aristolochia glauca, rambling over the bushes.
mauritanica, rambling over the bushes.
Daphne Gnidium, abundant.
Lavandula dentata, one or two specimens.
Genista linifolia.
Statice sinuata, abundant.
emarginata, abundant.
Teucrium polium.
Calendula incana.
Delphinium pentagynum.
Phlomis purpurea.
Rhamnus oleoides.
alaternus.
Allium sphærocephalum, very common.
Momordica Elaterium, extremely abundant by the road sides.
Crithmum maritimum, very common on the rocks. I saw it applied to a purpose quite new to me. In the Governor's garden at Europa Point it is used instead of grass to form a green sward around the flower borders: the small lawn in front of the house being a carpet of samphire, with a few small flower-beds.
Glaucium luteum, abundant.
Buphthalmum maritmum.
Colchicum autumnale, var. *gibraltaricum*, plant in flower.
Solanum Sodomæum, plant in flower.
Agave Americana, very abundant around the Alameda, the numerous gigantic flower-stalks telling of a great display of beauty which I was too late to see.
Sempervivum arboreum.
Lactuca tenerrima.
Chamærops humilis, the most common of all plants, many specimens with large clustersof golden coloured fruit, and the

stems of some rising from eight to ten feet high; but most of them were in tufts or hummocks scarcely more than two feet high and stemless.

Spartium monospermum.
spinosum.
Mesembryanthemum Aitonii.
Opuntia vulgaris.
Tamarix gallica.
Hedera Helix.
Valeriana rubra.
Cichorium Intybus.
Jasminum fruticans.
Ficus Carica, very large trees in Monkey's Cave.
Smilax aspera.
lusitanica.
Ruscus hypophyllum.
Pistacia Terebinthus.
Lentiscus.
Davallia canariensis.
Adiantum Capillus-Veneris.

In the Gardens.

Aloe arborescens.
Pinus sylvestris.
Populus alba.
Quercus Suber.
Ilex.
coccifera.
Olea europaea.
Catalpa syringifolia.
Jasminum grandiflorum.
Datura arborea, very large.
Ricinus communis, quite a woody plant, several years old.
Musa Paradisiaca.
sapientum.
Vinca media.
rosea.
Clematis cirrhosa.
Anona Cherimolia, which ripens its fruit.
Magnolia grandiflora.
Capparis spinosa, on the walls.
Citrus Limonum.
medica.
Aurantium.
var. *myrtifolium.*
vulgaris.

Melia Azedarach.
Schinus Molle.
Cercis Siliquastrum.
Ceratonia Siliqua.
Acacia Farnesiana.
Erythrina Corallodendrum.
Phaseolus Caracalla, a most exquisite plant, covering horizontal trellises so as to form shady roofs of arbours and verandahs, the clusters of curious snail-like flowers deliciously scented.
Eriobotrya japonica.
Amygdalus communis, this tree and the stone pine attract the rats in such numbers that they have to be protected in various ways ; if not, it is exceedingly disagreeable if sitting under the shade of the pine trees in the evening to hear the rats overhead, and occasionally to receive a blow from a falling cone with the kernels half gnawed out.
Punica Granatum.
Psidium pomiferum.
Pittosporum undulatum, called here the Bergamot tree, from the odour of the flowers.
Phœnix dactylifera.
Phytolacca dioica, called the *Bella Sombra.* The great gouty stems of these useful trees are many of them six feet in diameter at the base ; but, about three or four feet from the ground, they rapidly diminish to a third of that size.
Phytolacca decandra, but not common.
Arundo Donax, a most useful plant in the gardens.

This list is a small one ; but the season was not favourable for seeing many plants. The early spring in Gibraltar must be a delightful time for the botanist.

IV. *Report on the Open-air Vegetation at the Royal Botanic Garden.* By Mr M'Nab.

At the April meeting, I gave a list of the open-air plants then in bloom. The April meeting generally exhausts all the plants usually quoted, but the extreme backwardness of the season has left a few of them still unnoticed. These I now supplement. The temperature during the past month has never been very low ; but vegetation is still much behind, caused in a great measure by the dry state of the weather which we have recently experienced. The six lowest morning temperatures during the past month were on the 18th, 20th, and 27th April ; and 2d, 4th, and

7th May, when the thermometer indicated respectively 31, 35, 35, 34, 30, and 33 degrees; while the six highest early morning temperatures were on the 16th, 21st, 24th, and 25th April, and on the 6th and 10th of May, when the markings were respectively 43, 45, 44, 47, 45, and 47 degrees.

The following table exhausts the usual lists of spring flowering plants, with the dates of their flowering last year:—

	Date of Flowering, 1870.	Date of Flowering, 1869.
Fritillaria imperialis	April 15	March 24
Narcissus bicolor	April 16	March 29
Anemone nemorosa	April 17	April 3
Saxifraga virginica	April 19	April 2
Menziesia empetriformis	April 20	April 1
Ornithogalum exscapum	April 20	March 30
Primula ciliata purpurata	April 20	April 3
Epimedium rubrum	April 21	April 2
Ornithogalum montanum	April 28	April 2

V. *Miscellaneous Communications.*

1. Shetland Algæ.—Mr Peach gave a list of forty-one species of Algæ, collected by Miss Jeffreys in 1864, at the Outer Skerries of Whalsey, ten of which are additions to Edmonston's list.

2. *Saxifraga cernua.*—Mr Christie exhibited growing flowering plants of what appeared to be *Saxifraga granulata*, which he stated had been obtained from the bulblets of plants of *S. cernua* collected on Ben Lawers.

Professor Balfour remarked, that although it was believed by some that *S. cernua* was only an Alpine form of *S. granulata*, yet he doubted Mr Christie's conclusion, as plants of *S. cernua* from Ben Lawers had been cultivated in the Botanic Garden for many years, and never changed their normal form. Mr Sadler thought that, as *S. granulata* also occurred on Ben Lawers near the place where *Saxifraga cernua* grew, it was possible that the two species had been collected by Mr Christie, and got mixed before planting them in pots. Mr White stated, that as far as his knowledge of species went, he firmly believed that it would be yet fully proved that *S. cernua* was only a form of *S. granulata*.

3. *Salvinia natans*.—Professor Balfour exhibited growing plants of *Salvinia natans*, which had recently been sent to the Botanic Garden from Hamburg, and described its different stages of development and mode of reproduction.

4. *Tupa rhynchopetala*.—Mr Sadler exhibited dried specimens of *Tupa rhynchopetala*, a Lobeliaceous plant from Abyssinia, and called attention to the peculiar structure of its stem, in having a zone of woody cylinders arranged in a net-work through the cortical portion.

5. Mr A. Craig Christie exhibited and presented to the Museum a series of models, prepared by himself, illustrating the embryos and fruit of Cruciferæ, fruit of Umbelliferæ, flower of fuschia, and an ideal plant.

6. Miss Gibson-Craig exhibited a specimen of *Sphæria Robertsii*, the caterpillar fungus, from New Zealand.

7. Mr R. T. Mackintosh exhibited a portion of the trunk of an ash from Moffat, with a remarkable development of "knots."

8. Mr Evans, Bank House, Penicuick, presented fertile specimens of *Equisetum umbrosum*, collected on a bank near his house, in April last.

9. Mr M'Nab placed on the table a large collection of Alpine plants in flower.

10. Professor Balfour exhibited under microscopes the following species of diatoms, contributed by M. Eulenstein, of Dresden:—*Amphitetras antediluviana*, E.; *Cocconeis Grevillei*, Sm.; *Denticula thermalis*, Ktz.; *Fragilaria Harrisonii*, Sm.; *Hemiaulus polycystinorum*, Ehr.; *Navicula serians*, Breb.

9th June 1870.—Sir WALTER ELLIOT, President, in the chair.

The following Gentleman was duly elected a Resident Fellow of the Society:—

HUGH FRASER, Leith Walk Nurseries.

The following Communications were read:—

I. *Notes on the Ipecacuanha Plant.* By Dr Gunning, Rio Janeiro. Communicated by Professor Balfour.

Dr Gunning states that the Ipecacuanha plant is exceedingly scarce in the province of Rio Janeiro from having been pulled up, and no attention paid to its cultivation. It is exported from Sao Paulo, the province south of Rio, but chiefly from Matto Grosso, a thousand miles up the river Plate. Dr G. sent a number of cuttings to the Botanic Garden for transmission to India, where it is proposed to cultivate the plant extensively.

II. *New and Rare Mosses from Ben Lawers.* By Dr J. Stirton, Glasgow. Communicated by Mr Sadler.

It is proposed, in the following communication, to review the progress of discovery on Ben Lawers, within the last ten years, in this section of botany; to indicate in general terms the habitats of the rarer species, as well as their tendencies towards increased luxuriance or gradual decay and extinction.

There will also be noticed from time to time the affinities between the Cryptogamic Flora of the mountain and that of Scandinavia, more especially of the Dovrefjeld.

To any one conversant with both floras, this is remarkable in a two-fold sense: 1st, the identity of the species; 2d, and more especially, the close resemblance of the forms and even of the aspect of the plants from both regions.

I had proposed, besides, to frame a theory which might, in accordance with known facts, account for these close analogies; but, beyond the soft and friable nature of the Schistose rocks, on which the plants, for the most part, grow, in both instances, along with, of course, other geological features in common, I had nothing which could bear out strict investigation and comparison. The height of the mountain, along with its relative situation as part of the Breadalbane range, will not account for the exceeding richness of the flora, as almost all the varieties are found at elevations somewhat below 3000 feet;* and none of the rest

* [The climate, however, is influenced by the mountain being about 4000 feet in height. Ed.]

of the summits of the same range are lower than this. I may, however, recur to this subject on some future occasion.

With my own I have associated the name of Mr Alexander M'Kinlay of Glasgow, whose untimely end all true lovers of botanical pursuits must deeply deplore. I have the less scruple in doing so, as it had often been discussed between us, that a conjoined paper, on the subject of the bryology of Ben Lawers, might not prove unacceptable in its present detached state; besides, we have added considerably to what was known at the publication, in 1855, of the "Bryologia Britannica" of Wilson.

Sphagnum Girgensohni and *Sphagnum teres*, on the southern aspect of the mountain at a low level. On the whole, this peculiar group of mosses is not well represented; indeed, one is struck with their comparative scarcity, more especially one who is accustomed to climb our mountains nearer the west coast, where these mosses grow in great luxuriance and variety, and nowhere more so than on Ben Wyvis in Ross-shire, where Mr M'Kinlay, if I mistake not, discovered all the European Sphagna except *S. insulosum.*

Dicranum arcticum, in two or three marshy spots, at a considerable elevation, and bearing a remarkable resemblance to one set of specimens from the Dovrefjeld.

Dicranum longifolium, on large blocks of stone, in a ravine on the western slopes of the mountain, in great luxuriance, but barren. First detected in July 1865, and identified by Professor Schimper of Strasbourg with this species. Here again the resemblance between specimens from rocks of a corresponding formation on the Dovrefjeld and those from this locality is striking, as shown in the colour, texture of leaves, and manner of tufting.

Dicranum palustre var. *juniperifolium*, on the opposite side of the same ravine, in considerable abundance, and exactly resembling specimens from Sweden. Detected by Mr M'Kinlay in 1865.

It may be mentioned, as bearing out in a more extraordinary degree this analogy, that there is found, here and there on the mountain, a variety of *D. scoparium*, whose leaves are strongly and sharply serrated down nearly to the base, and otherwise bearing characters which would, *primâ facie*, lead one to refer it to *D. robustum*, a Scandinavian species.

Campylopus compactus, in great luxuriance on the grassy slopes on the same ravine; barren. The mode of propagation of the plant is well seen in the buds or lateral shoots from the axils of the older leaves, and which are pushed up by lateral pressure to the surface, owing to the density of the tufts, and scattered by the winds.

Radicular fibres, pretty constantly seen, serve to establish these buds in a suitable nidus.

It is remarkable that, with the exception of the above and perhaps *C. torfaceus*, sparingly, near the base of the mountain, I cannot call to recollection having seen another species of this genus on the mountain; quite a contrast, in this respect, to others nearer the west coast, as Ben Voirlich and neighbouring mountains by Loch Lomond, whose sides are lined with huge patches of *C. Schwarzii*, *C. alpinus*, *C. longipilus*, *C. fragilis*, as well as *C. compactus*, although much more sparingly, and in detached tufts.

Stylostegium cæspiticium is now very rare, and, so far as I know, confined to one spot at the head of this ravine, and in a situation very difficult of access. During my earlier visits, I detected it in several localities, where, however, I have looked in vain during my later visits. This rare moss is evidently on the decline, and threatens to become extinct. In the summer of 1865 I detected it in considerable tufts near the summit of Ben Lomond. In doubt as to whether this might not be a small barren state of *Blindia acuta* I submitted it to Professor Schimper of Strasbourg, who corroborated my former opinion.

Dicranum virens, the normal form, is seen nowhere in greater profusion, or fruiting so freely, as on the northern slopes of the mountain looking towards Glen Lyon.

On the grassy slopes, bordering the rills that trickle down the sides of the mountain on its northern aspect, were found, in July 1866, huge tufts of a moss, densely and almost inextricably matted together by purple radicles. Examination showed its affinity to *Trichostomum flexicaule*, inasmuch as the nerve bears the same relative proportion to the pagina, &c.; but the denser areolation, the shorter stouter leaf, and almost entire absence of denticulation at the apex, as well as the peculiar habitat, render the matter of specific difference probable.

The barren condition, in this instance, as well as the invariable barrenness in these islands of *Trichostomum flexicaule* (which by the way is got pretty plentifully in the neighbourhood of the moss in question), have hitherto deterred me from pronouncing upon the matter definitely. Provisionally I am inclined to name it *Trichostomum compactum*, to distinguish and yet show its affinity to the variety *densum* of *T. flexicaule.*

A form of *Racomitrium sudeticum* is pretty commonly seen of a nearly black colour, and otherwise characterised by the muticous condition of the leaves being the rule rather than the exception in any single specimen. The capsule is normal in appearance, form, and texture.

Zygodon Mougeotii was detected in 1863 on Craig na Gour, a neighbouring mountain, in a fertile state, when nearly twenty capsules were secured.

If we except the solitary capsule picked out by Mr Wilson from the herbarium of the late Professor Walker Arnott, this is the first recorded instance of this moss having been found in a fertile state in Great Britain or Ireland.*

The fruit has since been detected in specimens from the Campsie range of hills, where I secured forty capsules. This station was, however, destroyed by the precipitation of the rock, on which the moss grew, into the stream beneath. The Craig na Gour station has not been visited since the discovery.

Polytrichum sexangulare is found in great plenty at the head of the ravine, so often spoken of, in a barren state; and in another spot above marshy ground at a much lower level, and looking towards the inn at the foot of the mountain.

Timmia Norvegica was detected in 1863, on grassy slopes near the summit, having a western exposure; and during subsequent visits in other localities at a lower level, but always imbedded amongst grass. I am enabled to identify

* [It was collected in fruit in 1860 in Moffatdale, by Mr Bell, and in Glen Lochay in 1864, by Mr Sadler. Ed.]

this moss from having received authentic specimens from Professor Zetterstedt, of Jöhnköping, the original discoverer of the moss in Norway.

In some Continental lists, this moss is inserted as *Timmia Megapolitana* var. *Norvegica*, but it is undoubtedly a good species. The specimens show a wonderful resemblance to those from Norway, so much so, indeed, that the eye cannot detect any difference, except the greater prevalence of glittering particles of mica amongst the radicles of those from Ben Lawers.

Timmia austriaca was picked up by Mr Wilson on another part of the mountain, having the long sheathing bases of the leaves so characteristic of this species. In July 1869 were secured two small tufts of this moss in the Ordnance ravine, but on no other occasion have I detected it.

Tortula fragilis, first detected by Mr M'Kinlay in 1865, is found in great luxuriance in several places considerably below the summit, especially those having a western and south-western aspect, but, owing to its close resemblance in a dry state, to *Tortula tortuosa*, is apt to be overlooked. It is generally of a more lively green colour than the other, while the glossy appearance of the back of the nerve, as well as the fragile state of the leaves, serve to discriminate it in the field.

Encalypta commutata is also very common in similar situations to the above, but difficult of detection, as it is generally closely surrounded by other forms of vegetation, while, as is well known, *Encalypta rhabdocarpa* is only got within a radius of 100 yards of the summit.

On the perpendicular face of a huge detached rock was found, in July 1867, a moss, which at first sight I could not recognise; but the structure of the leaf, as revealed by the microscope, bearing a considerable resemblance to that of *Grimmia Hartmannii*, I was induced to identify it with this moss, and in this opinion I was seconded by Mr Wilson, author of the *Bryologia Britannica*. Since then I have carefully compared it with genuine specimens from Norway, and feel inclined to separate the two. The stems average three inches in length. The areolation of the leaves is denser, while their pellucid tips are in many instances scarcely discernible by the naked eye, and under the microscope are revealed, as clusters of three or four cells. The absence of fructification, as well as inflorescence, has hitherto deterred me from elevating it into the rank of a species.

Mr John Shaw discovered in July 1865, and Mr W. B. Boyd, of Ormiston, in 1869, a moss near the summit, which by Mr Wilson, although somewhat doubtfully, has been referred to *Grimmia atrata*. I have always felt considerable hesitation in the matter of the identity, but I mean to investigate the subject further should I be fortunate enough to alight upon the moss, in a fertile condition, during my next visit.

Bryum cirrhatum was found in 1866 for the first time, on the banks of the more westerly of the two most considerable streams that empty themselves into Loch Tay. The inflorescence is almost invariably synoicous, while in numerous instances male inflorescence may be detected at the apices of lateral shoots. A similar condition I have found to prevail in specimens from the Continent. It is remarkable also, that the specimens gathered at a low level rivalled in size *Bryum pseudo-triquetrum*, while they diminished in proportion to the increase of altitude ; until near the sources of the stream they scarcely reached the size of *Bryum cæspiticium*.

In this respect also is fully borne out what has been written concerning the moss by Continental botanists.

In connection with the above, I have considered it advisable to record here a slight description of a so-called variety of *Bryum pseudo-triquetrum*, which has puzzled others to whom I have referred it as well as myself. The stems are closely tufted, comparatively free of radicles, and scarcely at all branched. The leaves are deeply concave, obovate, abruptly pointed, with the nerve recurved at the apex ; the margins reflexed but not thickened, being composed of two series of cells narrower than those of the rest of the pagina, while the latter are larger, laxer, than in the normal form. It certainly is not *Bryum Neodamense* (*Itzig.*), and so far as the description extends in the *Bryologia Europæa*, not the variety *compactum* of *B. pseudo-triquetrum*.

It will have been noticed already, that I have given descriptions of several puzzling varieties of other mosses. I might extend the list considerably, as there is no other mountain in Scotland I have climbed that presents such curious and perplexing anomalies in its cryptogamic vegetation.

Almost at every step, in the more favoured spots, the botanist meets forms which seem to mock his powers of discrimination, and, above all, to warn him, that nature is not to be cramped and confined by any classification of man's devising.

In the remaining portion of this paper, I shall merely, with one exception, record under their respective species, the fact of certain varieties having been found on the mountain.

III. *Notice of Grimmias, collected on Arthur's Seat, near Edinburgh.* By Mr William Bell and Mr Sadler.

Arthur's Seat has long been a favourite place with Edinburgh botanists engaged in the study of mosses. It is not now our intention to give a complete list of *all* the mosses found on it, but only to notice briefly the different species of Grimmia which we know to be growing there at the present time. In point of number, as well as the rarity of some of the species found there, Arthur's Seat is perhaps richer than any similar area in Britain. But why it should thus be favoured above many other places which seem to have all the physical conditions requisite for the perfect development of cryptogamic life, is only one of the many questions of the kind to which Muscologists can give no answer. As yet too little is known regarding the nature of those laws which favour the extension in one direction and limit in another the existence and development of vegetable life. Still, although rich in point of number—with the exception of *Grimmia pulvinata*, *G. leucophæa*, and *G. subsquarrosa*—they are by no means generally distributed over the whole of the hill. Some are confined to very limited spots; for example, *G. anodon*, *G. Edinensis*, Ferg. MSS., *G. orbicularis* and *orbicularis* var. *oblonga*, *G. commutata*, *G. Doniana*. A little more widely distributed are *G.* (*Schistidium*) *conferta*, *G.* (*Schistidium*) *pruinosa*, Wilson's MSS., the last two mentioned on the soft crumbling clayey rock. *G. trichophylla* seems a little indifferent as to habitat, occurring on various kinds of rock. One large and well marked var. occurs on the basalt near the top of the hill. However, all the other members of the genus as represented there seem to have a preference for the amygdaloidal trap. Nothing really rare occurs on the basaltic rocks; even those species above indicated as being most common seem neither so abundant nor yet so luxuriant as they are on the trap. From the foregoing it will be seen that the greater number of the Grimmias found on Arthur's Seat occur on very limited areas, so limited indeed, and approaching each other so closely, that any one acquainted with them, and knowing the spot where each was to be met with, would find no difficulty in collecting specimens of the whole enumerated within half-an-hour, or less. In walking over the hill, it is both interesting and instructive to observe the abrupt transition from poverty to abundance, both in individuals and species, whenever the soft clay rock or the trap crops out. Nor is it less interesting to observe the decided preference that the section Schistidiæ show for the soft friable rock, and the other (the Grimmias proper) for the hard trap. In remarking that some of the species occupy very limited areas, it is not to be inferred that any one of them is the sole occupant of that particular area, for they often grow intermixed. As an example of this, there is a particular spot of a very limited area where quite two-thirds of the whole enumerated could be collected.

Regarding *Grimmia Edinensis*, Fergusson's MSS., there has already been and still seems to be a considerable difference of opinion. It was first collected by the Rev. James Fergusson, of New Pitsligo and ourselves in May 1869. All of us were more or less acquainted at that time with *Grimmia orbicularis*—the Arthur's Seat form,—none of us, however, had seen an extensive series of specimens of that moss. We were not at that time acquainted with that *nondescript* and persistently barren species, *G. subsquarrosa*, except by name. It is to Dr Dickie we are indebted for showing us that it is one of the commonest forms. That piece of information, added to the results of our own observations on *Grimmia orbicularis*, which are somewhat extensive, make us now feel pretty confident that we are correct in asserting that the original *G. Edinensis* is neither *G. orbicularis* as some say, nor yet what others say *G. subsquarrosa*, but a compound of both, at least such we find to be the case with our own specimens. Hence the difference of opinion amongst observers whose knowledge is extensive, and the fluctuation of opinion amongst those whose knowledge is less so. With increased knowledge subsequent observation showed that some of our specimens were forms of what is called *G. subsquarrosa*, and others were undisputably only stunted forms of *G. orbicularis.*

The next moss that we have to notice is one found in very small quantity last year, and was thought at the time to be *G. africana*, a variety of *pulvinata.* However, that was always regarded as doubtful, as the examination which led to that opinion was a little superficial—superficial because our specimens were scanty. Recent inspection has shown that it is not the *G. africana* of Hed., but the *africana* of Arnott in De Not. Syn., which is *G. orbicularis* of Schimper's Synopsis, the typical form. The *G. orbicularis* hitherto found on Arthur's Seat is, according to Mr Wilson, the var. *oblonga*, and that which we last year supposed to be *G. pulvinata* var. *africana*, now seems to be the typical form of *G. orbicularis.* In some of the specimens examined scarcely a trace of a peristome was observable, even when the specimens seemed mature; in other instances it was a little more developed, still often most rudimentary and very imperfect. In some cases the large spongy apex of the columella was quite conspicuous. Nor do our specimens assume that bright-red colour on the capsules as they approach maturity, which Mr Wilson remarks is characteristic of *orbicularis*, although they exhibit a very distinct band of red around the mouth of the capsule and the outer margin of the lid when mature. The following list of Grimmias is the result of an afternoon's excursion to Arthur's Seat about two months ago (April 1870) :—*Grimmia pulvinata*, *G. trichophylla*, *G trichophylla* var., *G. orbicularis*, *G. orbicularis* var. *oblonga*, *G. commutata*, *G. subsquarrosa*, *G. leucophæa*, *G. Doniana*, *G.*

anodon, *G.* (*Schistidium*) *pruinosa*, Wils. MSS , *G.* (*Schist.*) *apocarpa*, *G.* (*Schist.*) *conferta*.

IV. *Notes on some British Mosses.* By Mr Wm. Wilson. Communicated by Mr Sadler.

Mr Wilson referred to the British species of Andræa, which he has revised for the second edition of his "Bryologia Britannica," and especially to *Didymodon Jenneri*, a moss recently described and figured in the Society's *Transactions* by Prof. Schimper. The latter he believed to be in no way specifically different from *Cynodontium polycarpon*.

Mr Wilson says:—"It will be gratifying to Professor Schimper to learn that even his mistakes are conducive to the better knowledge of the species to which they relate. It is eminently so with regard to *Didymodon Jenneri*, which at length has led me to investigate more closely the two so-called varieties of *Cynodontium polycarpon*, and the var. *β strumiferum*, which until now I had never ventured to separate, though I have long suspected it to be specifically different, as it now proves to be. The areolation of the leaves is essentially different in the two, and the 'setting on' or mode of attachment to the stem quite different; the base of the leaf in *C. polycarpon* (as also in *Didymodon Jenneri*, its cognomen) being somewhat saccate and projecting from the stem; whereas, in *C. strumiferum* the base of the leaf is *as described* in reference to *Didymodon Jenneri*. I count this to be a most important diagnosis, and the detection of this is entirely owing to the fact, that *Didymodon Jenneri* was inaccurately described as to the base of the leaf, a fact which led me to examine *Cynodontium polycarpon* more closely than I should probably have done in other circumstances."

[It was suggested at the meeting that the specimen of the moss in the University Herbarium should be carefully examined by Mr Sadler and Mr W. Bell, and reported on.]

V. *On the Ferns found in the Valley of the Derwent.* By Mr T. W. Mawson.

Mr Mawson enumerated twenty-eight species and varieties of ferns as indigenous to the Valley of Derwent Water, including *Asplenium germanicum, A. septentrionale, Hymenophyllum Wilsoni, Osmunda regalis, Ophioglossum vulgatum, Cryptogramme crispa*, &c.

VI. *Miscellaneous Communications.*

1. Dr Alexander Christison presented Bulbs, which had been produced in place of fruit, on a large *Fourcroya gigantœa* at Agra.

2. Mr Sadler exhibited specimens of *Camelina sativa, Erysimum cheiranthoides*, and *Calicium chrysocephalum ;* the two former he had collected near Burntisland, and the latter in Arniston woods.

3. Professor Balfour exhibited growing plants of *Saxifraga cernua*, which had been cultivated in the Botanic Garden for many years, and which had shown no tendency to change into *S. granulata.*

4. Mr Wm. Wilson, the eminent muscologist, sent on his seventy-first birthday, 7th June 1870, growing plants of *Fissidens polyphyllus, Coniomitrium Julianum*, with young fruit, and *Wolffia arrhiza.*

5. Mr Methven exhibited a flowering branch of *Paulownia imperialis*, produced at Under Rock, Ventnor, the residence of Sir Lawrence Peel. The tree was 40 feet high, and had 225 trusses in flower.

6. Messrs Dickson and Co. exhibited a large series of seedling pansies, obtained from *Viola cornuta, V. lutea*, &c.

7. Rev. A. W. Williamson exhibited a growing plant of a species of Dioscorea, which he had brought from China.

8. Mr C. Howie presented specimens of wild hyacinth, having the flowering axis much shortened and the stamens petaloid ; also leaves of common garden cabbage assuming a pitcher-like form.

9. Mr John Reid, Haigh Hall Gardens, presented fibre which he had prepared from the leaves of the pine apple.

10. Mrs Curror presented dried specimens of ferns from New Zealand.

11. Mr M'Nab placed on the table a collection of flowering Alpine and other plants, in pots.

July 14, 1870—Sir Walter Elliot, President, in the Chair.

The following gentleman was elected a Resident Fellow :—

James Gow Black, M.A., D.Sc.

A letter was read from M. De Candolle, to Professor Balfour, in which he called attention to the name of Robert Brown as occurring in the Transactions of the Society, and which was apt to be confounded with the "R. Br." so well known to all botanists. He suggested that some means should be taken to distinguish the one from the other. The matter was remitted to the Secretary to correspond with MM. De Candolle and Brown.

M. De Candolle has suggested that the affix "Campst.," indicating the place of birth—Campster, in Caithness—of the present Robert Brown, be appended to his initials. The following is M. De Candolle's letter to Dr Brown :—

1er Aout 1870.

Monsieur,—Je vois par votre lettre du 19 Juillet, que vous avez senti vous-même l'inconveniens de porter des noms qui font une confusion avec ceux d'un autre botaniste. A mesure que vous publièrez, cet inconvenient deviendra plus réel, à moins de quelque procédé de distinction dans le genre de ceux que vous indiquez. Assurement vous êtes le seul et le meilleur juge pour choisir ce procédé, mais puisque vous me faites l'honneur de me consulter, je dirai que l'addition de la localité où vous êtes propriétaire serait un assez bon moyen. Nous avons dejà Schultz *bipontinus,* J. Müller *argoviensis.* Vous deviendriez R. Brown *campsterianus.* Comme la localité de Campster n'est pas bien connue il faudrait imprimer de temps en temps *R. Brown of Campster,* ou *R. Brown* (*of Campster*), ensuite on y serait habitué et l'abreviation *R. Br. campst.* se comprendrait parfaitement.

Dans les usages de la bonne latinité les adjectifs tirés des noms de lieux ou d'hommes ne prennent pas une lettre capitale. En botanique on a fait souvent le contraire; en particulier dans le Prodromus, mon père et moi nous avons mis des grandes lettres pour les noms specifiques tels que *Africanus, Jussiœanus,* etc. C'est afin d'étre plus clair. Ainsi une espèce appelée *grisea* doit avoir quelque chose de gris, mais celle que nous ecririons *Grisea* est nommée d'après M. Arthur Gris, botaniste français. Chacun me parait devoir rester libre de choisir entre une latinité irréprochable et une forme un peu plus claire. Dans bien d'autres cas les naturalistes ont employé des mots et des expressions que Virgile et même Pline auraient réprouvés.

Je vous prie, Monsieur, de recevoir l'assurance de ma considération distinguée. ALPH. DE CANDOLLE,

à Genève (Suisse).

Dr Lauder Lindsay has, since this letter was written, adopted these suggestions of M. de Candolle, by his nomenclature of *Verrucaria campsteriana* and *Lecidea campsteriana* (Linnean Society's Transactions, 1869–70).

A letter was read from Senhor Adolph Ernst, President of the Natural History Society of Caracas, thanking the Society for his election as a Foreign Member.

The following letter was read from Sir Walter Simpson :—

52 QUEEN STREET, EDINBURGH.
23*d June* 1870.

"DEAR SIR,—Absence from Edinburgh, and other circumstances, prevented me sooner acknowledging in my mother's name and my own the kind tribute to my father's memory offered by the Botanical Society of Edinburgh.

"For their sympathy with us in what is now a double bereavement, we are very grateful.

"The excerpt from the minutes of the Society will always be one of the most prized among the records of sympathy we have received.—I remain, &c. W. G. SIMPSON."

Professor J. H. Balfour, Hon. Secretary
Botanical Society, Edinburgh.

Professor Balfour noticed the loss which the Society had met with since the last meeting in the death of Professor

James Syme. Mr Syme joined the Society in 1858; and, although engaged in the arduous and engrossing duties of his profession, as an eminent surgeon and professor, he always took a warm and deep interest in botany and horticulture.

The following Communications were read:—

1. *Kashmir Morels.* By M. C. Cooke, M.A. Communicated by Mr Sadler.

It has long been known that Truffles and Morels are found in North-Western India and Kashmir, but no attempt has ever been made to determine the species. It is true enough that names have been applied to them by guess, but not based upon any recognition of specific characters. Four years ago, application was made to the Agricultural and Horticultural Society of the Punjab, and to other sources, for specimens, in order to determine these points, but without any result. Through the kindness of Dr J. L. Stewart, we have at length received from Mr Baden Powell of Lahore a string of dried morels, said to be the morels of Kashmir. This string of morels contains two distinct species, both of them small, and neither of them the *Morchella esculenta* of European markets.

Lieutenant Lowther alludes to these dried morels in his "Notes on the Products of Kashmir."* He says:—"I saw fungi of all sizes and hues daily collected and devoured by old women, which in Europe would have entailed death to the eater. Either the soil of this favoured valley, or the stomachs of these hungry beldames, must be of an uncommon order. On the green slopes, which are constantly grazed on by sheep and horned cattle, I gathered quantities of superior mushrooms, and observed numerous champillons (a French dainty) in the thickets on the hills. Morels or truffles are produced, which are dried and sold in the chief markets." The writer mentions a morel which sells at two annas per seer, and is called "Kungutch."

Honigberger observes, in his "Thirty-five Years in the

* Journal of the Agri.-Hort. Society of India, vol. viii. p. 207.

East" (p. 323), "Morels are imported from the hills into Lahore, but are very little used by the natives; and the English use them not medicinally, but for culinary purposes. The morels which are brought from the Hozara country are large." This would indicate the existence of another species of Morchella, different from the two we have received, since both of these are small. The remark in "Indian Domestic Economy and Cookery," that "morels are found in old white ants' nests in most parts of India" requires confirmation.

Dr Royle, in his "Botany of the Himalayas," says, "I only obtained specimens of common morels or *Morchella esculenta*, the "Kana Kuchoo" of the natives of India, which are every year brought down for sale from Cashmere, and whence some fine specimens were procured in 1831, by the plant collectors detached from the Saharunpore Botanic Garden." It is also remarked in the "Handbook of Punjab Products," that large quantities of morels are brought down from Kashmir to Umritsur.

Dr Stewart, in his recently published "Punjab Plants," refers the Kashmir morel to *Morchella semilibera*, and gives as vernacular names "Kana kach," "Kangach," "Kana bichu," and "Girch hatra;" and for the plains, "Khumb." He further states, "This appears to be abundant in and near Kashmir, from which considerable quantities are, after drying, exported to the plains. I have only once noticed it growing fresh at 6000 feet, near Chumba. It is much eaten by natives, both fresh and dry, and is said to be preferred by them to the mushroom. Dried, it is a not unsatisfactory addition to a stew, even for an European taste. I have no proof that a morel, which is found abundantly in the desert about Jhang, &c., and is said to be got near Hoshiarpur, &c., is the same species. It is considered a great dainty by natives, and relished by those Europeans who have tasted it."

Dr Henderson also mentions that "in Shahpur, and other districts where there is 'kalr' in the soil, both morels and mushrooms are abundant—the former in August and September, the latter in the end of the cold season, after heavy falls of rain." The same observer states that he has seen morels half a pound in weight, and mushrooms half a foot in diameter. Mussulmans eat only the morel, and consider the mushroom as unlawful food.

In the Jhang district, an underground morel (whatever that may be) called "Phaphor" is said to be found in fields of Sorghum. Edgeworth, in his "Florula Mallica," mentions an esculent morel, which he calls "Banphal."

This is a digest of all the information that we have been able to collect of the morels of Northern India; but from this it would appear that there is still one or more large species of morel different from the two about to be described.

The dried morels are perforated through the pileus, and strung upon coarse twine at about half an inch distance apart. Each fungus is from an inch to an inch and a half in length, and from a quarter to half an inch in diameter. Usually the short stem is broken off, and the pileus alone remains. The specimens received are of two species intermixed—one with the pileus attached to the stem at its base, and the other with the pileus free at the base, and about half way up. The former are the most numerous, the latter rather the largest. The following are their specific characters:—

Morchella deliciosa, Fr.—Pileus subcylindrical, acute, adnate at the base; ribs longitudinal, firm, connected by transverse folds; stem even, short; asci cylindrical; sporidia elliptical, one and a half diameters in length.—*Fr. S. M.,* ii. p. 8; *Krombholz,* t. 16, f. 17–19. "Kana kach," "Kan gach," "Kana kuchoo," of Lahore (fig. 1).

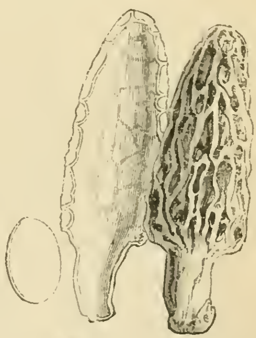


Fig. 1. *Morchella deliciosa,* and spore magnified 500 diam.

The total length of the dried specimens is an inch or an inch and a quarter, including the stem, which is about one-fourth of the entire length. It differs from *Morchella esculenta* in its much smaller size, different form of areolæ, longitudinal ribs, and smaller sporidia, as well as other points. Is found in Java, as well as in Kashmir and Europe. Sporidia, ·0006 by ·0004 in.

Morchella gigaspora, n. s.—Pileus subcylindrical or somewhat conical, free at the base, and nearly to the top of the pileus; ribs longitudinal, connected by distant transverse folds, forming elongated, nearly linear, pits; stem even, short; asci cylindrical; sporidia cylindrical, rounded at the ends, three diameters in length. "Kana kach," "Kan gach," "Kana kuchoo," of Lahore, partly; *Morchella semilibera*, Stewart's "Punjaub Plants" (fig. 2).

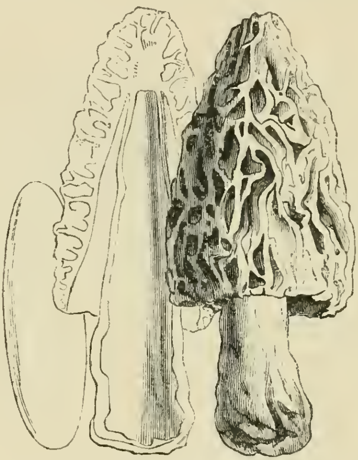


Fig. 2. *Morchella gigaspora*, and spore magnified 500 diam.

The total length of the dried specimens does not exceed an inch and a half. The exposed portion of the stem not more than three-eighths or half an inch in length, and the diameter of the pileus at the base, its broadest part, not more than three-quarters of an inch. Sporidia, ·002 in. long by ·0006 in. broad.

The last species is distinguished from all its congeners by the large spores. It is perhaps most closely related to *Morchella patula*, certainly not to *Morchella semilibera*. It would seem to be the least common of the two Kashmirian species. These are readily distinguished by the most superficial observer, if it be remembered that in *Morchella deliciosa* the base of the pileus is attached to the stem, and in *Morchella gigaspora* the pileus is free nearly to the top.

It is to be hoped that this notice may assist in securing for us specimens of the larger morels quoted above, so that we may be able at some future time to announce the species to which they may be referred.

II. *On the Characters of the Flowers of* Silene maritima *and* Silene inflata *as regards their Stamens and Pistils.* By Dr F. Buchanan White.

Being at present in a locality where *Silene maritima* (With.) grows commonly, I have examined a considerable number of flowers. Before beginning the examination, I consulted Hooker and Arnott's "British Flora," Babington's "Manual of British Botany" (edit. 6), and Grenier and Godron's "Flore de France," and was surprised to find that, whereas the two first mentioned works say nothing as to the nature of the flowers of *Silene maritima*, as regards stamens and pistils, and leave one to conclude that they are hermaphrodite, as in most of the other species of the genus, Grenier and Godron state that the flowers are polygamous or diœcious.

The following are the results of my examination. I should first mention, however, that *no selection* was made in collecting the specimens to be examined, but that flowers from *every* plant met with in a walk of a mile along the shore were examined.

Number of plants examined, 72.
Number of flowers examined, 201.
Number of plants perfectly hermaphrodite, 39.
Number of plants in which the stamens were quite abortive, 11.
Number of plants in which the styles were quite abortive, 10.
Number of plants in which the style had a tendency to be abortive, 11.
Number of plants in which the stamens had a tendency to be abortive, not clearly distinguished from the hermaphrodite plants.
(Plants of mixed character (partly ♂ partly ♀), 1,—probably diseased.)

In the perfectly hermaphrodite flowers, the stamens and styles were of nearly the same length, and the anthers (with pollen) and the stigmas and ovules well developed; but in the pistillate flowers the stamens, though always present, were reduced in length to from one-half to one-quarter the length of the styles, and the anthers varied from one-half the ordinary size to mere knobs on the ends of the filaments, and no pollen was produced. In these pistillate plants the styles were thicker and longer than usual, and the stigmas much more developed and rougher. In the staminate plants the stamens were from four to six times the length of the styles, which were, however, always represented. In the plants which showed a tendency for the staminate element to predominate over the pistillate, the styles were shorter and much more slender, and the stigmas but slightly developed. It must be noticed, however, that while the purely pistillate plants had healthy flowers, in no case were there any purely staminate flowers that had not the anthers filled with spores of *ustilago.* Not only does this apply to the flowers examined, but to all other staminate plants of *Silene maritima* that I have seen. Whether the attack of the *ustilago* is the cause of the abortion of the styles, I cannot say. The styles did not appear to be infected with the fungus.

In the hermaphrodite flowers the petals are of large size, as is usually the case, but in the staminate and pistillate flowers the petals are reduced to from one-half to one-third the size ; this is so invariably the case, that it is possible at some yards distance to tell from the size of the flowers whether the plant is hermaphrodite or diœcious. In many cases too, but not invariably, the crown of the petals in the diœcious plants is much reduced, in some cases to a mere protuberance at the junction of the limb and claw of the petal. In the staminate plants, the calyx is not so inflated, as the seed-vessel, of course, will not be matured, and I think, too, that there is a tendency in the panicle to have more flowers than is usual in the hermaphrodite plants.

The result of the above proves, I think I may venture to say, that the flowers of *Silene maritima* should be described as "polygamous or subdiœcious," and that we may conclude that it is a species in process of being developed into that higher order of plant life in which the stamens and pistils are separated and placed on different individuals.

In examining the 201 flowers, I also noted the number of the styles, which is variable in this species, ranging from three to five. The respective numbers were as follows :—

Flowers with three styles and three-celled ovary, 122.
Flowers with four styles and four-celled ovary, 68.
Flowers with five styles and five-celled ovary, 11.

After having examined the flowers of *Silene maritima*, I turned my attention to the flowers of *Silene inflata*, which grows commonly in a corn field here. The following are the results of the examination :—

Plants examined, 15.
Flowers examined, 40.
Perfectly hermaphrodite plants, 5.
Staminate plants, 3.
Pistillate plants, 6.
Plants with a tendency to be staminate, 1.

It thus follows that the flowers of *Silene inflata* are either polygamous or subdiœcious. In all cases both styles and stamens were present, but either abortive or strongly developed, as we saw was the case in *Silene maritima;* and, as in that species, the anthers of all the staminate plants were filled with the spores of *ustilago*. In both *Silene maritima* and *S. inflata* there seem to be no plants except staminate ones attacked by the fungus.

The size of the petals in the diœcious plants of *Silene inflata* does not appear to be reduced, though in the staminate plant the whole of the flower is reduced in size.

As regards the number of the styles, 38 of the flowers had three styles each, the remaining two flowers having four each.

Without entering into that *quæstio vexata*, the distinctness as a species of *Silene maritima* from *S. inflata*, I may mention that I think that one character on which stress is laid as a proof of their distinctness as species, namely, the scarious bracts in *S. inflata* and the herbaceous bracts in *S. maritima*, is not invariably constant, as I have found herbaceous bracts in *S. inflata*, and scarious bracts in *S. maritima*. Another character on which great reliance seems to be placed, is the presence or absence of a crown to the petals, but this also is subject to modification, as some plants of *S. maritima* have only the faintest trace of a crown, and some plants of *S. inflata* have their petals very nearly crowned,—in fact, they have more of a crown than have the above mentioned plants of *S. maritima*.

III. *Notes of a Botanical Excursion to the neighbourhood of Perth.* By Mr Sadler.

Mr Sadler gave an account of an excursion to Perth and its neighbourhood which he had made in company with Professor Balfour and about fifty botanical students on 2d July last. The places visited were the North Inch, banks of the Tay, the "Wooded Island," Bertha Woods, banks of the Almond, Pitcairnfield, and Methven Bog. Amongst the plants collected were the following:—

Thalictrum flexuosum.
Iberis amara.
Turritis glabra.
Silene maritima.
Stellaria nemorum.
Malva moschata.
Hypericum maculatum.
Geranium sylvaticum.
Genista anglica.
Alchemilla alpina.
Cicuta virosa.
Helosciadium inundatum.
Valeriana pyrenaica.
Dipsacus sylvestris.
Lactuca virosa.
Vaccinium Oxycoccus.
Menyanthes trifoliata.
Mimulus luteus.
Verbascum Thapsus.
Utricularia minor.
Armeria maritima.
Littorella lacustris.
Plantago maritima.
Anacharis Alsinastrum.
Habenaria chlorantha.
Narthecium ossifragum.
Scheuchzeria palustris.
Carex limosa.
Lastrea spinulosa.

Some of the party visited Scone and Kinnoul, and collected—

Hesperis matronalis.
Geranium Phæum.
Potentilla argentea.
hirta.
Rosa arvensis.
Linnæa borealis.
Moneses grandiflora.
Trientalis europæa.
Allium Scorodoprasum.
Ceterach officinarum.

IV. *On some Striped Stones from Hayle, near Penzance, Cornwall.* By C. W. Peach, F.R.P.S.

When in Cornwall last year, I examined a quarry at Hayle, which was worked for ballast for ships, and metal for the roads. A small strip of rock was left unquarried at the bottom. This attracted my attention; I ripped up a portion, and turned up a fine specimen, which caused me to say, "Had I got this in the carboniferous formation near

Edinburgh, I should unhesitatingly have pronounced it to be the impression of a Calamite." This specimen was a very good one, and I regret that I did not bring it with me—the more so, from being present, on my way home, at the Geological Society of London, when a paper on "The Eophyton Sandstone at Lugnas in Sweden" was read, and specimens from thence were exhibited. These specimens I was allowed to examine the next day, and in some of them I could trace a great similarity with those from Hayle. Soon after I got back to Edinburgh, I got the "Geological Magazine" for September 1869, in which is a paper "On the Fossils found in the Eophyton Sandstone at Lugnas, in Sweden." It is illustrated with three plates of the fossils, where in plate xi. figs. 3, 4, is a good figure of *Eophyton Linnæanum*, Y. Torell. I then became very anxious to have specimens from Hayle. Last week, through the kindness of Miss E. Carne, I received a small box of "striped stones" from that place, and of these I now show four or five specimens. They are not so good as the first I got. I am, however, obliged to the lady for so kindly attending to my wishes.

You will perceive that one has the appearance as if a branch sprang from it, and that it is striped in the same manner as the plate. The matrix is also a very fine-grained light-coloured sandstone, like that at Lugnas, and breaks in all directions, but is a bedded rock. As I had no time to examine carefully, I can only say that the beds are nearly horizontal, and are probably Silurian. At present no shells or other fossils have been found in them, unless these prove to be organic.

I refrain from farther remarks, being only desirous of showing the specimens to the members, so that in their holiday rambles, should they fall in with similar "striped stones," they may collect some and bring them to one of the meetings next winter for inspection.

If the Eophyton proves to be organic, it will be the earliest plant of very high type known.

V. *On the Guachamacan, a Poisonous Plant growing in the Llanos (Plains) of Venezuela.* By M. A. Ernst, Caracas.

Before entering on a botanical description of the *Guachamacan*, I beg leave to quote the following statements from a Venezuelan author,* which will be, I trust, sufficient reason for drawing the attention of the Botanical Society to this remarkable plant.

"It belongs to the extensive family of Apocyneæ or Dogbanes, whose poisonous qualities are known all over the world. So virulent is this poison, that meat roasted on spits made from the *Guachamacan*, absorbs sufficient poison to destroy all who partake of it. The lazy Indians make use of it to kill without trouble the cranes and herons on the borders of lagoons. For this they procure a number of sardines, besmear them with the juice of the plant, and spread them along the places frequented by those birds. The moment one of them seizes the fish, and before it is fairly swallowed, the bird drops dead; then the indolent hunter, issuing from his hiding-place, cuts off the parts affected by the poison, usually the head and neck, and feels no scruple in eating the remainder.

"A dreadful case of poisoning by means of this plant occurred once at Nutrias (a town in the Venezuelan State of Zamora, formerly province of Barinas), which created for a time great excitement even amidst that scattered population. A woman who lived with a man in the vicinity of that town, became jealous of the attentions he bestowed upon a charming neighbour of theirs, and determined to avenge herself, but in some manner that would not excite suspicions. In those remote regions, where coroners and chemists are unknown, it is impossible to detect murder, except where marks of external violence are visible. Accordingly, she prepared for her lover a bowl of *masato*, a favourite beverage of the country, made of Indian corn, boiled, mashed in water, and fermented; in this she soaked chips of the poisonous plant, and offered it to him with smiling grace. Delighted at the sight of the tempting

* Ramon Paez. "Wild Scenes in South America; or, Life in the Llanos of Venezuela." New York, 1862. Pp. 207, 208.

bowl, the unsuspecting lover invited several of his neighbours—among them the hated rival—to share it with him. The woman, not intending to destroy any but her perfidious lover, during his absence prepared another bowl, omitting this time the poison. Llanero politeness, however, obliged the host to mix his portion with the others, which, having done, he invited the company to dip their calabash cups into the bowl. Out of eleven persons there assembled, amongst them several children, not one escaped except the wicked perpetrator of this wholesale murder, nor even the donkeys and fowl of the household, as their attentive master had thrown them the remains of the deadly mixture.

"Such is the dread in which the *Llaneros* (inhabitants of the plains) hold this plant, that I was not even permitted to preserve the specimens of fruit and flowers I had collected, with the object of ascertaining the botanical characters of the species. They almost threatened to desert if I insisted upon carrying them among the baggage.

"The propagation of this plant throughout the Apure appears to be of recent origin, none of the oldest inhabitants recollecting to have met with it until within comparatively a short period."

Thus far Señor Ramon Paez.

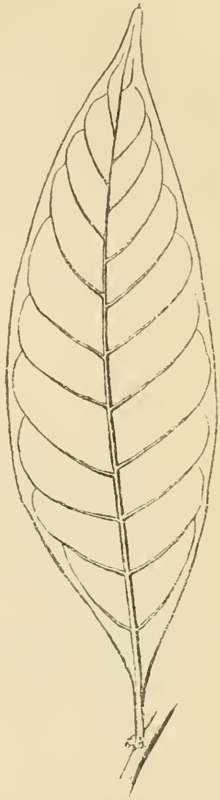
Many other cases of poisoning by *Guachamacan* are reported, which prove beyond any doubt that it must be an exceedingly poisonous, and, for the same reason, highly interesting plant. It is, however, not yet fully known to botanists, and not even mentioned in botanical works.

Humboldt does not speak of it. He mentions the name *Guaricamo*, which is said to be a synonym of *Guachamacan*, but refers it to *Patrisia affinis* (Nova gen. et spec. plant V., 357), a plant now placed among Bixineæ, and of which no poisonous properties are known. In his "Personal Narrative" (Bohn's Engl. edit. ii., 224) the *Guaricamo* is called *Ryania coccinea* (not *Hyania coccidea*, as printed in the quoted place), and a poisonous root is ascribed to it. This plant, however, did not attract the attention of the great traveller in such a degree as the true *Guachamacan* would undoubtedly have done; and it is altogether impossible that the *Guachamacan* should belong to *Ryania*, as it has *opposite* leaves. If Ramon Paez should be right in saying that the plant was formerly unknown in the Apure, Humboldt's silence with respect to it would be sufficiently explained.

The following incomplete description is partly translated from a Spanish work published by Dr Rénat de Grossourdy, under the title "El Médico botánico criollo" (Paris, 1864, 4 vols. vol. i. 295), partly drawn from a specimen branch *without* flowers, which Senhor Tosé Gregorio Villafane presented to the botanical collection of the Sociedad de Ciencias fisicas y naturales de Carácas. I hoped now to obtain flowers, fruits, and pieces of the stem. But as the present state of things in this country leaves but very little hope, communication being almost entirely interrupted, I think it best to give what I know; time may come that the sensible shortcomings will be completed.

Guachamaca toxicaria, R. de Gross., *loc. cit.* "*Rhizoma*(?) perpendiculare crassum, diametro interdum 6–pollicari, ligno albo levi, cortice tenui brunnea longitudinaliter striata, radiculas longas crassiusculas e parte inferiori emittens. *Caules* fruticosi numerosi recti subsimplices (8–12 ped. alt., 2–2½ poll. diam.), ramis oppositis ex axillis foliorum, cortice brunnea albo-punctata." *Folia* simplicia integra opposita breviter petiolata (petiolo semipollicari) ovato-lanceolata apice basique attenuata, mucronata, utrâque facie glaberrima, supra intense viridia, subter pallidiora, nervo venisque prominentibus, venis 11–13, inferioribus oppositis, superioribus alternis, limbus foliorum 5–6 poll. long., 2–2½ poll. lat. *Flores* luteo-virides axillares conferti longe pedunculati, pedunculo filiformi unifloro pollicari et ultra, glabro, apicem versus incrassato; *calyx* monosepalus 5–partitus lobulis margine membranaceis triangularibus acutis lineam longis; *corolla* hypocrateriformis calycem multoties superans, tubo basi ampliato pentagonali extus glabro intus pubescenti, limbo 5–partito, lobulis longis patentibus vel usque ad calycem reflexis margine undulatis, extus glabris, intus pilis longis albis instructis; *filamenta* fauce corollæ inserta; *antheræ* conniventes pubescentes; *ovarium* subsphæricum sulco verticali paullulum notatum, disco hypogynio; *stylus* albus filiformis longiusculus; *stigma* capitatum glandulosum, antheris adhærens. *Fructus ignotus.* Frutex orgyalis vel biorgyalis. Habitat in provinciis Apurensi et Barinensi Venezuelæ. *Guachamacan* incolarum."

The plant contains no milky juice. It appears, nevertheless, to belong to Apocyneæ, and there is apparently some affinity to Rauwolfia, Grossourdy mentioning a hypogynous disk. But his description of the floral parts is very deficient; he says nothing about the æstivation of the corolla, nor about the internal structure of the ovarium. I notice in the specimen before me at the base of the leaf stalks some small fragments of a dilacerated membrane, which perhaps united the two opposite petioles.



Leaf of Guachamacan, one-fourth the natural size. There is between the lateral veins a loose network of irregularly anastomosing veinlets.

The thick rhizoma and the numerous rather slender stems are perhaps no character of the species. In those regions the grass is every year set on fire, and the flames destroy nearly all the over-ground vegetation. The root remains fresh and alive, and new stems spring up from it.

I may add that the vulgar name of the plant has produced even a new verb, "*guachamacar*," *i.e.*, to poison by guachamacan.

I add a sketch of a leaf, taken from the above mentioned specimen, and shall be glad to forward specimens of this interesting plant as soon as I shall be fortunate enough to obtain any.

VI. *Results obtained from the Cutting and Transplanting of a plaited Horn-beam Hedge.* By Mr M'Nab, Curator, Royal Botanic Garden.*

The alterations recently carried on in the old Experimental Garden at Edinburgh, to adapt the ground for arboricultural purposes, necessitated the removal of a Horn-beam hedge. This hedge had been planted during the year 1824, in order to test the possibility of forming a Horn-beam fence as described in "Hunter's Evelyn," vol. i. p. 141, where it is stated:—"When a German husbandman erects a fence of Horn-beam, he throws up a parapet of earth, with a ditch on each side, and plants his sets (raised from layers) in such a manner as that every two plants may be brought to intersect each other, in the form of a St Andrew's cross. In that part where the two plants cross, he scrapes off the bark, and binds them closely together with straw. In consequence of this operation, the two plants consolidate in a sort of indissoluble knot, and push from thence horizontal slanting shoots, which form a living palisade or *chevaux des frise*, so that such a protection may be called a rural fortification. These hedges being pruned annually, and with discretion, will in a few years render the fence impenetrable in every part." Layers are recommended by Agricola in preference to seedlings, because the former are supposed not to grow so high, and to be more bushy.

The hedge alluded to in the Experimental Garden was originally planted on very sandy sloping ground, and for many years was a great source of attraction to visitors, being so united together that if shaken at one end the vibration was visible throughout its whole length. The sides were annually cut with the hedge shears, which gave it a trim and orderly appearance. The tops were also cut, with the exception of a few standards, left at regular distances, as shown in fig. 1. During the six years that the Society to whom the garden belonged was involved in pecuniary difficulties, the hedge was allowed to get into a wild condition. It received no pruning the year previous to its being broken

* The woodcuts to illustrate this paper have been kindly supplied by Mr Ravenscroft from "The Farmer." The original drawings were executed by Mr M'Nab.—Ed.

up for removal, when the roots were then partially cut on each side, and all the side branches pruned in, the tops alone being left untouched. The hedge had evidently been composed of seedlings, each seven or eight feet high, and planted two and two together. One plant of the pair had been made to slope to the right, and the other to the left, plaited at the same time, and afterwards tied at the top with a piece of strong cord, as evidenced by some peculiar swellings here and there observed. From the completeness of the union, the bark on each of the adhering sides of the stems must have been removed.

When the recent transplanting of the hedge was commenced, several large portions, varying in length from four

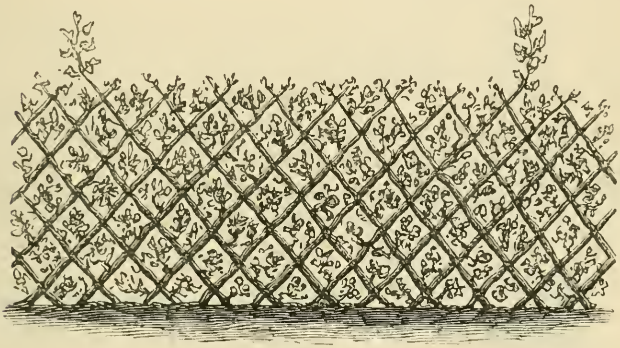


Fig. 1.

to eight feet, were sawn perpendicularly down at each end, so as to sever all the united stems, detaching roots from tops, and tops from roots. The soil was then dug out on each side, leaving large adherent balls of earth attached to the roots. These pieces of hedge were then laid over on a strong board, and carried to their destination, where they were gently slid off into the pits prepared for them. After the pits had been filled in with good soil, the plants were thoroughly watered, and frequent syringing was carried on during dry weather, till such time as the buds began to swell and burst. I then lifted a few flakes, and finding that the roots of some of the outside specimens had to be cut off, I was induced, in order to preserve an end root of each entire, to try some of the fantastic shapes shown in the following woodcuts.

Now that these fantastic portions have come into leaf for the second time, all thoroughly healthy, and with every appearance of continuing so, a few remarks regarding them may be interesting to those curious upon the subject of engrafting. Although the hedge was cut into forty different pieces, only two portions died. In every case of those now growing the union is most complete, as seen by the swellings at the various points of junction, and the larger and more complete the union, the greater was the liberty taken with that individual specimen. All the specimens were transplanted during the months of February, March, and April 1869.

The perpendicular-sided or square specimens which were first lifted, still show the original character of the hedge. To lift them all in this manner, it was found that a considerable waste of plants would be incurred. The preventing of this waste, as before stated, suggested the forms which many of them now present.

In fig. 2 the roots of six plants are united. The growing top is on its own root, although supplied indirectly by the roots of five other plants.

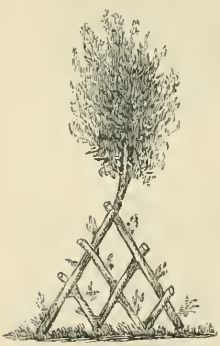


Fig. 2.

Fig. 3 forms a sort of living letter W. This example had the roots of three of the stems severed or cut off on each side; these now belong to one of the sides of fig. 2. Owing to the mass of adherent earth removed with this specimen, I felt convinced that the four lower or rooted portions might succeed, but could not be certain of the others; notwithstanding this uncertainty all are now in full leaf. The cut extremities of this, as well as of all the other specimens, after being severed with a saw, were smoothed over with a sharp knife, and afterwards covered with soft clay, which still remains on many of them.

Fig. 4 was also lifted with a chance of success, so far as the two principal limbs were concerned. On this specimen a third head was left, with a part of its stem projecting fifteen inches below the point of union; and, although

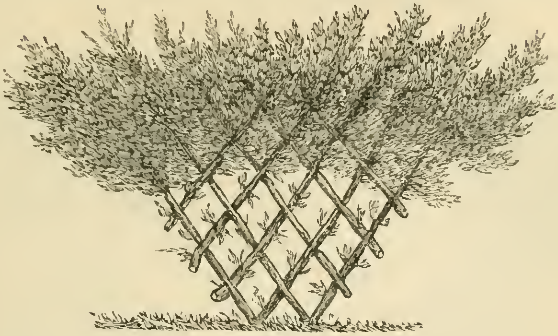


Fig. 3.

clayed over like the rest, it was not expected that it would live. To my surprise, this rootless portion put out last year new growths from the joints of some old side shoots, and these have been greatly augmented this year, the longest being now upwards of two feet. It is certainly one of the most remarkable of the whole.

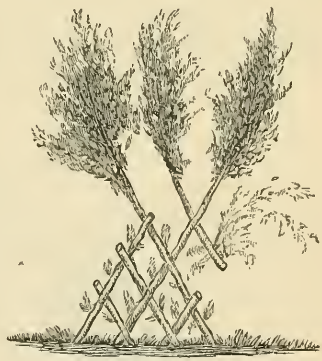


Fig. 4.

Many of the other specimens show similar growing points from the cut projections, but as they generally range from three to five inches the result is less extraordinary.

Figs. 5, 6, and 7, were the next specimens prepared. In fig. 5 two tops were left, each having strong stems, the root portions being cut off, receiving nourishment, more or less, from five roots. The tops of the three more direct feeders were taken off so as to throw the whole vigour of the roots into the two adopted leaders. The tops are equally healthy, and each has three attachments, two on one side and one on the other; and, although the lowest attachment is only on one side, the stem is equally healthy all round.

Fig. 6 has two growing tops left, and although solely supported by six rooted stems they are likewise doing well. In this example each of the growing portions has

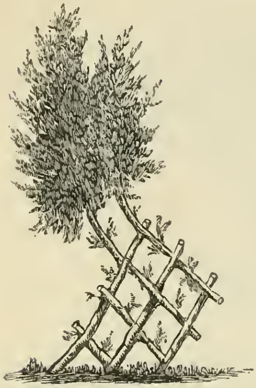


Fig. 5.

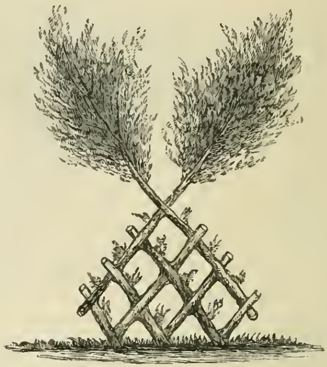


Fig. 6.

three attachments, two on one side and one on the other, besides being joined to each other at the top.

With fig. 7 this experiment was carried still further, the

Fig. 7.

Fig. 8.

top and stock being equally strong. Although the union is only on one side, it is sufficiently nourished by a single root.

This was a trying experiment, as the cut extremities were 8 or 9 inches in circumference, but, notwithstanding that the side portions were detached, the plant is perfectly healthy.

As the season advanced, and the results of the first experiments were satisfactory, as evidenced by the partial swelling of the leaf-buds, I was induced to try two other experiments of a more hazardous nature, and they also have been attended with success.

Fig. 8 has the main portion of the stem, which was originally in a sloping position, planted upright, having two cross portions left, each deprived of top and root. One of these portions is attached on each side. These cross portions continue to grow, and are supplied with sap, right and left, from the central stem, although only partially embedded on one side.

The last, and perhaps the most comical of the whole, were two specimens lifted and placed in such a position as to have the tops and roots exposed. One has four supports, and the other two, as in fig. 9. In this example, one portion

Fig. 9.

of the root, about three-quarters of an inch in diameter on the under side, was inserted in the soil, all the others being left exposed. The stem, between the root and the first upright, is covered with young growths, and the top is as healthy as any of the others. The tops of the leading supports were cut off so as to throw all the vigour into the horizontal stem.

It is curious to observe in some instances the effect of a weakly stem, when united to a strong one, as seen in fig. 10; the portion of the weakly stem below the junction frequently remains much in the same condition, while the part above the junction often flattens out to 4 or 5 inches in breadth, and not over $1\frac{1}{2}$ inch in thickness. It sometimes happens that one of the stronger stems, instead of enlarging up its own natural stem, takes an opposite direction, and leaves its own top weak. In fig. 10, it will be observed that the point A is the original top of root portion B, while the top C is the original top of the root portion D, having quite an opposite tendency from B A, while comparatively little difference is seen in F and E,—E being the top end. In this example the strength of B has run up through a portion of the stem of F E, and gone into the top of D C, thickening it up at the point G.

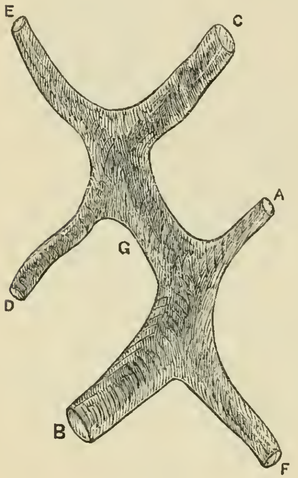


Fig. 10.

It is to be regretted that such hedges are not more generally used in this country, as they make such impenetrable fences. For railway embankments nothing could answer better, as they can be planted at once of full size, and could be made impenetrable to sheep immediately after planting.

Although the Horn-beam is the plant hitherto suggested and employed for this particular kind of hedge, many other species of plants could be profitably used, such as elms, hazel, ash, beech, laburnum, and willows; and now that the produce of the silk-worm is again becoming an article of commerce in England, hedges so constructed of mulberry plants would be found useful as a fence, beside yielding a very large amount of foliage for feeding purposes.

VII. *Miscellaneous Communications.*

1. A letter was read from M. De Candolle, in which he says:—"The drought has extended to Switzerland, and round Geneva particularly. We are suffering much. The

price of forage is enormous, and the cattle are sent twenty leagues from here to the mountains, so as to avoid being obliged to kill them. This is, of course, very expensive for the farmers. The glaciers are still sensibly diminishing. The glacier 'des Boissons' no longer supports, as formerly, the 'nevés' of Mont Blanc, and enormous crevasses have been made on the route to the summit. Notwithstanding this, an Englishman went to the summit a few days ago. You may perhaps be glad to hear that the seventeenth and last volume of the 'Prodromus' is in active preparation. I hope to be able to print it next winter."

2. Professor Balfour stated that plants of *Mandragora vernalis* were now fruiting in the Botanic garden, and that he had tried the juice of the fruit on the eye, and found it to dilate the pupil in a marked degree. The dilatation was as complete as that produced by belladonna, and its effects did not seem to continue so long. Professor Balfour also exhibited a plant of Dorema in full flower from the Botanic Garden. It had been sent by Mr Loftus from Persia under the name of *Dorema assafœtida*.

3. Principal Dawson, Montreal, presented specimens of the following fossil plants from the Lower Devonian strata:—*Dadoxylon ouangondianum*, St John's, New Brunswick, showing structure under the microscope, *Cordaites Robbii*, *Prototaxites Logani*, *Psilophyton princeps*, *P. princeps* var. *ornatum*, from Gaspé.

4. Mr Sadler reported, in accordance with instructions received at last meeting of the Society, that he and Mr Bell had examined the specimens of *Didymodon Jenneri* in the University Herbarium, and that they concurred with Mr Wilson in regarding that moss as not specifically distinct from *Cynodontium polycarpon*. Specimens were exhibited under the microscope.

5. Mr Robertson Munro exhibited flowers of a new hybrid passion-flower, produced between *Passiflora alata* and *P. macrocarpa*—*P. alata* being the fruit-bearing plant.

6. Dr Stewart, Chirnside, sent specimens of *Orchis pyramidalis* and *Linnæa borealis*, collected in that quarter.

7. Dr Macbean sent specimens of *Asplenium viride*, collected near Langholm, also leaves of common cabbage assuming a pitcher like form.

8. Mr Hoggan presented specimens of *Potentilla recta*, collected in a quarry near Dirleton. Mr Sadler stated that he had also met with this plant growing near Denny last year.

9. Mr F. S. Fraser presented a specimen of *Osmunda regalis* from Loch-na-Caillach, five miles S.W. of Lairg, Sutherlandshire.

10. Mr W. W. Evans presented specimens of *Luzula nivea* collected in Penicuik woods.

11. Mr M'Nab placed on the table a large collection of Alpine plants and ferns in pots, plants of a species of Malaxis, sent by Mr William Bell from the source of the Jumna, India; plants of *Arum cornutum,* with spathe and leafy spadix; also fruit of screw pine and spadix of *Arenga saccharifera*, which had been produced this season in the palm-house at the Botanic Garden.

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