TRANSACTIONS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON.

THE

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OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

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ERRATA.

Page 125, line 15, for "distal" read "discal"; l. 40, for *olivaceous* read *violaceous;* last line, for *Argiodes* read *Argiades*. P. 127, l. 14 and 20, for "Estcourt" read "Karkloof." P. 136, l. 18, for *Otaielia* read *Otacilla*.

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1850 Lowe, W. H., M.D., *Woodcote Lodge, Inner Park-road, Wimbledon Park*, S.W.

1893 Lower, Oswald B., *Bleak House, Park Side, Adelaide, South Australia.*

1850 † Lubbock, The Right Honble. Sir John, Bart., M.P., D.C.L., F.R.S., F.L.S., F.G.S., &c., *High Elms, Farnborough, Kent.*

1880 Lupton, Henry, *Lyndhurst, North Grange-rd., Headingley, Leeds.*

1887 M'Dougall, James Thomas, *Dunolly, Morden-road, Blackheath*, S.E.

1851 † M'Intosh, J.

1888 Mackinnon, P. W., *Lynndale, Mussoorie, N. W. P., India.*

1892 Mackonochie, The Rev. J. A., B.A. (Chaplain to the Earl of Home), *Douglas Castle, Lanarkshire;* and *The Hirsel, Coldstream.*

1858 McLachlan, Robert, F.R.S., F.L.S., F.Z.S., Treasurer, *Westview*, 23 *Clarendon-road, Lewisham*, S.E.

1887 Manders, Surgeon-Captain Neville, L.R.C.P., M.R.C.S., *Agincourt House, Yorktown, Surrey.*

1891 Manger, William T., 100 *Manor-road, Brockley*, S.E.

1892 Mansbridge, William, 3444 *Park Avenue, St. Louis, Mo., U.S.A.*

1865 Marshall, The Rev. Thos. Ansell, M.A., *Botusfleming Rectory, Hatt, Cornwall.*

1856 † Marshall, William, *Auchinraith, Bexley, Kent.*

1874 † Mason, Philip Brooke, M.R.C.S., F.L.S., *Trent House, Burton-on-Trent.*

1865 Mathew, Gervase F., R.N., F.L.S., F.Z.S., F.R.G.S., *Lee House, Dovercourt, Essex.*

1887 Matthews, Coryndon, *Erme Wood, Ivybridge, South Devon.*

1860 May, John William, K.N.L., *Blenheim House, Parson's Green-lane, Fulham*, S.W.

1872 † Meldola, Professor Raphael, F.R.S., F.R.A.S., F.C.S., 6 *Brunswick-square*, W.C.

1885 Melvill, James Cosmo, M.A., F.L.S., &c., *Kersal Cottage, Prestwich, Lancashire.*

1887 Merrifield, Frederic, 24 *Vernon-terrace, Brighton.*

1888 Meyer-Darcis, G., c/o Sogin & Meyer, *Wohlen, Switzerland.*

1880 Meyrick, Edward, B.A., F.Z.S., *Ramsbury, Hungerford, Berkshire.*

1883 Miles, W. H., *The New Club, Calcutta.*

1879 Monteiro, Senhor Antonio Augusto de Carvalho, c/o Messrs. Sampson, Low, Marston & Co., *St. Dunstan's House, Fetter-lane,* E.C.

1853 Moore, Frederic, D.Sc., A.L.S., F.Z.S., *Claremont House, Avenue-road, Croydon-road, Penge,* S.E.

1886 Morgan, A. C. F., F.L.S., *Villa Nova de Gaya, Oporto, Portugal.*

1889 † Morice, The Rev. F. D., M.A., Fellow of Queen's College, Oxford, 27 *Hillmorton-road, Rugby.*

1893 Morton, Kenneth J., *Glenview Cottage, Carluke, N.B.*

1889 Mosley, S. L., *Beaumont Park, Huddersfield.*

1869 † Müller, Albert, F.R.G.S.

1872 † Murray, Lieut.-Colonel H., 43 *Cromwell Houses, Cromwell-road,* S.W.

1886 Mutch, J. P., 359 *Hornsey-road,* N.

1886 Neave, B. W., 95 *Queen's-road, Brownswood Park,* N.

1889 Nevinson, Basil George, M.A., F.Z.S., 3 *Tedworth-square, Chelsea,* S.W.

1887 Newman, The Rev. W. J. H., M.A., *The Vicarage, Steeple Barton, Oxon.*

1878 Newman, Thomas P., 54 *Hatton Garden,* E.C.; and *Hazelhurst, Haslemere, Surrey.*

1890 Newstead, R., *The Museum, Chester.*

1882 Nicéville, Lionel de, F.L.S., C.M.Z.S., *Indian Museum;* and 13 *Kyd-street, Calcutta.*

1886 Nicholson, William E., *School Hill, Lewes, Sussex.*

1893 Nonfried, A. F., *Rakonitz, Bohemia.*

1886 Norris, Herbert E., 15 *Market Place, Cirencester.*

1878 Nottidge, Thomas, *Ashford, Kent.*

1869 Oberthür, Charles, *Rennes, France.*

1877 Oberthür, René, *Rennes, France.*

1893 † Ogle, Bertram S., *Steeple Acton, Oxfordshire.*

1883 Oldfield, George W., M.A., F.L.S., F.Z.S., 21 *Longridge-road, Earl's Court,* S.W.

1893 Oliver, John Baxter, 12 *Avenue-road, St. John's Wood,* N.W.

1873 Olivier, Ernest, *Ramillons, près Moulins (Allier), France.*

1886 Olliff, Arthur Sidney, *Government Entomologist, Department of Agriculture, Macquarie-street, Sydney, N. S. Wales.*

1878 Ormerod, Miss Eleanor A., F.R.Met.S., *Torrington House, Holywell Hill, St. Albans, Herts.*

1880 Ormerod, Miss Georgiana, *Torrington House, Holywell Hill, St. Albans, Herts.*

1893 Paulcke, Wilhelm, 33 *Langstrasse, Baden-Baden, Germany.*

1888 Pennington, F., jun., 7 *Park-place, St. James'*, S.W.

1883 Péringuey, Louis, *South African Museum, Cape Town, South Africa.*

1879 Perkins, Vincent Robt., *Wotton-under-Edge, Gloucestershire.*

1887 Phillips, Charles Edmund Stanley, *Castle House, Shooter's Hill, Kent.*

1891 Pierce, Frank Nelson, 7 *The Elms, Dingle, Liverpool.*

1885 Poll, J. R. H. Neerwort van de, *Heerengracht* 476, *Amsterdam.*

1870 † Porritt, Geo. T., F.L.S., *Greenfield House, Huddersfield.*

1884 † Poulton, Professor Edward B., M.A., F.R.S., F.L.S., F.G.S., F.Z.S., Vice-President, Hope Professor of Zoology in the University of Oxford, *Wykeham House, Banbury-road, Oxford.*

1851 Preston, The Rev. Thomas Arthur, M.A., F.L.S., *Thurcaston Rectory, Leicester.*

1878 Price, David, 48 *West-street, Horsham, Sussex.*

1893 Prout, Louis Beethoven, 12 *Greenwood-road, Dalston*, N.E.

1886 Ragonot, E. L. (Ex-President Ento. Soc. France), 12 *Quai de la Rapée, Paris.*

1882 † Ramsden, Hildebrand, M.A., F.L.S., 26 *Upper Bedford-place, Russell-square*, W.C.

1874 Reed, Edwyn C., C.M.Z.S., *Baños de Cauquenes, Chili.*

1893 Reid, Captain Savile G., late R.E., *Foyle House, Alton, Hants.*

1891 Reid, William, *Pitcaple, Aberdeenshire.*

1890 Rendlesham, The Right Honble. Lord, *Rendlesham Hall, Woodbridge, Suffolk.*

1891 Richardson, Nelson M., B.A., *Montevideo, near Weymouth, Dorset.*

1853 Ripon, The Most Honourable the Marquis of, K.G., D.C.L., F.R.S., F.L.S., &c., 9 *Chelsea Embankment*, S.W.

1889 Robinson, Arthur, B.A., 1 *Mitre Court Buildings, Temple*, E.C.

1892 Robinson, Sydney C., *Goldsmith's Hall*, E.C.

1869 † Robinson-Douglas, William Douglas, M.A., F.L.S., F.R.G.S., *Orchardton, Castle Douglas, N.B.*

1890 Robson, John Emmerson, *Hartlepool.*

1886 Rose, Arthur J., 6 *Gracechurch-street*, E.C.

1868 Rothney, George Alexander James, 15 *Versailles-road, Norwood*, S.E.

1888 Rothschild, The Honble. Walter de, F.Z.S., 148 *Piccadilly*, W.; and *Tring Park, Tring, Herts.*

1890 Routledge, G. B., 50 *Russell-square*, W.C.

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

1865 Rylands, Thos. Glazebrook, F.L.S., F.G.S., *Highfields, Thelwall, Warrington.*

1885 Sabel, Ernest, F.Z.S., F.R.G.S., *Lynton House, South Side, Clapham Common*, S.W.

1891 St. John, The Rev. John Seymour, B.A., 42 *Castlewood-road, Stamford Hill*, N.

1875 Sallé, Auguste, 13 *Rue Guy de la Brosse, Paris.*

1866 † Salvin, Osbert, M.A., F.R.S., F.L.S., V.P.Z.S., 10 *Chandos-street, Cavendish-sq.*, W.; and *Hawksfold, Fernhurst, Haslemere.*

1886 Salwey, Reginald E., 3 *Berkeley-place, The Ridgway, Wimbledon*, S.W.

1865 † Saunders, Edward, F.L.S., *St. Ann's, Mount Hermon, Woking, Surrey.*

1861 † Saunders, G. S., 20 *Dents-rd., Wandsworth Common*, S.W.

1886 Saunders, Prof. Wm., *Central Experimental Farm, Ottawa, Canada* (President of the Entomological Society of Ontario).

1881 Scollick, A. J., *Allandene, Dorset-road, Merton Park, Wimbledon*, S.W.

1886 Scudder, Samuel H., *Cambridge, Mass., U.S.A.*

1875 † Sealy, Alfred Forbes, *Cochin, South India.*

1864 Semper, George, care of *Bernhard Beer, Esq.*, 10 *Newgate-street*, E.C.

1862 Sharp, David, M.A., M.B., C.M., F.R.S., F.L.S., F.Z.S., *Hawthorndene, Hills-road, Cambridge;* and *University Museum of Zoology and Comparative Anatomy, Cambridge.*

1883 Shaw, A. Eland, M.R.C.S., *Aspley-road, Wandsworth*, S.W.

1883 † Shelley, Capt. George Ernest, F.G.S., F.Z.S., 13 *Rutland Gate*, W.

1887 Sich, Alfred, *Burlington Lane, Chiswick*, W.

1887 Sidgwick, A., M.A. (Fellow of Corpus Christi College, Oxford), 64 *Woodstock-road, Oxford.*

1877 Slater, John Wm., 36 *Wray-crescent, Tollington Park*, N.

1869 Smith, Henley Grose, F.Z.S., 5 *Bryanston-square, Hyde Park*, W.

1885 South, Richard, 12 *Abbey-gardens, St. John's Wood*, N.W.

* † Spence, William Blundell, *Florence, Italy.*

1889 Standen, Richard S., F.L.S., 67 *Earl's Court-square, South Kensington*, W.

1890 Stearns, A. E., *New Mills Cottage, Henley-on-Thames.*

1892 Steuart, Douglas Stuart, *North Leigh, Prestwich, Lancashire.*

1862 Stevens, John S., 7 *Ravenna-road, Putney*, S.W.

1837 Stevens, Samuel, F.L.S., *Loanda, Beulah Hill, Upper Norwood*, S.E.

1891 Still, Major John Nathaniel, 12 *Seafield-terrace, Seaton, Devon;* and *Junior United Service Club, Charles-street, St. James'*, S.W.

1889 Straton, C. R., F.R.C.S., *West Lodge, Wilton, Wilts.*

1886 Surrage, J. Lyddon, B.A., 82 *Mornington-road, Regent's Park*, N.W.

1882 Swanzy, Francis, *Stanley House, Granville-road, Sevenoaks.*

1884 Swinhoe, Colonel Charles, M.A., F.L.S., F.Z.S., Vice-President, *Avenue House, Cowley-road, Oxford.*

1893 Swinhoe, Ernest, *Avenue House, Cowley-road, Oxford.*

1876 Swinton, A. H., *Flora Villa, Montreux, Switzerland.*

1893 Taylor, Charles B., *Rae-street, Rae Town, Kingston Jamaica.*

1886 Theobald, F. V., B.A., *Chestnut Grove, Kingston-on-Thames.*

1889 Thornewill, The Rev. C. F., M.A., *The Vicarage, Bakewell, Derbyshire.*

1892 Thornley, The Rev. A., M.A., *South Leverton Vicarage, Lincoln.*

1893 Townsend, Professor C. H. Tyler, *The Institute of Jamaica, Kingston, Jamaica.*

1859 † Trimen, Roland, F.R.S., F.L.S. (Curator of South African Museum), *Cape Town, Cape Colony.*

1891 Tuffnell, Carleton, *Greenlands, Border-crescent, Sydenham*, S.E.

1893 Turner, Henry Jerome, 13 *Drakefell-road, St. Catherine's Park, Hatcham*, S.E.

1886 Tutt, J. W., *Rayleigh Villa, Westcombe Park, Blackheath*, S.E.

1893 Urich, F. W., *Trinidad, British West Indies.*

1866 Verrall, George Henry, *Sussex Lodge, Newmarket.*

1889 Vivian, H. W., *Glenafon, Taibach, South Wales;* and *Trinity College, Cambridge.*

1876 Wakefield, Charles Marcus, F.L.S., *Belmont, Uxbridge.*

1886 Walker, Alfred O., F.L.S., *Nant Glyn, Colwyn Bay, Denbighshire.*

1870 Walker, The Rev. Francis Augustus, D.D., F.L.S., *Dun Mallard, Cricklewood,* N.W.

1878 Walker, James J., R.N., F.L.S., 23 *Ranelagh-road, Marine Town, Sheerness.*

1863 † Wallace, Alfred Russel, D.C.L., Oxon., F.R.S., F.L.S., F.Z.S., *Corfe View, Parkstone, Dorset.*

1889 Walley, The Rev. John, *Manor House, Moddeshall, near Stone, Staffordshire.*

1866 † Walsingham, The Right Hon. Lord, M.A., LL.D., F.R.S., F.L.S., F.Z.S., Vice-President, High Steward of the University of Cambridge, *Merton Hall, Thetford, Norfolk.*

1886 Warren, Wm., M.A., c/o The Honble. Walter Rothschild, *Tring Park, Tring, Bucks.*

1869 Waterhouse, Charles O., *Ingleside, Avenue Gardens, Acton,* W.; and *British Museum, Cromwell-road,* S.W.

1891 † Watson, Capt. E. Y., F.Z.S., Indian Staff Corps, care of Messrs. King & Co., 45 *Pall Mall,* S.W.

1893 Webb, John Cooper, 32 *Henslowe-road, Dulwich,* S.E.

1845 Weir, John Jenner, F.L.S., F.Z.S., *Chirbury, Beckenham, Kent.*

1876 † Western, E. Young, 36 *Lancaster Gate, Hyde Park,* W.

1882 Weymer, Gustav, *Sadowa-strasse* 21 *a, Elberfeld, Rhenish Prussia.*

1886 Wheeler, Francis D., M.A., LL.D., *Paragon House School, Norwich.*

1868 † White, F. Buchanan, M.D., F.L.S., *Annat Lodge, Perth, N.B.*

1865 White, The Rev. W. Farren, M.A., *Stonehouse Vicarage, Gloucestershire.*

1884 White, William, *The Ruskin Museum, Meersbrook Park, Sheffield.*

1882 Williams, W. J., *Zoological Society, Hanover-square,* W.

1881 Wood, The Rev. Theodore, 23 *Broderick-road, Upper Tooting,* S.W.

1891 Wroughton, R. C., Conservator of Forests, *S. C. Belgaum, Bombay Presidency, India.*

1888 Yerbury, Colonel J. W., R.A., *Army and Navy Club, Pall Mall,* S.W.

1892 Yondale, William Henry, F.R.M.S., 52 *Main-street, Cockermouth, Cumberland.*

1886 Young, Morris, *Free Museum, Paisley, N.B.*

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During the Year 1893.

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Bromilow (F.). Butterflies of the Riviera. 2nd ed. Nice, 1893. *The Author.*

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Candeze (E.). Elatérides recueillis par M. Modigliani dans l'île d'Engano en 1891. [Ann. Mus. Civ. Genova, 1892.]

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Note on three North Indian Butterflies — *Euthalia nara*, *E. sahadeva*, and *E. anyte*. [Proc. Asiatic Soc. Bengal, 1892.]
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The Life-history of certain Moths of the Family *Cochliopodidæ*, with notes on their Spines and Tubercles. [Proc. Am. Phil. Soc., 1893.]
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Attempt at a new classification of the Bombycine Moths.
Notes on the Notodontian genus *Ichthyura*. [Entom. News, 1893.] *The Author.*

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Peckham (Geo. W.) and (Elizth.). Ant-like Spiders of the Family *Attidæ*. [Occ. Papers, Nat. Hist. Soc. Wisconsin. Vol. II., 1893.] *The Authors.*

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28. The more destructive Locusts of America north of Mexico. By L. Bruner.
29. Report on the Boll Worm of Cotton. By F. W. Mally.
30. Reports of Observations and Experiments in the Practical Work of the Division. Dept. of Agric.

Walker (J. J.). Entomological Notes from the Eastern Archipelago. [Ent. Monthly Mag., 1893.] *The Author.*

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———— & Alcock (A.). Natural History Notes, 'Investigator' Survey. Ser. 2, No. 1. Calcutta, 1892. *The Authors.*

N.B.—In addition to the above, a large number of pamphlets, which are enumerated in the Supplement to the Society's Library Catalogue, 1893, have been presented by Lord Walsingham, Dr. Sharp, and Messrs. Brongniart, Candèze, Champion, Distant, Hamilton Druce, Herbert Druce, Gahan, McLachlan, Moore, J. J. Walker, and Waterhouse.

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ARGENTINE REPUBLIC.

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EUROPE.

AUSTRO-HUNGARY.

BRÜNN. Naturforschender Verein in Brünn. Verhandlungen. Band XXX. *By Exchange.*

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THE

TRANSACTIONS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR 1893.

I. *A revision of the genus* Ypthima, *with especial reference to the characters afforded by the male genitalia.* By HENRY J. ELWES, F.L.S., F.Z.S., President of the Entomological Society, &c., and JAMES EDWARDS, F.E.S.

[Read November 2nd, 1892.]

PLATES I., II., & III.

THE genus *Ypthima* has been for many years a stumbling-block to lepidopterists, on account of the difficulty of separating certain of the species by any outward characters, of the great variation in the seasonal forms, and the impossibility of satisfactorily determining several of the species described by the older authors. When, therefore, I attempted, with Mr. Edwards' help, to arrange the large number of specimens in my collection, and he suggested that an examination of the male genitalia might furnish characters of as great value in separating them as I had previously found those derived from the form of the pouch in the genus *Parnassius* to be, I welcomed his proposal to make a careful study of them; and, though in some cases the species we have recognised must remain doubtful for the present, and we do not consider our arrangement as more than pro-

visional, yet we hope that this paper will be of some assistance to others in determining the species of this difficult genus.

It should be stated that Elwes is solely responsible for the remarks on geographical distribution and habitat, as well as all statements appearing in the first person singular; whilst Edwards is responsible for the grouping, tabulation, and description of the species, and the whole of the dissections and drawings.

In preparing this paper we have carefully studied the rich collections of Messrs. Godman and Salvin, Mr. J. H. Leech, and the British Museum, as well as Elwes' collection, which contains a good series of almost all the Eastern species. We have to thank these gentlemen, as well as Herr P. C. T. Snellen, of Rotterdam, and Mr. de Nicéville, of Calcutta, for the loan of many doubtful specimens for examination. Mr. Moore has kindly furnished the names of some species which were in course of description in his work, and we are thus enabled to avoid the creation of synonyms.

The main feature of this attempt to deal with these insects is the employment of the structural characters afforded by the male genitalia. If we except the work of Messrs. Godman and Salvin, no large amount of practical use has hitherto been made of these characters in this country, and therefore a few remarks on the general subject may not be out of place. Connected as these accessory organs of generation are with the function of reproduction, their importance in the economy of the organism will be readily conceded, and experience proves that they present great stability of form in the different groups which we are accustomed to regard as species; whilst it is an open question whether they are not of more importance as indications of natural affinity than characters derived from colour or markings, even when the latter are very decided. At the same time, the use made of these characters must be rational, mere differences of degree are of no more account here than elsewhere, and if trivial individual differences are taken as conferring specific rank, such a course can lead to nothing but disappointment and disgust on the part of those who have to work from our descriptions. Taxonomically considered, the real value of the study of the primary sexual characters consists in the removal of individual

judgment as a factor in doubtful cases, and the final appeal which it affords in cases of difference. There is no universal test character, however, and as with all others, so sexual characters sometimes fail. It not unfrequently happens that several species have so nearly the same form of structure that there is no sufficient difference to have specific value in doubtful cases (e.g., *Y. sakra*, *Dohertyi*, and *persimilis*); in other cases, however, no two species are alike, and the widest variation within generic limits allows definite specific limitation. A few remarks on the means adopted for the utilisation of these characters will serve to show that there is no reason why their study in the Lepidoptera should not be extended. All that is really necessary in the way of manipulation is to separate the parts and gum them in suitable positions on pieces of card, which may be pinned in the cabinet by the side of the insect. This is best accomplished by first removing the apex of the abdomen entire, an operation which, if neatly performed, detracts but little from the appearance of the specimen. The parts to be preserved are, first, the *tegumen*, a more or less saddle-shaped piece, which terminates the abdomen above; this should be fixed on the card by its proximal edge, as this position greatly facilitates the examination of its inner side, which is sometimes armed with large hooks, as in many *Lycænidæ*; second, the two *clasps* which form the lower boundary of the anal aperture—as these are symmetrical paired organs, it is better to fix one of them on the card with its convex side uppermost, and the other in the reverse position; third, the *œdeagus*, a single chitinous piece occupying a subcentral position in the anal aperture, and having muscular attachments to both the tegumen and the clasps; the form of the free portion of this organ sometimes furnishes a distinctive character when the others fail. As we are dealing with the subject from the systematic point of view and not that of the anatomist, the preservation of the other parts is merely a matter of taste. The method of mounting here advocated has the advantage that any number of specimens may be compared under a variety of aspects, and a similar aspect secured in each case. Those entomologists who work with the microscope will probably prefer to mount the genitalia as transparencies, either as ordinary microscopic slides, or according to the

excellent method devised by Mr. Salvin, who by means of a combination of cardboard and cover-glass produces a cell for balsam-mounting which possesses all the advantages of the ordinary cell, and moreover may be pinned in the cabinet; the chief points in the latter method are the rendering of the cardboard impervious to the mounting fluid by soaking it in a solution of white shellac,* and the provision of a channel by which air-bubbles may be got rid of, and the mounting fluid augmented, if perchance any should happen to be absorbed by the cardboard. These transparent preparations are undoubtedly better and more scientific than the products of the rough-and-ready plan before described, which has been adopted in preparing the material for this paper, since they illustrate the arrangement and ultimate structure of the parts to perfection; but they only admit of examination in one aspect, that at right angles to the plane of the cover-glass, and every one has not the time and ability necessary for their preparation; therefore, so far as the mere question of identifying species is concerned, some persons may give the preference to the dry-mounted separate parts.

A word as to the figures which accompany this paper. They are all more or less diagrammatic, being simply intended to convey to the mind an idea of the contour of the object under a given aspect; all the shaded figures are drawn to the same scale, correct proportion having been secured by the use of the camera lucida, and the amount of amplification never exceeds that which may be obtained with a good hand-lens. Figures of this kind seem more likely to answer the purpose than more complex representations of the parts *in situ* from specimens mounted as transparent objects for the microscope, whether these are produced by camera drawings or photography; we have excellent examples of the former in Plate II. of our 'Transactions' for last year, and of the latter in 'Iris,' vol. i., plate xi.

The species of this genus are of a prevailing brown colour, with a large subapical ocellus on the fore wing, which reaches its greatest development on the under surface, and is obsolescent or wanting on the upper surface of the males of certain species, and from one to

* Gold size answers equally well.—J. E.

six ocelli near the margin of the hind wings above; the under side is, in the majority of the species, whitish or yellowish grey, with a number of close short irregular curved transverse brown striolæ, and the hind wing bears from one to seven ocelli near the margin. This peculiar marking of the under side is, as far as we know, with one exception (*Callerebia hyagriva*, M.), confined to the genus as here limited. The first subcostal nervule in the fore wing is emitted before, at, or beyond the end of the cell; but the second subcostal nervule is never emitted before that point; the middle disco-cellular is generally arcuate, not elbowed, and the tegumen is nearly always elongate, triangular, and simple. In writing of this genus it appears customary to transcribe Westwood's definition (Gen. Diurn. Lep., 394) *in extenso*, but this, as is too frequently the case, substitutes long details of structure for precise words of limitation. The only point of any value upon which writers on this group are agreed, is the circumstance that in no case is more than the first subcostal nervule emitted before the end of the cell; if we add to this the general facies, and the simple uncus, this combination of characters enables us to limit with precision a fairly natural group of reasonable extent; and, having regard to the fact that the difficulty of limiting genera increases in proportion to the natural affinity *inter se* of the species to be classified, this is all that can fairly be expected.

This course, however, leaves to be accounted for two insects which have at one time or another found a place in the genus under consideration, namely, *narasingha*, Moore, and *hyagriva*, Moore. The latter possesses so many of the characters of *Callerebia*, that it is perhaps best placed in that genus as a matter of convenience, notwithstanding that its facies is, if we except the broadly-rounded fore wings, Ypthimoid. The former would fall well into *Callerebia*, if it were not that the first subcostal nervule only is emitted before the end of the cell; and in this connection it should be mentioned that out of two males and four females examined we found one male in which both the first and second subcostal nervules are emitted before the end of the cell, a feature which would, in conjunction with the elbowed middle disco-cellulars, the tridentate uncus, and the general facies, make this specimen at least a *Callerebia*. The

fact seems to be that *megalomma*, Butl., and *narasingha*, M., form a passage from *Ypthima* to *Callerebia*, and that *hyagriva*, M., and *nareda*, Koll., form a similar passage from *Callerebia* to *Ypthima;* but it will be more convenient to place them both in *Callerebia* pending the discovery of other insects which shall resemble them respectively more nearly than they do any other species, in which case *narasingha* and *hyagriva* may well be taken as types of new genera.

A very useful character for distinguishing between closely allied species is found in the presence or absence of an opaque space of greater or less extent on the disk of the fore wing in the male, and arising in the immediate neighbourhood of the median nerve. The taxonomic value of this "sex-mark" has apparently been somewhat misunderstood, possibly because Marshall and de Nicéville, who make great use of it, describe it as a "broad patch of more densely packed scales on the upper side of the fore wing along both sides of the median nervure, with a somewhat silky appearance"; this would almost lead one to suppose that when present it is something always observable in the aspect of the insect above, which is by no means the case. Doubtless the opacity above mentioned is due to more densely packed scales, but the nature and extent of the character can only be seen on holding the insect up against a strong light; judged of from its aspect above, the character is very variable, being conspicuous enough in some specimens of *Marshalli*, Butl., while in the same aspect of *Dohertyi*, Moore, it might well be pronounced absent, although really present and well defined.

It will be observed that considerable use has been made of the number of the ocelli on the *under side* of the hind wing as a distinctive character,* and up to a certain point their number and arrangement is very constant. These ocelli may be treated as forming a submarginal series, which is variously interrupted in all the species except *fasciata*, Hew., and *itonia*, Hew., where the seven ocelli form a continuous row; the number of the ocelli near the apex of the hind wing beneath (one,

* It must be remembered that the ocelli are liable to become partially or wholly obsolete in the dry-season forms of several species which occur in India, but it is almost always possible to see the position which the ocelli would occupy if present.

two, or three) gives us well-defined minor groups which are easy of recognition, and the total number of the ocelli is generally constant in the normal specimens of the same species, but the tendency to subdivision of the anal ocellus must not be overlooked. The actual number of ocelli on the upper side of the hind wing proves too liable to vary to be of any value as a specific character, but their numerical tendency may sometimes be used with advantage.

The diversity observable in the clasps of forms outwardly nearly alike has almost certainly been brought about by natural selection; the possession of a given colour or pattern was probably conducive to the preservation of the individual, and consequently something very nearly approaching community of exterior was gradually acquired; whilst the clasp, being merely concerned in the reproductive function, and not at all calculated to endanger the safety of its possessor by attracting its enemies or retarding its escape from them, remained unaltered. The species of the *Motschulskyi* group are cases in point, for some of them are really only to be determined with certainty after an examination of the male genitalia. It is clear that species which it is almost impossible to define with accuracy by means of external characters may frequently be separated with ease by certain characteristic peculiarities in the male genitalia, the persistence of which may be proved by direct experiment; it follows, therefore, with regard to future descriptions of closely allied species in this genus, that one of two things must happen,—either the statement of diagnostic characters must include an account of the male genitalia, or the characters derivable from this source must be ignored, with the result that the number of insufficient descriptions will be increased indefinitely, to the great detriment of scientific progress in this particular direction. At the same time, although there can be but little doubt that the use of these characters will ultimately be greatly extended, there undoubtedly exist two grave objections to their general adoption; in the first place, their use entails the exercise of a certain amount of patience, combined with some manual dexterity; and in the next, there must necessarily be "mutilation" of specimens (*types* even occasionally) by the removal of the extreme apex of the

abdomen in one or more examples. On the whole, the application of the "genitalia test" to these insects goes to show that the species are more numerous, and, in themselves, less liable to vary than has been generally supposed; the latter circumstance, indeed, was to be expected, if one considers how much easier it is to ascribe variability to a known species than to investigate the affinities of a possible new one.

It is a fact within the experience of Edwards, based upon nearly twenty years' continuous observation of the characters afforded by the male genitalia in the Homopterous Hemiptera, as well as insects of other orders, and supported by the experience in the same direction of Dr. Sharp and Mr. Champion in the Coleoptera, Mr. McLachlan in the Trichoptera, &c., and Messrs. Godman and Salvin in the Lepidoptera, that any well-marked peculiarity of form in these organs generally proves to be constant in all the individuals which we are not otherwise precluded from considering as belonging to the same species. Under these circumstances we have in this paper described and illustrated certain insects which we were perfectly able to define, although we had not, in some cases, more than a single example before us. It has been suggested that we ought not to describe and name insects until we were in possession of substantial information as to their range, time of appearance, habits, &c.; but it was not explained how these statistics were to be collected whilst the objects of them remained without names.

Throughout this paper the term "ocelli" without modification is to be taken as referring to those of the under side of the hind wing; and it is essential that the Tables of Species be used in conjunction with the detailed descriptions and collateral matter.

Group I.

Small feeble species; sex-mark in ♂ absent or but little developed (well marked in *indecora*). Ocelli variable, sometimes punctiform, rarely altogether absent.

Table of Species.

1 (24). Upper side of hind wing without an orange band.

2 (23). More than one ocellus.

3 (20). One subapical ocellus.

4 (19). Subapical ocellus in first subcostal interspace.

5	(18).	More than two ocelli.	
6	(13).	Four ocelli (or, by gemination of the anal one, five).	
7	(12).	Upper side of hind wing brown.	
8	(9).	Upper side paler, with dark submarginal and marginal lines	1. *Hübneri.*
9	(8).	Upper side darker; no dark submarginal or marginal lines.	
10	(11).	Clasp as in fig. 6	2. *Kasmira.*
11	(10).	Clasp as in fig. 7	*egregia.*
12	(7).	Upper side of hind wing in part white ..	3. *ceylonica.*
13	(6).	Three ocelli (or, by gemination of the anal one, four).	
14	(15).	Subapical ocellus nearly as large as the one on the fore wing	4. *ariaspa.*
15	(14).	Subapical ocellus small or punctiform.	
16	(17).	Clasp as in figs. 4, 44 *b*	5. *asterope.*
17	(16).	Clasp as in figs. 44, 44 *a*	6. *granulosa.*
18	(5).	Two ocelli (or, if three, anal one very minute, unipupillate)	7. *simplicia.*
19	(4).	Subapical ocellus in second subcostal interspace; ocelli punctiform	8. *inica.*
20	(3).	Two subapical ocelli.	
21	(22).	Ocelli punctiform or rarely absent; sex-mark distinct	9. *indecora.*
22	(21).	Ocelli well defined, uppermost of the subapical pair very small in proportion to the one next to it	10. *baldus.*
23	(2).	One ocellus only, in the first median interspace, or ocelli entirely wanting	11. *arctous.*
24	(1).	Upper side of hind wing with a broad post-median orange band abbreviated at each end	12. *aphnius.*

1. *Ypthima Hübneri.* (Pl. I., fig. 5).

Ypthima philomela, Hübn. (nec Linn.), Zutr. Ex. Schmett., figs. 83, 84 (1818); Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 284.

Y. Hübneri, Kirby, Syn. Cat. Diurn. Lep., p. 95; Dist., Rhop. Mal., p. 57, pl. vii., fig. 5, ♀; Marsh. & de Nicé., Butt. Ind., i., p. 226, pl. xvii., fig. 65, ♂.

Y. howra, Moore, Journ. As. Soc. Beng., 1884, p. 17; Waterhouse, Aid, ii., pl. 179, fig. 4, ♂.

Y. apicalis, Moore, *l. c.*, p. 17; Waterhouse, *l. c.*, fig. 2, ♂.

Y. catharina, Butler, Ann. & Mag. N. H. (5), xviii., p. 183 (sec. spec. typ.).

Seasonal dimorphism is strongly exhibited in this species in the great variation in size of the ocelli on the under surface of the hind wing; there is also no constancy in the relative size or number of the ocelli on the upper side of the hind wing. In a ♂ example lent to us by Messrs. Godman and Salvin, from Darjeeling, ex. coll. Lidderdale, the under side of the hind wing is whitish grey, practically devoid of striolation, with a pale yellow-brown irregular transverse line just beyond the middle; the ocelli in this specimen are mere black points. It is, of course, merely an extreme form, but is noteworthy on account of the entire disappearance of the normal striolation.

Hab. Plains of Bengal (*Knyvett, de Nicéville*), Assam (*Doherty*), Khasias (*Elwes*), Cachar (*Wood-Mason*), Arnamalai Hills (*Davison*), Malabar (*Marshall*), Akyab (*Adamson*), Shan States (*Manders*).

2. *Ypthima Kasmira.* (Pl. I., fig. 6).

Ypthima Kasmira, Moore, Journ. As. Soc. Beng., 1884, p. 17; Waterhouse, Aid, ii., pl. 179, fig. 5, ♀.

We should not have ventured to separate this from *Hübneri* by the slight external characters, which consist solely, as far as we know, in the slightly darker colour and absence of a submarginal dark line on the fore wing above. The form of the clasp is, however, constantly different.

The distribution is peculiar, as, though found in several parts of the North-west Himalayas, I have specimens from Mysore and the Arnamalai Hills which agree with *Kasmira* rather than *Hübneri* in all these points. Probably it will be found to occur in intermediate localities.

Hab. Mandi, 4500 ft. (*G. Young*); Chumba (*Marshall*); Kujiar, 6000 ft., April, 1889 (*McArthur*); Rajaori, 4000 ft., Sept., 1887 (*Leech*); Mysore, Arnamalai Hills, S. India (*Davison*).

A single specimen in my collection from Sikkim differs in the clasp, which is figured No. 7 on Pl. I. under the provisional name of *egregia*, which, if other specimens should be found agreeing with it, may prove to be a distinct species.

3. *Ypthima ceylonica.* (Pl. I., fig. 8).

Ypthima ceylonica, Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 288, pl. xviii., figs. 14, 15 (1864); Moore, Lep. Cey., p. 25, pl. xii., figs. 5 ♂, 5*a* ♀; Marsh. & de Nicé., Butt. Ind., i., p. 288; Taylor, Butt. Khorda in Orissa, p. 3, Calcutta, 1888.

It has been suggested by Taylor that this is merely a local form of *Hübneri*, but the form of the clasps entirely negatives any such assumption.

Hab. Ceylon, low country (*Elwes, Mackwood*); Nilgiris (*Davison, Hampson*); Ganjam (*Minchin*); Sumatra (*Sachs, in coll. Godman & Salvin*); Khorda, Orissa (*Taylor*).

4. *Ypthima ariaspa.*

Ypthima ariaspa, Moore, P. Z. S., 1874, p. 568; Marsh. & de Nicé., Butt. Ind., i., 224.

Y. rara, Butler, P. Z. S., 1883, p. 145, pl. xxiv., fig. 1 (sec. spec. typ.).

Y. dædalea, Swinh., P. Z. S., 1886, p. 423 (sec. spec. typ.).

Allied to *nareda*, Koll., but smaller (expanse 1·1 to 1·4 inches); under side whitish, finely, evenly, and moderately closely striolate, with no coalescence of the striolation to form markings in the shape of bands or clouds on either wing. The male, according to Marshall and de Nicéville, has no sex-mark.

We have hitherto seen but one ♀ example of this species, but we entertain no doubt of its distinctness. The under side is well figured (as *Y. rara*, Butl.), P. Z. S., 1883, pl. xxiv., fig. 1.

A ♂, taken by Mr. Godman at Indore, India, has the subapical ocellus scarcely larger than that in the first median interspace, but is otherwise typical.

Hab. Fyzabad, Oudh; Bholahât, Maldah; Mhow (*Swinhoe*); Rajputana (*Elwes*).

5. *Ypthima asterope.* (Pl. I., fig. 4; Pl. III., fig. 44*b*).

Hipparchia asterope, Klug, Symb. Phys., pl. xxix., figs. 11—14 (1832).

Ypthima asterope, Hewitson, *l. c.*, p. 283; Marsh. & de Nicé., Butt. Ind., i., p. 224.

Y. mahratta, Moore, Journ. As. Soc. Beng., liii., p. 16; Waterhouse, Aid, ii., pl. 179, fig. 1.
Y. alemola, Swinhoe, P.Z.S., 1885, p. 127.
Y. complexina, ibid., *l. c.*, 1886, p. 423, pl. xl., fig. 2 ♀.

On the under side of the fore wing the ocellar space is open to the costa, but otherwise limited by a dark line, and the striolation coalesces near the posterior angle to form a brown cloud of greater or less extent. The species may always be distinguished in the ♂ sex by the comparatively short twisted clasp.

This species appears to have a very wide range, from S. Africa (*Trimen*) to Abyssinia and Arabia, and from thence through the drier and arid regions of Western, North-western, and Central India to the extreme South, whence I have a specimen which is typical. The ocelli both in Syria and India are sometimes either nearly or entirely obsolete.

We are unable to separate African, Arabian, and Indian specimens.

Hab. Beyrout, Antioch, Syria (*Zach*); Poona, Mhow, W. India (*Swinhoe*); Kujiar, 6000 ft., April, 1889 (*McArthur*); Chumba, N.W. Himalayas, Tinnevelly, S. India (*Marshall*); Cashmere (*Hewitson collection*); Aden (*Yerbury*); Somali coast (*B. M.*); Anseba, Abyssinia (*Jesse*); Nubia; China, coll. Kaden (*in coll. Godman & Salvin*).

6. *Ypthima granulosa*. (Pl. III., figs. 44, 44*a*).

Ypthima granulosa, Butler, Ann. & Mag. N. H. (5), xii., p. 101 (1883).

Resembles the preceding so closely that any description of its appearance is needless. It is, however, abundantly distinct in the structure of the clasp; the apex of this organ, when viewed from the side, appears rounded, and the serrulation is continued towards the base for a little distance on one side. In the same aspect of the clasp of *Y. asterope*, amongst other features, its apex is seen to be subtruncate, and the serrulate plate is strictly apical.

The specimen to which the above remarks apply is from Zanzibar, in coll. Godman & Salvin. Butler's *Y. granulosa* was from Victoria Nyanza, and seems to be the same species; it has therefore been thought well

to adopt his name for our insect, for the reasons detailed in treating of *Y. multistriata*, p. 18, *post*.

7. *Ypthima simplicia.* (Pl. III., fig. 54).

Ypthima simplicia, Butler, Ann. & Mag. N. H. (4), xviii., p. 481 (1876).

♂. Scarcely distinguishable on the upper side from *asterope*, Klug. Under side pale grey, closely and finely striolate after the manner of that species. Fore wing with one large bipupilled ocellus; ocellar space bounded, except on the costa, by a brown line. Hind wing with two well-developed ocelli, one, a little the larger, in the first subcostal interspace, and one in the first median interspace; in some examples there is also a minute unipupillate ocellus near the anal angle. Sex-mark wanting. Clasp narrow and elongate, gradually widened to the subtruncate apex, which bears a serrulate accessory plate.

The type is in the British Museum, but this description is taken from Abyssinian specimens.

Hab. Abyssinia (*in coll. Godman & Salvin*), Wadelai (*Emin Pasha*), Victoria Nyanza.

8. *Ypthima inica.* (Pl. I., fig. 9).

Ypthima inica, Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 284, pl. xvii., fig. 5 (1864); Marsh. & de Nicé., Butt. Ind. i., p. 225.

Y. alkibie, Swinhoe, P.Z.S., 1886, p. 422.

This species bears considerable resemblance to *indecora* on the under side, but the space between the two discal bands on the hind wing has occasionally a decided buff tint; it is, however, a smaller insect, and the form of the clasp is, so far as we know, unique in the genus.

Hab. Bholahat, Bengal (*Irvine*); Mhow (*Swinhoe*); Wynaad (*Davison*).

9. *Ypthima indecora.* (Pl. I., figs. 10, 14).

Ypthima indecora, Moore, P. Z. S., 1882, p. 238, pl. xii., fig. 7; Marsh. & de Nicé., Butt. Ind., i., 218.

The great breadth of the œdeagus of this species in proportion to its length will always distinguish the male from that of *Marshalli*. The colour and pattern of the under side, moreover, is characteristic, although the species has certainly the facies of a depauperate *Mar-*

shalli, when viewed from above, and the resemblance extends even to the possession of a sex-mark.

Its clasp and œdeagus are somewhat like those of *baldus*, but the presence of a distinct sex-mark and obsolete ocellation of the under side separate it clearly from that species. The range of this species, as far as known, is very limited.

Hab. Kulu, 3600 ft., March, April (*G. Young*); Kangra (*Hocking*).

10. *Ypthima baldus*. (Pl. I., figs. 15, 16).

Papilio baldus, Fabricius, Syst. Ent., App., p. 809 (1775); Donovan, Ins. Ind., pl. xxxvi., fig. 2 (*Hipparchia*).

? P. philomela, Johanssen, Amæn. Acad., vi., p. 404 (1767), *cf.* p. 26 *post*.

Ypthima tabella, Marsh. & de Nicé., Butt. Ind., i., p. 234.

The only figure of the *P. baldus* of Fabricius is that of Donovan, above cited; and, as it is a fair representation of our insect (which has been known as *tabella*, and of which Javanese specimens were sent by Snellen as *Hübneri*, Kirby), we have adopted the Fabrician name. Westwood, in his edition of Donovan's Ins. Ind., p. 53 (1842), puts *Papilio lysandra*, Cr. (pl. 293, figs. G, H) as a synonym of *baldus*, Fab., and there are some old specimens of our insect in the Godman & Salvin collection, one of which bears the name "*Lifander*, Cr." on a manuscript label evidently of the Fabrician period. The statement of Marshall & de Nicéville that this species appears at first sight to be only a dwarf specimen of *Y. sakra*, seems to us very misleading.

Hab. India (*Donovan*); Nilgiri Hills, 3500 ft. (*Hampson*); Wynaad (*Marshall*); Java (*Snellen*); Padang, Sumatra (*Sachs*).

11. *Ypthima arctous*. (Pl. III., fig. 49).

Papilio arctous, Fabricius; Godart, Enc. Meth., p. 552 (1823).

Ypthima arctous, Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 283.

♂. Upper side brown, a single well-defined ocellus on each wing, that on the fore wing bipupilled. Sex-mark wanting. Under side yellowish grey, closely and finely striolate, the striolation

coalescing to form a pale brown cloud near the posterior angle of the fore wing; ocellus of the fore wing as on the upper side; one small well-defined unipupillate ocellus on the hind wing in the first median interspace. Expanse, 34 mm.

Hab. Sydney (*Macleay*); Queensland (*in coll. Godman & Salvin*); Aru, Port Denison (*fide Hewitson*).

Specimens from Port Moresby, New Guinea (*Goldie*), in coll. Godman & Salvin, only differ in their smaller size, and in sometimes wanting the ocellus on the hind wing both above and below; this ocellus shows a tendency to disappear in a specimen from Queensland. The shape of the apex of the clasp bears some resemblance to that of *Hübneri*.

12. *Ypthima aphnius.*

Satyrus aphnius, Godart, Enc. Méth., p. 551 (1823).
Ypthima aphnius, Hewitson, *l. c.*, p. 292, pl. xvii., figs. 8, 9.

Easily recognisable by the character given in the foregoing table.

Hab. Timor (*Wallace*), Isle of France (*fide Hewitson*).

Group II.

Species of moderate or large size, having three ocelli (or, by gemination of the anal one, four); one in the first subcostal interspace, one in the first median interspace, and one near the anal angle.

Table of Species.

1 (26). Subapical ocellus usually much the largest.
2 (17). ♂ with a sex-mark.
3 (16). The pale ground colour of the under side of the hind wing greyish white.
4 (11). Ocellus on upper side of fore wing obsolescent or absent.
5 (10). Clasp widened at the apex.
6 (9). Apical expansion of clasp various, but not resembling a bird's head.
7 (8). Accessory serrulate plate of clasp apical .. 13. *Motschulskyi.*
8 (7). Accessory serrulate plate of clasp lateral .. 14. *imitans*, n. s.
9 (6). Apical expansion of clasp resembling a bird's head .. .. 15. *obscura*, n. s.
10 (5). Clasp not perceptibly widened at the apex, which is subtruncate, and armed with about five short teeth .. .. 16. *multistriata.*
11 (4). Ocellus on upper side of fore wing large and well defined.

12 (13). Expanse exceeding 50 mm. .. .. .. 17. *prænubila.*
13 (12). Expanse much less than 50 mm.
14 (15). Ocellar space on under side of fore wing undefined .. .. 18. *sordida*, n. s.
15 (14). Ocellar space on under side of fore wing well defined .. .. 19. *perfecta.*
16 (3). The pale ground colour of under side of hind wing ochreous .. .. 20. *lycus.*
17 (2). Sex-mark wanting.
18 (19). Ocellar space on under side of fore wing limited by a dark line, except on the costa 21. *pupillaris.*
19 (18). The inner boundary of the ocellar space on under side of fore wing wanting.
20 (21). Clasp short and wide, its apex produced inwardly into a strong simple spine .. 22. *nareda.*
21 (20). Apex of clasp not produced into a spine.
22 (25). Clasp elongate, distinctly modified at the apex.
23 (24). Apex of clasp bearing a transversely oblong serrulate plate .. .. *fusca.*
24 (23). Apex of clasp produced inwardly into a lobe bearing a few (about five) teeth, and a little below this another simple lobe .. .. 23. *chinensis.*
25 (22). Clasp narrow and elongate, its apex apparently simple, but really flattened and minutely serrulate .. .. 24. *newara.*
26 (1). Subapical ocellus never larger than that in the first median interspace, frequently smaller.
26 (27). Under side of hind wing whitish on the disk, owing to the sparsity of the striolation .. 25. *pandocus.*
27 (26). Under side of hind wing well covered with striolation.
28 (29). ♂ with a sex-mark .. .. 26. *loryma.*
29 (28). Sex-mark wanting.
30 (31). Inner edge of the ocellar space on upper side of fore wing scarcely darker than the ground colour .. .. 27. *impura*, n. s.
31 (30). Ocellar space on upper side of fore wing bounded inwardly by a strong suffused dark band .. .. 28. *doleta.*

13. *Ypthima Motschulskyi.* (Pl. II., fig. 34).

Satyrus Motschulskyi, Bremer, Beitr. zur Fauna Nordl. China's, p. 8, n. 26 (1853); Ménétries, Enum. Corp. Anim., pl. vi., fig. 5 (1855).

Ypthima amphithea, Ménétries, in Schrenk's Amur. Lande, p. 41, pl. iii., fig. 10; Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 289; Stgr. in Rom. Mem., vi., 203.

The insect which we have taken to represent this name agrees in every respect with the figure of Ménétries above cited, except that the latter does not show the dark velutinous patch on the disk of the fore wing.

It would be a mere waste of time to attempt to trace the full synonymy of this species, as we can only separate it with certainty from its allies by the form of the clasp; but we have treated *amphithea*, Mén., as a synonym in deference to Staudinger's opinion, as expressed in Rom. Mem., vi., p. 203.

Hab. Nagasaki, Japan; Fusan, Korea (*Leech*); Kiukiang (*Pratt*); Shanghai (*Pryer*).

14. *Ypthima imitans*, n. s. (Pl. III., fig. 53).

♂. Upper side brown; fore wing with a dark velutinous shade on the disk, coincident with the sex-mark; hind wing with an irregular dark submarginal line, one large ocellus in the first median interspace, and a minute geminate one near the anal angle. Under side greyish white; fore wing with the pale ocellar space subtriangular, well defined, reaching the inner margin, and bounded inwardly by an oblique transverse brown band, which gradually widens to the inner margin; the dark submarginal line which forms its outer boundary scarcely so well defined; ocellus bipupilled, well defined; hind wing with the striolation becoming suddenly sparser on the distal half, which is therefore whiter than the rest of the wing; an irregular submarginal line attenuate at each end; ocelli 3, subequal in size, one subapical, one in the first median interspace, and one anal, the latter bipupilled. Expanse, 46 mm.

Hab. Hainan. Described from a single example in coll. Godman & Salvin.

15. *Ypthima obscura*, n. s. (Pl. II., fig. 35).

♂. Upper side fuliginous brown, with pale grey fringes, ocellus of the fore wing barely indicated, one well-defined subanal ocellus on the hind wing, the dark velutinous patch on the fore wing indistinct. Under side greyish white, the striolation moderately close and fine, the latter on the distal half of the fore wing coalescing to form a brown cloud arising in the posterior angle and limiting the subcircular ocellar space; striolation of the hind wing closer in the basal two-thirds, and coalescing to form a submarginal band, which widens irregularly inwardly between the subapical ocellus and the one below it; ocelli 3, as in *Motschulskyi*, &c.

♀. Upper side somewhat paler than the ♂; the ocellus of the fore wing large and well defined. Under side similar to the ♂, but the only brown markings beyond the striolation are the faint brown bands, which limit the subtriangular ocellar space. Expanse, ♂ 45 mm., ♀ 44 mm.

There are several specimens of this species in Mr. Leech's collection from Korea under the name of *Motschulskyi*. This species may always be recognised by the peculiar shape of the apex of the clasp.

Hab. Gensan, Korea, July, 1886 (*Leech*). Type in coll. Elwes.

16. *Ypthima multistriata.* (Pl. II., fig. 36).

Ypthima multistriata, Butler, Ann. & Mag. N. H. (5), xii., p. 50 (1883).

The male of this species may be separated from *Motschulskyi* by the entire absence of the ocellus from the upper side of the fore wing, and the presence of a minute ocellus near the anal angle of the hind wing above, which is wanting in all our males of true *Motschulskyi*; it resembles our *Y. imitans* on the upper side, but is distinguished from all its allies by the form of the clasp.

Hab. Ichang (*Pratt*).

In outward appearance our insect closely resembles *Y. multistriata*, Butl., from Formosa, and the only means of proving their distinctness or the reverse lies in a comparison of the ♂ genitalia; as this comparison is not in the least degree likely to take place between the type of *multistriata* and our insect, we have provisionally adopted Butler's name rather than make a synonym.

17. *Ypthima prænubila.* (Pl. III., fig. 47).

Ypthima prænubila, Leech, 'Entomologist,' xxiv., Suppl., p. 66 (Sept., 1891); Butt. China, &c., p. 87, pl. x., fig. 8, ♂.

Distinguished from its immediate allies by its large size (56—64 mm.); it differs from *Y. sordida* in having two ill-defined dark bands limiting the ocellar space on the under side of the fore wing, and it wants the irregular pale band found on the under side of the hind wing in *perfecta;* in the structure of the clasp it somewhat approaches *Y. multistriata*, a species which, so far as we

know, does not develop the ocellus on the upper side of the fore wing in the ♂.

Hab. Ta-chien-lu, Chia-kou-ho, Moupin, Omei-shan, Wa-shan, Kiukiang (*Leech*).

18. *Ypthima sordida*, n. s. (Pl. III., fig. 52).

♂. Upper side brown; fore wing with an ill-defined dark velutinous shade on the disk coincident with the sex-mark, and a well-defined bipupilled subapical ocellus; hind wing with a well-defined unipupillate ocellus in the first median interspace. Under side whitish grey; fore wing with the striolation very close, and in parts coalescent, so that the surface has a brown appearance; ocellus as on the upper side, ocellar space absolutely undefined; hind wing with the striolation somewhat irregular, coarser, and sparser, so that the surface has a somewhat hoary appearance; ocelli three, one subapical, as large as that on the fore wing, one about half as large in the first median interspace, and a bipupilled one of similar size to the last near the anal angle. Expanse, 46 mm.

Hab. Kiukiang, June, 1887 (*Pratt*). Described from a single example in coll. Elwes.

19. *Ypthima perfecta*. (Pl. II., fig. 37).

Ypthima Motschulskyi, var. *perfecta*, Leech, Butt. China, &c., p. 88, pl. x., fig. 7, ♂ (1892).

This is distinguished from its allies by the well-defined, straight-sided ocellar space on the under side of the fore wing, which is open both to the costa and the inner margin, and the irregular pale band on the under side of the hind wing, but most certainly by the different form of the clasp.

This species occurs in Central and Western China at 5—10,000 ft. (*fide* Pratt).

Hab. Kiukiang, Huang-muchang, Wa-shan, Hankow (*Pratt*).

20. *Ypthima lycus*. (Pl. II., fig. 39).

Ypthima lycus, de Nicéville, Jour. Bomb. Nat. Hist. Soc., iv., No. 3, 1889, p. 165, pl. A, fig. 2, ♂.

Y. Motschulskyi, Marsh. & de Nicé., Butt. Ind., i., p. 214

Smaller than *Motschulskyi* (expanse, 1·5 to 1·6 in.). Fore wings narrower and more pointed, the velutinous shade scarcely visible above; ground colour of under

side yellow, exceedingly closely and finely striolate, so that the entire surface has a yellow-brown appearance. A very good and distinct species.

Hab. Khasi Hills (*Johnson*).

21. *Ypthima pupillaris.*

Ypthima pupillaris, Butler, P. Z. S., 1888, p. 59.

♂. Size and upper side of *Y. nareda*, Koll. Under side pale brown, closely and finely striolate; ocellar space of fore wing rounded-triangular, limited by a dark line, except on the costa; ocelli three, one subapical, one in the first median interspace, and one anal; all three rather small, and placed in a right line from the costa to the anal angle.

Hab. Central Africa (*Emin Pasha*).

The ♀ specimen associated with the type of this species in the B. M. collection might easily be passed over as a pale example of *Y. nareda*, Koll.

22. *Ypthima nareda.* (Pl. I., fig. 2; Pl. II., fig. 40).

Satyrus nareda, Kollar, in Hügel's Kaschmir, iv., pt. ii., p. 451, n. 12 (1844).

Ypthima nareda, Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 284, pl. xvii., fig. 6; Marsh. & de Nicé., Butt. Ind., i., p. 221, pl. xvii., fig. 63, ♂.

The only superficial character of any value in separating this species from *newara*, M., is that pointed out by Marshall & de Nicéville in their table of species, *l. c.*, p. 220, namely, the widening on the inner margin of the submarginal brown band on the upper side of the fore wing. This seems to be a persistent character where males are compared; in the female the pale speckled portion near the apex of the fore wing scarcely extends inwards beyond the ocellus. The form of the clasps, and also of the *tegumen*, is very characteristic. Doherty (Jour. As. Soc. Beng., lv., pt. 2, No. 2, 1886, p. 119) says of this species:—"The uncus (*tegumen*) is not exactly lobed, but flattened out horizontally like a tile, appearing from above very broad and square cut." He evidently overlooked the linear spiniform apical portion.

Hab. Mandi, 4500 ft. (*G. Young*); Simla, Theog, Mashobra (*Marshall*); Kangra (*Hocking*); Kujiar,

6000 ft., April, 1889 (*McArthur*); Kulu Valley, Sept. (*McArthur*). All in the N.W. Himalaya.

The very different form of the clasp alone enables me to concur with Edwards in treating this as distinct from *newara*, but its distribution seems almost confined to the N.W. Himalayas. The localities given are taken from specimens in my own collection.

A specimen from Margharita, Upper Assam, has the clasp as shown in Pl. II., fig. 41, different from either *nareda* or *newara*, and may be a distinct species, in which case it will bear the name of *fusca;* but I do not feel justified at present in separating a single specimen on an anatomical character alone.

The specimen in question may be distinguished from *nareda* on the upper side by the submarginal brown band of the fore wing, which does not expand towards the inner margin, and on the under side by the whiter ground colour and coarser striolation, the straight even submarginal brown band of the fore wing, and the distinct indication of a whitish post-median band on the hind wing.

23. *Ypthima chinensis.* (Pl. II., fig. 43).

Ypthima newara, var. *chinensis*, Leech, Butt. China, p. 89, pl. x., fig. 5 (1892).

Somewhat larger than *newara*, M., from which it may be distinguished on the upper side by the paler colour of the outer area of both wings in the ♂. The under side is whitish grey, without any markings beyond the ordinary striolation, which exhibits a tendency to coalesce and form a brown cloud about the inner margin of the fore wing. The constancy of the form of the clasps has been tested in four cases.

Hab. Kiukiang, Chang-yang, Central China (*Pratt*).

24. *Ypthima newara.* (Pl. II., fig. 42).

Ypthima newara, Moore, P.Z.S., 1874, p. 567; Marsh. & de Nicé., Butt. Ind., i., pp. 220, 222; Waterhouse, Aid, ii., pl. 179, fig 7.

Y. nareda, Hewitson, *l. c.*, pl. xvii., fig. 7.

As a rule this species is larger than *nareda*, Koll., with coarser striolation on the under side; the sub-

marginal brown band on the upper side of the fore wing is not widened towards the inner margin in either sex, and in the female the pale speckled portion near the apex of the fore wing extends well inwards beyond the ocellus.

Hab. Sikkim, Bhutan, 4—5000 ft. (*Elwes*) ; Khasia, 4—5000 ft. (*Elwes*) ; Assam, Naga Hills (*Doherty*) ; Bernardmyo, Burmah (*Doherty*) ; Aracan (*Adamson*) ; Mandi, N.W. Himalaya, 3—5000 ft. (*Young*) ; Kangra (*Hocking*).

25. *Ypthima pandocus.* (Pl. II., fig. 38).

Ypthima pandocus, Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 290, pl. xviii., fig. 12 (1864).
Y. corticaria, Butler, Trans. Linn. Soc. Lond., 2nd ser., vol. i., Zool., p. 537 (1876) ; Distant, Rhop. Mal., pp. 55 and 419, pl. vi., fig. 8.
Y. sempera, Felder, Wien. Ent. Mon., vii., p. 125 ; Semper, Schmett. Philipp. Ins., i., p. 49, pl. x., fig. 1, ♂ under side, fig. 2, ♀ upper side.
Y. loryma, Hew., pars., *l. c.*, p. 289, pl. xviii., fig. 16 (1864) ; Stgr., Ex. Tagf., pl. lxxxiii.
Y. kalelonda, Westwood, Trans. Ent. Soc. Lond., 1888, p. 475, pl. xii., fig. 4.

This species presents a considerable amount of local variation, but all its forms agree in possessing a very elongate twisted clasp, with a simple spiniform apex ; and it may always be recognised amongst the species of moderate or large size by the white ground colour of the under side of the hind wing, which is sparsely and very irregularly striolate, and bears three ocelli, of which the subapical one never exceeds in size the one in the first median interspace. The smallest examples are those from the Philippines and Palawan ; ours, from Java and Pulo Laut, are larger, but the largest are those from Celebes ; the latter have the fore wing rather narrower and more pointed, and are the *Y. loryma* of some writers, and of Hewitson's fig. 16.

Hab. Java (*Piepers*) ; Perak (*Doherty*) ; Nias Island (*Mogdiliani*) ; Pulo Laut (*Doherty*) ; Philippines (*Semper*) ; Palawan (*Platen*) ; Borneo (*coll. Hewitson*) ; Malacca, 2000 ft. (*coll. Hewitson*) ; Labuan (*Low, coll. Godman & Salvin*).

26. *Ypthima loryma.* (Pl. III.; fig. 50).

Ypthima loryma, Hewitson, *l. c.*, p. 289, pl. xviii., fig. 17 (nec 16), 1864.

Y. celebensis, Rothschild, Iris, v., p. 433, pl. v., fig. 3 ♂, 4 ♀.

♂. Upper side dark chocolate-brown; fore wing with a dark velutinous shade occupying the disk, and a dark submarginal line, which is parallel with the hind margin throughout; sex-mark very large and distinct, nearly coincident with the dark shade; hind wing with the ocellar space paler than the disk, not sharply limited inwardly, and bounded outwardly by an irregular dark submarginal band; one well-defined subanal ocellus. Under side greyish white, with a faint vinous tinge, the striolation chocolate-brown, on the hind wing forming a series of very irregular band-like blotches, and an irregular submarginal line, on the fore wing forming an oblique post-median band and a submarginal line, the two latter limiting the subtriangular ocellar space; ocelli three, one subapical, one in the first median interspace, and one anal.

Hab. Celebes (*in coll. Hewitson, Godman & Salvin, and B. M.*). In the form of the clasp this species is closely allied to *pandocus*, Moore, but it is distinguishable by the small sharp tooth near the apex.

Hewitson's fig. 16, and Staudinger's figure of *Y. loryma* on pl. lxxxiii. of his Exot. Tagf., merely represent a large dark variety of *pandocus*, Moore.

27. *Ypthima impura*, n. s. (Pl. III., fig. 48).

♂. Much resembling the same sex of *Y. doleta*, Kirby, in the aspect of the under side, but readily separable by the pattern of the upper surface. Upper side brown, both wings with a narrow dark submarginal band, and a double marginal dark line; fore wing with the ocellar space suboval, well defined, especially outwardly; ocellus bipupilled; sex-mark wanting; hind wing with one unipupillate ocellus in the first median interspace, and sometimes one or two minute supplementary ones near it; ocellar space not defined. Under side brownish grey, closely and somewhat unevenly striolate; ocellus of fore wing as on the upper side, the dark lines limiting the ocellar space widened at their junction near the posterior angle; hind wing with three ocelli, one in the first subcostal interspace, one in the first median interspace (frequently without a pupil), and a geminate one near the anal angle. Expanse, 37—40 mm.

Hab. Angola (*Monteiro*); Gaboon; Zambesi (*Brown*); in coll. Godman & Salvin; Delagoa Bay (*in coll. Hewitson*). Type in coll. Godman & Salvin.

This species may be separated at a glance from *Y. doleta* by the difference in the upper side of the fore wing; in the former the ground colour is even in tint from the base to the ocellar area, the inner limit of which is scarcely darker than the ground colour; in the latter the inner limit of the ocellar area is defined by a narrow irregular band as dark as that which limits it beyond the ocellus.

The clasp of this species resembles that of *pandocus* in its elongate and twisted form, but it is gradually widened to its subtruncate apex; in ultimate structure the clasp has a small oblong serrulate plate on one side just below the apex, and the edge of the latter is serrulate.

28. *Ypthima doleta*. (Pl. III., fig. 51).

Ypthima doleta, Kirby, Proc. Roy. Dubl. Soc. (2), ii., p. 336 (1880).

♂. Upper side pale brown, with a somewhat mottled appearance, owing to the thin texture of the wings allowing the striolation of the under side to be faintly seen; fore wing with one large bipupilled ocellus, the suboval pale ocellar space as well defined before the ocellus as beyond it, the dark line limiting it on all sides except the costa widened towards the posterior angle; hind wing with one ocellus in the first median interspace, and two (or three) minute supplementary ones near it; ocellar space limited inwardly by a narrow irregular dark brown band, and outwardly by a dark submarginal line, which is attenuate towards each end; the subapical ocellus proper to the under side is sometimes visible on the upper surface. Under side exactly similar to that of *impura*, save that there is on the hind wings an indication of a narrow irregular brown post-median band, which coincides with the dark brown band which forms the inner limit of the ocellar space on the upper surface. Expanse, 37—40 mm.

Hab. Sierra Leone (*Foxcroft*); Angola (*Rogers*); Cameroons. In coll. Godman & Salvin; also four in coll. Hewitson.

The clasp in this species is altogether unlike that of *impura*, which is otherwise its nearest ally.

Group III.

Species of moderate or small size; ocelli 6 in 3 pairs in échelon, variable in size, frequently minute, rarely absent. Fore wing of ♂ always ocellate above.

Table of Species.

1 (10).	Sex-mark distinct, or, if indistinct or absent, clasps subequally bilobed.	
2 (7).	Under side of hind wing with striolation variable, but always evenly distributed.	
3 (6).	Ground colour of under side of both wings practically concolorous.	
4 (5).	Post-median dark band on under side of fore wing more or less oblique, inclining from the base to the apex of the wings as it passes from the costa to the inner margin ..	29. *Marshalli.*
5 (4).	Post-median dark band on under side of fore wing practically straight, its inclination (if any) near the inner margin being rather towards the base than the apex	30. *stellera.*
6 (3).	Ground colour of under side of hind wing whitish grey, producing a hoary appearance, with a single broad irregular yellow-brown median band	31. *zodia.*
7 (2).	Under side of hind wing greyish white; striolation very sparse and irregular.	
8 (9).	Ocellus of fore wing vertical. Under side of fore wing with the inner edge of the post-median dark line nearly vertical. Clasp without any upright lobe on its inner face near the apex	32. *Horsfieldii.*
9 (8).	Ocellus of fore wing oblique. Under side of fore wing with the post-median dark line oblique, joining the inner margin at a point directly below the centre of the ocellus. Clasp with an upright lamellar lobe on its inner face, just below the apex	33. *leuce.*
10 (1).	Sex-mark absent.	
11 (12).	Apex of clasp bluntly bilobed	34. *sobrina*, n. s.
12 (11).	Apex of clasp simple.	
13 (14).	Under side paler; ocelli small; hind margin of fore wing very faintly concave in the middle	35. *similis*, n. s.
14 (13).	Under side darker (as dark as *fasciata*); ocelli large; hind margin of fore wing even ..	36. *affectata*, n. s.

29. *Ypthima Marshalli.* (Pl. I., fig. 1, 1a, 11).

Ypthima Marshalli, Butler, Ann. & Mag. N. H. (5), ix., p. 373, 1882 (sec. spec. typ.).

Y. baldus, Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 286 (♂).
Y. philomela, Marsh. & de Nicé., Butt. Ind., i., p. 216; Leech, Butt. China, &c., p 90; de Nicé., Jour. As. Soc. Beng., lv., p. 232; sec. spec. comm.
Y. evanescens, Butler, *t. c.* (5), vii., p. 134 (1881).
Y. methora, Distant, Rhop. Mal., p. 56 (♂ nec ♀), Pl. vi., fig. 9.
Y. Newboldi, ibid., Ann. & Mag. N. H. (5), ix., p. 396; Rhop. Mal., p. 57, Pl. iv., fig. 6, ♀.

It is evident, from Hewitson's supplementary remarks, that he had more than one species under consideration; but his description of the ♂ contains all the salient diagnostic characters of this species (except the possession of a sex-mark), and if he had used any other name than *baldus*, Fab., it must have been adopted. The name *philomela*, Johanssen, or *philomelus*, Linné, must be dropped altogether, as it is impossible now to determine what insect was intended, although the probability seems to be that it was the *baldus* of this paper, which is very common in Java, from whence *philomela* was described.

De Nicéville's investigation of the seasonal dimorphism of this species proves conclusively that the dry-season form has the ocelli on the under side of the hind wing very much smaller than in the wet-season form; it is also well to note that the distinctness of the dark bands on the under side is in direct proportion to the reduction in size of the ocelli; and it must be borne in mind that Butler's description of *Y. Marshalli* applies only to the dry-season form. Distant's description of *methora* fits the ♂ of this insect well, but his figure is not characteristic. The specimens of *Y. Newboldii* in the British Museum are all *Y. Marshalli*, wet-season form, the type being a ♀ in which the uppermost of the subapical pair of ocelli is accidentally wanting.

Hab. Sikkim, 1—5000 ft., Bhotan, Khasias (*Elwes*); Assam (*Doherty*); Bombay (*Elwes*); Bengal (*Minchin*); Akyab (*Adamson*); Mysore, Nilgiris (*Davison*); Perak (*Doherty*); Foochow (*Leech*).

30. *Ypthima stellera*. (Pl. III., fig. 45).

Hipparchia stellera, Eschscholtz, Kotzebue Reise, iii., p. 216, Pl. x., fig. 24, a, b, ♀ (1821).

Ypthima stellera, Hewitson, *l. c.*, p. 285; Semper, Schmett. Philip., i., p. 48; Staudinger, Exot., Tagf., p. 231, Pl. lxxxiii.

? *Y. sepyra*, ibid., *l.* c., p. 292, Pl. xvii., fig. 10 (?).

Smaller than average specimens of *Marshalli*, from which it may be distinguished by the white or whitish ground colour of the under side, and the fact that the post-median brown band on the under side of the fore wing is practically vertical, its inclination near the inner margin being rather towards the base than the apex; in *Marshalli* this band is always more or less oblique, inclining from the base to the apex of the wing as it passes from the costa to the inner margin; Staudinger's figure is not characteristic in this respect. The brown bands on the under side are all more sharply defined than in *Marshalli*. Sex-mark distinct. Viewed a little obliquely, with the concavity uppermost, the clasp of *stellera* appears to have each apical angle produced into a broad, sharp, triangular tooth; in the same aspect of the clasp of *Marshalli* each apical angle appears to be produced into a subequal bluntly rounded lobe, the clasp thus bearing a rough resemblance to a letter Y.

A ♂ from the Philippines is abnormally small, only expanding 28 mm., and wants the sex-mark; the latter circumstance may be due to abrasion, but more probably it is the result of feeble organisation.

Y. sepyra, Hew., from Gilolo Batchian (*Wallace*), may possibly prove distinct; the three examples in the Hewitson collection are distinguishable from wet-season *Marshalli* and *stellera* by the very broad orange iris of the ocelli, which coalesces in the case of each pair, as in Hewitson's figure. The insect seems to us, however, to be more nearly allied to *stellera* than to wet-season *Marshalli*, but the striolation of the under side of the fore wing is close and rather regular, giving to the surface a dark appearance, and the line bounding the ocellar space inwardly is very indistinct.

Hab. Java (*Kaden*); Philippines (*Semper*); Palawan; Davao, S.E. Mindanao (*Platen*).

31. *Ypthima zodia.* (Pl. I., figs. 12, 13).

Ypthima zodia, Butler, Trans. Ent. Soc. Lond., 1871, p. 402; Leech, Butt. China, &c., p. 91, Pl. x., fig. 10, ♂.

Y. albescens, Poujade, Ann. Soc. Ent. Fr. 1885, p. xli. (*fide* Leech, *l. c.*).

In this species there is considerable variation in the size of the ocelli on the under side of the hind wing, but we have seen no specimen in which any of the six proper to the species were actually absent. The difference in the shape of the œdeagus would seem to negative Leech's suggestion (*l. c.*) that this is the vernal form of *Marshalli* as represented in China, although it is undoubtedly very closely allied to that species.

The typical form of this species from Ningpo is smaller, paler, and has the brown band better defined than the form found in Western China.

Hab. Ningpo (*Pryer, Leech*) ; Ichang, Ta-tsien-lo (*Pratt*).

32. *Ypthima Horsfieldii*.

Ypthima Horsfieldii, Moore, Jour. As. Soc. Beng. liii., p. 18, 1884; Waterhouse, Aid, ii., Pl. 179, fig. 3, ♂.

Y. baldus, apud Snellen ; sec. spec. comm.

Very closely allied to the following, but separable by the characters given in the table above; of these distinctions the difference in the direction of the ocellus on the fore wing is, perhaps, the most obvious; but the difference in the direction of the post-median dark line and the absence of a distinct submarginal dark line on the under side of the fore wing is evident in many specimens. The clasp resembles that of *leuce*, Doh., but wants the upright lamellar lobe on its inner face.

Hab. Java (*Horsfield, Snellen*).

33. *Ypthima leuce*. (Pl. I., figs. 21, 22).

Ypthima leuce, Doherty, Jour. As. Soc. Beng. lv., p. 169 (1891).

♂. Upper side; similar to *Marshalli*, but colours brighter, and pattern more strongly marked; in particular the irides of the ocelli have a strong orange tint; there is also a difference in the direction of the submarginal dark line on the fore wing, which recedes from the hind margin as it approaches the inner margin; in *Marshalli* it continues parallel to the hind margin from the middle to the inner margin; sex-mark very distinct. Under side: ground colour greyish white, the striolation closer on the fore wing,

which has consequently a darker appearance than the hind wing, the dark lines limiting the ocellar space distinct, and separately touching the inner margin; striolation of the hind wing fine, irregular, and sparse, becoming gradually closer and more distinct towards the base; ocelli 6 in three pairs in échelon, variable in size.

♀. Under side as in the ♂; upper side similar to the same sex of *Marshalli*, but differs in the particulars noted above, and in the dark line which forms the inner margin of the ocellar space being straighter and somewhat more oblique.

Although we have in the above description compared this insect with *Y. Marshalli*, the commonest Indian species of this group, it is most nearly allied to *Y. Horsfieldii*, Moore, from which, however, it is readily separable.

Hab. Island of Sambawa (*Doherty*). There are also two specimens from the Island of Flores, standing under the name *sepyra* in the Hewitson collection in the British Museum.

34. *Ypthima sobrina*, n. s. (Pl. I., figs. 17, 18).

Ypthima philomela, in part, Elwes, P. Z. S., 1891, p. 267.

♂. Upper side pale greyish brown, paler in the region of the ocelli, with a regular brown marginal band on all the wings; one bipupilled subapical ocellus of moderate size on the fore wing, two subanal, with another minute anal, on the hind wing. Under side greyish white, regularly and moderately closely striolate; a narrow submarginal dark line on both wings, and a more or less distinct oblique post-median dark band; ocelli 6 in three pairs in échelon. No trace of a sex-mark.

♀. Larger and paler than the male, the pale irrorate ocellar spaces on the upper side of both wings very conspicuous and sharply defined, and the two subapical ocelli of the hind wing appearing on the upper side.

This is so close in outward appearance to *Marshalli*, that I should not have thought of separating it. It is also very near *similis* on the upper side, and the female might be referred to that species, but for the under side, which agrees exactly with the ♂ *sobrina*. Like *affectata*, it has no sex-mark, and the form of the clasp is distinctive.

Hab. Karen Hills, March, April (*Doherty*). Type in coll. Elwes.

35. *Ypthima similis*, n. s. (Pl. I., fig. 19).

Ypthima philomela or *methora*, in part, Elwes, P.Z.S., 1891, p. 267.

♂. Rather larger than the average of the same sex of *Marshalli*, to the female of which it bears a considerable resemblance, as the ocellar spaces on the upper side of both fore and hind wings have that well-defined pale irrorate appearance which is proper to the female of *Marshalli* and its allies; it may, however, be distinguished by the slightly concave hind margin of the fore wing, and the form of the clasp is very different from that of *Marshalli*. On the under side it greatly resembles specimens of *Marshalli*, in which the ocelli of the hind wing are of small size, with the usual concurrent indication of dark bands.

I should not have ventured to consider this as a species, but for the distinct form of the clasp, especially as I have the male sex only from one locality; the six males, however, in my collection are absolutely similar.

Hab. Karen Hills, 4—5000 ft., March, April (*Doherty*). Type in coll. Elwes.

36. *Ypthima affectata*, n. s. (Pl. I., fig. 20).

♂. Upper side similar to that of a large and dark specimen of *Marshalli*, but the bipupilled ocellus on the fore wing is very much larger, and the ocellar space, although not strongly defined inwardly, is distinctly pale and irrorate; on the under side the ground colour is as dark, and the striolation is of the same character as in *fasciata*, Hew.; the dark line, which limits the concolorous ocellar space on the inner side, forms a distinct oblique median band, but the line which should limit the outer side of the same space (the submarginal line) is barely indicated or entirely wanting, and an ante-median band is sometimes faintly indicated; the hind wing has two distinct narrow bands and six ocelli placed as in *Marshalli*. There is no trace of a sex-mark, and the form of the clasp is characteristic.

♀. Subsimilar, but paler and generally larger.

This species is described from one male and two females, taken by myself at Terria Ghat and Mamloo, in the Khasias, 1500–3000 ft. elevation, September.

I had considered it as *philomela* (*Marshalli*) until Edwards showed its distinctness by the difference in the clasp, and also in the absence of a sex-mark. It is, however, possible, that it may be the wet-season form of

similis, notwithstanding the difference in the shape of the fore wing and clasp; the colour and ocellation of the under side show exactly the change that *similis* ought to exhibit under such climatic influences as exist in the place and season in which *affectata* occurred.

Group IV.

Species of moderate size. Ocelli normally 5 (in the type of *Prattii*, 4 only), but sometimes 6 by subdivision of the anal one; in the latter case, however, the species may always be known from those of the *Marshalli* group by the anal pair being practically in line with those next above them.

Table of Species.

1	(4).	Fore wing of ♂ with the ocellus obsolete or wanting on the upper side.	
2	(3).	No submarginal dark line on under side of fore wing	37. *singala.*
3	(2).	Under side of fore wing with a distinct submarginal dark line	38. *avanta.*
4	(1).	Ocellus well defined on both surfaces of fore wing in both sexes.	
5	(6).	A very distinct post-median nearly straight dark brown transverse line on under side of hind wing	39. *striata.*
6	(5).	No distinct transverse nearly straight dark brown line on under side of hind wing	
7	(10).	Inner boundary of the ocellar space on the upper side of fore wing in the ♂ undefined.	
8	(9).	Marginal dark band on upper side of fore wing in the ♂, when present, not darker on its inner edge	40. *argus.*
9	(8).	Marginal dark band on upper side of fore wing in the ♂ darker and sharply defined on its inner edge	*Humei.*
10	(7).	Inner boundary of the ocellar space on the upper side of fore wing in the ♂ straight, oblique, and sharply defined	*Prattii.*

37. *Ypthima singala.* (Pl. I., figs. 26, 26a).

Ypthima singala, Felder, Verh. zool. bot. Gesellsch., xviii., 283 (1868); Moore, Lep. Cey. 24, pl. xii., figs. 3, 3a, ♂; Marsh. & de Nicé., Butt. Ind. i., p. 230; Doh., Jour. As. Soc. Beng., lv., pt. ii., p. 120 (1886).

Neither sex of this species is distinguishable on the upper side from *avanta*, Moore, and below it somewhat

resembles *argus*, Butl.; it is, however, in its mere external characters sufficiently distinct from either, and the form of its clasp is perfectly characteristic. Under side greyish white; the striolation fine, even, and rather close, closer on the fore wing than on the hind; the ♀ (in our specimen) with a faint indication of a dark marginal band, and a distinct oblique post-median dark line; ocelli 6 in three pairs, the uppermost of the subapical pair very small in proportion to the one next to it, the middle pair subequal and of moderate size, the anal pair very small and geminate; the middle and subanal pairs practically in line.

The ♂ specimen to which the above remarks refer was kindly sent to us as *singala*, Feld., by Mr. de Nicéville, and we have also examined a ♂ specimen from Kumaon in which the form of the clasp is identical with our figure.

Hab. Bholahat (*Irvine*); Ceylon (*Mackwood*); Kumaon (*Doherty*).

Y. thora, Moore (Lep. Cey., p. 24, pl. xii., figs. 4, 4a), of which we transcribe the description below, is said by Mr. de Nicéville to be a synonym of *singala*, Feld., and in this opinion Mr. Hampson concurs:—

"Male. Upper side brown. Fore wing with a prominent subapical bipupilled ocellus. Hind wing with a small indistinct subanal ocellus. Under side cinereous, numerously covered with short delicate brown strigæ. Fore wing with a very indistinct discal and marginal band; ocellus prominent. Hind wing with five very minute ocelli disposed in linear order."—Moore, *l. c.*

There is a single specimen in the Godman and Salvin collection, from Malewoon, Tenasserim, which we have been unable to identify with any known species, and of which we have figured the clasp under the provisional name of *Humei* (Pl. III., fig. 46). It has considerable resemblance to *avanta*, and has a well-defined sex-mark. It may be a form of *singala* like *thora*, but we have not been able to examine the genitalia of that form, and the clasp of the present specimen differs as shown from that of *singala*.

The following are the distinctive characters of the specimen in question:—

♂. Allied to *argus* and *avanta*, but distinct from either in the form of the genitalia, and in the more pointed fore wing; it agrees with the former on the upper side, save that it has a well-defined wide dark marginal band on the fore wing, and a dark submarginal line on the hind wing; on the under side it agrees well with certain of our specimens of *avanta* with small ocelli, but the dark bands are entirely wanting. Viewed with the concavity uppermost, the clasp appears to have each apical angle slightly produced to form a broad rounded-triangular lobe, and from the apex of one of these lobes a vertical plate runs inwards and downwards for a distance about equal to half the width of the apex of the clasp.

38. *Ypthima avanta*. (Pl. I., fig. 27).

Ypthima avanta, Moore, P.Z.S., 1874, p. 567; Marsh. & de Nicé., Butt. Ind., i., p. 218, pl. xvii., fig. 66, ♂ (*ordinata* recte *avanta*); Waterhouse, Aid, vol. ii., pl. 179, fig. 6, ♂.

In the wet-season form of this species the ocelli on the under side of the hind wing are five only, the anal bipupillate, but in the reduction which takes place in the size of these ocelli in the dry-season form the anal ocellus is more or less completely broken up into two. The female is lighter in colour than the male, and has the ocellus on the upper side of the fore wing well developed; it may, however, be distinguished from its allies by the presence of the narrow dark bands on the under side.

Hab. N.W. Himalayas from Kashmir to Kulu (*Johnston, G. Young*); Kangra (*Hocking*); Naga Hills (*Doherty*), one pair only; Upper Burmah, Tenasserim (*Watson*); Changyang, Ichang, C. China (*Leech*); Hong Kong (*Pryer*).

Y. ordinata, Butl. (P.Z.S., 1880, p. 148, pl. xv., fig. 3), is sometimes quoted as a synonym of this species, but the type of the former in the British Museum possibly represents a distinct species, or may be what is called *thora;* it seems to be a ♂, although the determination of this point is rendered difficult by the fact that its body has been replaced with shellac, with its apex next the thorax; assuming, however, that it is really a ♂, it may be distinguished from *avanta* by the possession of an ocellus on the upper side of the fore wing, and the

want of dark bands on the under side of the hind wing. The figure which accompanies the original descriptions of *ordinata* does *not* represent the specimen which bears the type-label in the British Museum.

39. *Ypthima striata*. (Pl. I., figs. 23, 24).

Ypthima striata, Hampson, Jour. As. Soc. Beng., vol. lvii., p. 349 (1888).

Under side white, rather sparsely striolate; ocellar space of fore wing nearly concolorous, subtriangular, and open both to the costa and the inner margin, bounded on each side by a well-defined narrow dark brown band; hind wing with a narrow nearly straight well-defined brown post-median band, and in some specimens, particularly of the ♂, there is a trace of a narrow curved ante-median brown band, and the subanal series of ocelli stand on a brown band.

Hampson, *l. c.*, points out that the dry-season form of the ♂ has a slight patch of dense scales on the median nervure of the fore wing, of which there is no trace in the wet-season form, and, moreover, that the former has the ocellus of the fore wing very small and indistinct above.

Hab. Nilgiri Hills, 3500 ft. (*Hampson*).

"The wet-season form occurs commonly at about 3000 ft. on the southern slopes of the Nilgiris in August, and the dry-season form in December and January. On August 25th of this year (1888)—one in which there has been hardly any rain on that side of the hills—I took at 5000 ft. a single male with no trace of the patch of dense scales on the fore wing, which also had no trace of an ocellus; the under side darker,—the colour of *Y. mahratta*, Moore,—the fasciæ of both wings indistinct as in the dry-season form, the ocelli on the under side of the hind wing even smaller and more separated.

"The disposition of the ocelli and general appearance of the two forms is the same, as also that of the single male above described; and I believe them to constitute one species, which I suspect to be the one mentioned as *Y. singala* from Kumaon, and *Y. thora* from Ganjam, by Mr. Doherty, J. A. S. B., 1886, vol. lv., part ii., No. 2, p. 120. The species is allied to, but quite distinct from, *Y. singala* and *thora*, which I suspect are two forms of one species."—Hampson, *l. c.*

40. *Ypthima argus.* (Pl. II., fig. 28).

Ypthima argus, Butler, Jour. Linn. Soc. Zool., ix., p. 56 (1866); Leech, Butt. China, &c., p. 90 (*philomela*, var.).

Y. baldus, Fab., *apud* Stgr., Elwes, P.Z.S., 1881, p. 904; Staudinger, in Rom. Mem., vi., p. 202 (1892).

Mr. Leech treats this as a variety of *philomela* (*Marshalli*), but gives no reason for this, and we must consider it a perfectly distinct species, which appears to be confined to North-eastern Asia and Japan, where it is very common. Staudinger says the Japanese form is a variety with paler under side, but the difference is very trifling.

A specimen from Hakodadi (*Whiteley*) in coll. Godman and Salvin wants the ocellus in the second median interspace on the right side, and has it merely indicated by a faint yellow spot on the left side.

Hab. Japan (*Pryer, Leech, &c.*); Amurland (*Graeser, &c.*); Corea (*Leech*).

A specimen from Ichang in Mr. Leech's collection is very puzzling, and, judging from the clasp alone, which we have figured under the name of *Prattii*, Pl. III., fig. 55, would be a distinct species. It has most resemblance to *argus*, but the upper ocellus of the middle pair is absent, though on the proper right side there are some scales, which make us think that the specimen is an abnormal one in which the spot is absent. If, however, others should be found in China showing that this is a normal specimen, we should be unable to treat it as a variety of any known species. On the upper side it differs from any specimen of *argus* that we have yet seen in that, being a male, it has on all the wings a dark marginal band of which the inner edge is sharply defined, and the ocellar space sharply defined on both wings.

In order to facilitate the recognition of similar specimens, a detailed description of this insect is given below.

♂. Upper side brown; fore wing with a wide dark marginal band; the pale irrorate ocellar space subtriangular, reaching from the costa to the inner margin, its inner edge straight, oblique; sex-mark wanting; ocellus large, well-defined, bipupilled; hind wing with a wide dark marginal band, separated from the actual

margin by a pale line, the pale irrorate ocellar space broad and band-like, its inner edge irregular; a large unipupillate ocellus in the first median interspace, a minute one just below it, and another small one faintly indicated in the second subcostal interspace. Ground colour of the under side whitish grey; fore wing with the inner edge of the ocellar space bounded by an oblique, elongate-triangular brown band, widest on the inner margin; outer edge of the ocellar space bounded in the lower half by a brown curved line, which starts from the posterior angle, and becomes evanescent about the middle of the hind margin; from the base of the wing to the oblique band the striolation is closer; hind wing with the striolation moderately close and rather irregular, with a faint trace of an irregular median yellow-brown band coincident with the inner edge of the ocellar space on the upper side; ocelli 4, 2 subapical and 2 subanal, the anal one bipupilled Expanse, 46 mm.

Group V.

Large species, about 50 mm. Ocelli five or six.

Table of Species.

1 (4). Ocelli 6, in three pairs; anal pair geminate.
2 (3). Under side pale brown, striolation close; no ante-median dark band on under side of fore wing. No sex-mark .. .. 41. *methora.*
3 (2). Under side whitish grey, striolation sparse; an ante-median dark band on under side of fore wing. Sex-mark distinct .. .. .. 42. *savara.*
4 (1). Ocelli 5; anal one bipupilled, scarcely ever divided into two.
5 (10). Sex-mark present.
6 (9). A more or less distinct post-median dark band on under side of fore wing.
7 (8). Under side greyish white; striolation fine, even, and moderately close, distinctly sparser in the ocellar areas; dark band indistinct .. .. 43. *Dohertyi.*
8 (7). Under side darker, striolation coarser and uneven; dark band very distinct .. .. .. 44. *conjuncta.*
9 (6). No dark post-median band on under side of fore wing; an indistinct pale post-median band on under side of hind wing .. .. 45. *methorina.*
10 (5). Sex-mark absent.
11 (12). Subapical ocelli barely touching, not geminate. *persimilis.*
12 (11). Subapical ocelli perfectly geminate .. .. 46. *sakra.*

41. *Ypthima methora.* (Pl. II., fig. 29).

Ypthima methora, Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 291, pl. xviii., fig. 20 (1864); Elwes, Trans. Ent. Soc. Lond., 1888, p. 326, nec Elwes, P.Z.S., 1891, p. 267.

♂. Upper side similar to *Dohertyi*, but in some examples darker and warmer in tint; no trace of a sex-mark. Under side pale brown, closely, evenly, and finely striolate, a feeble oblique yellow-brown post-median band, and a narrow submarginal line on fore wing, and a post-median dark band on the hind wing; ocelli on the latter six in three pairs, small or large.

♀. On the under side like the ♂, on the upper similar to ♀ *Dohertyi*, but with the ocelli on the hind wing less developed.

The specimens with large ocelli, taken in the rainy season, are darker in colour than the dry season form, and in one ♂, not otherwise aberrant, the ocellus of the fore wing is exaggerated to afford room for a third minute pupil below the normal two.

Two of the three specimens in the Hewitson collection, one of which is marked N. India and the other Darjeeling, are this species; the third is *Dohertyi*, Moore.

Hab. Sikkim, British Bhutan, 3000 ft., Feb.—Sept. (*Elwes*); Khasias, 3000 ft. (*Elwes*).

42. *Ypthima savara.* (Pl. II., fig. 30).

Ypthima savara, Grose-Smith, Ann. & Mag. N. H. (5), xx., p. 267 (1887).

Y. methora, pt. Elwes, P.Z.S., 1891, p. 267.

♂. Upper side similar to *Dohertyi*, Moore, but rather greyer; the general pattern has a blurred appearance, the sex-mark is much more extensive, and the ocellus of the fore wing has one pupil; but there is frequently a slight upward extension of the black part of the ocellus, and sometimes this extension bears a minute point of silver scales. Under side greyish white, striolation very fine and sparse, somewhat closer on the fore wing, which bears three dark bands, one straight, ante-median, scarcely reaching the costa, one post-median, oblique, not reaching the costa, and widened considerably towards the inner margin, and one submarginal, commencing near the posterior angle, and becoming evanescent at the level of the second median nervule or thereabouts; ocellus bipupilled; hind wing with three dark bands, two nearly straight, ante-median and post-median, and one submarginal, which bears the ocelli, and is widely interrupted between the

subapical and subanal series of the latter; ocelli six, of rather small size, the four in the subanal series not so completely out of line as in *Marshalli*.

♀. Similar to the ♂ below, on the upper side resembling the same sex of *Dohertyi*; ocellus of fore wing bipupilled.

The above description was written before it was known to us that the insect was already described, and, as it gives more detail than the original description, it has been allowed to stand.

Hab. Karen Hills, 2500 ft., March, April (*Doherty*); Shan Hills (*Manders*); Tilin-yaw, Burmah (*Watson*).

43. *Ypthima Dohertyi*. (Pl. II., fig. 31).

Ypthima Dohertyi, Moore, Lep. Ind., ii., p. 65, pl. 108, figs. 1, 1*a*.

Y. methora, Elwes, P. Z. S., 1891, p. 267, in part, pl. xxvii., fig. 1, ♂.

♂. Upper side greyish brown; both wings with a brown marginal band, that of the fore wing subequal in width throughout, that of the hind wing narrower and unequal, and separated from the margin by a pale line; fore wing with a large rather blurred bipupilled ocellus, limit of the ocellar space not defined inwardly, sex-mark very distinct; hind wing with five ocelli, and frequently a minute supplementary anal one; the pale ocellar space well defined inwardly. Under side greyish white, evenly and moderately closely striolate; the ocellar areas well defined, paler by reason of the sparsity of the striolation, that of the fore wing subtriangular, that of the hind wing fasciiform; ocelli as on the upper side.

♀. Under side like the ♂; upper side the same, except that the pale irrorate ocellar spaces are very conspicuous and sharply defined, and the marginal dark band of the fore wing is separated from the actual margin by a pale line. Expanse, ♂ 54, ♀ 54—60 mm.

The ♂ of this species is recognisably figured on pl. xxvii. of Proc. Zool. Soc. Lond., 1891, but the yellow tint of the ground colour of the under side of the fore wing should have been omitted, since it is really non-existent.

Hab. Karen Hills, 4—5000 ft. (*Doherty*).

This species had been described by ourselves as *marginata*, but on learning from Mr. Moore that he had

already figured, though not yet published it as *Dohertyi*, we have adopted his name to avoid a synonym.

44. *Ypthima conjuncta.* (Pl. II., fig. 32).

Ypthima conjuncta, Leech, 'Entomologist,' xxiv., Suppl., p. 66 (1891); Butt. China, &c., p. 82, pl. x., figs. 3 ♂, 4 ♀.

In its typical form this species is easily separable by the characters given in the table above, but it shares with *methorina* a tendency in certain individuals to recede more or less from the type; the form of the clasp, however, will distinguish it from *methorina* and *picta*.

Hab. Kiukiang, Omei-shan, Ta-tsien-lo (*Pratt*).

45. *Ypthima methorina.* (Pl. II., fig. 33).

Ypthima methorina, Oberthür, Etud. d'Ent., xv., p. 15, pl. ii., fig. 15 (1891); Leech, Butt. China, &c., p. 83.

The ♂ differs from *Dohertyi*, on the upper side, in the darker brown colour, and in the ocellar space of the hind wing not being appreciably paler than the remainder; on the under side of the hind wing the indication of an irregular whitish band just before the subanal series of ocelli, and just beyond the subapical pair, is said to be characteristic. We have seen no female of this.

Y. methorina differs from *methora* by having a distinct sex-mark, by the coarser striolation, and a whitish band on the under side.

Hab. Kweichow, Ta-tsien-lo (*Pratt, Biet.*).

We have a pair of specimens from Mao, Manipur, 7000 ft., marked by Doherty *methora?* and *methora* var. ?, which we cannot identify with any other species. Though they come extremely close to *methora* in appearance, yet the clasp is exactly similar to that of *Dohertyi*. As we have no other species of this group from the same neighbourhood, we are inclined to think it may be a distinct species, in which case it may be called *persimilis*.

The following is a detailed description of these specimens:—

♂. Upper side brown, the ocellar regions but little paler than the remainder; an ill-defined brown submarginal band; ocellus of fore wing moderate in size, unipupillate; hind wing with two subanal ocelli, the upper much the smaller, and one anal minute. Under side pale brownish grey, somewhat darker by reason of the coarser striolation towards the base of the wings; faint traces of an oblique post-median dark band on the fore wings; ocelli on the hind wing five, the anal one large and bipupilled; the ocellus of the fore wing bipupilled. Clasp similar to that of *Y. Dohertyi* (Pl. II., fig. 31).

♀. Under side like the ♂. Upper side also similar to the ♂, but the ocellar spaces are rather paler and faintly irrorate, and the ocellus of the fore wing is bipupilled.

We are not at present able to say whether these apparently different forms of *Ypthima*, which seem to be so localised, are really confined to the limited areas from which alone at present we know them; restricted, however, as they seem to be to the higher ranges, it is possible that the intervening tracts of lower country act as a barrier to their extension and interbreeding, and thus tend to produce variations which, however slight, cannot be overlooked, if constant. The attention of collectors and travellers in these hill ranges cannot be too closely directed to such apparently trifling points as these, and therefore we have felt justified in giving provisional names in the hope that further light will be thrown upon them.

46. *Ypthima sakra.*

Ypthima sakra, Moore, Horsf. & Moore, Cat. Lep. E. I. C., i., p. 236 (1857); Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 290, pl. xviii., fig. 18; Marsh. & de Nicé., Butt. Ind., i., p. 232, pl. xvii., fig. 67, ♂.

Y. nikæa, Moore, P. Z. S., 1874, p. 567; Marsh. & de Nicé., *l. c.*, p. 232; Waterhouse, Aid., ii., pl. 179, fig. 8, ♀.

Well distinguished from its immediate allies by the constant yellowish ground colour of the under side; the gemination of the two subapical ocelli on the under side of the hind wing also occurs in *methorina* and *conjuncta*, but in the two latter the ♂ has a sex-mark as in *Dohertyi*, a feature which is invariably absent in *sakra*. Clasp similar to that of *Y. Dohertyi*, Pl. II., fig. 31.

One of the commonest and most easily recognised species in the Himalayas, from the North-west to Bhutan. It occurs during most of the year, and is found usually at elevations of about 4—7000 ft. in the forest.

We have seen no indications of a tendency to lose the ocelli, except in a ♂ from Bhutan and a ♀ from Bernardmyo; but in both these the ocelli, though smaller than usual, are quite distinct. Specimens from Murree (*nikæa*) are usually smaller and paler coloured than those from the East, but true *sakra* also occurs in the North-west Himalayas.

Hab. N.W. Himalayas (*G. Young, Marshall, &c.*); Nipal, Sikkim, Khasia (*Elwes, &c.*); Nagas, Bernardmyo (*Doherty*).

Group VI.

Rather large species, characterised by the great obliquity of the large suboval bipupilled ocellus on the fore wing.

Table of Species.

1 (4). Under side of hind wing distinctly striolate.
2 (3). Ocelli 4 .. .. 47. *ciris.*
3 (2). Ocelli 3 .. .. 48. *iris.*
4 (1). Under side of hind wing brown with a purplish tinge, with a wide irregular post-median band of a somewhat darker tint, bounded by a distinct darker line, which is faintly yellowish inwardly .. .. .. 49. *Beautei.*

47. *Ypthima ciris.*

Ypthima ciris, Leech, 'Entomologist.' xxiv., Suppl., p. 4 (Jan., 1891); Butt. China, &c., p. 85, pl. x., fig. 9, ♂.

Y. clinia, Oberthür, Etud. d'Ent., xv., p. 16, pl. ii., fig. 13 (July, 1891).

Easily recognised amongst all the species known to us which have four ocelli only on the under side of the hind wing, by its superior size, and the very large bipupilled subapical ocellus on the under side of the hind wing, which is nearly twice as large as any of the others on the same wing.

Hab. Ta-tsien-lo (*Biet*); Western China, generally distributed (*Leech*).

48. *Ypthima iris.*

Ypthima iris, Leech, 'Entomologist,' xxiv., Suppl., p. 57 (June, 1891); Butt. China, &c., p. 84.
Y. dromonides, Oberthür, Etud. d'Ent., xv., p. 15, pl. ii., fig. 14, ♂ (July, 1891).

This large and well-marked species may be readily distinguished in the group having three ocelli only on the under side of the hind wing, by the extreme obliquity of the large bipupilled ocellus of the fore wing.

Though we have at present no recorded cases of seasonal variation in this group, it seems to me that *dromon*, Ob., which I only know from his excellent figure, may be a dry or cold season form of *iris*, in which the ocelli are almost obsolete. Its habitat also strengthens this view, as I have previously remarked that seasonal variation does not exist in China to the same extent as in India (*cf.* P. Z. S., 1891, p. 267, note).

Hab. Wa-su-kow, Ta-tsien-lo, 5—8000 ft.. W. China (*Pratt, Biet*); Tse-kou, Yunnan (*Delavay*).

49. *Ypthima Beautei.*

Ypthima Beautei, Oberthür, Etud. d'Ent., ix., p. 18, pl. ii., fig. 1 (1884); Leech, Butt. China, &c., p. 85.

A true *Ypthima*, with the under side almost that of an *Erebia*, although two subapical and three subanal ocelli are generally indicated on the hind wing by black points. On the upper side it greatly resembles *Y. ciris*, Leech, but has normally only one subanal ocellus on the hind wing.

Hab. Ta-tsien-lo, West China (*Biet, Pratt*).

Group VII.

Under side of hind wing with an elongate-triangular pale post-median transverse space, which is widest on the costa. Ocelli four (or, by gemination of the anal one, five), one on the pale space in the first subcostal interspace, and three (or four) gradually increasing in size, standing on a dark band, in a line from the anal angle.

Table of Species.

1 (2). Pale post-median space on under side of hind wing greyish white .. .. 50. *chenui.*

2 (1). Pale post-median space on under side of hind wing but little paler than the adjoining parts 51. *ypthimoides.*

50. *Ypthima chenui.*

Satyrus chenu, Guérin, in Deless. Souv. Voy. Ind., pt. ii., p. 77, pl. xxi., figs. 2, 2*a* (1843).

Ypthima chenu, Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 285.

Y. chenui, Marsh. & de Nicé., Butt. Ind., i., p. 228; Hamps., J. A. S. B., lvii., pt. 2, p. 350 (1888).

The male of this well-marked species is a little darker in colour than the ♀, but the difference between the sexes in point of size is inappreciable. The sex-mark is wanting in the ♂, as supposed by Marshall and de Nicéville.

Hab. Nilgiri Hills, 5—7000 ft. (*Hampson, Davison*); Arnamalai Hills (*Davison*).

51. *Ypthima ypthimoides.*

Callerebia ypthimoides, Moore, Trans. Ent. Soc. Lond., 1881, p. 307.

Ypthima Robinsoni, Distant, Ann. & Mag. N. H. (5), x., p. 406.

Y. ypthimoides, Marsh. & de Nicé., Butt. Ind., i., p. 230.

This very distinct species resembles *chenui* in the number and situation of the ocelli on the under side of the hind wing, but that surface is usually dark brown, and the striolation is only apparent on the pale portions.

Hab. Palnai Hills (*coll. Oberthür*); Arnamalai Hills, S. India, 4—7000 ft. (*Hampson, Davison*); Travancore, 3—4000 ft. (*Fergusson*).

Group VIII.

Seven ocelli in a continuous row on a dark band.

Table of Species.

1 (2). ♂ with a sex-mark. Size larger .. .. .. 52. *fasciata.*

2 (1). Sex-mark wanting. Size smaller .. .. .. 53. *itonia.*

52. *Ypthima fasciata.*

Ypthima fasciata, Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 287 (1864); Distant, Rhop. Mal., p. 420, fig. 122.

The continuous series of ocelli on the under side of the hind wing separates this insect from all the described species except *itonia*, Hew., which lacks the three dark brown bands on that wing-surface. Distant, *l. c.*, has a capital woodcut of *Y. fasciata*.

Hab. Perak, Borneo (*Doherty*); Sumatra (*fide Hewitson*).

53. *Ypthima itonia.*

Ypthima itonia, Hewitson, *l. c.*, p. 287, pl. xviii., fig. 13 (1864).

Resembles the last species in the continuous series of ocelli, but is distinguished by its smaller size (exp. 30—35 mm.), and the want of a sex-mark in the ♂.

Hab. Lower Niger (*Forbes*), Angola (*Monteiro*), Zambesi (*in coll. Godman & Salvin*), Fernando Po (*coll. Hew.*).

Group IX.

Large species, with the facies of *Callerebia;* normal striolation absent from the under surface of the hind wing.

Table of Species.

1 (2). No trace of ocelli. Under side of hind wing brown, with a broad irregular pale grey post-median band, narrowest in the middle, and joined on the abdominal margin to a blotch of the same colour, which occupies the lower half of the base of the wing .. .. 54. *megalomma.*

2 (1). Ocelli 2 or 3.

3 (4). Under side of hind wing whitish, with a broad ill-defined olivaceous band from the middle of the outer margin, which unites on the disk with a similar band passing from the costa to the inner margin .. .. 55. *insolita.*

4 (3). Under side of hind wing brown, with a broad suffused whitish grey band occupying the discal third .. .. 56. *Vinsoni.*

54. *Ypthima megalomma.*

Ypthima megalomma, Butler, Cist. Ent., i., p. 236 (1874); Leech, Butt. China, &c., p. 86, pl. ix., fig. 2, ♂.

A large and handsome species, with the facies of *Callerebia* and the neuration and genitalia of *Ypthima*.

Hab. Shanghai (*Pryer*); Ichang, Chang-yang, Central China (*Pratt*).

55. *Ypthima insolita.*

Ypthima insolita, Leech, 'Entomologist,' xxiv., Suppl., p. 66 (Sept., 1891); Butt. China, &c., p. 86, pl. ix., fig. 1, ♂.

May be easily recognised by the pattern and colour of the under side of the hind wing. Expanse, 56 mm.

Hitherto a rare species, known only from three male specimens.

Hab. Wa-ssu-kow, W. China, 5000 ft.; June (*Pratt*).

56. *Ypthima Vinsoni.*

Ypthima Vinsoni, Guenée, Vinson's Voyage à Madagascar, &c., Annexe F., p. 39 (1865).

Erebia rakoto, Ward, Ent. Mo. Mag., vii., p. 30 (1870).

♂. Upper side brown; fore wing with a broad dark marginal band, darker on its inner edge; ocellus well defined, bipupilled; iris orange-red; sex-mark distinct; hind wing with a faint narrow dark submarginal line and two ocelli, one each in the first and second median interspaces, unipupillate, irides orange-red. Under side: Fore wing brown, suffused with whitish grey at the apex; ocellar space paler than the disk; ocellus as on the upper side. Hind wing brown, with a broad suffused whitish grey band occupying the discal third; ocelli two, minute, one in the first subcostal and one in the first median interspace.

Hab. Madagascar.

We have not been able to examine the genitalia of this insect, but its neuration is Ypthimoid.

Group X.

Ocelli three. Under side of hind wing wholly or in part pure white, the white portion absolutely devoid of striolation.

Table of Species.

1 (4). Under side of hind wing for the most part pure white.

2 (3). Under side of hind wing with a brown streak along the costa from the base .. .. .. 57. *corynetes.*

3 (2). Under side of hind wing with the basal third brown .. .. 58. *Batesii*.

4 (1). Under side of hind wing brown, with a white elongate-triangular band, narrowest on the costa .. .. 59. *excellens*.

57. *Ypthima corynetes*.

Satyrus corynetes, Boisduval, Voy. Deleg., ii., p. 594 (1847).

Strabena corynetes, Grandidier's Madagascar, p. 36, pl. viii., figs. 6, 7.

Ypthima niveata, Butler, Ann. & Mag. N. H. (5), iv., p. 229.

♂. Under side of hind wing pure white, with a narrow basal streak along the costa, a patch in the region of each ocellus, and a marginal line, brown. Ocelli three, one subapical, and one each in the first median interspace and at the anal angle. Ocellar space on under side of fore wing triangular, pure white. There is apparently no sex-mark, but the specimen examined (the type of *niveata*, Butl.) is rubbed.

Hab. Natal (sec. Boisduval; not noticed, however, in Trimen's 'South African Butterflies'); Madagascar (*Foy*).

58. *Ypthima Batesii*.

Ypthima Batesii, Felder, Reise Nov. Lep., iii., p. 486, pl. lxviii., figs. 10, 11 (1867).

♂. Under side of hind wing for the most part pure white, with the basal third, a patch in the region of all the ocelli, and the hind margin narrowly and irregularly, brown; ocelli three, one subapical, and one each in the first and second median interspaces; ocellus on upper side of fore wing well defined; sex-mark distinct.

Hab. Madagascar (*Kingdon, Deans Cowan*).

59. *Ypthima excellens*.

Ypthima excellens, Butler, Ent. Mo. Mag., xxi., p. 198.

♂. Under side of hind wing brown, with a pure white elongate-triangular band, which is narrowest on the costa; ocelli three, one subapical, one in the first median interspace, and a bipupilled one at the anal angle; sex-mark distinct.

Hab. Madagascar (*Deans Cowan*).

The following four species present so many points of divergence from the preceding groups, and from each other, that they might reasonably be taken as the types of separate groups of equal value to the others.

60. *Ypthima Watsoni.* (Pl. I., fig. 25).

Ypthima Watsoni, Moore, Lep. Ind., ii., p. 89, pl. cxiii., figs. 4, 4 *a*.

Y. philomela, part, Elwes, P.Z.S., 1891, p. 267.

♂. Upper side: Fore wing pale greyish brown; the pale irrorate ocellar space limited, except on the costa, by a dark line, which scarcely reaches the inner margin; a narrow double marginal dark line; ocellus large, subcircular, bipupilled; no trace of a sex-mark. Hind wing pale greyish brown to just beyond the middle, where that colour is limited by a dark line, thence to the hind margin dirty whitish, closely irrorated with fuscous; a narrow irregular submarginal dark band, and a fine double marginal dark line; one well-defined unipupillate ocellus near the anal angle, frequently with traces of another very minute one below it. Under side: Fore wing sordid yellowish grey; normal striolation fine, sparse, and even; the ocellar space concolorous with the rest of the wing, but limited by a yellow-brown line; hind margin narrowly yellow-brown. Hind wing concolorous with the fore wing, but the striolation is exceedingly fine and sparse; three narrow irregular yellow-brown bands, one before and one just beyond the middle, the third submarginal and attenuate at each end; ocelli three, indicated by silvery punctiform spots, narrowly margined with black; hind margin with a fine double grey line. Expanse, 42 mm.

♀. Similar, but larger and paler. Expanse, 47 mm.

Hab. Karen Hills, 4—5000 ft., March, April (*Doherty*).

Resembles *Marshalli* in the colour and pattern of the upper side, but has only three ocelli on the hind wing below.

This is one of the forms which I had previously been unable to define by the external characters, though I have now better grounds for doing so. Besides two males and a female in my own collection, there is a male in the British Museum, taken in the Karen Hills in April by Dr. Watson.

61. *Ypthima bolanica.*

Ypthima bolanica, Marshall, Marsh. & de Nicé., Butt. Ind., i., 231.

This species may readily be distinguished from all its congeners by the three ocelli in the subapical series on the under side of the hind wing.

As far as at present known, it is confined to the arid tracts of the Trans-Indus, and may extend into Baluchistan and Afghanistan.

Hab. Bolan Pass (*Swinhoe*), Attock (*Yerbury*).

62. *Ypthima bera.*

Ypthima bera, Hewitson, Ent. Mo. Mag., xiv., p. 107.

♂. Upper side brown; fore wing with a large round bipupilled ocellus; ocellar space but little paler than the disk, suboval, angularly produced to a point a little below the second median nervule, and limited by a well-defined dark line; a dark submarginal line; sex-mark wanting; hind wing with a dark submarginal line and two unipupillate ocelli, one each in the first and second median interspaces. Under side brownish grey; fore wing with the ocellar space much paler than the disk, its boundary line and the submarginal line as on the upper surface, but more sharply defined; a faint brown line across the apical third of the cell; hind wing with the pale ocellar space limited by a sharply defined irregular brown line, which starts from the costa, and is continued round the anal ocellus to the costa again; a sharply defined brown submarginal line, and a brown median line from the costa to the base of the first median nervule; ocelli five, unipupillate, one (the largest) in the first subcostal interspace, one (the weakest, and evidently liable to disappear) in the lower disco-cellular interspace, one each subequal in size in the median interspaces, and one near the anal angle. Expanse, 40—44 mm.

Hab. Lake Nyassa (*Simons*, *Cotterell*). In coll. Godman & Salvin and B. M.

63. *Ypthima albida.*

Ypthima albida, Butler, P. Z. S., 1888, p. 59.

♂. Upper side silvery bluish white, the hind margin and ocellar region of the fore wing, and hind margin of the hind wing, brown; ocellus of fore wing indistinct on upper side, a little more distinct

below; hind wing with one indistinct subanal ocellus above. Under side brown, striolation not visible; hind wing with three small ocelli, one subapical, one in the first median interspace, and one anal.

Hab. Central Africa (*Emin Pasha*). In coll. B. M.

The following is a list, so far as we can make out, of all the described species of *Ypthima* not otherwise dealt with in this paper:—

Y. sakalava, Saalmuller, Ber. Senck. Ges., 1877—8, pp. 79, 80.

Madagascar.

Y. leucobensis, ibid., *l. c.*

We can find no mention of either this species or the preceding in their author's work on the Lepidoptera of Madagascar, published under date of 1884.

Y. micrommatus, Holland, Trans. Amer. Ent. Soc., xiv., pl. ii., fig. 3.

Hainan.

"Upper surface grey; anterior wing with a very small black subapical ocellus pupilled with blue, and surrounded by a narrow circle of pale ochraceous; posterior with two subanal ocelli, like that on the anterior wing. Under side paler than the upper, with the subapical spot of the primaries much larger than on the upper surface. This spot is oval in form, with two blue spots on the black ground, and a broad ring of yellow surrounding it. Two bands of brown across the anterior wing; posteriors with six exceeding small ocelli, four near the anal angle, two near the external angle. ♀ like the ♂, except that there is but one small ocellus upon the upper surface of the secondaries. Two ♂, one ♀ in coll. Holland. Exp. $1\frac{3}{8}$ inch."—Holland, *l. c.*

The figure above cited represents an insect with three subapical ocelli in a line, of which two are in cell 6, and one in cell 7; and four in a linear subanal series, of which two are in cell 1 *c*, and one each in cells 2 and 3; but on calling Dr. Holland's attention to the discrepancy between the description and the figure, he informed us that the description is correct and the figure incorrect; the ocelli are really mere points, and placed four in the subanal series, and one each in cells 5 and 6.

Y. jocularia, Swinhoe, P.Z.S., 1889, p. 396.

Mahableshwar, near Bombay.

♂. Upper side that of a pale *Hübneri*, but the distal third of the hind wing is faintly suffused with dirty whitish before the irregular dark marginal band. Under side dirty greyish white, with pale greyish brown striolation, which is sometimes sparser or wanting on the distal half of the hind wing; fore wing with a faint oblique post-median dark line, and a faint submarginal dark line arising in the posterior angle, and obsolescent in cell 3 or thereabouts; hind wing with a faint irregular submedian dark line, which is angularly produced outwardly on vein 5 or thereabouts; ocelli punctiform, small, or wanting; clasp similar to that of *kasmira* and *ceylonica* (Pl. I., figs. 6, 8).

♀. Similar to the ♂, but larger and paler. Expanse, 36—40 mm.

This insect might easily be passed over as one of the pale extremes of the cold weather form of *Hübneri*; the form of the clasp, however, shows that it has really nothing to do with *Hübneri*, but is more probably an interesting case of an incipient species which has made some little progress in a course of colour variation from *kasmira* to *ceylonica*, or *vice versâ* (but at present much nearer the former), since the form of its clasp is practically identical with that of either of those species. The feeble pale suffusion on the upper side of the hind wing is appreciable in the majority of specimens, though wanting in some, and rather less evident in the female. We are indebted to Col. Swinhoe for lending us his cotypes, and furnishing us with specimens for dissection. Some misapprehension with regard to this species has been caused by the fact that its author distributed a small pale form of *Marshalli* under the MS. name of *jocularia*, and afterwards published the latter name in connection with the insect above described. This species is not inserted in its place, which would be between *kasmira* and *ceylonica*, as we had not the opportunity to examine authentic specimens until after this paper was in type.

Y. tamatavæ, Boisduval, Faune Ent. de Madagascar, pl. 8, figs. 6, 7 (*Satyrus*); Hewitson, Trans. Ent. Soc. Lond., ser. iii., vol. ii., p. 293.

This insect, which is from Madagascar, is probably not an *Ypthima*; if it is, it may be distinguished by the

shape of the fore wing, which has the apical angle produced as in the genus *Kallima*.

Y. Austeni, Moore, Lep. Ind., ii., p. 69, pl. cix., figs. 3, 3*a*.

Khasia and Naga Hills, Lushais, and Upper Burmah.

"Allied to *sakra*, but has pale outer-discal fasciæ on under side; strongly marked in the ♀."—Moore, *in litt.*

Y. dromon, Oberthür, Etud. d'Ent., xv, p. 15, pl. ii., fig. 12 (1891).

Chiefly differs from the same author's *Y. dromonides*, *l. c.*, fig. 14 (=*iris*, Leech) by the reduction in the size of the ocelli, which, in the case of those on the under side of the hind wing, almost reaches vanishing point.

Tsé-kou, Yunnan.

Y. clinioides, Ob., *l. c.*, p. 16.

According to its author, this species bears the same relation to *Y. clinia*, Ob. (=*ciris*, Leech) as *Y. dromon*, Ob., does to *iris*, Leech (*dromonides*, Ob.).

Oberthür figures (Etudes d'Ent., xv., pl. ii., fig. 17), under the name of *Epinephele phania*, an insect from Yunnan, which has for us all the appearance of an *Ypthima*, and is possibly the true *Y. amphithea* of Ménétries; but see p. 17, *ante*.

Y. norma, Westw., Gen. Diurn. Lep., pl. lxvii, fig. 1 (1851).

The types of this species in the British Museum seem to be distinguished from *asterope* by the absence of the ocellus on the hind wing above, and the different character of the striolation of the under side; but we think it highly probable that an examination of the ♂ genitalia would show a structural distinction, as it is difficult to believe that a species so characteristic of a desert fauna as *asterope*, which does not occur in the Indo-Chinese region, should reappear in China, the specimens labelled "China, coll. Kaden," in coll. Godman & Salvin, referred to p. 12, *ante*, notwithstanding.

Hab. Foochow (*Lay*).

With this species in the British Museum collection is a specimen from Java, and another from Amboyna, to both of which the above remarks will apply, though they have the ocellus, which is wanting in the type.

Y. argillosa, Snellen, Tijdsch. voor Ent. xxxv., p. 133 (1892).

This species is compared by its author with *Y. aphnius*, Godt., from which it is said to be distinguished by the want of an orange band or spot on the upper side of the hind wing. Under side of hind wing with six ocelli, the two largest in cells 2 and 3, two smaller in cells 5 and 6, and two, very small, in cell 1*a*. Expanse, 30—32 mm. Described from one male and two females taken in Java by Piepers.

We gather from the description that the sex-mark is very distinct in the male of this species, but we much regret that our very limited acquaintance with the Dutch language prevents us from doing justice to this author's descriptions both of this species and the next.

Y. nigricans, id., *t. c.*, p. 135.

Compared by its author with *Y. pandocus*, M., from which it seems only to be distinguished by its smaller size and darker colour, in which latter particular it resembles *Y. loryma*, Hew. Expanse, 32—37 mm. Described from five males from West Java (Buitenzorg, Mr. Piepers; Zandbai, Dr. van Bemmelen). It appears to fly in May, whilst *pandocus* is taken by Piepers in April, and it is considered by its author not to be a seasonal form of the latter.

Mr. Hampson has been good enough to allow us the free use of a box of Ypthimas belonging to him, which have been submitted to Mr. Moore, and labelled by the latter with the names under which they will appear in his 'Lepidoptera Indica.' There are many species, and with regard to all except the two mentioned below Mr. Moore's views agree with our own:—*Ordinata:* of three ♂ specimens thus labelled, two are certainly *singala* and *avanta* respectively, as proved on dissection by the form of the clasps, and the third is also *singala*. *Howra:*

seven specimens standing under this name are *jocularia*, Swinh., as we have proved by the dissection of two males. As noted at p. 9, *ante*, we identify *howra* with *Hübneri* by the figure in Waterhouse's 'Aid' (ii., pl. 179), and that figure certainly does not represent the external characteristics of *jocularia*.

Explanation of Plates.

PLATE I.

Fig. 1. Tegumen of *Y. Marshalli*, from above; 1*a*, ditto, from the side.
2. Tegumen of *Y. nareda*, from above.
3. Tegumen of *Callerebia narasingha*, from below; 3*a*, ditto, from the side.
4. Clasp of *Y. asterope*.
5. ,, *Y. Hübneri*.
6. ,, *Y. kasmira*.
7. ,, *Y. egregia*.
8. ,, Y. *ceylonica*.
9. ,, *Y. inica*.
10. ,, *Y. indecora*.
11. ,, *Y. Marshalli*.
12. Œdeagus of *Y. zodia*.
13. Clasp of the same.
14. Œdeagus of *Y. indecora*.
15. Clasp of *Y. baldus*.
16. Œdeagus of *Y. baldus*.
17. ,, *Y. sobrina*.
18. Clasp of *Y. sobrina*.
19. Clasp of *Y. similis*.
20. ,, *Y. affectata*.
21. ,, *Y. leuce*.
22. Œdeagus of *Y. leuce*.
23. Clasp of *Y. striata*.
24. Œdeagus of *Y. striata*.
25. Clasp of *Y. Watsoni*.
26. ,, *Y. singala*; 26*a*, ditto, from the side.
27. ,, *Y. avanta*.

PLATE II.

FIG. 28. Clasp of *Y. argus.*
29. ,, *Y. methora.*
30. ,, *Y. savara.*
31. ,, *Y. Dohertyi.*
32. ,, *Y. conjuncta.*
33. ,, *Y. methorina.*
34. ,, *Y. Motschulskyi.*
35. ,, *Y. obscura.*
36. ,, *Y. multistriata.*
37. ,, *Y. perfecta.*
38. ,, *Y. pandocus.*
39. ,, *Y. lycus.*
40. ,, *Y. nareda.*
41. ,, *Y. fusca.*
42. ,, *Y. newara.*
43. ,, *Y. chinensis.*

PLATE III.

FIG. 44. Clasp of *Y. granulosa;* 44*a*, apex of ditto, from the side; 44*b*, similar aspect of apex of clasp of *Y. asterope.*
45. Clasp of *Y. stellera.*
46. ,, *Y. Humei.*
47. ,, *Y. prænubila.*
48. ,, *Y. impura.*
49. ,, *Y. arctous.*
50. ,, *Y. loryma.*
51. ,, *Y. doleta.*
52. ,, *Y. sordida.*
53. ,, *Y. imitans.*
54. ,, *Y. simplicia.*
55. ,, *Y. Prattii.*

II. *The effects of temperature in the pupal stage on the colouring of* Pieris napi, Vanessa atalanta, Chrysophanus phlœas, and Ephyra punctaria. By Frederic Merrifield, F.E.S.

[Read December 7th, 1892.]

Plate IV.

I wish to premise that nothing approaching to the amount of variation one would find in large collections can be expected as the result of these temperature experiments. In such collections we find the results of a combination of different causes, including individual tendencies to sport, and they contain selections from thousands of individuals of different broods and from different localities, the object of most collectors being to assemble the most abnormal specimens they can meet with. My object, on the contrary, has been to obtain sets of individuals naturally as much alike as possible, so as to make sure that any changes were the results of the different temperature conditions applied; and to secure this natural invariableness I always, where it was possible, obtained a set from the same parents. Notwithstanding all the consequent limitations in result, I think there are some varieties, plainly attributable to temperature, among the specimens I exhibit this evening, that would be noticed in any cabinet.

Let me further remark that when in the course of this paper I speak of certain of my artificial temperatures as corresponding with the temperature of certain seasons or countries, I am well aware that the correspondence is in some cases incomplete. Natural temperatures are so fluctuating that it is difficult to imitate them artificially, but I do not think the difference in this respect is for my purposes an important one, for in many instances I have used both artificially equable, and naturally fluctuating temperatures, and in these cases I have invariably found that a fluctuating temperature produced results similar to those obtained from an equable

temperature corresponding to the mean of the fluctuating one.

Again, in reference to the known English mean temperatures of the spring and summer months, it must be borne in mind that these are shade temperatures, and are below, and under certain circumstances of exposure or absence of cloud considerably below, those to which objects exposed to both sunshine and shade under natural conditions would be subjected.

In the experiments hereafter described, the pupæ were exposed to the different temperatures in nearly all cases within a day or two, and often within a few hours, after pupation. The pupal period in which the temperature has been found to be in general most effective as regards the colouring is that which intervenes between the central inactive stage and that in which the colouring of the imago begins to be perceived in the pupa.

P. NAPI.—It is well known that this species is seasonally dimorphic, the most so of the three British species of Pieris. Professor Weismann ('Studies in Heredity,' by Professor Meldola) has recorded some experiments upon the summer brood, the result of which was that by exposing the pupa for a period of three months to a temperature of about 33° F. it was converted into the spring form, and, as might have been expected, my results are in general accordance with his, but with some difference of detail, more particularly in relation to the temperature during the latter part of the pupal stage, a point to which no particular importance seems formerly to have been attached.

Mr. Vine sent me, on the 20th May last, a pair taken near Hailsham. They paired once or twice afterwards, and eggs to the number of 32 were laid on a potted plant of *Cardamines*, on which the larvæ were fed. These hatched in about a week, and 31 pupated from the 19th to the 28th June. Four pupæ were placed at 90°, these emerged in 6 days; four more were exposed to the temperature of the room, averaging about 67°, and three of them emerged in from 12 to 13 days, one going over till next spring. There is no considerable difference between these two lots, which I shall therefore class together as 7 brought out at a high summer temperature. The remaining 23 were placed at 33° for from three to four months, and then divided, 12 being exposed to a temperature averaging 54°—about equal to the shade temperature of an

English May; of these all but 4, which have "gone over" to the spring, emerged in from about 36 to 40 days (with one exception, which was a few days more). The residue of 11 that had been iced, were placed at about 80°, and all but 3, which have "gone over," emerged in from 6 to 10 days. None were in any way crippled.

We thus have for comparison, individuals of the summer brood of three classes, *viz.*—(1) placed throughout at a high summer temperature; (2) first exposed to a severe artificial winter of 3 or 4 months, and then exposed to an artificial spring of 5 or 6 weeks; (3) first exposed to the artificial winter, and then to a high summer temperature for a week or ten days, without any intermediate spring. Class 1 was of course of the usual form of the summer emergence. A comparison of it with Class 2 shows that the effect of the artificial winter and spring on these pupæ, belonging naturally to the summer form, was to bring out most, but not all, of the characteristics of the spring form, thus—on the upper surface the greater suffusion, but less intensity of dusky colouring, especially along the nervures, and particularly in the females, and the characteristic colouring of the dark parts, *viz.*, grey instead of dark brown; on the under surface, faintness of the spots on the fore wings, the strong marking of the nervures of all the wings, and the stronger colouring of the yellow tinted parts.

In Class 3, *i.e.*, those exposed to a hot summer temperature immediately after a winter one, all these characteristics are noticeably less, especially the faintness of the spots on the under surface of the fore wings, but with one remarkable exception—that the nervures, especially on the hind wings, are more strongly marked than in either of the two other classes, the greater strength of the marking, however, being attributable more to the darkness of it than to an extension of its area.

The only general remark I will make on these results is that I think the experiments prove that some, but not all, of the characteristic colouring of this species depends, not on the particular emergence, *i.e.*, summer or spring, to which the insect when entering on the pupal stage belongs, but on the temperature to which the individual pupa is exposed. I have nearly 90 pupæ naturally belonging to the spring emergence on which I shall experiment during the approaching winter and spring, and may then perhaps have some more definite conclusions to bring forward.

It will have been observed that no less than 8 out of 31 of those *P. napi* which entered the pupal stage (*i.e.*, more than a fourth) had made their election, if I may use the expression, to belong to the spring emergence. This spontaneous splitting of a brood into the two emergences is a common occurrence (attributable, as I believe, generally to individual congenital causes), with many double brooded species, and notably with *P. napi*. Professor Weismann records ('Studies in Heredity,' by Meldola, pp. 39, 40) that a whole brood of his went over in this manner, and thinks this may have been owing to the mechanical motion to which they were subjected in a seven-hour railway journey, but I should question whether the occurrence was not rather to be ascribed to a congenital tendency happening in his case to affect all the individuals of the brood; in other species I have often known a whole brood go over in this way. His statement that the butterflies from eggs laid by the spring emergence of *P. napi* under ordinary circumstances always emerge in the summer, generally in July, of the same year, is I think not in accordance with the experience of many English collectors. Mr. Hawes informs me that of a large brood he had, more than half went over to the spring.

V. ATALANTA.—This is an insect which generally varies but slightly in appearance, and from which I should not have expected such results as have been in fact obtained.

I collected more than 100 larvæ with a few pupæ between 24th August and 16th October last. About 15 per cent. died from having been attacked by parasites.

My first temperature divisions were as follows:—

(1) At between 80° and 90°; these all emerged in 6 days.

(2) At the room temperature, 62° to 69°, averaging about 64°; these emerged in 18 to 19 days.

(3) In a cellar at an equable temperature of about 56°; emerging in about 34 days.

(4) In a cool place out of doors, at about 51° to 64°, averaging 54° or less; these emerged in 44 days.

(5) In the refrigerator, averaging about 45° by day, and in the room by night, averaging about 58°; 51° being about the general average, and the insects emerging in about 40 to 50 days.

Classes 2, 3, and 4, *i.e.*, those at temperatures from about 54° to

64° corresponding with such temperatures as may be met with in English summers, do not greatly differ *inter se*, but Class 1 at 80° to 90° differs appreciably from them.

Class 1, *compared with Classes* 2, 3, *and* 4. On the *upper surface* the black is not really black, but slightly suffused with golden brown, so as to give it a rusty look, and the scarlet bands are broad. At the three lower temperatures the black is intense, the scarlet band narrower, with a greater tendency to be broken up into parts on the fore wings and to be invaded by black scales at the anal angle in the hind wings; all the colours seem more intense, the intensity, I think, slightly increasing as between the 3 classes with the lowering of the temperature, and there is certainly with this lowering an increased development of the lavender-gray submarginal broken band. *On the under surface* of the *fore wings* of 2 out of the 12 at 90° a new small scarlet spot appears between the scarlet band and the inner edge. On the under surface of the *hind wings* of those at the three lower temperatures there is an even stronger intensification of colouring than on the upper surface, and especially of the dark colouring. The ground colour of the hind wings is decidedly much darker than in those at the higher temperature. On the other hand, the light parts are decidedly lighter and more strongly marked in those at the lower temperature. The chief of these light parts are—(1) a conspicuous cream coloured spot, something like a figure of 8 with the upper loop much the larger; this spot becomes more dense and conspicuous, and the loops have a tendency to be filled up and to spread along the costa, so as to give the spot a triangular form. (2) a light ochreous cloud near the middle of the hind margin. This becomes lighter and more strongly marked, and light cloudy markings begin also to appear near the centre of the hind wings. These effects on the under surface of the hind wings mostly increase with the progressive lowering of the temperature.

In Class 5 there is no great difference on the upper surface, the scarlet being, however, a little deeper in hue, but on the under side of the hind wings the effects of the low temperature are visibly enhanced—the creamy spot becoming denser and increasing in its tendency to spread along the costa, and the light cloudings becoming more marked and increasing in area, and even appearing in additional places. A few of these individuals show slight indications of suffering from the temperature.

Class 6. A sixth lot was kept wholly in the refrigerator at about 45° (corresponding with the latter part of an English November) for from 32 to 47 days, and then brought into various temperatures ranging from 90°, at which they emerged in 6 days more to

the temperature of the room, ranging from 48° to 63°, averaging about 55°, at which they emerged in from 34 to 19 days more, making in all from 40 to 70 or more days. Here the invasion of black on the *upper surface* has made greater progress, the scarlet band on the fore wings being narrowed and invariably broken up into several parts, and approaching carmine in colour, and there is a tendency, which in 3 specimens out of 7 is very strongly marked, for the white and lavender scales to spread so as to diffuse the edges of the white spots and to dust the black parts in patches with lighter scales. The blue at the anal angle of the hind wings, which is usually confined to one or two spots, in some of this class extends, but in a minute degree, and as lavender rather than blue, to nearly all the small black spots on the marginal scarlet band, and in two, but mostly so in the one figured (Fig. 5), there is on the extreme margin a row of minute blue or lilac spots alternating with minute marginal black spots on the fringe. On the *under surface* the tendency to spread is stronger, the metallic blue inverted U near the costa of the fore wings is scattered into a shapeless form, and the conspicuous "figure of 8" spot on the costa of the hind wings becomes an elongaged whitish cloud, in two specimens extending along the whole of the costal margin; the other light parts of the hind wings are lighter and more spread. The light colouring of the hind margin forms a broad ochreous marginal band, and is in several cases divided by a submarginal, well-defined darker line parallel with the outer edge, this line being in one case of a deep or tawny orange hue; and the whole of the central area of the hind wings has a blurred or clouded effect, produced by a suffusion of lilac scales dusted over the surface.

Those exposed to this low temperature (45°) for less than 45 days, though their colouring is much affected by it, do not seem to have suffered in vigour, but most of those exposed to it for longer periods died or were crippled.

Next, some experiments were tried by icing the pupæ, *i.e.*, placing them at a steady temperature of 33°. The result was uncertain. Little or no effect seems to have been produced on their colouring or markings by thus icing them for 47 days or less, and then exposing them to an ordinary summer temperature, though in many cases such icing caused death or crippling. I have one specimen iced 47 days, and then exposed to a temperature of 50° to 60°, when it emerged in 23 days more, making in all 10 weeks, and it is not to be distinguished from normal specimens. Of two iced 46 days, and then placed at an average temperature of 54°, and emerging in 29 days more, making in all nearly 11 weeks, one has

the scarlet band on the upper wings clouded with a whitish yellow colour, and that this is the result of temperature is shown by the other of the two, which exhibits a trace of the same colouring. There is also a tendency to yellowness of the scarlet band on the hind wings in some of those which are more or less crippled.

The results with *V. atalanta* may be summed up as follows :—

I. At 90°, pupal period 6 days (Fig. 3). *Upper surface.*—The black is rusty, the scarlet is of wide area and bright. *Under surface.*—The ground colour of the hind wings is brown, not dark brown, the light parts not very light. In two a new scarlet spot appears between the scarlet band on the fore wings and the inner edge.

II. At 64° *to* 51°, period 18 to 50 days (Fig. 4). *Upper surface.*—The black is intense, the scarlet rather deeper in colour and narrowed. *Under surface.* Ground colour of hind wings dark brown, light parts lighter.

III. At 45°, period 47 to 32 days, and then at various temperatures from 90° to an average of 55°, emerging in from 19 to 34 days more (Figs. 5 and 5*a*.) *Upper surface.*—Further invasion of scarlet by black, scarlet band further narrowed and broken up, and of a hue approaching carmine; spread of white and lavender scales over black parts, edges of spots diffused ; minute blue or lilac spots on orange marginal band of hind wings increased in number. *Under surface.*—Great increase in lightness and area of light parts; diffusion of edges of spots and of some markings, and appearance of some new markings.

The results obtained by extreme and protracted cold *i.e.*, 45°), though probably such as would rarely be met with in nature, seem to me exceedingly interesting—first, as proving by this extreme case that the less marked intermediate results are caused by temperature; and secondly, because, owing to the great change in marking and colouring which they exhibit, especially on the under side of the hind wings, they may, it seems to me, possibly throw some light on the evolution of the markings in the Vanessas. This difference of appearance in these extreme cases is so great that I think if some of the insects could be seen in the resting position, *i.e.*, showing only the under side of the hind wings and the

comparatively uncoloured tips of the fore wings, they would be taken as belonging to different species.

I may here make a general observation on the minute white spot on the scarlet band which has been the subject of some discussion. About one in four of mine shows this spot or traces of it on the upper surface; the whole of them—over 60 in number—show it or faint traces of it on the under surface. Its existence does not seem dependent on temperature.

Hibernating stage of atalanta.—This species is well known to hibernate in the perfect condition, coming out in May or June, and then pairing and laying its eggs on nettle, the larvæ being found through July and August, and the fresh butterflies from them appearing through the latter part of August and September, and being seen as late as October or even November, and then going into winter quarters. Mr. Scudder states that in the south of Europe and in the southern part of the United States it has two or three broods, and that even in the northern States some pupæ of a second brood hibernate, and the butterflies emerging from them mingle with the butterflies which have hibernated. My experiments rather confirm the ordinary opinion that in England none hibernate as pupæ, though I have no doubt many of the butterflies of the summer emergence pair and lay eggs, resulting in butterflies which emerge in the late summer or autumn and hibernate, for I have found young larvæ as late as 16th October, and I have now a pupa from one which did not pupate till 16th November. But of all the pupæ which I subjected to a low temperature none have yet survived more than about 11 weeks. My last perfect specimens emerged 26th and 27th November.*

C. PHLÆAS.—I have been for some time desirous of experimenting on this species, because it is known that, while not considered materially affected by the great difference in temperature between a summer and a winter in Central Europe, it is apparently affected by the somewhat higher temperature of Southern Europe, the summer emergence having there a tendency to be suf-

* Note of 31st December. I subjected about thirty to winter conditions, some placed out of doors shortly after pupation; all these have died.

fused with dusky scales; an example of this is figured in Weismann's work before quoted.

By the kindness of friends, Mr. Fletcher and Mr. Nicholson, I was last spring supplied with some living specimens of the butterfly, which laid eggs on dock and sorrel, and from them I had more than 70 pupæ, which proved exceedingly healthy. Ten of these were forced at 85° and 10 at 80°, all emerging in from 6 to 7½ days. There is little difference between these two lots, which are remarkable for the large size of the spots, and the comparative dulness of the colouring, the black parts being less intense, and the coppery parts especially having a slightly brassy appearance, and being in most cases more or less suffused with dusky scales, especially towards the bases of the fore wings, and often on the nervures; the coppery band on the hind wings is also narrow and broadly serrated. Six were brought out at the temperature of the room, averaging about 70°,—fairly representing an English summer temperature,—emerging in 11 to 15 days. These are noticeably different—the colours are more intense, the dark parts blacker, the coppery parts more vivid, and the spots smaller. Another lot of 6 was placed in a cool and shady place out of doors, the temperature averaging about 58°, *i.e.*, about the mean shade temperature of the latter part of May, and emerged in from 22 to 30 days; these show a slight further increase in the brightness of the coppery parts, especially towards the bases of the fore wings, the spots are, I think, still smaller, and the coppery band on the hind wings is broader. Another lot, of 10, was placed in a cellar at a uniform temperature of about 56°, emerging in from 29 to 33 days; these are very similar to those last mentioned. Six more were placed in the refrigerator at about 47°, representing the shade temperature of the earlier part of an English April, from which they evidently suffered, for only 3 emerged, in from 57 to 59 days, and one of these is unsymmetrical, one wing having a rather silvery hue; these 3 show a still further advance in the lightness (but not in the brightness) of the coppery parts, and certainly in the breadth of the coppery band on the hinder wing.

More were kept at a temperature of 33° for about 10 weeks, and then brought into a temperature averaging about 55°, thus representing winter conditions followed by spring, and emerging in from 34 to 36 days more—*i.e.*, in all about 15 weeks. About half died or were crippled. In those which emerged all the effects of the low temperature are seen in their extreme—the light colour of the coppery parts, the reduced size of the spots, one or two of

which have almost disappeared, and the breadth and conspicuousness of the coppery band on the hind wings, which ceases to be serrated, though the coppery scales are often prolonged along the nervures from the band towards the base of the wings. I tried a further experiment with some iced at 33° for 9 or 10 weeks, which I consider sufficiently proves that the dusky suffusion is, at least to some extent, the effect of a moderately low temperature extending over some of the later pupal stages. Six of those iced for about 10 weeks were transferred at once to a temperature of 90° ; these all emerged in from 5 to 6 days, and it will be seen that they have most of the features of those that were never at a lower temperature than 80° to 90°, and especially the suffusion of the bases of the fore wings with duskiness, and the reduced size of the coppery band on the hind wings. The contrast in colouring between the last two lots, the only difference between them in treatment being that, both having been long iced, one lot emerged at 55° while the other emerged at 90°, is noticeable.

The only individuals which seemed at all injured by the temperature applied were those at 47°, and those which after long icing were placed at about 55°. Mere icing for 10 weeks did not seem at all injurious.

I will summarise the results as follows :—

I. At 80°—90°. Representing a very hot continental summer temperature (Figs. 1 and 1*a*). Emerged in 6 days. Spots large, not sharply defined ; dusky suffusion of fore wings.

II. At about 70° (English summer temperature). Emerged in 11 to 15 days. Spots smaller, copper colour more vivid, black more intense.

III. At about 56° *to* 58° (rather cool summer or late spring temperature). Emerged in 22 to 23 days. Copper colour still more vivid ; copper band on hind wings broader.

IV. At about 45° (temperature of cold spring). Emerged in 57 to 59 days. Effects intensified.

V. At 33° *for* 10 *weeks, then at* 55° *for* 5 *weeks* (winter and spring temperatures) (Figs. 2 and 2*a*). Extreme effects produced, especially in smallness of spots and breadth of the coppery band on hind wings.

VI. At 33°, *then* 90° for 6 days (winter, immediately followed by very hot summer). Re-appearance of dusky suffusion and of narrowness of copper band on hind wings.

It seems to follow that in this species the principal effects on colour, &c., are produced not by long exposure to severe cold, but by exposure, during the period when the active part of the pupal stages has begun, to (1) great heat, producing duskiness, or (2) moderate cold, producing vividness and intensity of colouring in both the coppery and the dark parts, smallness of spots, and great enlargement of the copper band on the hind wings.

These experiments show, I think, that the difference in appearance between *phlœas* from Southern Europe and *phlœas* from England is not necessarily to be attributed to the existence of races of different colouring, but may be owing to the difference between the temperatures to which the individuals are exposed in the two climates.

My results show an interesting parallelism with those produced, apparently by corresponding natural differences of temperature, in the American copper, *hypophlœas*, which nearly resembles *phlœas* in appearance. In this species Mr. Scudder remarks that the spring individuals [*i.e.*, those which emerge in the colder weather] are of a more fiery red, and the orange band on the under surface of the hind wings is broader; while in later broods [*i.e.*, those emerging in the hot American summer] the markings are less vivid and less distinctly marked. He adds that there is a longer tooth on the margin of the hind wings; this feature appears to exist in a slight degree in my *phlœas* brought out at a high temperature; the orange band on the under surface of the hind wings is in all mine very inconspicuous. I am indebted to Mr. Frohawk for the observation that the markings on the under sides of all the wings are considerably stronger in those exposed to the high temperature than in those at lower temperatures, and in those at the lowest temperature the spots on the fore wings are much reduced in size, and on the hind wings are almost obliterated.

Ephyra punctaria.—This species is well known for its seasonal dimorphism.

Mr. Fletcher sent me a female taken in the New Forest, which reached me 4th June last, with from 140 to 150 of its eggs, which were just hatching, and from which I have bred 113 moths, besides 7 pupæ which have gone over till next spring. 21 of these

moths were from pupæ at about 90°, emerging in from 4 to 5 days; 22 at the temperature of the room, about 70°, emerging in from 10 to 11 days; 17 in a cellar at a regular temperature of about 56°, emerging in 22 to 27 days; 13 in the refrigerator at a temperature averaging 45°, and emerging in from 57 to 70 days. In all the lots there was a preponderance, generally a large one, of females.

There are not many differences in appearance between those at 90° and those at 70°, the chief ones being that those at the lower temperature are rather more sprinkled with dark scales, giving them the appearance of a slightly darker ground colour, and that all the markings are also slightly darker; both generally show the "inner" line as well as the "central" and "outer" lines; and, in both, nearly every specimen, male and female, shows very conspicuously the blotches usual with the summer emergence between the outer line and the margin; in those at 90° all but one are thus blotched, in those at 70° all but about 4. Coming to those brought out at 56°, there is a slight increase in the dark ground colour, the central line has become conspicuously darker, and the disappearance of the blotches has made further progress, only 7 or 8 individuals out of 17 showing them. Passing on to those at 45°, the ground colour is again slightly darker, and the central line darker still, while the blotches have disappeared, leaving indeed very faint traces in about 3 out of 13.

A large number were kept in ice at 33° for three months, and were then placed out of doors (being in cold weather brought indoors), the temperature averaging about 54°, and the moths emerging in from 36 to 42 days more; these are very like those brought out at 56° without icing; only 4 out of 20 are blotched, and these but faintly.

Of those iced at 33° for 3 months, 19, placed at 87°, emerged in from 5 to 7 days. These are remarkable for a near return in appearance to those which were never at a lower temperature than about 90°—in general lightness of colour, owing to the sparseness of dark sprinkling, and in the reappearance of the blotches, 14 of the 19 being blotched, some conspicuously so.

I may add that on the under sides most of these effects may be faintly traced.

None seem to have suffered in any way from the temperature except those at 45°, nearly a quarter of which died or were crippled.

To sum up. We have in *E. punctaria* a gradual disappearance of the submarginal blotches, increase of dark sprinkling, and intensification of the central line, as the temperature is lowered from 90° through 70°,

and 56° to 45°. A temperature of 33° seems to suspend the physiological changes without much, if any, other effect, for those which were thus iced for over 3 months and then exposed for from 5 to 7 days to a high temperature, closely resemble in appearance those exposed to a similar temperature without having been iced at all.

Explanation of Plate IV.

Figs. 1 and 1*a*. *C. phlœas*, at 80°—90°, emerging in 6 days.

2 and 2*a*. *C. phlœas*, at 33° for 10 weeks, then at 55°, emerging in 5 weeks more.

3. *V. atalanta*, both sides, at 90°, emerging in 6 days.

4. *V. atalanta*, under side only, at about 45° to 58°, emerging in 40 to 50 days.

5 and 5*a*. *V. atalanta*, at 45° for 42 days, then at about 48° to 63°, emerging in 19 days more.

III. *On the phylogenetic significance of the variations produced by difference of temperature in* Vanessa atalanta. *An Appendix to the preceding paper.*

By Dr. Frederick Augustus Dixey, M.A., M.D., Fellow of Wadham College, Oxford.

[Read February 22nd, 1893.]

Mr. Merrifield has kindly invited me to express my opinion as to the bearing of the variations produced by differences of temperature in his specimens of *Vanessa atalanta* on the question of the race-history of the Vanessas. I am strongly disposed to think that further data are necessary before very much light can be thrown on the subject from this source; nevertheless, certain conclusions seem possible from the remarkable series so carefully reared by Mr. Merrifield under accurately recorded conditions of temperature, and perhaps a brief note on the subject may be not devoid of interest, even at the present stage of the enquiry.

For the purposes of this note, I divide Mr. Merrifield's specimens of *V. atalanta* that I have seen as follows:—

A. Reared from pupæ at a temperature of 80° to 90° F. 10 specimens. (Fig. 3).
B. Reared at ordinary temperatures. 10 specimens.
C. Reared from pupæ at about 54° to 56°. 10 specimens. (Fig. 4).
D. Reared from pupæ at 45°. 7 specimens. (Figs. 5 and 5*a*).

Both A and D exhibit features which appear to be ancestral, together with other features which would seem to be the direct result of temperature conditions, or at least to have no assignable phylogenetic import. Although both A and D show indications of reversion, the ancestral marks are different in the two cases. The specimens grouped as C do not differ very greatly from the normal, but are in most respects intermediate between B and D.

Ancestral marks produced at high temperatures (A).

(1). The presence of a scarlet patch on the under surface of the fore wing between the first median nervule and submedian nervure (in two specimens).

(2). The increased width of the scarlet band on the fore wing, and the tendency in some cases of its inner margin towards resolution.

(3). The somewhat diminished intensity of the scarlet of the fore wing.

(4). The suffusion of the dark portion of the wings with golden brown.

In all these respects the specimens of A approach *P. callirrhoë*, which is, in my view, an older and less specialised form than *V. atalanta* (Trans. Ent. Soc. Lond., 1890, p. 123, and note). The scarlet patch (1) is undoubtedly identical with a light-coloured area, between the spots distinguished as II. 8 and III. 8, which is met with on both surfaces of *P. callirrhoë*, and is present in a more ample form in other members of the group (ibid., Pl. III., figs. 33, 40, 41, representing *V. polychloros*, *A. levana*, and *P. carye* respectively).

Ancestral marks produced at low temperatures (C and D).

(1). The presence, in some specimens, of blue or lavender centres to the black submarginal spots of the hind wings.

(2). The presence, in two specimens, of minute groups of blue scales near the margin of the dark portion of the hind wing, indicating the centres of another series of spots (the series distinguished as III., well seen in *G. c-aureum* and *P. gonerilla*, ibid., Pl. II., fig. 25).

(3). The presence, in two specimens, of marginal blue on the hind wing.

With regard to (1), it is clear that the tendency is for the blue centring to increase as the temperature diminishes. Thus (to use the system of nomenclature proposed by the writer, *loc. cit.*) IV. 15 is, of course, universally blue-centred; IV. 14 is blue-centred in one of A, five of B, eight of C, and all of D; moreover, five of the seven specimens comprising the latter group have blue centres to other members of IV. as well. The remarkable specimen of D figured (fig. 5) has IV. 12 to

15 undoubtedly blue-centred in each hind wing. Reasons for considering this a character that belonged to the earliest members of the *Vanessa* group may be found in Trans. Ent. Soc. Lond., 1890, p. 97, *et seq.*

The marks referred to above under (2) are exceedingly minute, but still certainly visible in a fair light. They occur in only one of group D. In this insect the right side has III. 10 to 14, and perhaps 15, the left side III. 10 to 14, indicated by very minute patches of blue scales, somewhat like the rudimentary ocellus in *V. io*, but even smaller. One specimen of the intermediate group C has similar indications of III. 12 to 14.

The marginal blue (3) is in all probability an extension of the blue often seen on the marginal side of the large blue-centred spot IV. 15 in normal specimens of *V. atalanta*, and appears to represent that survival of the original bluish ground colour which is visible in *A. niphe* close to the margin, and especially at the anal angle of the hind wing, externally to those remains of the ground colour from which are developed the blue centres of IV. (ibid., p. 101).

To other characters seen in specimens of C and D, such as the remarkable alterations in the under side of the hind wing, and the suffusion of the fore wing with white and lavender scales, I am not able to assign any phylogenetic import.

A fair proportion of the effects of both heat and cold thus seem to point in the direction of reversion to an older form than the normal *V. atalanta*. But what is especially noticeable is—that in the first case (that of heat) the form approached is *P. callirrhoë*, a very near relative of *V. atalanta;* while in the second case (that of cold) the approach is to a still more ancestral form, such, indeed, as may be supposed to be the common progenitor of *Vanessa*, *Pyrameis*, *Hypanartia*, and *Grapta*.

General Observations.

Is it possible that a disturbance of natural temperature conditions, whether in the direction of heat or cold, can produce in a monomorphic species a tendency towards reversion? Mr. Merrifield's experiments seem to go far towards answering this question in the affirmative. It need hardly be pointed out that Weismann's results with *A. levana* and *P. napi*, as also Edwards's with

P. ajax (all many-brooded species) are interpreted by the former author in a like sense. These results, however, are confined to the artificial production of the oldest of several still extant forms of the same polymorphic species; whereas Mr. Merrifield's experiments with a monomorphic and not very variable insect seem to have revived forms of the species older than any now extant.

The possibility that exposure to greater heat as well as cold may induce reversion is alleged by Weismann ('Studies in Theory of Descent,' ed. Meldola, 1882, vol. i., p. 37). But that features so revived should be entirely distinct in the two cases, although ancestral in both, is, so far as I am aware, a quite new and unexpected result.

It would seem that unless the whole alteration in these cases is the direct consequence of temperature conditions, which is unlikely, we must admit the possibility that a greater or less degree of atavism may be induced by disturbing conditions; the point to which the species "throws back" being controlled by the nature of the disturbance. Mr. Merrifield's experiments with the double-brooded *S. illustraria* (Trans. Ent. Soc. Lond., 1890, p. 131, &c.) appear to indicate that the case of this latter is not completely parallel with that of *A. levana*, inasmuch as the "summer" as well as the "winter" form is in *S. illustraria* capable of being artificially produced (though with difficulty), whereas in *A. levana*, as is well known, it is not possible to artificially produce the "summer" form. This fact with regard to *S. illustraria* may be due, as he suggests (ibid., p. 142), to the direct effect of temperature; or, as he has also pointed out to me, it may possibly indicate that the summer form of *S. illustraria* is itself a reversion to an ancestral condition. If this latter be the case, the supposed explanation of the different effects of heat and cold in the instance of *V. atalanta* would receive some confirmation, for we should then have another example in which the point to which reversion was directed could be to some extent controlled.

On the whole, therefore, it seems to me just conceivable that earlier forms which were developed under certain natural temperature-conditions may sometimes be under similar conditions independently restored.

Assuming this to be the case, we may perhaps explain the results arrived at by Mr. Merrifield with *V. atalanta* as follows:—

The warm "*callirrhoë*" stage is more recent than the cool "blue-centred" stage (see above, p. 71). The normal *V. atalanta*, though still more recent than the "*callirrhoë*" form, shows in some respects a kind of atavism, skipping the "*callirrhoë*" stage, and reverting in certain points (*e. g.*, the white spots on the fore wing, and the blue about the anal angle of the hind wing) to an earlier one. By the subjection of the pupæ to a sufficient amount of cold, the moderate atavism of the recent *V. atalanta* may be rendered more pronounced; while the substitution of heat at the same time both checks the atavism and encourages reversion to a more immediate ancestor. In other words, the normal *V. atalanta* may be *warmed back* towards *P. callirrhoë*, or *cooled back* still further towards the "protovanessa."

IV. *Notes on* Hydroptilidæ *belonging to the European Fauna, with descriptions of new species.* By Kenneth J. Morton, F.E.S.

[Read December 7th, 1892.]

Plates V. & VI.

The discovery of a species of *Oxyethira* new to the British Islands, and the enquiries made in connection with its determination, have resulted in bringing before me a considerable mass of *Hydroptilidæ*, including species of much interest, several of which are quite new. Noteworthy amongst the material referred to is a large consignment, from the collection of Mr. McLachlan, of undetermined *Hydroptilidæ*, in which forms apparently belonging to the genus *Hydroptila* are most numerous, and comprise at least three which are undescribed. I now describe these, together with the British *Oxyethira* above alluded to, which has proved to be new; and I also take the opportunity to describe another new *Oxyethira*, received from Dr. John Sahlberg, of Helsingfors. A few notes are added concerning points of interest in connection with previously-known species.

In these notes I have endeavoured to follow the terminology used by Mr. McLachlan in describing the appendages of the male; but in such minute and densely hairy insects, the points of origin and true nature of these parts are not always easy to trace. I think, however, that with the aid of the accompanying figures, drawn under the microscope with the camera lucida, there should be no difficulty in understanding what is intended.

Genus Hydroptila, *Dalman*.

Hydroptila stellifera, n. sp.

Antennæ about 34-jointed in the male, fuscous; clothing of vertex yellowish white, the hairs on the face darker; palpi

yellowish; legs dingy testaceous, with greyish pubescence. Anterior wings brownish, with yellowish white markings arranged in what appears to be the usual manner in the genus, *viz.*, a slight marking near the base, an oblique fascia about the middle intersecting the fringes of both margins, an ill-defined patch beyond the middle; nearer the apex is another fascia, often vague and little more than a strong marking on the costa and one on the inner margin; the apex itself is also usually pale; costal fringes nearly black, save where intersected by the whitish markings; inner margin with dark grey fringes. Posterior wings dark grey and iridescent, with concolorous fringes on the inner margin; costal fringes darker. In the male there is an elongate dorsal plate, with incurved edges; this plate narrows towards the apex, which is slightly upturned when viewed from the side. Penis long and slender, with downturned point. Lower penis-cover with dilated angulated apex; from the angles radiate short hairs or spines, and from the outer margin arises a strong down-turned blackened hook. The inferior appendages (?) are short, rounded and somewhat incurved. Ventral processes long, narrow and contiguous, with blackish tips. Lobe of ante-penultimate ventral segment long. In the female there is a rather long and slender ovipositor. Expanse of male about 6 mm.; female slightly larger.

Italy (Apennino Pistojese, 27th July and 5th August), 5 males and 5 females (*Eaton*).

In almost all respects different from any of the known European species.

Plate V., fig. 1, apex of abdomen of male, from beneath; 2, same, from side.

Hydroptila fortunata, n. sp.

Antennæ about 35-jointed in the male, inclining to fuscous in colour; vertex clothed with whitish hairs; palpi yellowish; legs yellowish testaceous. Anterior wings brownish, darker on the costa; markings white, arranged pretty much in the usual way; apex margined with yellowish white; fringes of inner margin dark silky grey. Posterior wings greyish, darker at tip, with concolorous fringes; iridescent. In the male there is a large, semi-transparent, dorsal plate, with usually much incurved lateral margins (but apparently varying in this respect in the dry insect); in certain aspects its outer margin appears excised. The penis is slender, with a very slight dilatation before the apex, which terminates in a sharp twisted hook (like the last turn of a cork-screw). There is probably a single spiral sheath. Of the lower penis-cover

there is usually visible the down-turned black apex. Inferior appendages, seen from the side, are large, elongate, obtuse, almost semitransparent at apex, which is slightly curved inwards and downwards; very hairy externally and their upper and lower margins regularly beset with short hairs. There are also two subparallel ventral processes, between which the black apex of the lower penis-cover usually lies. Ventral lobe large and long, minutely serrate on its margins. Expanse about 6 mm.

Grand Canary, 9th and 11th December, 5 males (*Rev. A. E. Eaton*). Several mutilated specimens, including a female, from the same locality, doubtless belong to the same species. Thirteen examples from Teneriffe, 15th Dec. and 25th Dec., also appear to be identical, and I can detect no appreciable differences in a single male from Madeira, 20th November; all collected by Eaton.

A very distinct species, easily to be distinguished on account of the large inferior appendages and the apex of the penis. The broad inferior appendages are sometimes turned in, and lying close to the dorsal plate conceal the inner parts. The density of the hair is also a difficulty, on account of which figure 2 is not quite satisfactory.

PLATE V., fig. 1, apex of abdomen of male, from beneath; 2, from side (in outline); 3, penis; 4, apex of ditto (more enlarged).

Hydroptila uncinata, n. sp.

Antennæ about 31-jointed in the male (mutilated ?), fuscous. Vertex densely clothed with white hairs, hairs in front darker. Palpi yellowish white. Legs dingy testaceous. Anterior wings dark brown or blackish, with white markings arranged in the usual way. Posterior wings greyish, iridescent, with concolorous fringes on the inner margin; costal fringes darker. In the male there is a large semitransparent dorsal plate, with incurved edges, slightly produced at apex; outer angles bearing a long down-turned incurved hook. The penis is slender, scarcely dilated towards the apex, where it is twisted. Lower penis-cover bearing some analogy to that of *H. fortunata*, but apparently broader at apex. Inferior appendages large and elongate, their apices obtuse, semitransparent and concave, outwardly hairy, and their margins regularly beset with short hairs. Ventral processes as in *H. fortunata*. Ventral lobe large and long. Expanse about 5½ mm.

Italy (Apennino Pistojese, 26th July (2), and 5th August (1)), three males (*Eaton*).

A species with a certain amount of resemblance to *H. fortunata*, but amply distinct therefrom, on account of the hooks on the dorsal plate.

PLATE V., fig. 1, apex of abdomen of male, from beneath; fig. 2, same, from side.

Hydroptila Maclachlani, Klap. — This very distinct species was described by Klapálek in Sitz. Böhm. Ges., 1890. It proves to have a wide distribution, and examples from the following localities are now before me:—

England (Charmouth, Dorset, June 18th, *Rev. A. E. Eaton*); Scotland (Carluke, August, very common, *Morton*); Pyrenees (Léz and Laruns, 14th and 24th July, *Eaton*); Portugal (Silves, 17th May; Cintra, 31st May, *Eaton*, many examples); and evidently the same species from Madeira (one male, 21st Nov., *Eaton*).

As Klapálek's figures may not be generally accessible, I give, on Plate VI., a figure of the apex of abdomen from beneath (fig. 1); also one of the penis, which is peculiar and has not been previously figured.

Note.—I have denuded and examined the heads of many examples of the foregoing four species, with the view of satisfying myself regarding the presence or absence of the large valve-like lobes given by Mr. McLachlan as a leading character of the genus *Hydroptila*. That these lobes do not exist at all in *H. Maclachlani* is, I think, certain; and if they are present in any of the other species, they almost certainly do not reach the enormous proportions to which they are developed in such species as *H. occulta* and *H. femoralis*. Without doubt good characters exist for generic subdivision, but as one or more of the previously described species are doubtful in respect of the elevated lobes, steps in this direction are not yet safe. Each species should be carefully studied on the point from fresh material, when the chance occurs.

The neuration of the four species may be said to agree both among themselves and with Mr. McLachlan's figure.

Genus STACTOBIA, *McLach.*

Stactobia atra McL.—Mr. McLachlan has kindly communicated the figure of the neuration of this species, referred to at page 72 of his 'First Additional Supple-

ment.' As he has there indicated, *S. atra*, being so much larger than the other described species, this figure gives a better idea of the neuration of the genus than his earlier one.

Two insects from Madeira (*Eaton*) appear to belong here. The anal parts are much concealed in the hairs, and the figures given are from an example entirely denuded and mounted in balsam. The true form of the part between the pieces which are produced into a spine at the apex, is a little uncertain.

PLATE VI., fig. 3, neuration of anterior wing (from Mr. McLachlan's drawing); fig. 1, apex of abdomen, from beneath fig. 2, apex of abdomen, latero-ventral view.

Genus OXYETHIRA, *Eaton.*

Oxyethira costalis, Curt.—It appears to me that the lower margin of the inferior appendages in this species does not run continuously to the incurved apex, but is angulated before the apex, as shown in Plate VI., fig. 1. There is a pair of down-turned hooks lying above the ventral plate, one of which is shown in fig. 2.

Oxyethira ecornuta, n. sp.

Antennæ 33-jonted in the male (mutilated?), fuscous; clothing of head whitish yellow; palpi fuscous; legs dingy testaceous. Anterior wings brown, with whitish markings and darker fringes. The ventral plate in the male is large and usually much produced, the excision in its outer margin being shallow but extensive; the lateral lobes of the plate when viewed directly from beneath are small, but well marked, inturned and blackened. The inferior appendages are very short and scarcely incurved. Above the ventral plate is a pair of black much downturned hooks. The penis is not exserted in the examples before me; its apex, as far as visible, seems to be more decidedly dilated than in *O. costalis*. Ventral lobe apparently as in that species. Expanse of male about 5 mm.

Three males and one female from Teisko, Finland, received from Dr. John Sahlberg.

A species *very* closely allied to *O. costalis*, Curt., yet sufficiently distinct. It differs in the form of the ventral plate, and of the hooks above the plate; also and especially in the absence of the black inturned tips which mark the inferior appendages of *O. costalis*. From

O. distinctella it differs in the absence of the bifid superior appendages.

PLATE VI., fig. 1, apex of abdomen, from beneath; 2, same, in front; 3, same, from side; 4, hook; 5, apex of penis.

Oxyethira distinctella, McLach.—The types of the species were very kindly forwarded for examination, by Dr. John Sahlberg, of the Helsingfors Museum. Although closely allied to the foregoing species, it is very distinct, on account of what I have called above the bifid superior appendages, which are shown in figure, Plate V.

Oxyethira unidentata, McLach.—A unique species, belonging to the group of *O. costalis* on account of its having distinct inferior appendages. Mr. McLachlan was good enough to favour me with a sight of the types and I here give two figures, as none has been published.

PLATE V., fig. 1, apex of abdomen from beneath (the closure of the anal cavity above is not shown); fig. 2, same, from side.

The species which follow seem to differ from the foregoing in wanting definite inferior appendages. They are characterized by having black spines on the lower angle of the dorsal section of the last segment.

Oxyethira spinosella. McLach.—I am also indebted to Mr. McLachlan for having let me see the types of this species, and I give a few figures taken therefrom.

PLATE V., fig. 1, apex of abdomen from side, obliquely; 2, same, from above; 3, ventral plate and penis; 4, 5 and 6, various aspects of penis.

Oxyethira falcata, n. sp.

Antennæ 37-jointed in the male, usually fuscous (apparently with pallid tip), but sometimes paler; clothing of head yellowish white on vertex, black in front; legs dingy testaceous, the femora sometimes fuscescent, and the tarsi indistinctly annulated with darker. Anterior wings brown, with white or yellowish markings; fringes very dark, save where the paler markings intersect them. In the male the last dorsal segment has the lower angles inturned, and these angles bear two (or three) short blackish spines. The penis varies much in appearance according to the aspect from which it is viewed; it is dilated asymmetrically, one side being produced into a kind of tusk, the margin of the other side being angulated. The inner anal parts are complicated, but a pair of ear-shaped appendages are usually visible, if a strong reflected

light is thrown into the cavity. The ventral plate is rather deeply excised with well-marked lateral lobes; from between the lobes springs a broad process which almost fills up the space between the lobes, and which tapers slightly towards the pointed apex; anteriorly, the margins of this process appear to be narrowly folded and are blackish along with the apex. Expanse of male about 5 mm., female about 7 mm.

Scotland (Redmyre Loch, near Carluke, about 600 ft., not rare, *Morton*); England (near Woodbury, and Ottery St. Mary, Devon, in July, *Eaton*); Ireland (Knappagh Laogh and Cushinsheen Laogh, near Westport, *J. J. King*).

A species abundantly distinct, on account of the process arising from between the lateral lobes of the ventral plate. It appears to belong to the same group as the Madeiran *O. spinosella*, McLach., but differs in the peculiarity of the ventral plate alluded to; the spines, too, are different, the innermost spine in *O. spinosella* standing apart from the others, and being carried on an obtuse process. The penis in the two species is on the same plan.

PLATE V., fig. 1, apex of abdomen in front; 2, ventral plate; 3, outline of apex of abdomen from side continued beneath, to show ventral lobe; 4, 5, 6 and 7, aspects of penis.

Oxyethira Frici, Klap.—This species was also described in Sitz. Böhm. Ges., 1890. At one time I considered the above-described British insect might belong to this species, but Professor Klapálek, who has kindly presented specimens of his species to me, points out the following differences:—The spines in the British insect are much stouter and shorter than in *O. Frici*, in which there are on the left side 4, and on the right 3 spines. In *O. Frici* the penis is dilated quite symmetrically, but the teeth are a little asymmetrical, being nearer to the apex on the one side than on the other. The form of the ventral plate in *O. Frici* is also peculiar, and there is no process between its lateral lobes.

A reproduction of Klapálek's figures is here given.

PLATE VI., fig. 1, apex of abdomen from beneath; 2, same, from side; 3, penis, from above.

Explanation of Plates V. & VI.

PLATE V.

Hydroptila stellifera.—Fig. 1, apex of abdomen of male from beneath; 2, do., from side.

H. fortunata.—Fig. 1, apex of abdomen of male from beneath; 2, do., from side (in outline); 3, penis; 4, apex of penis (more enlarged).

H. uncinata.—Fig. 1, apex of abdomen of male from beneath; 2, do., from side.

Oxyethira distinctella.—Superior appendages.

O. unidentata.—Fig. 1, apex of abdomen of male from beneath; 2, do., from side.

O. spinosella.—Fig. 1, apex of abdomen of male from side, obliquely; 2, do., from above; 3, ventral plate and penis; 4, 5 and 6, various aspects of penis.

O. falcata.—Fig. 1, apex of abdomen of male, in front (fig. inverted); 2, ventral plate; 3, outline of apex of abdomen from side, continued beneath to show ventral lobe; 4, 5, 6 and 7, aspects of penis.

PLATE VI.

Hydroptila Maclachlani.—Fig. 1, apex of abdomen of male from beneath; 2, penis.

Stactobia atra.—Fig. 1, apex of abdomen of male from beneath; 2, do., latero-ventral view; (*a*) obtuse process, (*b*) pieces produced into spine at apex, (*c*) downturned lobes, (*d*) inferior appendages (?) (*cf.* McLach., Mon. Rev., 1st Additional Supplement, p. 72); 3, neuration of anterior wing.

Oxyethira costalis.—Fig. 1, apex of abdomen of male from beneath; 2, hook above ventral plate.

O. ecornuta.—Fig. 1, apex of abdomen of male from beneath; 2, do., in front; 3, do., from side; 4, hook above ventral plate; 5, apex of penis.

O. Frici.—Fig. 1, apex of abdomen of male from beneath; 2, same from side; 3, penis from above.

V. *Descriptions of new genera and species of Neotropical Rhynchota.* By W. L. Distant, F.E.S.

[Read December 7th, 1892.]

The following descriptions were written eight years ago at the request of Mr. Whymper for inclusion in the Natural History Appendix to his 'Travels amongst the Great Andes of the Equator.' This publication appeared in the spring of the present year, and my species and genera are only indicated by name, as I was refused an opportunity of correcting proof with the woodcuts inserted in the text, and therefore declined to allow the sheets to go to press. It thus becomes a duty I owe to my brother students of the order to publish the full descriptions, while the above explanation will serve as comment to a footnote which Mr. Whymper has chosen to place to the first page of my contribution. I also correct some errors in what was thus printed without my supervision.

Descriptions and Corrections.

Suborder HETEROPTERA.

Fam. PENTATOMIDÆ.

Subfam. PENTATOMINÆ.

Nezara nebulosa, in Whymper's Travels Great Andes, Append., p. 112 (1892).

I originally considered a specimen collected by Mr. Whymper in the "Forests above the Bridge of Chimbo" as sufficiently distinct from *N. stictica*, Dall., to be indicated as *N. nebulosa*, n. sp., but the subsequent examination of a long series of specimens collected throughout Central America proved the character to be of a varietal nature only (Biol. Central Am. Rhynchot. Heterop., p. 338, "1890").

This is one of the errors to which I have referred, and *N. nebulosa* as a new species would have disappeared in the correction of the proof.

Fam. COREIDÆ.

Division *Spartoceraria.*

Sephina culta, n. sp., Dist. MS., in Whym. Travels Great Andes, Append., p. 112, n. 6 (1892).

Black; a central longitudinal fascia to both corium and scutellum, and a spot on disk of corium, ochraceous; eyes greyish; abdomen above dull reddish, the base and apex more or less black, connexivum with some oblique black spots; membrane dark olivaceous. Body beneath black; lateral margins and central basal margin of mesosternum, and two central discal spots to abdomen, ochraceous; lateral margins of abdomen pale castaneous. Antennæ finely pilose, first and second joints subequal in length, third shortest; basal joint and apex of third joint incrassated; pronotum with the lateral angles acutely produced; posterior femora armed beneath with some short obtuse spines near apex.

Long. 22 millim. Exp. lat. ang. pron. 8 millim.

Hab. Milligalli (height unknown).

S. culta, by its peculiar markings, is nearest allied to *S. geniculata*, Dist., a Costa Rican species.

Division *Corearia.*

Margus tibialis, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 113, n. 7 (1892).

Brownish grey, thickly and finely punctured with brown; head with the eyes and ocelli pale castaneous, the antenniferous tubercles obtuse, not spined; antennæ concolorous, the basal joint more or less black-speckled, especially beneath; the apical joint fuscous with its base paler, the second joint slightly longer than the third; extreme lateral margins of the pronotum ochraceous, spotted with fuscous, the rounded lateral angles narrowly fuscous or black; scutellum with the apex luteous, and with an indistinct pale central longitudinal line; nervures of the corium pale, spotted with reddish brown; membrane fuscous; abdomen above blackish, the connexivum reddish brown, indistinctly banded with luteous at the segmental incisures; body beneath pale brownish; abdomen with two central and a lateral row of small fuscous spots; legs ochraceous, the femora very thickly spotted and annulated with black, the tibiæ with a few blackish spots, the apices of the tarsi black; rostrum, especially in apical half, more or less clouded with piceous.

Long. 7 to 8 millim.

Hab. Eastern side of Corazon (12,000 ft.), eastern side of Pichincha (12,000 ft.), Hacienda of Guachala (9217 ft.), Machachi (9—10,000 ft.), Pacific slopes (7—8000 ft.).

This species is allied to both *M. pectoralis* and *M. pallipes* of Dallas.

Division *Harmostaria.*

Harmostes corazonus, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 113, n. 8 (1892).

Fuscous, thickly and closely punctate; head dark fuscous, eyes pale ochraceous; antennæ with the basal and apical joints reddish brown, the last with its base ochraceous, second and third joints ochraceous speckled with brown, third a little longer than second; pronotum with a central longitudinal line, and the posterior margin very narrowly ochraceous, the lateral margin broadly ochraceous, punctured with brown, the punctures confluent at lateral angles; scutellum dark fuscous (*mutilated with pin*), the lateral margins narrowly ochraceous, with a pale spot on disk; corium with a distinct double series of fuscous spots on costal margin, and the nervures spotted with reddish brown; membrane pale hyaline; abdomen above black, the connexivum and a large apical spot ochraceous, the last containing two smaller black spots; body beneath more reddish brown than above, disk of mesosternum and central sulcation to metasternum black; femora reddish brown, thickly and darkly punctate; tibiæ and tarsi pale ochraceous speckled with brown, apices of the tarsi black; posterior femora with some apical spines beneath, of which two are long, ochraceous, and apically black; rostrum ochraceous, with the apex black.

Long. 5½ millim.

Hab. Eastern side of Corazon (12,000 ft.).

This species is apparently allied to the Chilian *H. raphimerus*, Spin.

Harmostes montivagus, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 113, n. 9 (1892).

Ochraceous, the head, pronotum, and scutellum thickly punctured with brown; antennæ ochraceous speckled with brown, the apical joint darker, pilose, and with its base ochraceous; third joint longer than second; pronotum with the margins (anterior and posterior narrowly) and a central longitudinal line ochraceous scutellum with the margins and a central longitudinal line ochra-

ceous, the apex blackish; corium with some black punctures on costal margin, and a large brown patch near apical margin; the clavus brown-punctate; membrane pale hyaline, mottled with pale brownish; abdomen above ochraceous, the base, a transverse fascia about centre followed by two shorter fasciæ on each side, black; body beneath and femora ochraceous, punctured with reddish brown; tibiæ and tarsi luteous thickly speckled with fuscous, apices of the tarsi black, femora spined beneath at apex, two spines being prominent, long, and with their apices fuscous; rostrum ochraceous with its apex fuscous.

Long. 6 millim.

Hab. Machachi (9—10,000 ft.), eastern side of Corazon (12,000 ft.).

Fam. LYGÆIDÆ.

Division *Orsillaria*.

Nysius procerus, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 113, n. 10 (1892).

Greyish, spotted and marked with fuscous and black. Head coarsely punctate, with a broad fascia between the eyes, interrupted in the centre; the lateral margins and the margins of the central lobe blackish; antennæ fuscous, second joint a little longer than the others, third and fourth subequal in length; eyes fuscous; pronotum coarsely punctate, with a broad transverse blackish fascia near anterior margin, and from which five narrow fuscous fasciæ radiate to posterior margin; lateral angles (excepting apex) dark fuscous and moderately nodulose; scutellum coarsely and blackly punctate, with a central black levigate cruciform impression, and the apex pale greyish ochraceous; corium longitudinally spotted with fuscous along the veins, and with three dark fuscous elongate spots on apical margin; membrane greyish, obscurely spotted with pale fuscous. Body beneath *imperfectly seen owing to specimen being carded;* legs pale ochraceous, femora spotted with dark fuscous, extreme base of tibiæ and apices of tarsi fuscous.

Long. 4 millim.

Hab. Machachi (9—10,000 ft.).

This species should be nearest allied to the Colombian *N. nubilus*, Dall., the type of which is no longer to be found in the British Museum.

Fam. CAPSIDÆ.

Subfam. CAPSINÆ.

Division *Miraria.*

Neomiris, gen. nov., Dist. MS., in Whym. Trav. Great Andes, Append., p. 113 (1892).

Allied to *Miris*, and differing from that genus principally in having the posterior margin of the pronotum slightly emarginate and not covering the base of the scutellum, which is punctate, thus differing from *Megaloceræa* and allies.

Head moderately long, scarcely or not deflected in front, and with a distinct and narrow longitudinal sulcation on basal half; antennæ about as long as the body, with the first joint robust, strongly pilose, and considerably longer than the pronotum; second joint finely pilose, and about twice the length of the first; third joint one-third shorter than second, and considerably longer than fourth. Pronotum coarsely punctate, longer than broad, the anterior margin slightly concave, the lateral margins more strongly concave, the lateral angles subnodulose, and with a somewhat faint transverse constriction near anterior margin, the basal margin emarginate and not covering the base of the scutellum. Scutellum coarsely punctate. Rostrum reaching or slightly passing the intermediate coxæ.

In the same year (1884) as I wrote the description of this genus, Dr. Reuter founded his *Dolichomiris* for the reception of a West African species; and I am obliged to Dr. Bergroth for informing me that a species of the same genus has since been received from Venezuela. *Neomiris* is closely allied to *Dolichomiris*, but differs by the coarsely punctured pronotum and scutellum; the subnodulose lateral angles to the pronotum, &c.

Neomiris præcelsus, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 113, n. 11 (woodcut), (1892).

Body above brownish ochraceous; head with a broad black streak in front of each eye, and continued along margin to apex; antennæ with the apical half of the second joint more or less castaneous, the third and fourth joints fuscous. Pronotum coarsely punctate, with a central pale levigate longitudinal line, a large black spot at each anterior angle, extending to near middle of pronotum, and sometimes narrowly and more faintly continued to basal margin, which is also (excluding angles) blackish. Scutellum

coarsely punctate, with the apex and a central longitudinal line pale and levigate, and with a large black spot near each basal angle; corium finely punctate and pilose, the lateral margins and cuneus ochraceous; the clavus also *sometimes* paler; membrane fuscous; legs ochraceous, apices of the tarsi black. Body beneath imperfectly seen owing to the specimen being carded.

Long. 8 millim.

Hab. Hacienda of Antisana (13,300 ft.).

Division *Phytocoraria*.

Dionyza, gen. nov., Dist. MS., in Whym. Trav. Great Andes, Append., p. 114 (1892).

Allied to *Compsocerocoris*, Reuter, but differing by the greater length of the basal joint of the antennæ, which is as long as the head and pronotum together; head more robust, wider and somewhat gibbous between the eyes; pronotum much flatter, not deflected from basal half.

Dionyza variegata, n. sp., Dist. MS., in Whym. Trav. Great Andes, p. 114, n. 12; woodcut facing p. 13 (1892).

Dull ochraceous, more or less mottled with dark fuscous; head with two dark fuscous spots near apex, and with a central longitudinal line, crossed by a lunate line between eyes, pale fuscous; eyes dark greyish; antennæ dull ochraceous, apex of the first joint narrowly whitish, before which is a short obscure pale fuscous annulation; second joint with a blackish annulation near base and apex, both of which are whitish; third joint pale fuscous, the extreme base and apex paler (fourth joint mutilated); pronotum thickly mottled with fuscous, the anterior and posterior margins ochraceous, and with a large central quadrate greyish spot; scutellum with a broad central fascia and the apex dark fuscous; corium mottled with pale fuscous, the apex of the clavus and some costal spots dark fuscous; cuneus pale ochraceous, the apex, a spot at each basal angle, and one on inner margin, dark fuscous; membrane ochraceous, mottled with fuscous. Body beneath and legs ochraceous, the margins more or less dark fuscous; femora annulated with fuscous on their apical halves, tibiæ annulated with fuscous near their extreme base and apex, apices of the tarsi dark fuscous; rostrum ochraceous, its apex fuscous.

Long. 7 millim.

Hab. Eastern side of Corazon (12,000 ft.).

Calocoris montanus, n. sp., Dist. MS., in Whym. Trav. Great Andes, p. 114, n. 13 (1892).

Brownish ochraceous, mottled with greyish; eyes fuscous; antennæ brownish ochraceous, apex of first joint whitish, second joint about twice the length of the first, its apex whitish preceded by a blackish annulation, base of the third joint whitish (fourth mutilated); membrane brownish ochraceous, mottled with fuscous. Body beneath brownish ochraceous, margins reddish castaneous; legs brownish ochraceous, femora with their apices annulated with fuscous, apices of the tibiæ and tarsi fuscous.

Long. 7 millim.

Hab. La Dormida, Cayambe (11,800 ft); Pacific slopes (7—8000 ft.).

Only one perfectly developed specimen of this species was captured, the others being immature examples. As observed in these the upper surface of the abdomen is reddish castaneous.

Division *Capsaria.*

Lygus collinus, n. sp., Dist. MS., in Whym. Trav. Great Andes, p. 114, n. 14 (1892).

Ochraceous, with blackish markings; head rather darker, with the eyes dark grey; antennæ with the second joint twice as long as the first, the apex blackish, apex of the third and the whole of the fourth joint fuscous; pronotum with the anterior margin greyish white, the lateral and basal margins (the last very broadly) blackish; scutellum blackish, the lateral margins from a little beneath basal angles and the apex pale ochraceous and levigate; corium with the disk infuscated, the clavus more or less infuscated, with the outer margin dark fuscous; cuneus infuscated, its inner margin dark fuscous; membrane dark fuscous. Body beneath obscurely seen, owing to specimen being carded; legs mutilated.

Long. 6 millim.

Hab. Hacienda of Guachala (9217 ft.).

Lygus sublimatus, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 114, n. 15 (1892).

Ochraceous, covered with golden pubescence; eyes castaneous; antennæ black, first and second joints with an ochraceous annulation, that of the first central and of the second subbasal; scutellum with the basal margin and disk more or less blackish; corium with two blackish streaks, one on claval margin occupying its apical

half, the other commencing about middle of costal margin, and terminating at inner basal angle of cuneus; cuneus brownish; membrane pale fuscous, the cellular margin paler. Body beneath with the sternum fuscous, the abdomen ochraceous, legs ochraceous; femora with their apices speckled with fuscous; apices of the tarsi blackish.

Long. 5 millim.

Hab. La Dormida, Cayambe (11,800 ft.).

Lygus excelsus, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 114, n. 16 (1892).

Ochraceous, marked and spotted with blackish; antennæ ochraceous, the apex of the second joint and the whole of the third and fourth joints fuscous; pronotum with two large basal central wedge-shaped spots, and a small spot at lateral angles, blackish: scutellum with the centre of the basal margin blackish; clavus more or less shaded with blackish, except at apex; corium with a broad irregular central transverse blackish fascia; cuneus ochraceous; membrane pale fuscous, spotted with darker fuscous at base and apex. Body beneath pale brownish ochraceous, with a central blackish fascia; legs mutilated.

Var. Paler than the typical form as here described; the spots on the pronotum smaller; clavus pale and unicolorous; the transverse fascia to corium smaller and more indistinct.

Long. 5 millim.

Hab. Eastern side of Corazon (12,000 ft.).

Division *Bryocoraria*.

Lyde, gen. nov., Dist. MS., in Whym. Trav. Great Andes, Append., p. 114 (1892).

Allied to *Ania*, but differing by the shorter and more ovate body; the basal joint of the antennæ much shorter, very little longer than the head; the second joint half as long again as the first; pronotum relatively shorter and broader.

Lyde translucida, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 114, n. 17; woodcut facing p. 113 (1892).

Head dull ochraceous, with a black spot behind the eyes, which are greyish; antennæ ochraceous, the outer margin of the basal joint, the apex of the second, the apical third of third, and the whole

of the fourth joint, fuscous; pronotum pale ochraceous, the punctures on the basal half dark and pale brownish, the anterior collar greyish and margined with black both above and beneath, the preceding constriction dark ochraceous, the lateral angles subnodulose and dark fuscous; scutellum black; corium pale hyaline, base of costal margin and an oblique linear spot near inner apex blackish; cuneus pale hyaline; membrane pale hyaline, very slightly infuscated; anterior legs pale ochraceous, remainder mutilated. Body beneath pale ochraceous, sternum with two blackish marginal oblique spots.

Long. $4\frac{1}{2}$ millim.

Hab. Pichincha (12,000 ft.).

Fam. ARADIDÆ.

Subfam. BRACHYRHYNCHINÆ.

Division *Brachyrhyncharia.*

Cinyphus? obscurus, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 114, n. 18; woodcut, p. 115 (1892).

Fuliginous brown; legs and antennæ darker and more fuscous; apex of the last joint of antennæ and bases of the tibiæ ochraceous; eyes obscure greyish; apex of the corium pale fuscous; body beneath very dark fuscous; coxæ ochraceous, tarsi beneath with their bases distinctly ochraceous; rostrum brownish ochraceous, its apex somewhat pitchy. The head has a long prominent spine on each side in front of the eyes at the base of the antennæ, and a second more obtuse spine behind the eyes; antennæ with the basal joint globosely incrassated and reaching apex of head, which is cleft; third joint slightly longer than first; fourth globosely incrassated, and subequal to, or a little shorter than, second; pronotum with the anterior angles lobately produced, behind which the lateral margins are concavely sinuated, convexly round at middle, and then obliquely truncated to lateral angles; basal margin slightly concave before base of scutellum, disk of anterior lobe with two central stout obtuse tubercles; scutellum with two central large and deep foveæ; corium slightly and lobately produced at base of costal margin.

Long. 8 millim.

Hab. Forests above the Bridge of Chimbo (1—300 ft.).

I have provisionally retained this species in the genus *Cinyphus*, to which it has the strongest affinities. It differs, however, in the structure of the antennæ, and

will doubtless eventually necessitate the creation of a new genus for its reception.

Aneurus flavomaculatus, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 115, n. 19 (1892).

Black; membrane with a large irregular dull ochraceous spot at base; basal joint of the antennæ short, very globosely incrassated, and not reaching apex of head; second and third joints subequal, apical joint very much the longest; pronotum with the anterior angles rounded, the lateral margins acutely sinuate near centre, lateral angles rounded. The head, pronotum, and scutellum are very coarsely punctate. Body beneath black, the coxæ and disk of abdomen castaneous.

Long. 6 millim.

Hab. Eastern slopes of Pichincha (12,000 ft.).

Fam. REDUVIIDÆ.

Subfam. STENOPODINÆ.

Stenopoda scutellata, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 116, n. 23, woodcut (1892).

Pale ochraceous; eyes black; head with a central longitudinal fascia on basal third, interrupted at eyes and forked anteriorly; pronotum with three central fasciæ, widened and fused posteriorly; a shorter and narrower fascia on each side, and a narrow marginal line; scutellum, excluding apex, a broad central streak to clavus—widened posteriorly—a basal spot and a larger and irregularly bifid central spot to membrane, a series of linear, marginal, and oblique spots to connexivum, irregular spots and markings to anterior femora, apices of intermediate and posterior femora, a central annulation to posterior femora, two broken annulations to tibiæ—one at and the other near base—apices of tibiæ and tarsi, a marginal line to prosternum, an oblique lateral line to meso- and metasternum, a submarginal fascia to abdomen, a series of spiracular spots and connexivum, with the markings as above, dark fuscous or blackish; antennæ with the basal joint pale ochraceous, with a broad central fuscous annulation; second joint fuscous, with a subapical pale annulation; third joint ochraceous, remainder mutilated; scutellum with a small suberect nodulosity on each side near base.

Long. 20 millim.

Hab. Guayaquil (indoors).

Pnohirmus whymperi, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 117, n. 24, woodcut (1892).

Pale ochraceous, marked and shaded with fuscous; head with the lateral margins, a central longitudinal line on the post-ocular portion, and two lines with a common base on the ante-ocular portion, fuscous; antennæ ochraceous, the basal joint mottled with brownish; eyes fuscous; pronotum with a central longitudinal fascia, widened posteriorly, on each side of which are two other more obscure narrower fasciæ, fuscous; scutellum fuscous; corium infuscated, with the veins ochraceous; membrane pale fuscous; connexivum spotted with fuscous. Body beneath and legs ochraceous; anterior femora mottled with brownish, and with a distinct subapical brownish annulation; intermediate and posterior femora mottled with brownish, with black apical annulations (the intermediate in some varieties with a second black annulation); anterior and intermediate tibiæ biannulated with brownish; the lateral angles of the pronotum are obtusely nodulose; the scutellum has a deep central basal longitudinal sulcation.

Long. 13 to 14 millim.

Hab. La Mona (100 ft.).

Fam. ACANTHIADÆ.

Acanthia andensis, n. sp., Dist. M.S., in Whym. Trav. Great Andes, Append., p. 118, n. 26, woodcut (1892).

Shining black; apex of the head, costal margin of corium, excepting base, and terminating in a spot at apex and a spot near base, membrane, excluding cellular margins, coxæ, and legs, ochraceous; some small obscure greyish spots on disk of corium, and two spots of the same colour at apical margin, the largest and outermost with a black centre; antennæ castaneous, the two apical joints more or less fuscous; margins and veins of the membrane fuscous; eyes greyish, mottled with dark fuscous; apices of the tibiæ and tarsi dark fuscous; rostrum pale castaneous; the membrane possesses four normal cells, a fifth and innermost being more or less rudimentary; the antennæ are strongly hirsute, the second joint longest (almost twice the length of the first), the third a little shorter than the fourth.

Long. 4 millim.

Hab. Machachi (9—10,000 ft.).

Suborder HOMOPTERA.

Fam. CICADIDÆ.

Carineta fimbriata, n. sp., Walk. MS., in Brit. Mus.; Dist. MS., in Whym. Trav. Great Andes, Append., p. 119, n. 31, woodcut (1892).

Head and pronotum above ochraceous; the abdomen castaneous; the former moderately pilose, the last strongly so; ocelli red; eyes sometimes greyish, sometimes black; pronotum with two contiguous central black spots at anterior margin, united posteriorly and extending in a central line to edge of posterior margin; on each side of these is a rounded black spot, followed by an oblique looped marginal spot; mesonotum with four obconical black margined spots at base, the two central shortest, behind which is a black spot, subquadrate in shape, with a central lanceolate production; abdomen thickly covered with greyish pile. Body beneath strongly pilose, the sternum more or less ochraceous, the abdomen dark castaneous; legs ochraceous, the anterior femora subannulated at base and apex with blackish, the intermediate and posterior femora streaked beneath with blackish; anterior tarsi blackish, intermediate and posterior tarsi with the bases and apices blackish; rostrum castaneous, the apical half castaneous; tegmina and wings pale hyaline; tegmina with the basal half of the venation more or less ochraceous, the remainder fuscous; costal area and membrane ochraceous; a spot at the end of radial area, a spot at the base of second and third apical areas, a small spot beneath radial area, and the "limbus enervis" from apex of lower ulnar area to base, fuscous; some obscure marginal spots on apical third of costal and on the whole of outer margins; wings with a central fuscous spot, and the abdominal area margined with the same colour.

Long. 21 millim.; exp. tegm. 70 millim.

Hab. Nanegal (3—4000 ft.), Quito (9350 ft.), Machachi (10,000 ft.).

I had previously received this species from Ecuador, where it seems to be of a somewhat abundant character. It is named *C. fimbriata*, Walk., in the collection of the British Museum, but I have failed to find any published description of the species.

Fam. CERCOPIDÆ.

Subfam. CERCOPINÆ.

Sphenorhina ruida, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 119, n. 32 (1892).

Dark brownish ochraceous, very thickly and finely punctured; head paler ochraceous; the eyes, antennæ, and a broad central longitudinal fascia, black; tegmina with a distinct greyish white spot on costal margin at about one-third from base; a much more obscure and less pale mark at base, and the apical half of tegmina also more or less paler in hue. Body beneath pale ochraceous; the upper half of face black, margins and apex of abdomen castaneous; legs pale greenish, ochraceous beneath, brownish ochraceous above; apices of the femora, bases and apices of the tibiæ, and the tarsi, fuscous; rostrum brownish, with the apex black.

Long. 8 millim.

Hab. Forests above the Bridge of Chimbo (1—3000 ft).

Sphenorhina tullia, n. sp. (*S. jullia*, sic), Dist. MS., in Whym. Trav. Great Andes, Append., p. 119, n. 33 (1892).

Pale brownish ochraceous, thickly and finely punctured; head ochraceous; eyes, antennæ, and a broad central longitudinal fascia to head black; pronotum with two obscure ochraceous discal spots near anterior margin; scutellum with the apex ochraceous; tegmina with a pale ochraceous spot at base of clavus, a transverse fascia (somewhat fractured by the veins) at about one-fourth from base, and two longitudinal fasciæ on basal half also pale ochraceous; abdomen above brownish ochraceous, the apex pale. Body beneath and legs pale ochraceous, the abdomen brownish ochraceous, with the apex pale; upper portion of the face black; anterior and intermediate tibiæ, apices of the posterior tibiæ, and the tarsi, fuscous.

Long. 9 millim.

Hab. Forests above the Bridge of Chimbo (1—3000 ft.).

Fam. JASSIDÆ.

Subfam. TETTIGONIINÆ.

Tettigonia medusa, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 120, n. 36 (1892).

Head black; anterior margin, inner margin of eyes, lateral portions of posterior margin divided by a subquadrate spot, yellow; pronotum with the anterior portion black, the posterior area choco-

late-brown, with two large central spots and a small intervening spot yellow; scutellum black, with four yellow spots, the two anterior longitudinal and curved, the two posterior transverse; tegmina pale chocolate-brown, the inner claval margin and two discal longitudinal fasciæ, the outermost connected with the costal margin by a spot near apex, very pale creamy stramineous; the centre of the costal margin narrowly yellowish. Body beneath black; the inner margin of eyes, face—interrupted by a black line—some spots at lateral margin of pronotum, yellow; abdomen with the connexivum orange spotted with black, the apex and posterior margin of the abdominal segments yellowish; legs ochraceous, the tarsi and the tibial spines black.

Long. 8 millim.

Hab. Machachi (9—10,000 ft.).

This species is allied to the *T. Walkeri*, Sign., a species received from Quito.

Tettigonia duplicaria, n. sp., Dist. MS., in Whym. Trav. Great Andes, Append., p. 120, n. 37, woodcut (1892).

Black; head with the eyes and a large central frontal spot (sometimes divided) greyish; tegmina with the apical half more or less irregularly ochraceous, traversed by an irregular longitudinal black fascia, the claval margin also black; wings pale hyaline; body beneath and legs black.

Var. Tegmina with the apical half irregularly greyish instead of ochraceous.

Long. 8 millim.

Hab. Machachi (9—10,000 ft.), Hacienda of Guachala (9217 ft.).

VI. *On some neglected points in the structure of the pupæ of Heterocerous Lepidoptera, and their probable value in classification; with some associated observations on larval prolegs.* By Dr. Thomas Algernon Chapman, M.D., F.E.S.

[Read February 22nd, 1893.]

Desultory and unrecorded observations of many years on pupæ were recently thrown into order and invested with a meaning by a study of the earlier stages of the *Adelidæ*, and I have since taken more accurate notes of the structure of the pupæ of many species. Such accurate record, however, is a tedious and laborious process, and to go over the whole ground, or even a large fraction of it, will involve many years' work, and require the combined energies of a number of observers. I have therefore thought it better to bring the subject forward in its present imperfect state, in order to direct attention to it, rather than wait an indefinite time for the comparatively small additions I should myself be able to make; and, whilst apologising for the want of a larger mass of material, I may say that the indefinite and unnoted work of many years enables me to handle the material I have with more confidence than its own amount might appear to justify.

Descriptions of pupæ are often very minute in various particulars, but it is curious that they are usually silent on the points that I desire to draw attention to. One consequence of this is, that almost every fact that I here report has had to be observed by myself, with no assistance from any published description. The reference to the pupa of *Nascia cilialis*, described by Mr. W. H. B. Fletcher, is, indeed, almost the only exception, though I am indebted to various correspondents for materials for observation. This is one excuse for calling attention to the subject as early as possible. It is very desirable that these omissions may in the future be supplied, and

that the description of an interesting pupa may not be found wanting, as at present it constantly is, in just the most important particulars.

The pupæ of the great mass of Lepidoptera Heterocera are of one or other of two forms characterised by very distinct and decided characters; the exceptions are, in a few instances, amongst the *Tineina:* with regard to these, I require to obtain more material and devote more study to them before venturing to say whether they are aberrant forms of either of the two principal divisions, whether they include perchance connecting forms, or whether they represent other and distinct divisions of equal importance (except in numbers) with the two principal divisions; but I think it probable that instances of each of these cases present themselves. One thing is certain, that they prove—already perhaps sufficiently evident—that the *Tineina*, instead of being a homogeneous group like the *Geometræ* or the *Tortricina*, contains groups of equal importance, for classificatory purposes, with them, and is in fact a mere heading for a number of very different groups of unclassified affinities, agreeing only in consisting of individuals of small size.

Before describing in detail these two forms of pupæ, I may make the way clearer by first directing attention to what I have called the "free segments,"—that is to say, the segments of the pupa that preserve freedom of movement. It would, perhaps, be more accurate to describe incisions where movement is preserved. Thus in a *Noctua* pupa we find movement exists between the fourth and fifth, between the fifth and sixth, and between the sixth and seventh, abdominal segments; but such description is more cumbrous, and therefore more inconvenient, than to say simply that the fifth and sixth abdominal segments are "free,"—that is, preserve freedom of movement with the segments adjacent to them on both sides, and one has not to revert to the more accurate but more circumlocutory expression, except when movement remains in one incision only (as in *Cœnonympha pamphilus*) when there is no "free segment," and the incision at which movement remains has to be stated.

I have not dealt with the butterflies, which require to be treated separately from the moths in this matter, as

their variations in free segments and correlated matters do not come into line with the moths at all. My observations on them have, indeed, been too scanty to do more than show that this is so. I can only say that, in a few species at least, one finds in *Lycænidæ* no movement, in *Satyridæ* one incision with movement, in *Pieridæ* and *Erycinidæ* one free segment, in *Nymphalidæ* and *Papilionidæ* two free segments.

With the exception, then, of two or three small groups in the *Tineina* (so far as my observations extend), the *Heterocera* fall, in the matter of "free segments," into the two great classes I have mentioned,—*viz.*, 1st, those in which the free segments are the fifth and sixth abdominal, and only these, in both sexes; 2nd, those in which the seventh abdominal segment is free in the male, fixed in the female.

The first group is remarkably uniform in this, and in certain correlated characters throughout; whilst the second presents, along with some very fixed correlated characters, considerable variations in various directions, especially in the number of forward abdominal segments which are free.

These two forms of pupa present other and remarkable points of difference from each other; many of these other characters may be grouped together, as associated with definite differences of structure. The pupa with segments 5 and 6 only, free in both sexes, is that we are most familiar with, say amongst the *Noctuæ*. Such a pupa presents a hard, strong, chitinous exterior. When the larval skin is cast, the appendages, legs, wings, &c., fall into their places, and lie together so as to form a smooth exterior, which becomes hard and solid, whilst the surfaces that are hidden by being applied against each other have but a delicate pupal skin, represented, when the moth emerges, by a few flimsy shreds, whose previous position is almost impossible to determine, so that the empty pupa-case consists almost entirely of that portion which formed the outer covering. Such a pupa has been named "obtected," and was the pupa in view when the pupa of Lepidoptera was so described.

The pupa with the seventh abdominal segment free in the male, on the other hand, presents characters that bring it into line with those of bees and beetles. It is, to a great extent, "incomplete."

These two divisions agree so far with the division into Macros and Micros that one might almost be satisfied with those names for the pupæ and the groups they characterise, and I have learned to so regard them so far as to often use these names. There are, however, sufficient exceptions to make it desirable perhaps to have another name, and I will use those just suggested as being most descriptive. The first form of pupa (Macro) I will call "obtected," and the group which presents it "*Obtectæ*" (Macros); the other pupa "incomplete," more strictly semi-incomplete, and the group of moths presenting it "*Incompletæ*" (Micros).

The semi-incomplete pupa is of course familiar to every lepidopterist, but I believe little notice has been given to its peculiarities beyond noticing its motility and the dorsal spines that facilitate its movements, and especially it has been regarded, in each family where it occurs, as a special variation from some allied obtected form, whereas the truth appears to be that, wherever it occurs, it presents certain characters that show that its possessors belong to a separate division from the *Obtectæ*,—that it is probably a lower form, although many families of the *Incompletæ* have, in different directions, acquired higher characters than many of the *Obtectæ* have; such as the *Zygænidæ* in one direction, the *Pterophoridæ* in another, and the *Lithocolletidæ* in a third. Of these characters, none is more constant or more interesting—not only in itself, but in having, so far as I am able to point out, no necessary connection with the incomplete type—than the freedom of the seventh segment in the male; nor am I aware that attention to it has hitherto been directed.

In the pupa of the *Incompletæ* (Micros) the exposed surface is often perhaps less solid than in the *Obtectæ*, but at any rate the pupal skin of covered surfaces is much stronger than in them, and on emergence of the imago hangs together, so that the nature of each portion is rarely difficult to determine, and some portions, as in *Tortrices* for instance, the inner wing-coverings, the portions of segments 2 and 3 (abdominal) covered by the wings and their intersegmental membranes, are only a little less firm than the coverings that are fully exposed. We here want a term to describe the process of breaking up of the pupa-case on the emergence of the moth, and

I find "dehiscence"—a term employed in Botany to describe the method in which the seed-vessels break up for the escape of the seed—meets the occasion.

On dehiscence these covered portions of the incomplete pupa become more or less fully exposed, and the appendages show an independence of each other quite at variance with ideas formed from the dehiscence of the obtected (Macro) pupa. In some *Tineæ*, even before emergence, the appendages and segments of the pupa—though apparently fused together—separate, on the least violence being applied, almost as perfectly as they would in the imago, without any fracture or tearing occurring: this would be quite impossible in an obtected (Macro) pupa.

The pupa of *O. antiqua*, female, interestingly illustrates the obtected pupa, and the fixity of the character of the fifth and sixth abdominal segments only being free; the wings and appendages are so short as not to reach the fourth abdominal segment, which might thus very easily be free, but there is no movement between it and the third either before or after dehiscence.

Certain other characters of the pupæ of the group with the seventh abdominal segment free in the male, which result from, or rather constitute, their "incomplete" structure, may now be noted.

In this pupa the head-coverings separate from the rest of the pupa in dehiscence, yet remain attached to one another in one piece,—that is, the plate covering the head and eyes; the antennæ-cases and the cases of the mouth parts separate from the rest of the pupa in one piece. In the Macro pupa these parts usually separate from each other; the head-cover is often one piece; the two antennæ-cases are separate, and the mouth-pieces may be separate, but more usually the mouth-pieces remain in one portion with the leg-coverings, and the antennæ-cases either with these or with the wings; whilst in the few cases (in Sphinges, Notodonts, and allied Bombyces) in which the head-coverings remain in one piece, they do so because they remain attached to the leg- or wing-coverings; they never remain in one piece when detached from the rest of the chrysalis-case. And similarly for the other segments in the *Incompletæ*, the pupal coverings of the wings, legs, &c., separate more or less from each other and retain their attachments

to their own proper segments, so that the empty pupa-case affords very often more information, as to the true relations of its several parts than the living pupa does.

Another aspect of this same peculiarity presents a feature in the dehiscence in which the Macro and Micro pupæ often markedly differ. An empty Macro pupa shows at once that the fifth and sixth abdominal segments were free, and no others; but an empty Micro pupa leaves much doubt as to which were free segments, because at many places, where no movement was allowed in the pupa, movement has taken place in dehiscence. Thus in *Tortrices*, where the free segments are four, five, and six (and seven in male), on dehiscence it would appear as if the wings were partially free from segments 2 and 3 (of abdomen), and as if these segments were free.

If an empty Micro pupa be examined,—and for this purpose *Cossus* and *Sesia* are most convenient, from their large size,—the cover of any appendage is found to be nearly perfect; the antennæ-case, for instance, is a tube with an opening on the inner surface close up to the head, through which the antenna has been withdrawn: in a Macro pupa it is a plate only, the inner side of the tube may or may not present just a discoverable shred of membrane.

Here an interesting observation presents itself by the way. The eyes of nearly all lepidopterous pupæ have an outer portion cut off by a sharp line from the upper and inner portion; and usually this outer portion is smooth and glassy, whilst the inner is rough, or at least similar to the rest of the pupa. Scudder ('Butterflies of New England,' p. 1554) has a short excursus on this subject, and regards this glazed eye as a remains of an ancestral pupal eye, and says it occupies the position of the line of larval ocelli. Now the dehiscence of the Micro pupa exhibits this piece as having no connection whatever with the head or eyes, but as belonging to the prothoracic segment. At any rate, what may be observed is this:—The antennæ-cases are removed from the groove in which they lie, the first portion of which is across the prothorax; the pupa-cover of the prothorax is continuous under this groove, and terminates in front in this glazed eye, which separates completely from the head (including true eyes), legs, &c., and forms a tip to

the prothoracic case. The prothorax is dorsally so degenerate a structure in Lepidoptera that the same divisions in it, as in the meso- and meta-thorax, cannot be made out in the imago, and in the obtected pupa it is covered by one plate, divided into two lateral portions. But in the *Incompletæ* (Micro) there is a very narrow plate, best seen after dehiscence, between this portion and the head, and it is with this plate that the glazed eyes are connected. If with this knowledge in hand one examines a Macro (obtected) pupa, not too near to the period of emergence, we find that from the surface line dividing the glazed from the true eye, a very strong dissepiment descends, showing here also that the two portions, though so closely and constantly associated, belong to quite different sections of the insect. I am not, of course, prepared to assert that this anterior portion of the prothorax may not have some less simple relationships, and may not be found to throw some light on the question, that is often suggested by the larva, whether the anterior portion of the second segment, which is dorsally a double one, does not ventrally contribute to supply portions of the head.*

The nature of the incomplete (Micro) pupa may be further illustrated by the way in which the long antennæ of *Adela* and *Gracilaria*, and some others, when they project beyond the other appendages, each remains separate and free to its extremity, and the same occurs as to the posterior legs in some cases; whilst in Macros (*Obtectæ*) long antennæ are carried carefully round the margin of the wing (*N. cilialis*, *D. applana*), or a long proboscis is doubled up in a projection (*Sphinx*, *Cucullia*), and so on.

Among the other characters that distinguish the Micro pupa is one which is closely associated with the semi-incomplete nature, that is, the mobility of the

* Mr. Poulton has most kindly shown me certain drawings, which, with some observations they suggest, appear to prove that the inner semilunar portion of the glazed eye is the true eye both of larva, pupa, and imago, and on such a point Mr. Poulton's authority is unquestionable. What I have regarded as part of the dorsal prothorax would therefore prove to be really part of the head. In any case, what I am just now most concerned to show, *viz.*, that there is a remarkable difference here, in structure and dehiscence, between the obtected and incomplete pupa, remains unaffected.—T. A. C.

Micro pupa. No Macro pupa leaves its cocoon or other place of pupation for the emergence of the moth; though this would often appear to be a desirable accomplishment, as, for instance, for the *Nonagrias*, the *Chilos*, the *Acronyctas*, that bore into wood or the many *Noctuæ* and others that bury themselves deeply in the soil for pupation. The Micro pupæ all do this, and are armed with various rows of hooks and spines on the abdominal segments to facilitate the process. To this rule the *Pterophori* form an exception. They have a free seventh male segment, and in dehiscence are true Micros, yet the pupa is fixed.

There is another distinction in habit between Macros and Micros that is possibly accidental, as it is by no means a universal one; still it is the case that Macros love to hibernate as pupæ. Micros very much avoid doing so. I say possibly accidental, because there are many families in both groups in which different species hibernate in different stages, and not a few genera even in which such a variety of habit is found; therefore, if this habit was originally a distinction between the two forms, it is not surprising that it has been broken in upon in many directions. But it seems probable that the semi-incomplete Micro pupa is inherently less adapted to hibernation than the fully obtected Macro. Many Micros pass the winter as larvæ in their cocoons, changing to pupæ in the spring. Among the Macros (*Obtectæ*), this habit is only common among the Pyrales. A curious illustration of this peculiarity is recorded by Mr. Healy in E. M. M., vol. iv., p. 10, in the case of *Antispila* (a true Micro, and probably indeed belonging to the *Adelidæ*). *Treitschkiella* passes the winter in its cocoon as a full-fed larva, but *Pfeifferella* as a pupa; but the moth begins to develop within it at once, and is well advanced before winter is fully set in, so that the hibernation is not truly that of a pupa. *Lithocolletes* (and *Gracilaria?*) present the largest proportion of instances of hibernating pupæ of any Micro genera; it is a curious coincidence that these have the first four abdominal segments fixed as in Macros.

In examining the mouth parts of the pupæ of certain *Adelids* (*Lampronia*, *Incurvaria*, *Adela*, &c.), I found a structure that was new to me, and which to avoid theory I called the "eye-collar." It is a narrow strip lying

transversely immediately below the eye, and stretching from the maxillæ to the antennæ, and comparable in width with the antennæ or tarsi. I suspected it to clothe some mouth part, but the curious thing was that it did not appear to unite with the mouth parts, though closely approaching them, but seemed to come from beneath the antenna. The possibility that it was some appendage of the prothorax was thus suggested. I then found the same organ in the pupa of *Sesiidæ* (*Bembeciformis*, *Tipuliformis*, and others), and, looking to the size of *Bembeciformis*, felt sure I should have no difficulty in determining what the "eye-collar" really was. In the meantime I had submitted the problem to our great authority on pupal morphology, Mr. E. B. Poulton, but he had not met with the structure, and was unable to suggest what it was. When *Bembeciformis* was ready to emerge, and also on emergence, I carefully examined this structure, and whilst disappointed in the hope of determining the question, found the problem much more interesting by the circumstance that this pupal structure did not contain any imaginal part, but was empty. I succeeded, however, shortly after, in solving the problem, by means of the pupa of *Nepticula*, in which the "eye-collar" is very well developed. It proved to be the case of the maxillary palpus, and the appearance of coming not from the mouth, but from under the antennæ and passing inwards, was in agreement with the actual fact. The palpus 5- (or 6- ?) jointed, on leaving the maxilla, passes backwards in the angle between the head and prothorax, until it is situated deeply beneath the antenna, then it turns forwards to the antenna, and only reaches the surface by emerging from beneath the antenna and turning inwards, forming the "eye-collar," which contains only its terminal joints, the others being concealed deeply.

The greatest interest of this observation perhaps consists in the light it throws on the relationship of *Sesiidæ* and others, showing that they are descended from ancestors with well-developed maxillary palpi, which are still retained in the pupal state.

The "eye-collar" is also well developed in the *Cochliopodidæ*, which in many respects closely approach *Nepticulæ*, and in almost the whole Tineal section.

As to the maxillary palpi, indeed, I do not know any

facts that would actually contradict an addition to the definition of *Obtectæ* and *Incompletæ* that would state the former to be without maxillary palpi, the latter to have them, or some trace of them at least, in the pupa state.

The very simple maxillary palpi of Pyrales would appear to be an exception to this. They are less apparent in the pupa than in the imago. Traces at least of jointed maxillary palpi always exist in a Micro pupa.

The development of the maxillary palpi will deserve a special research. *Lithocolletes* is the only form of *Incompletæ*, except *Pterophorus*, and in some degree *Zygæna*, in which the "eye-collar" is difficult to detect in the pupa, whilst many families possess a largely-developed "eye-collar," whose imagines have no maxillary palpi. In these there exists, therefore, theoretically, a 5- or 6-jointed maxillary palpi. In *Obtectæ* no maxillary palpi are seen in the pupa, and in those Pyraloids that possess one it is small and simple, and does not reach the surface in the pupa.

I have suggested that these characters probably have much value for purposes of classification. This idea arises from the circumstance that they are apparently very constant throughout each family, and thus suggest a classification that happens to be nearly identical with that now accepted; that they confirm certain more or less recent movements of groups or families to fresh positions; and that where they are at variance with accepted classification, it is usually with reference to small groups whose present position is already held to be open to much doubt.

The true Macros are at once separable from the remaining *Obtectæ* by a larval character, but I have not succeeded in determining a corresponding character in the pupa. In the Macros proper the full-grown larva has the hooks of the abdominal (4 ventral pairs) prolegs developed only along their inner margin, whilst in the remainder (Pyraloids ?) the hooks form a complete circle on the four pairs in 7, 8, and 9, and 10 segments (3, 4, 5, and 6 abdominal). I am not aware that any absolute diagnosis of Macro-Heterocera has hitherto been given, though every tyro believes in its existence.

The structure of the prolegs has received too little attention, and I do not know that anyone has noted that it differs in different families. A. S. Packard, in a recent

paper, appears to refer to all that has been written on the subject, and it does not amount to much.

My own observations are still very imperfect, and the subject, like that of the pupæ, is a large one, with room for a great deal of work. The best records of individual species I am acquainted with is that in Scudder's 'Butterflies of New England,' a work which is a model in many other respects.

I think one finds in the *Adelidæ* some indications of how the prolegs and their hooks were developed. If, as is perhaps hardly probable, they do not present us with the actual history of their development, they, by reversion or some other process, give us what are probably some of the stages. In *Eriocephala* (*Micropteryx pars*) there are no prolegs. In *Nemotois* (*fasciellus*) and *Adela* (*rufimitrella*) there are series of chitinous points, beautifully arranged in rows like the teeth of a shark, the larger in front, those in each row alternating with those in the next rows, and gradually getting smaller till they merge in the fifth or sixth row in the ordinary integumental points. In the ordinary position of each proleg there are two such sets of points facing each other along a transverse line (only the anterior set in segment 10). In *Incurvaria muscalella* the prolegs have two rows of hooks, facing each other in this way along a transverse line. In *Lampronia capitella* the young larva has no hooks, but the full-grown larva has hooks placed in a circle, yet with gaps showing that they are still an anterior and posterior set.

In *Tortrices* the row of hooks is usually double; that is, there are longer and shorter hooks, but they are always in one perfect row; but in other families we find that traces of the multiple rows of *Nemotois* persists. This is the case in *Hepialus*. In *Sesiidæ* again the circle of hooks is flattened antero-posteriorly, and weak or wanting at the outer and inner ends, showing a relationship to *Incurvaria*.

The anal prolegs very rarely have more than the anterior half developed. In *Hepialus* the circle is fairly complete.

The *Crambidæ* have hooks of alternate size like *Tortrix* (as have other Pyraloids), *Crambus* often (always ?) has 3 sizes of hooks alternated in one row.

Though it is outside my brief, I cannot help referring

to the case of the *Hesperidæ*, that in their three rows of hooks show a persistence of Adelid (or at least very low) structure, whilst the true butterflies (adult larvæ) have the same structure as the true Macros.*

The proleg then seems to reach its full development with a complete circle of hooklets. A higher development of the insect is accompanied by a fuller development of the inner half of this circle, but by the degeneration and disappearance of the outer half. This may often be followed out in Macros, where the young larva has Pyraloid prolegs, which often suddenly (at one moult), or more gradually (in two or three) assume in the full-grown larva the unilateral Macro (proper) type.

I think there can be little doubt, since it accords with conclusions arrived at on other grounds, that the highest Lepidoptera-Heterocera are those that possess unilateral prolegs in their first stages. This is the case in (some at any rate) *Sphinges*, *Notodonts*, &c., and also in *Nycteolidæ*, recently promoted, but for long kept among the *Tortrices*. They are, however, true Macros, and of a high type, probably as high as the *Sphinges*, but probably in no way related to them. The pupæ are wholly unlike any Micros, and are of strictly Macro type, with fifth and sixth abdominal segments free.

The true Macros thus defined (pupa with only fifth and sixth abdominal segments free, adult larva with only inner half of proleg furnished with hooks), correspond precisely with those usually so called, including *Nycteolidæ*, *Nolidæ*, *Deltoides*, &c., with the exception of a group of Micros that have been placed with them only on account of their size, and whose relationship to each other has been at length recognised by getting them all close together, though they are nearly related to each other in no other way than that they are all Micros (*Incompletæ*). These are the *Zygænidæ*, *Sesiidæ*, *Cossidæ*, *Zeuzeridæ*, *Cochliopodidæ*, and the *Psychidæ*, if the latter are not already by common consent placed with the *Tineæ*.

The other sections of *Obtectæ*—the Pyraloids—include the Pyralids, Phycids, Crambi, Eudoridæ, and certain

* Some pupæ of *Hesperidæ* I have seen look as if the 7th was, or had recently been, free in the ♂; but I have seen very few altogether.

groups usually placed in the *Tineæ*, some of which (like the *Gelechidæ*) are sufficiently allied to the rest of the group to be undoubtedly Pyraloids: others of which may be entitled to form groups of the *Obtectæ* of equal value with the Macros (proper) and Pyraloids. But here I must say that I have not examined enough species of each group, or minutely enough, to give more than a a very provisional opinion. These groups are the *Epigraphiidæ*, *Hyponomeutidæ*, *Plutellidæ*, *Œcophoridæ*, *Argyresthidæ*, *Coleophoridæ*, and possibly a few genera of doubtful position.

I have not formed any strong opinion as to the value of the remarkable character of many Gelechid pupæ, by which the movement of the free segments is confined to an antero-posterior one only, with something of the manner that belongs to the movement of the click-beetles. There are several oddities among the Pyrales, and this seems hardly a sufficient one to require a distinct class.

Of the Pyraloid families mentioned above, the *Hyponomeutidæ*, *Argyresthidæ*, and *Coleophoridæ*, seem to be those that are most probably of value corresponding to the Macros (proper) and Pyraloids, whilst the others rather fall in line with the other families of Pyraloids. As to this I am by no means confident, but the *Coleophoridæ*, for instance, have a pupa of by no means the hard texture of a Macro or Pyraloid, and it is not cylindrical, having on each side of the dorsum a deep hollow so that a cross section presents re-entering angles.

Finally, there is *Alucita*.

It is curious that in all these groups, whether they be classed as Pyraloids in one group or separately, the larvæ have 16 legs, and complete circles of hooks on abdominal prolegs, differing in this way from the Macros (proper) where we have groups with 14 and 12 and 10 legs (missing legs lost), and from the Micros (*Incompletæ*), where variations occur even to an apodal state (missing prolegs often (?) never acquired). I think it is also true that though nearly all are more or less concealed feeders, leaf-miners are wanting, or very rare.

The Micro (*Incompletæ*) pupæ are more interesting than the Macros, in so far that they present much more variety. Their incomplete character suggests that they are a lower form than the *Obtectæ*, and this is confirmed

by their close resemblance to many tipulid pupæ, especially those of some gall-gnats, a resemblance that appears to be one of relationship rather than accidental, from the dipterous pupa having hind wings, although the imago has halters, and from the imago presenting scales of quite a lepidopterous character.

In the Micros the number of free segments varies, the 7th is always fixed in the female and free in the male, except in *Hepialus*, when the 7th segment tends to become fixed in the male, and I am not sure that it is always quite free in all *Gracilarias*, but in both these cases the pupa is in other respects so typically Micro and related to other species in which the 7th (male) segment is free that no doubt of their position can arise.

Another character, that of free mobility, is also universal, except in the Pterophorids, which are typical Micros in "incompleteness," dehiscence, and 7th male segment.

This character of the *Pterophori* probably entitles them to the highest place in the division. There is, however, a competitor on another ground, *viz.*, the *Zygænidæ*. In the *Obtectæ* (Macros) we found the higher portion, the Macros proper, distinguished from the Pyraloids and others by the character of the abdominal prolegs, *viz.*, that they had hooks only on the inner sides. This same distinction obtains in the *Zygænidæ*, which are thus parallel with the Macros (proper).

This character of prolegs is no doubt correlated with the habit of feeding externally. The complete circle, with feeding internally or under a web, between united leaves, &c. The external habit is very rare amongst the Micros, and indeed only exists, besides the *Zygænidæ*, in the *Cochliopodidæ*, where it has been met in a different manner: and in *Micropteryx* (*calthella*), which possesses well-developed true legs (and anomalous abdominal legs). These three families are therefore close together. The free segments of *Zygæna* and *Limacodes* are the same (3456—34,567), and the curious appendages in *calthella* larva may represent the urticating organs of Cochliopod larvæ. Among the Macros proper the internal and concealed feeders retain the true Macro structure, and must be supposed to be descended from external feeders, and to have reverted to the ancient

habit, without having regained the correlated structure so far as the prolegs are concerned.

Zygæna has the 3rd and 4th, 5th and 6th (and 7th in ♂) abdominal segments free; it very markedly opens the other incisions on dehiscence, and has the other characters of a Micro dehiscence—head parts united together and separate from the others, internal pupal coverings very distinct, pupa emerges from cocoon, &c. It possesses ill-developed eye-collars (maxillary palpi). It is the only one I have noticed to retain the glazed eye with the head parts; they separate from the anterior prothoracic case, which is distinctly developed. The dehiscence is otherwise typically "incomplete."

In *Pterophorus* the dehiscence is also characteristically incomplete, the free segments are (abdominal) 4, 5, and 6 in the female, 4, 5, 6, 7 in the male.

The remaining *Incompletæ* (Micros) are not very easily divisible, but appear to form two groups that we may call *Tortrices* and *Tineæ*, or rather *Tortricoids* and *Tineoids*, but I find a difficulty in stating any definite characters (pupal) to divide them. The best appears to be in the development of the maxillary palpi. In the *Tineæ* these are always well developed in the pupæ. In the *Tortrices* they are ill-developed or almost wanting. In *Cossus*, after dehiscence, the cases of the maxillary palpi are small but quite evident, and the same obtains in most *Tortrices*.

There are, however, a few *Tineæ* in which it is also ill-developed.

Perchance the *Tortricoids* and *Tineoids* should be taken as one group and divided according to the segments that are free, or a division might be made by defining the *Tortricoids* as having a row of spines along the hind margins of the segments. This would somewhat vary the grouping.

The *Tortrices* proper form the greater part of the section of Tortricoids. They are distinguished by having the 4th, 5th, and 6th segments free in both sexes, and the 7th also in the male, by having two rows of hooks for progression across the dorsum of each segment, and by the marked way in which the 2nd and 3rd (abdominal) segments become free on dehiscence, whilst retaining a modified attachment to the wing cases. There are still many genera of *Tortrices* that I have not

been able to examine, but there is so great a uniformity amongst those that I have examined that I hardly expect to meet among the others with any wide departure from the type. *Fabriciana* differs from *Tortrices* in the hinder set of dorsal points being wanting, in the 2nd segment not so markedly becoming free on dehiscence, and in the wing cases projecting over 4th segment (though free from it), though this feature does occur in true *Tortrices*. The pedicellate legs of the larva also point to this family, though very close to *Tortrix*, being entitled to a separate place. The egg is very curious.

In *Cossus* I can find no character at any stage to distinguish it from *Tortrices*. The pupa may be taken as (very conveniently from its large size) showing the *Tortrix* character. The larva, with its circles of hooks of alternate lengths on the prolegs, is of strictly *Tortrix* pattern. The imago agrees with *Tortrix* in every detail, the venation is almost identical with that of *C. pomonana*, the palpi, spurs on legs, &c., are the same, the wing pattern closely resembles that of *Retinia*, to which its habits suggest it is probably closely allied. The dorsal structure of the metathorax in *Cossus* agrees absolutely with *Tortrix*, the metascutum being divided into two lateral parts that just meet in the middle line without uniting. In nearly all true Macros these two portions are widely separate, whilst they unite in the middle line, forming one piece in certain *Tineæ* only, especially *Adelids*. It is of interest to find that this same Tineal conformation is strongly marked in *Hepialus*, and less so in *Sesia* and *Limacodes*. I am indebted to Dr. Wood for calling my attention to this interesting point; it is one we have yet done little more than glance at, though it is referred to by several authorities.

Zeuzera and *Hepialus* differ from *Tortrix* in having the 3rd abdominal segment free, but in a peculiar and modified manner: the wing cases project over it, and appear to be fixed to it, but really the incision between it and 2nd is bent backwards as it passes towards the ventral surface, a very unusual modification of structure, which impedes the free movement of 3 on 2. In *arundinis* the dorsal spines become less developed posteriorly. Of *Hepialus* I have not been able to get abundant material, but certain pupæ, apparently males, have the 7th segment fixed, or nearly so; if this is so, it is clearly

related to the very unusual immense ventral flange on that segment and the great dwarfing of segments 8, 9, and 10. These and all the other characters of *Hepialus* would lead one to place it very distinctly from *Cossus*, yet there appear to exist in Australia many forms uniting *Cossus*, *Zeuzera*, and *Hepialus* into one family, both in their imaginal and pupal characters, and it must be in Australia that the derivation of a Hepialid form from an Adelid one, and of *Tortrix* from the *Cossus* side of the group, must be worked out. No doubt intermediate forms do or did exist between any two families that may be named, and therefore that we know many of them in any particular case, as that of *Cossus* and *Hepialus*, should not prevent us regarding these as tolerably wide apart.

The metathoracic structure of *Hepialus* came as a very unexpected confirmation of the idea that of the Tortricoid group it was the nearest to the lower Adelids, and, despite its specialisation, was near the line by which *Tortrix* was derived from some Adelid form.

Since the removal of *Cossus*, &c., from the *Bombyces* to the Micros will have to meet a great deal of what has become almost instinctive belief, I may mention one or two further points supporting the Micro character of these families. To take, first, the pupa: there is in the pupal outline of the Micros (*Incompletæ*), viewed laterally, a strong tendency to form a waist by the sinking in dorsally of the 5th segment (1st abdominal); this is almost unknown in the Macros (*Obtectæ*). This is well seen in *Cossus* (as in all *Tortrices*). *Bembeciformis* presents this character markedly.

The wing-patterns of all (*? Arctia*, &c.) true Macros consist of transverse lines in certain well-known positions, and of certain stigmata. These do not exist very distinctly in many of the Pyraloids, except, perhaps, true Phycids, and are wholly wanting in all *Incompletæ*. The *Adelidæ* may be taken as showing the fundamental pattern in these, a uniform colour strongly tending to be metallic, and with markings in irregular patches and spots (*L. rubiella*); the more definite pattern of *L. capitella* also obtains largely amongst Micros. Now, none of these families—*Zygæna*, *Cossus*, *Sesia*, &c.—present the Macro pattern; *Zygæna*, the highest of them, has even retained the metallic tints of *Adela*, and is marked by

irregular blotches. These also occur in *Zeuzera*, and are extraordinarily developed, as well as metallic surface, in some exotic *Hepiali*. The blotching in *Zeuzera* seems to have settled down into transverse striation in *Cossus*, from which the passage through *Retinia* to *Carpocapsa* is easy to some of the definite (but far from Macro) patterns of *Tortrix* markings.

When we come to the Tineoid section of the Micros, or true *Tineina*, I must assert that my ignorance greatly exceeds my knowledge; that is to say, that I have examined several species of all the larger genera, and have examined a good number of other genera, but there are still genera of which I know nothing; and whilst I do not expect these will alter the general outline, they will no doubt throw considerable light on some details, and will probably present some interesting and anomalous forms, as it is amongst these that the largest variety exists, both in the larval and pupal states. Here almost every genus presents a slightly different type, whilst among the Macros (true) an extensive field affords only one type; and among the *Tortrices* it seems to be much the same.

The Tineoid section of *Incompletæ* therefore wants study of larger material than I yet have, in order to say anything very decided about them.

In *Nepticula* we have as typical an example as any; the parts of the pupa separate readily on slight violence, so much so that it is not easy to be sure whether the first free segment is the 2nd abdominal or the 3rd, but I believe it is the latter. This is also the case in *Limacodes*, in *Tischeria*, and in Adelids. In *Tinea* and in *Sesia*, and in *Psychidæ*, the first free segment is the 4th, but I have not examined enough *Tineæ* to say that this is the rule in the genus. *Lithocolletes* and *Gracilaria* present the first four abdominal segments fixed as in *Obtectæ*, but in all other characters—7th free in male, dehiscence, mobility, eye-collar, &c.—they are typical *Incompletæ*. *Gracilaria* shows free extremities to legs and antennæ in some instances. In *G. elongella* there seems to be a tendency to the 7th segment becoming fixed in the male; when I say a tendency, I have seen some male pupæ (empty) in which I could not satisfy myself that it was free, though distinctly so in others.

As there are many genera of the *Tineina* of which I

know nothing, the following list will probably be lengthened; but I may note certain species as not, so far as I have yet studied them, clearly belonging to either of the sections (*Obtectæ* and *Incompletæ*); *Elachistidæ* (*Tischeria* belongs to *Incompletæ*); *Perittia*, *Lyonetidæ* (*Bucculatrix* belongs to *Incompletæ;* the free segments are 4, 5, 6 (and 7), eye-collar not detected). To go into any detail as to these till the structure of many more species has been noted would be of little use.

I think it is probable that the association of the Sesiids with the Tineids will not meet with much objection. I have already referred to the well-developed maxillary palpus of the pupa as a remarkable confirmation of this position, as well as to the Tineid character of the larval prolegs. But possibly a little more detail as to *Limacodes* may be required. In many respects *Limacodes* and *Nepticula* seem extremely different; apart from the matter of size, the former is an external feeder. Then the venation of *Nepticula* is crippled by the minute size of the moths, so as to render them very different, though probably not essentially so in this respect. It is therefore somewhat surprising to find a resemblance that is almost identity in the pupa. In both the pupal skin is very delicate; the free abdominal segments begin at the 3rd, if not at the 2nd; the appendages are easily separated, as they might be in a bee or beetle pupa; the dorsal spines are arranged in several rows of small equal points towards the dorsal margin of the segment. The maxillary palpus (eye-collar) is strongly developed, large and obvious in *Testudo;* in *Asellus* it stretches right across from the antennæ to the mouth-parts, and on dehiscence remains attached to the head coverings. It is, indeed, larger proportionally in these species, where it is obsolete in the imago, than in *Nepticula* or others, where it persists in the imago. The pupa emerges from the cocoon in much the same manner, and leaves a very delicate pupa-case, in which, after the manner of the *Incompletæ*, the covered parts are nearly as strong as the exposed.

The larva passes the winter in a passive state in the cocoon, changing in spring; whilst its apod character might be explained by its very recent descent from a footless mining larva. The urticating properties of sundry exotic species of the group may perhaps be

allied in nature to the secretion by some of these miners, and especially *Nepticula*, of some poison that retards the autumnal decay of the leaf they inhabit.

The imago is without maxillary palpi, but the pupa proves this to have been quite recently lost. When we examine the metathorax, the anterior section (scutum) has at first sight a Macro structure, that is, there are two well-developed lateral portions; but on close observation these are found to be continuous in a narrow but distinct chitinous ridge, such as does not occur in any of the Macro section of the *Obtectæ*.

Nepticula and *Limacodes* present us, indeed, with the *Incomplete* pupa in an extreme form; the empty pupa-skin has every segment and each appendage quite free from the others. The dorsal armature consists, in Cochliopods, of a number of rows of very fine spines, all belonging to one series. In the species of *Nepticula* I have examined there are no spines to the hind margin, but the anterior set is in some species a single row of largish spines, in others two rows and three rows; in the latter instances the spines are much smaller. There is therefore a variability in the armature that might easily extend to include the Cochliopod form.

Nepticula, however, has one character that I have not met with elsewhere, *viz.*, the antennæ-cases on dehiscence divide into the cover of the first joint and that of the remainder, each separate from the head, yet still held together sufficiently to keep their places fairly.

I have only had a portion of a pupa-case of *Micropteryx* (*calthella*), so do not like to insist further than I have already done on the association (from larval characters) of *Zygæna*, *Limacodes*, and *Micropteryx*.

In *Sesia* the larval prolegs, the strong development of the maxillary palpi, and the continuity in the imago of the anterior section of the metathorax across the middle line, appear to determine its place among the Tineoids in spite of some Tortricoid characters, such as the posterior dorsal rows of spines.

Though I have, regarding this communication as largely preliminary, omitted detail wherever I could, as, for instance, I see I treat *Alucita* in four words, though this covers the rearing of a number from the egg and the examination of some dozens of pupæ, I ought, perhaps, to note the ova of *Zygæna* and *Lima-*

codes. The former has a very delicate transparent shell, and the whole egg looks so soft and unprotected that it seems more suited for the internal situation of an Adelid egg than the exposed position in which it is laid; whilst that of *Limacodes asellus* is a flat, colourless, transparent speck, much like that of *Nepticula*, but not resembling that of any true *Bombyx*.

I have specially avoided notice of those *Tineinæ* that appear to present some indications of transition between the *Obtectæ* and *Incompletæ*. But of those that are in no sense transitional, it is interesting to note, in the Pyrales, the possession of maxillary palpi, and the habit of hybernating as full-fed larvæ, characters much commoner in *Incompletæ;* and in the *Lithocolletes*, on the other hand, the obsolescence of the maxillary palpi, the habit of hybernating as a pupa, and the loss of freedom in the first four abdominal segments. Remaining, however, true *Incompletæ* in the free 7th male segment, in mobility, in dehiscence, and in the facility with which the appendages separate in a sound pupa.

I have endeavoured to show the leading points in a tabular form, but, like all linear arrangements, it does not give the proper values to the several facts, emphasising some and slurring over others.

I hope some day to go into details as to some of the families, when I have material to more fully work them out; but I hope that others more able will in many instances forestall me.

To summarise the facts here brought forward. There are two very distinct types of pupæ in the Lepidoptera-Heterocera, each presenting such a constant set of characters that the members of each group must be more closely related together than to any of the other group.

This shows the true relationships of the group of Macros (?) *Zygæna*, *Sesia*, *Hepialus*, *Cossus*, &c.

It also shows the Pterophorids to be unrelated either to Pyraloids or to Alucitids.

It shows some of the directions in which the *Tineina* must be divided.

The existence of a well-developed maxillary palpus in sundry pupæ whose imagines are without it.

A certain amount of light on the relations of the glazed eye.

A definite diagnosis of Macro-Heterocera.

LEPIDOPTERA-HETEROCERA.

A.—OBTECTÆ.—Pupa smooth and rounded, externally solid, inner dissepiments flimsy. Free segments in both sexes 5th and 6th (abl.). Never emerges from cocoon, or progresses in any way. Dehiscence by irregular fracture.

1.—Macros.—Larva with hooks of ventral prolegs on inner side only. (Exposed feeders.) *Sphinges*, *Bombyces*, *Nolidæ*, *Nycteolidæ*, *Noctuina*, *Geometræ*.

2.—Pyraloids.—Larva with complete circle of hooks to ventral prolegs. (Concealed feeders.) *Pyrales*, *Phycidæ*, *Eudoridæ*, *Crambidæ*, *Gelechidæ*, *Plutellidæ*, *Œcophoridæ*. (*Epigraphiidæ*, *Alucitidæ*.)

3.————?.—Doubtful whether Pyraloids or of separate (classificatory) value. *Hyponymeutidæ*, *Argyresthidæ*, *Coleophoridæ*. (Perittia?), (Elachistidæ?).

B.—INCOMPLETÆ.—Pupa less solid and rounded, appendages often partially free. Free segments may extend upwards to 3rd (abdominal). 7th always free in male, fixed in female. Dehiscence accompanied by freeing of segments and appendages previously fixed. (Except in 1) pupa progresses and emerges from cocoon.

1.—Pupa attached by cremaster. Free segments. 4 5 6 7. 4 5 6. *Pterophorina*.

2.—Pupa free to move and emerge from cocoon.

a.—Larva concealed feeder, often miner, and usually rather active when not cramped by mine.

1.—Free segments. 5 6. 5 6 7. *Lithocolletidæ*, *Gracilariidæ*.

2.—Free segments. 4 5 6. 4 5 6 7.

a.—Tineæ (*Tineidæ*, *Psychidæ*, *Sesiidæ*).

b.—Tortrices (*Tortricina*, *Cossus*, *Exapate*, *Simæthis*). (Castnia.)

3.—Free segments. 3 4 5 6. 3 4 5 6 7.

a.—Zeuzera and Hepialus tend to lose 3rd as a free segment (are gaining it as a fixed segment?).

b.—Tischeria.

c.—Adelidæ. Ovipositor (of imago) formed for piercing plant-tissues.

d.—Nepticulidæ. Antennæ separate from head in dehiscence.

b.—Larva exposed feeder. Slug-like in form and movements, head very retractile. Free segments. 3 4 5 6 7. 3 4 5 6.

1.—Micropterygidæ.* Eight pairs abdominal legs, curious appendages, moss feeders.

2.—Cochliopodidæ. Legs evanescent, but traces of extra pairs and of curious appendages. Max. palps large in pupa, not in imago.

3.—Zygænidæ. Legs of Macro type. Max. palps evanescent in pupa.

C.————?.—Pupa with no free segments, appendages adherent to all abdominal segments. *Lyonetia*, *Cemiostoma*, *Bedellia*.

Note.—*Eriocephala* (*Micropteryx purpurella*, &c.) appears by imaginal characters to belong to *Adelidæ*. But the pupa is truly *Incomplete*, not semi-incomplete, as all the other *Incompletæ* are,—that is, the appendages are all absolutely distinct and free, and all the abdominal segments are "free"; moreover, it possesses working jaws.

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* I have only seen a portion of a pupa of these, and of Psychids I have had none of my own, and have not been able to examine them freely.—T. A. C.

VII. *Description of a new butterfly of the genus* Calinaga *from Siam.* By James Cosmo Melvill, M.A., F.L.S.

[Read December 7th, 1892.]

Plate VII.

Calinaga Sudassana, sp. n.

♀. Wings: Upper side smoky grey, subhyaline, merging into black towards the outer margin beyond the disco-cellular nervules; primaries elongate-triangular; costa somewhat arched, with whitish grey powdering of scales between this and the subcostal nervules; posterior margin slightly emarginate, having a double series of submarginal white spots in the following arrangement:—Two in the centre of the space between the lowest subcostal and the upper discoidal nervules, two a little wider apart between the two discoidal nervules, two smaller and closer together between the lower discoidal and the first median nervule. Between this latter and the second median nervule the outer spot all but touches the posterior margin; the inner is central, large, and whitish; there is a large grey dash between this and the median nervure, and there are similar markings between the second and third median nervules. Between this last and the submedian nervure the spots and dashes get more conspicuous and almost confluent, merging into the space between the submedian nervure and the anal angle in a long sweep of almost unbroken light grey, nearly corresponding in size to the discoidal cell, which is of a similar colour, with slight central clouding of darker hue; the median nervure is very distinctly clothed with black scales, as in *C. Buddha* (Moore), and the nervules in like manner also are very marked. The secondaries have also a double row of submarginal spots; the discoidal cell and abdominal margin pale hyaline grey, the latter tinged very conspicuously and prominently with bright ochraceous yellow; the median nervure notably clothed with dark black scales, as also the median nervule. Under side as in the upper, but less clearly marked, the black giving way to a suffused brown, and the clear ochre-yellow at the abdominal angle of the secondaries is barely noticeable. Thorax reddish crimson, with long soft hairs. Abdomen black, with scattered black hairs. In the two specimens I

have examined very slight variation in the submarginal spots of the primaries is alone discernible. Expanse of wings, 4 in.

Hab. Mountainous regions about 100 miles N.W. of Chieng Mai, Siam. Coll. Richard Roberts, C.E.

Three specimens obtained, which are now in the collections of the Hon. Walter Rothschild, Mr. Hastings Charles Dent, F.L.S., and my own, respectively.

This species is in many respects like the type of the genus, *C. Buddha* (Moore), from N. India (Cat. Lep. in Mus. H. E. I. C., vol. i., pp. 162, 163 (1857)), but a handsomer insect, and principally conspicuous for the bright yellow blotch at the abdominal margin of the secondaries. In size it slightly exceeds that species also. Antennæ, thorax, and abdomen wholly correspond with *C. Buddha*.

Explanation of Plate VII.

Fig. 1. *Calinaga Sudassana*, sp. n.
2. ,, ,, under side.

VIII. *On some new or imperfectly-known species of South African butterflies.* By Roland Trimen, F.R.S., F.L.S., &c., Curator of the South African Museum, Cape Town.

[Read February 8th, 1893.]

Plate VIII.

The butterflies described in this paper are as follows, *vid.* :—

LYCÆNIDÆ.

Lycæna Grahami, n. sp. ♂, ♀. Cape Colony.
,, *procera*, n. sp. ♂, ♀. Natal.
,, *Osiris*, Hopff. ♀. Natal.
,, *Barkeri*, n. sp. ♂, ♀. Natal.
Lycænesthes neglecta, Trim. ♀. Natal.
,, *Millari*, n. sp. ♂. Natal.
,, *minima*, n. sp. ♂, ♀. Natal.
Zeritis simplex, n. sp. ♂, ♀. Cape Colony, Damaraland, &c.

PAPILIONIDÆ.

Papilio Junodi, n. sp. ♂, ♀. Delagoa Bay.

HESPERIDÆ.

Pamphila Roncilgonis, Plötz. ♂, ♀. Delagoa Bay and Angola.
,, *detecta*, n. sp. ♂, ♀. Natal.

Eight of these eleven species are forms apparently undescribed hitherto; and of the remaining three species, two have been known in the male sex only, while another has been insufficiently described.

Family LYCÆNIDÆ.

Genus Lycæna, *Fab.*

Lycæna Grahami, n. sp. (Pl. VIII., figs. 1 (♂), 2 (♀).

Exp. al. (♂), 1 in. 4—5 lin.; (♀), 1 in. 6 lin.

♂. *Glossy, rather deep violaceous blue (not so pale as in* L. patricia, *Trim., or so glittering as in* L. Caffrariæ, *Trim.), with narrow but pronounced fuscous hind-marginal edging; cilia white, shining, more or less completely interrupted with fuscous at ends of nervules. Fore wing:* Terminal disco-cellular fuscous

mark rather indistinct, almost linear. *Hind wing :* Costal margin bordered with fuscous grey as far as 1st subcostal nervule ; between 1st and 2nd median nervules a hind-marginal blackish spot, not strongly marked, elongated longitudinally ; *no* tail on 1st median nervule. UNDER SIDE.—*Brownish grey (darker than in* L. patricia, *and greyer than in* L. Caffrariæ) ; *ordinary terminal disco-cellular mark, and discal and submarginal series of spots, darker and browner than ground colour, and on both sides white-edged ;* in hind wing a conspicuous white discal transverse bar (much as in *L. Pephredo*, Trim., but not so sinuate) formed by confluence of the diffuse outer white edging of the discal macular series and inner lunulate edging of inner submarginal macular series ; nervular interruptions of cilia dark brown, better defined than on upper side. *Fore wing :* Terminal disco-cellular mark very variable in width and shape, but almost always with a more or less pronounced median outer projection ; six spots of discal series rather large (the first smallest, the last largest), connected so as to form a regular very slightly curved chain ; submarginal and hind-marginal lunulate series closely crowded together between discal series and cilia, the outer lunules being especially narrow and faint, but their sagittiform thin inner white edgings piercing the lunules of the inner series between nervules. *Hind wing :* Subbasal series consisting of four white-ringed spots, the first circular, black, well-defined ; the second subovate, brown, disco-cellular ; the third immediately below the second, small, brown, obsolescent ; and the fourth small, fuscous, almost as well defined as the first, on inner margin ; between costal nervure and 1st subcostal nervule, about middle, a conspicuous round black spot, like the 1st subbasal one, but larger, is, though widely separated, the first of the discal series ; terminal disco-cellular lunule outwardly angulated, and almost always confluent with 3rd and 4th spots of discal series ; of this series, spots 2—7 are brown, unequally elongated, and confluent into an irregular band, while the 8th, on inner margin, is small, round, and almost as black as the 1st ; *white band immediately beyond discal series narrow and interrupted near costa and inner margin, but elsewhere broad, almost even, and conspicuous ;* sagittiform inner white edgings of outer lunules usually rather faint ; black hind-marginal spot between 1st and 2nd median nervules densely spangled with greenish silvery externally ; below it, just above submedian nervure, usually the traces of a similar much smaller spot.

♀. *Dull greyish brown, with a space (variable in width) of violaceous blue in both wings from base over median nervure and its nervules. Fore wing :* Blue encroaches superiorly over lower

half of discoidal cell, and is bounded inferiorly by submedian nervure; terminal disco-cellular mark fully twice as broad as in ♂; in one example faint traces of an almost median series of fuscous spots bounding the blue externally. *Hind wing:* Blue fainter and more restricted in width than in fore wing; hind-marginal blackish spot much larger and rounder than in ♂, and bounded internally by a broad dusky orange lunule. UNDER SIDE.—As in ♂, but ground colour slightly browner.

(Described from eighteen male and three female examples). On the upper side the ♂ most resembles the ♂ *L. Tantalus*, Trim., but is not of so dull a tint,* and has interrupted instead of uniform cilia. On the under side the ♂ differs entirely from *Tantalus*, coming, on the whole, closest to *L. Caffrariæ*, Trim., although, in the form of the distal white bar of the hind wings, it is nearer to the ♂ *L. Pephredo*, Trim., which is not blue above, but dark greyish brown. On the upper side the ♀ *Grahami* is most like the ♀ *Caffrariæ*, but differs in its much darker ground colour, absence of whitish discal and hind-marginal lunules, and faint and much reduced orange lunule in hind wing.

This species was first brought to my notice by Mr. U. L. Langley Feltham, of Kimberley, who received three ♂ specimens from Mr. Francis Graham, and sent them to me in July, 1891, with the information that they had been taken at Dordrecht, on the N.E side of Cape Colony, by the latter. Since then Mr. Graham, who has most zealously and assiduously attended to the butterflies of his district, has presented to the South African Museum the series of this species above described; and it is in recognition of his services to Entomology that I have named the insect after him. He notes this *Lycæna* as frequenting rough broken ground, and having a rapid, restless, and jerky flight, which renders its capture most difficult. It is on the wing in December, January, and February.

Hab. Dordrecht, Cape Colony (*F. Graham*).

Lycæna procera, sp. n. (Pl. VIII., figs. 3 (♂), 4 (♀)).

Exp. al. (♂), 1 in. 5—5½ lin.; (♀), 1 in. 6 lin.

♂. *Pale olivaceous blue (close to tint of* ♂ L. Bœtica); *fore*

* The colour is that exhibited by the males of the European *L. Argiodes* (Pall.) and *Semiargus*, Rott.

wing with a broad, internally ill-defined, brownish grey hind-marginal border; hind wing with a broad costal and apical, but narrow sublinear, hind-marginal border, the latter preceded by a series of very faint small fuscous spots; cilia whitish, for the most part grey at origin; no tail. Fore wing: A moderately distinct, rather thin, terminal disco-cellular fuscous lunule, sub-angulated outwardly; some very faint indications of darker and lighter markings traversing grey border. *Hind wing:* Costal grey border extending as far as 2nd subcostal nervule; hind-marginal series of five spots, immediately preceded by faint indications of whitish lunules, and succeeded by an interrupted whitish line; the spot between 1st and 2nd median nervules less indistinct than the rest. UNDER SIDE.—*Pale brownish grey; ordinary markings most like those of* L. Letsea, *Trim., the discal and subbasal spots being small but well defined, and very distinctly white-ringed. Fore wing:* Terminal disco-cellular lunule white-edged on both sides; spots of discal series (which is almost straight) five, with the trace of a sixth below 1st median nervule; *the third spot, between lower radial and 3rd median nervules, more elongate than the rest, and obliquely placed;* two rows of white submarginal lunules, and a thin white line immediately before hind margin, all well defined. *Hind wing:* Three small round black spots in subbasal series, of which that on inner margin is much smaller than the others; first and last spots of irregular discal series like the subbasal ones, and considerably before the rest; the other spots darker or lighter brown, like those in fore wing, but the 2nd quite apart from the 3rd, and the 7th beyond the 6th; white submarginal lunules and streak well defined; a hind-marginal black spot, externally marked with bluish silvery, and bounded internally by a dull yellowish lunule, between 1st and 2nd median nervules; cilia white, traversed mesially by a grey line, more apparent in hind wing.

♀. *Similar to* ♂, *but with darker and broader hind-marginal border, and in fore wing also a broad costal border of the same dark tint. Fore wing:* Costal border extends from base and occupies upper half of discoidal cell. *Hind wing:* Hind-marginal spots and lunules less indistinct than in ♂, the spot between 1st and 2nd median nervules bounded internally by traces of a dull orange-yellow lunule. UNDER SIDE.—As in ♂.

The most distinctive feature of this *Lycæna* is the length of its wings, and especially of the fore wings, which are also exceptionally acute apically. The close resemblance between the sexes is further noticeable, as

well as the little but apparently constant character of the oblique position and elongation of the third spot in the discal series on the under side of the fore wings. The species does not closely approximate to any South African form, but may provisionally follow *L. Letsea*, although in the latter both sexes are dull greyish brown on the upper side.

In length of wing *L. procera* reminds one of the European *L. Alcon*, W. V., but the two species are totally different in other respects.

A solitary ♂ of this *Lycæna* was acquired by the South African Museum in 1879, in a collection made in the Transvaal by Mr. T. Ayres; and another example of the same sex subsequently reached me from Estcourt, Natal, where it had been taken by Mr. J. M. Hutchinson. Quite recently (in August, 1892), Mr. Hutchinson sent three more males and a female, captured in the same locality, and has thus enabled me to define the species sufficiently.

Hab. Estcourt, Natal (*J. M. Hutchinson*); Potchefstroom District, Transvaal (*T. Ayres*).

Lycæna Osiris, Hopff.

♂ *Lycæna Osiris*, Hopff., Monatsb. Preuss. Ak. Wissensch., 1855, p. 642, n. 21.

♀. *Exp. al.* 1 in. 1½—4½ lin.

Fuscous, with a limited but bright violaceous blue median space in fore wing, and a faint gloss of the same tint over the inferior half of hind wing. Fore wing: Blue extends from near base to beyond middle, covering median nervure and a considerable length of its three nervules, but not more than inferior half of discoidal cell, and extending along inner margin to scarcely beyond middle, so as to leave a very broad, costal, apical, and hind-marginal fuscous border; a terminal disco-cellular narrow fuscous transverse mark, the lower part of which is rather conspicuous on the blue; cilia grey, mixed with whitish, becoming white at posterior angle. *Hind wing:* Blue occupying much the same position as in fore wing, but faintly extending nearer to hind margin; costal border as far as 2nd subcostal nervule unbrokenly fuscous to apex, below 2nd subcostal nervule, an inner submarginal row of sagittiform, and an outer one of lunular more or less distinct white marks; in the inner row, the two marks between 2nd median nervule and submedian nervure are usually obsolete or obsolescent;

in the outer row, the two marks correspondingly situated are altered and expanded into very broad bright orange lunules; immediately before fuscous line bounding hind margin a more or less conspicuous white line, broken by nervules into portions which form imperfect irregular rings in combination with the outer submarginal row of white marks; externally bounding the two broad orange lunules are two conspicuous black spots; cilia white, tipped with grey, and with grey linear nervular interruptions. UNDER SIDE.—As in ♂, but slightly browner in tint, and with all the white-edged markings rather darker. *Fore wing*: Small white-ringed subcostal spot before discal series—so rare in ♂—almost always present and well defined.

The ♀ differs remarkably from the ♂ in her rounded wings, which are not prominent either at apex of fore wing or anal angle of hind wing, but with decidedly convex hind margins. This feature is one of those distinguishing it from the ♀ of its near ally, *L. Barkeri*, n. sp., the others being the darker ground colour and deeper blue above, the absence of any whitish discal markings on the upper side of the fore wings, the large and well-developed second (anal-angular) orange lunule in the hind wings, the small white-ringed costal spot on the under side of the fore wings, and the additional inner-marginal spot (8th) in the discal row on the under side of the hind wings.

Though evidently nearly related to *L. Cnejus*, Fab., a native of the Oriental and Australian regions, *L. Osiris* is decidedly distinct. The ♂ upper side is of a deeper violaceous with a marked cupreous gloss, and presents two conspicuous orange lunules internally bounding the two black hind-marginal spots of the hind wings. The ♀ has the upper side colouring (both the fuscous ground and the blue discs) of a much deeper tint, with much broader and brighter orange lunules in the hind wings. On the under side the resemblance to *Cnejus* is in both sexes very close, the only notable difference being the straighter, less interrupted, discal fascia in both fore and hind wings.

As noted above, *Osiris* varies greatly in size, especially in the ♀, where the range in expanse of the fore wings is $\frac{1}{4}$ in. A dwarf ♀ from Delagoa Bay is rather under 1 in. in expanse. Both sexes occasionally present an unusually dull under side, with all the markings reduced in size, and more or less indistinct; this is possibly a

seasonal (winter) form, but I have not sufficient dated material to pronounce on the question. Two females from Madagascar in the South African Museum are well marked on both surfaces, and agree entirely with South African examples, except that, in the larger of the two, the submarginal sagittiform white marks on the upper side of the hind wings are somewhat enlarged and more elongated.

Localities of Lycæna Osiris.—Natal, D'Urban and Pinetown (*D'Aquilar*); Delagoa Bay, Rekatla (*Rev. U. Junod*); Transvaal, Pretoria and Potchefstroom (*W. Morant*); Barberton (*C. F. Palmer*); Swaziland, Usutu River (*C. N. Barker*); Mozambique, "Querimba" (*Hopffer*); Madagascar, Murundava (*Grevé*); Southern Ambuella, Ourrora (*A. W. Erihsson*).

Lycæna Barkeri, n. sp. (Pl. VIII., figs. 5 (♂), 6 (♀)).

♀ *Lycæna Osiris*, Trim. (nec Hopff.), S. Afr. Butt., ii., p. 15 (1887).

Exp. al. (♂), 1 in. 2½—4 lin.; (♀), 1 in. 2—5 lin. Nearly allied to *L. Osiris*, Hopff.

♂. *Pale shining pinkish violaceous (without cupreous gloss); a rather wide greyish fuscous hind-marginal edging (submacular in hind wing); cilia shining pale greyish, near anal angle of hind wing becoming white. Fore wing:* A short, thin, almost linear, terminal disco-cellular greyish fuscous lunule. *Hind wing:* A linear, black, white-tipped tail at extremity of 1st median nervule; immediately above this nervule a conspicuous hind-marginal black spot, bounded internally by a very broad orange-yellow lunule, and externally by a very fine white line, which is continued to anal angle, and here preceded by an elongate fuscous greyish marking. Under side.—Very pale brownish grey, with white-edged darker markings arranged almost as in *Osiris*, but presenting the following differences:—*Fore wing:* Discal row less regular, its component spots more detached and out of line. *Hind wing:* 3rd (inner-marginal) spot of subbasal row further from base; discal macular row more irregular, its 1st (black, white-ringed) spot further before the 2nd, which is placed transversely, and its last spot the 7th (the inner-marginal one found in *Osiris* not being represented); black spot on hind margin inwardly bounded by broad orange-yellow lunule as on upper side, but marked externally with a greenish silvery line; at anal angle no 2nd black spot, but some greenish silvery scales preceded by some orange-yellow ones.

♀. *Brownish grey, rather widely suffused from bases with bright pale bluish; lower two-thirds of discs bearing submarginally two white lunular series representing those of the under side;* in fore wing indistinct, but well marked in hind wing. *Fore wing:* Disco-cellular terminal lunule usually darker and thicker than in ♂; bluish suffusion extends over lower half of discoidal cell, along inner-marginal area and over disc to beyond middle; outer whitish lunular series obsolescent. *Hind wing:* Bluish suffusion much fainter and more restricted than in fore wing, but filling discoidal cell; hind-marginal white line extending along the whole hind margin; black spot and orange-yellow lunule much larger than in ♂; in most specimens a faint orange-yellow mark close to anal angle. UNDER SIDE.—As in ♂, but in many examples an additional very small, round, black, white-ringed spot close to inner margin near base of hind wing.

As noted by me (*op. cit.*, p. 16) the under side in both sexes is sometimes very obscure, all the white markings being faint, and the subbasal and first discal round spots in the hind wing being scarcely or not at all darker than the rest. In a pair taken *in copulâ* by Col. Bowker the markings are all quite obsolescent, and in the ♀ hardly traceable. From the few dated specimens received, I am inclined to think that these feebly-marked individuals are a seasonal (winter) form of the species.

This species is distinguished from *L. Osiris*, Hopff., in both sexes, by having, on both upper and under sides of the hind wings, only one black hind-marginal spot and orange lunule (the lower one, if indicated at all, consisting of a simple trace of orange), and on the under side of the hind wings by wanting altogether the eighth (inner-marginal) spot of the discal series; also by the discal under side spots in both wings being more disconnected and in a less straight line; moreover, in neither sex does there ever appear the small separate white-ringed costal spot a little beyond the middle on under side of the fore wings, which is almost invariably present in the ♀ *Osiris*, and sometimes exhibited by the ♂. The want of cupreous gloss on the upper side, and the deeper browner tint of the under side further distinguish the ♂, and the paler duller upper side colouring and discal whitish lunules of the fore wings the ♀, from the corresponding sex in *Osiris*.

In my 'South African Butterflies' (ii., p. 15), I confused this species with *L. Osiris*, placing its ♀ as that of

the latter. Paucity of material chiefly occasioned this mistake, as I took no* ♂ of *L. Barkeri* while in Natal; and, overlooking the only two true females of *Osiris* that I met with, I associated the females of *Barkeri* with the males of *Osiris* which I captured in the same localities. Colonel J. S. D'Aquilar first (May, 1889) called my attention to the true ♀ *Osiris*, as a ♀ *Lycæna* not included in my work, but approaching in its characters the ♀ I had described under that name. But it is to Mr. Cecil N. Barker, of Malvern, Natal, that I owe the rectification of the error, as he has not only pointed out the distinctions between the two forms, and sent much material in illustration of them, but has recently (May, 1891) forwarded a pair of each species taken *in copulâ*.† I have accordingly much pleasure in naming the apparently undescribed species after Mr. Barker, who has for some years collected and observed very carefully the butterflies of Natal and Zululand, and has latterly most liberally communicated both specimens and notes in aid of my researches.

As *L. Osiris* represents in Africa the Indo-Malayan *L. Cnejus*, Fab., so *L. Barkeri* may be considered as the representative of *L. Strabo*, Fab., which has almost as wide a range as *Cnejus*.‡ On the upper side, however, the ♂ *Barkeri* differs totally in colour, *Strabo* ♂ being of a bright pale lavender-blue; the former also presents in the hind wings an orange lunule (edging the hind-marginal black spot), which is wanting in the latter. The ♀ *Barkeri* is very like the ♀ *Strabo* on the upper side, but has the submarginal white markings larger and more elongated, and often very conspicuous. On the under side, in both sexes, the ground colour is of a much browner tint, and the discal fascia is in both wings less irregular than in *Strabo;* and the small but very distinct black spot at the anal angle borne by the latter species is wanting.

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* Mr. Barker notes (February, 1892) that while the ♂ of *L. Barkeri* is much more rarely met with than the ♀, the reverse is the case with *L. Osiris*.

† *L. Osiris* on the Hleto River, and *L. Barkeri* (11th March, 1891) on the Little Usutu River, Swaziland.

‡ Mr. de Nicéville (Butt. Ind., &c., iii., p. 178) records a note by Mr. W. U. Irvine, that "he once took *C. Strabo* coupled with *C. Cnejus*, Fab."

L. Barkeri inhabits the same localities and presents the same habits as *L. Osiris* in Natal, haunting grassy spots; but Mr. Barker observes that the former frequents higher ground and shorter grass than the latter, and that he has not found the two species flying in company.

Localities of Lycæna Barkeri. — Natal: D'Urban, Verulam. Zululand: St. Lucia Bay (*the late Colonel U. Tower*); Etshowe (*the late T. Vachell*). Transvaal: Lydenburg District (*T. Ayres*); Swaziland: Little Usutu River (*C. N. Barker*). Delagoa Bay: Lorenço Marques (*Mrs. Monteiro*); Rikatla (*Rev. U. Junod*). Southern Ambuella: Otiembora (*A. W. Erihsson*).

Genus Lycænesthes, *Moore*.

Lycænesthes neglecta, Trim. (Pl. VIII., figs. 7 (♂), 8 (♀)).

♂ *Lycænesthes neglecta*, Trim., Trans. Ent. Soc. Lond., 1891, p. 175.

♀. *Exp. al.* 1 in. 1 lin.

Brownish grey, paler on discs, with a moderately wide violaceous suffusion (very slightly glossed with cupreous, but at bases more distinctly blue) on basal area; hind wing with two rows of whitish lunules, the submarginal ones sagittate. Fore wing: Violaceous occupies only basal third or half of discoidal cell, and beneath cell extends to about or rather beyond middle of inner margin; a moderately distinct rather wide fuscous grey terminal disco-cellular lunulate transverse mark. *Hind wing:* Violaceous occupies much the same position as in fore wing, but does not extend beneath submedian nervure; six or seven lunules of submarginal row violaceous whitish, the first on costa, but the second widely separate from the first, below 2nd subcostal nervule; a very well-defined small black hind-marginal spot between 1st and 2nd median nervules, bounded inwardly by an orange-yellow lunule; an indistinct sublinear terminal disco-cellular fuscous grey mark. Under side.—As in ♂, except that ground colour is decidedly paler, and with scarcely any brownish tinge, and all the white edgings of the markings are much more distinct.

I have mentioned (*loc. cit.*) the near alliance of the ♂ to *L. Liodes*, Hewits., and also its points of relationship to the larger *L. Sylvanus* (Drury). The ♀ differs widely from the corresponding sex in both those species (and especially from *Liodes*) in the absence of any dark discal

markings in either wing on the upper side. In this respect, and in the colouring of the upper side, the ♀ *neglecta* more resembles the ♀ *L. livida*, Trim. (Trans. Ent. Soc. Lond., 1881, p. 443), but differs in the brighter and more restricted blue suffusion of both fore and hind wings.

I received the first specimen of the ♀ in February, 1891, from Mr. A. D. Millar, with the note that it had been recently taken by him at D'Urban; and this was followed, in May, by two examples taken respectively on the Sinquasi River, Natal coast, and near Etshowe, Zululand, by Mr. C. N. Barker. The two latter localities were not recorded for the ♂ of this butterfly.

Hab. D'Urban (*A. D. Millar*) and Sinquasi River (*C. N. Barker*), Natal; Etshowe (*C. N. Barker*), Zululand.

Lycænesthes Millari, n. sp. (Pl. VIII., fig. 9 (♂).

Exp. al. (♂), 1 in. 1 lin.

♂. *Brownish grey, with a bright pale blue space, and a rather broad terminal disco-cellular transverse fuscous mark, in both wings. Fore wing:* Blue fills discoidal cell, but does not extend above or beyond it, and occupies basal half to inner margin, also narrowly extending along the latter to posterior angle; a black hind-marginal bounding line, immediately preceded by an indistinct broken whitish one; before the latter, between 1st median nervule and submedian nervure, a small faint bluish mark. *Hind wing:* Blue bounded superiorly (except for a slight tinge above discoidal cell near base) by subcostal nervure and its 2nd nervule, but extending in a fainter greyer tint over all remaining area, except a narrow inner-marginal and hind-marginal border; between 2nd subcostal nervule and submedian nervure, a hind-marginal series of rather well-defined subsagittiform whitish lunules, succeeded by a conspicuous line of pure white immediately preceding a fine hind-marginal black bounding line; each of the whitish lunules between 2nd median nervule and submedian nervure is bounded externally by a black spot; before this lunular series there are traces—along the outer edge of the greyish blue—of a similar series of whitish lunulate marks. *Cilia* of fore wing grey, except a whitish portion about posterior angle; of hind wing white next margin, greyish externally, and with very fine linear darker grey nervular interruptions. UNDER SIDE.—*Very pale brownish grey, with rather broad markings in both wings*, vid.: A broad terminal

disco-cellular marking, whitish in the middle, brownish grey on each side, and whitish edged anteriorly and posteriorly; and a discal series, inwardly inclined inferiorly, of similar confluent marks, more widely whitish mesially, of which, *in fore wing*, the 6th (lowest) is considerably larger than the rest; two submarginal lunulated whitish streaks, with the space between them rather darker than the ground colour; a sharply-defined black hind-marginal bounding line, immediately preceded by a white one; four whitish dots on costa, two above disco-cellular mark, and two above (one of them before) first mark of discal series; cilia white next bounding line, grey externally. *Hind wing:* Discal series of marks very irregular, the 1st (costal) separate from and before the 2nd, and just above terminal disco-cellular mark, the 3rd largest, subquadrate, and nearest hind margin, the 6th and 7th elongate, as near base as the 1st, and forming an angle on submedian nervure; a subbasal series of three small, rounded, fuscous white-ringed spots, one just below costal nervure, one in discoidal cell, and one on inner margin (the middle and lower spots more faintly marked in one example); on hind margin a well-marked black spot, bounded inwardly by an orange lunule, and sprinkled with bluish silvery scales, between 1st and 2nd median nervules, and a second similar marking at anal angle, crossed by submedian nervure.

This species is well characterised by the brightness and paleness of the upper side blue, and by the abruptness with which that colour in the fore wings terminates (except narrowly along inner margin) about the middle. From its near ally, *L. livida*, Trim., it differs on the upper side also in its greyer ground colour without cupreous gloss, in the much more strongly marked terminal disco-cellular mark of the fore wings; while in the hind wings there is no discal dusky streak, and no orange lunule between 1st and 2nd median nervules, but the hind-marginal white lunules are much more developed, and there are traces of a submarginal series of whitish lunules also. The under side is distinguished by its greyish ground (less brownish in tint), and more pronounced whitish markings, and in the hind wings by a subbasal series of three spots (instead of a single subcostal spot), and a rather more irregular discal macular series.

The discovery of this butterfly is due to Mr. A. D. Millar and Mr. C. W. Morrison, who together took speci-

mens near Estcourt, in Natal, on the 1st November, 1889, and each of whom kindly sent me an example. Only males were observed and captured; they are noted by both captors as flying round, settling upon, and chasing each other about a tree known as "wild cabbage," at the summit of a lofty hill.

I have the pleasure of associating with this butterfly the name of Mr. Millar, of D'Urban, an experienced observer of Lepidoptera, who since 1887 has rendered me most valuable assistance in working out the South African species.

Hab. Natal, Estcourt (*A. D. Millar and C. W. Morrison*).

Lycænesthes minima, n. sp. (Pl. VIII., fig. 10 (♂).

Exp. al. (♂), 10½ lin.; (♀), 10—11 lin.

♂. *Brown, with a slight violaceous cupreous surface-gloss; bases rather widely tinged with fuscous; a terminal hind-marginal fuscous line; cilia of fore wing brown, with a white space below apex, and another above posterior angle; of hind wing white, with narrow brown nervular interruptions. Hind wing:* On hind margin, between 1st and 2nd median nervules, a good-sized but not sharply defined round fuscous spot. UNDER SIDE.—*Brownish grey; ordinary markings (terminal disco-cellular, discal, submarginal, and hind-marginal) not conspicuously defined (especially towards hind margins), scarcely darker than ground colour, white-edged on each side, and broadly whitish mesially. Fore wing:* Discal series of markings highly irregular, forming four pairs of contiguous coalescent spots, of which the 1st and 3rd pairs are about equidistant from base, the 2nd rather nearer to hind margin, and the 4th nearest to base (being in a transverse line with terminal disco-cellular spot); usual series of submarginal lunules and hind-marginal spots indistinctly marked. *Hind wing:* A subbasal transverse series of four small, black, white-ringed spots, of which the 4th (on inner margin) is minute; discal series highly irregular, composed of eight spots, contiguous but separate (except the 5th and 6th, which are coalescent), of which the 1st and 8th are nearer, and the 3rd and 4th further, from base than the rest; submarginal and hind-marginal markings indistinct, with the exception of two rounded black spots, bounded anteriorly by a yellow lunule—a large one between 1st and 2nd median nervules, and a small one (geminate, and with a few metallic bluish silvery scales) at anal angle.

♀. Like ♂. *Hind wing:* On hind margin, near anal angle, a white or whitish line immediately before the terminal fuscous line, and indistinct traces of two small fuscous spots—one on each side of the spot between 1st and 2nd median nervules. UNDER SIDE.—Paler than in ♂; all the markings considerably darker and more distinct, with rather conspicuous white edging, especially the submarginal and hind-marginal ones, and the subbasal four spots in hind wing.

The very small size of this *Lycænesthes*, and the similarity of, and almost entire want of violaceous colouring in, both sexes on the upper side, render it easily recognised. The extremely broken and irregular condition of the discal series of spots on the under side, as well as the existence of four spots in the subbasal series of the hind wings, indicate an alliance with the much larger and very different *L. Amaroh*, Guér., and *L. Larydas* (Cram.); while the tint of the upper side is not unlike but darker than that of the ♀ *L. Otaielia*, Trim. As usual in the genus, the ♀ has more rounded wings than the ♂, the fore wings especially having a blunter apex and a decidedly convex hind margin.

This description is made from four examples taken by Mr. Cecil N. Barker in the coast districts of Natal, *vid.*: a ♂ at Verulam, one ♀ at Malvern, and two females on the Sinquasi River. These examples are all noted by Mr. Barker as occurring on the yellow flowers of a thorny *Acacia*, the Malvern ♀ on the 9th January, 1890, the Verulam ♂ at the end of November, and the Sinquasi females on the 1st December, in the same year.

Hab. Natal, coast districts (*C. N. Barker*).

Genus ZERITIS, *Boisd.*

Zeritis simplex, sp. n.

Exp. al. (♂), 1 in. 2–3½ lin.; (♀), 1 in. 4½ lin. Closely allied to *Z. Thyra* (Linn.).

♂. *Pale orange-yellow, with a linear fuscous edging along hind margin, only widening in fore wing at apex; bases very narrowly fuscous. Fore wing:* A fine linear fuscous edging along costa; apical expansion of dark border slight or moderate, and narrowing into the linear portion about lower radial or 3rd median nervule. UNDER SIDE.—*Hind wing and apex of fore wing pale greyish brown, with dark-edged whitish markings* arranged as in *Thyra*. *Fore wing:* White centres to disco-cellular and upper

discal spots much larger than in *Thyra;* no basal or subbasal black spot below median nervure. *Hind wing:* The discal irregular dentated whitish streak of *Thyra* represented by distinctly separate spots of different sizes and shapes; the submarginal dentated streak is submacular.

♀. Like ♂; in one of the two examples the pale spots of the under side are much less distinct.

The reduction of the dark border in this form is carried to the extreme short of its entire disappearance. This striking feature, in combination with the other differences above noted, may warrant its separation from *Thyra;* but it must be noted that there is evidence of linking gradations to the latter widely-spread and variable species.

Of the four specimens known to me, three are from Damaraland, *vid.*: a ♂ and ♀ collected as long ago as 1862 by the late Mr. C. J. Andersson, and a ♀ taken in the same year by Mr. J. A. Bell. The fourth is a small ♂, with the apical border in the fore wings rather wider, and the under side spots rather brighter, which occurred in a collection made in Khama's Country and Mashunaland, acquired by Mr. C. N. Barker in 1891.

A near approach to the latter example is made by a ♂ taken (August, 1890) at Port Nolloth, in Little Namaqualand, by Mr. R. M. Lightfoot, in which the dark border is quite as linear in the hind wings, and not very much wider in the fore wings; but the upper side ground colour is redder, and on the under side the basal and subbasal black spots characteristic of *Thyra* are present in a reduced form.

Another grade in the direction of typical *Thyra* is presented by two males from D'Urban, Natal, received in 1889 from Mr. A. D. Millar, in which the dark border is very much narrowed, but retains the characteristic strong exterior costal development in the fore wings, and to a less extent in the hind wings.

Hab. Port Nolloth (*R. M. Lightfoot*), Cape Colony; Damaraland (*C. A. Bell and the late C. J. Andersson*); between Khama's Country and Mashunaland (*C. N. Barker*).

Family PAPILIONIDÆ.

Genus Papilio, *Linn.*

Papilio Junodi, n. sp.

Exp. al. (♂), 3 in. 3—5½ lin.; (♀), 2 in. 11 lin.—3 in. 5 lin. Intermediate between *P. Policenes*, Cram., and *P. Porthaon*, Hew.

♂. *Brownish black, with pale dull greenish yellow stripes and spots, which in hind wing are paler, and in some lights mostly* white; common basal and subbasal stripes, and discal macular band, arranged as in *Porthaon;* but disco-cellular transverse bars in fore wing not sinuated or angulated as in that species, but as straight as, though considerably narrower than in, *Policenes; spots of common submarginal series greatly reduced, so as to be almost obsolete as regards lower two-thirds of fore wing and whole of hind wing. Fore wing:* 7th spot of discal macular band wider than in either species named, more as in *Policenes*, but with a longer and acuter superior inward projection; small subcostal spot immediately above 2nd spot of discal series minute, scarcely noticeable; first three spots of submarginal series well marked and of moderate size, but the 4th very small, and the remaining four minute and obsolescent. *Hind wing:* Broad costal bar, which, as in *Porthaon*, mainly represents discal band, not approximating to cellular expansion of subbasal stripe, but almost as widely apart from it as in *Policenes;* remaining portion of discal macular band exceedingly defective, represented only by a small isolated spot between radial and 3rd median nervules, and (in one specimen) by a second similar smaller spot between 3rd and 2nd median nervules; submarginal lunulate spots wanting altogether below 2nd median nervule, and above it represented only by three minute obsolescent marks; traces of three hoary-grey broad lunulate hind-marginal marks below 3rd median nervule only; an exceedingly faint indication of an anal-angular dull red spot; tail with as much white at and near the tip as in *Porthaon*. Under side.—Glistening brown, somewhat darker than in *Policenes* and *Porthaon;* markings of upper side reproduced, but of a paler tint, and the spots of submarginal series larger and not so indistinct; in hind wing, between large subbasal and discal markings and small submarginal ones, a series of six broad black internervular rays, much longer and more strongly marked than in *Porthaon;* series of seven crimson inwardly finely white-edged marks from costa to anal angle arranged more continuously than in *Porthaon* and almost as in *Policenes*, but black-bordered on both sides as in *Porthaon*, the two last marks being much more widely so bordered than in the latter species.

♀. Like ♂, but with the usual enlargement of the basi-inner-marginal band in hind wing, and with the four lower spots of discal series in fore wing considerably wider than in ♂, and distinctly confluent. *Fore wing:* Subbasal stripe considerably wider on inner margin; submarginal spots below lower radial more elongate and more indistinct. *Hind wing:* In one example the lower, and in the other both, of the small isolated discal spots wanting. UNDER SIDE.—As in ♂, but with differences in the stripes and band corresponding with those on the upper side.

(Described from two male and two female examples).

This *Papilio* very notably combines the features of *P. Policenes* and *P. Porthaon*, as pointed out in the foregoing description, but differs from both in the marked tendency to obsolescence in the submarginal series of spots in both wings, and the total lack of the lower spots of the discal series in the hind wing.

The discovery of this species is due to the Rev. U. Junod, of Rikatla Delagoa Bay, after whom I have great pleasure in naming the insect. M. Junod did not observe the butterfly in life, the specimens sent having been taken at Morakwen, on the coast, by his native collectors, in June (?), November, and December, 1891. The first example, a small ♀, was stated to be flying high, but the others flew near the ground, like *P. Colonna*, with a rather slow but erratic course.

A small imperfect example, expanding only 3 in. 10 lin., is in the Hewitson Collection at the British Museum; its locality does not appear to have been recorded.

Hab. Morakwen, Delagoa Bay (*Rev. U. Junod*).

Family HESPERIDÆ.

Genus PAMPHILA, *Fab.*

Pamphila Roncilgonis, Plötz. (Pl. VIII., fig. 11 (♂)).

Hesperia Roncilgonis, Plötz, Stett. Ent. Zeit., 1882, pp. 450—51.

Exp. al. (♂), 1 in. 2½—3½ lin.; (♀), 1 in. 6 lin.

♂. *Glossy brownish black, with four semitransparent white spots, and one more opaque yellowish spot in fore wing, and a row of four very small indistinct opaque yellowish spots in hind wing; cilia whitish, much mixed with brown in apical half of fore wing. Fore wing:* White semitransparent spots small but very clearly defined, two contiguous (one above the other) in

discoidal cell near its extremity, and the other two a little apart below cell—the larger quadrate, between 1st and 2nd median nervules, the smaller ovate, between 2nd and 3rd median nervules; solitary almost opaque yellowish spot small, elongate longitudinally, in a line directly below cellular spots, just above submedian nervure; costa rather densely and broadly scaled with dull fulvous yellowish from base to cellular spots, and again over a small space between middle and apex; two longitudinal dull pale yellowish streaks from base, one very short, just below median nervure, the other extending along inner margin to beyond middle. *Hind wing:* Four opaque yellowish spots form a curved discal row between 2nd subcostal nervule and submedian nervure; two longitudinal pale yellowish streaks as in fore wing from base, one short in discoidal cell, the other extending to about middle between 1st median nervule and submedian nervure. Under side.—*Hind wing and apical area of fore wing fulvous ochreous, very strongly glossed or "shot" with submetallic violaceous; hind wing conspicuously spotted with black. Fore wing:* Costa bordered with fulvous, brighter at base; spots as on upper side, except that the almost opaque inferior one is white; apical area crossed by six internervular well-defined black rays. *Hind wing:* Two subbasal black spots, one between costal and subcostal, and the other between median and submedian, nervures; a similar spot towards end of discoidal cell; and a strongly-curved discal series of six spots of different sizes and shapes between costal and submedian nervures; a blackish linear edging along hind margin; inner-marginal fold devoid of the general fulvous ochreous ground tint. Head and palpi black, conspicuously spotted with white; antennæ black. Thorax above clothed with pale yellowish hair, the patagia and pterygodes chestnut fulvous, the latter black-edged and yellowish-tipped; beneath apparently fulvous ochreous. Legs with black, white-edged coxæ and femora, creamy white fulvous-tinged tibiæ, and greyish tarsi. Abdomen above fuscous, densely clothed basally with long dull yellowish hair, and at tip with short fulvous hair; the segmental incisions sharply defined by slender yellowish rings; beneath creamy at base, becoming more yellow towards tip.

♀ (worn example). *Not nearly so dark, dull brown, with larger spots (especially the discal series in hind wing). Fore wing:* An additional minute round semitransparent white spot between 5th subcostal and upper radial nervules; disco-cellular spots confluent into one mesially constricted mark. *Hind wing:* Spots of curved discal row very much enlarged, forming a continuous band; a good-sized spot of the same in discoidal cell, rather beyond its middle. Under side.—Hind wing and costal

border and apical area of fore wing much paler, of a greyish creamy, slightly tinged with rufous, but without violaceous gloss; discal spots of hind wing smaller.

In the ♀ the wings are more elongate than in the ♂, especially the fore wings, which are more distinctly convex about the middle of the hind margin.

(Described from two ♂ specimens and one ♀).

A worn example of the ♂ was sent to me from Delagoa Bay by Mrs. Monteiro in 1886, and a rather faded ♀ by the Rev. U. Junod in June, 1891. This latter example was followed by a ♂ in very fine condition, reared by M. Junod from the larva on 29th August, 1891.

This larva was found at Rikatla, about twelve miles from Lorenço Marques, on a small tree, and is described by the discoverer as whitish, inclining to a bluish tint, with a dorsal interrupted black line and black spiracles. The head is brown, with a reddish brown spot on each side of its lower portion. and two double parallel black lines ending on the forehead. The second segment, hidden behind the head, is edged posteriorly with black. Anal flap semicircular, green, divided into five triangular portions by four white lines. It is very sluggish, living between the sides of a leaf which it has drawn together with silk. It very slowly changes to the pupa, gradually assuming a tinge of rusty red. Length, 1 in. 1 lin.

The pupa, judging from the skin of this individual,—which M. Junod, in forwarding, remarks is not very different from the living insect in colouring,—is sandy ferruginous; the head and back of thorax tinged with whitish, and the abdominal segments dorsally sparsely mottled with dull white, and bearing an interrupted greyish median streak marked on the 4th and 5th segments with a small but conspicuous pure white spot. The wing-covers are white. Length, 7½ lin.; rather stout. Attached to leaf by the tail, and by a strong silken girth round the posterior border of the thorax.

Hab. Delagoa Bay: Lorenço Marques (*Mrs. Monteiro*), Rikatla (*Rev. U. Junod*), "Angola," Plötz.

Pamphila detecta, n. sp. (Pl. VIII., fig. 12 (♂).

Exp. al. (♂), 1 in. 4½ lin.; (♀), 1 in. 5 lin.

♂. *Dull brown, with nearly all hind wing and three longitudinal stripes in fore wing suffused with ochreous yellow, inclining to olivaceous; a discal series of small vitreous spots.*

Fore wing: In upper part of discoidal cell, near extremity, a very small somewhat elongate spot; seven spots in discal series—the first three minute, forming a curved subcostal and subapical marking; the 4th minute, nearest to hind margin, isolated, between lower radial and 3rd median nervules; the fifth small, subquadrate, between 2nd and 3rd median nervules not far from their origin; the sixth of moderate size (but three times as large as the fifth), nearer to base, rather variable in form, but somewhat rounded on its inner side, and with a more or less prominent acute inferior projection on its outer side; and the seventh small, tinged with yellow, just above submedian nervure, and in a straight line directly beneath the disco-cellular spot; ochreous yellow stripes running from base, and consisting of a rather ill-defined subcostal and partly disco-cellular one extending as far as disco-cellular spot; a strongly-marked one of about the same length, bounded superiorly by submedian nervure, and a third inner-marginal one, bounded superiorly by submedian nervure, strongly marked, and extending almost to posterior angle. *Hind wing:* Ochreous yellow, bounded costally by a well-defined moderately wide fuscous brown border; below apex the border is not so dark, and less well defined inwardly, narrowing gradually along hind margin to anal angle; a discal series of five minute vitreous spots between costal nervure and 1st median nervule, of which the lower two or three are partly hidden by the ochre-yellow hairs of the lower disc. Cilia dull whitish. Under side.—*Hind wing and wide costal border of fore wing olivaceous ochreous yellow* (*paler than the tint on the upper side*); spots as on upper side, but those on hind wing all distinct and usually six in number. *Fore wing:* Wide inner-marginal area dark greyish, on which the seventh (lowest) spot of discal series (which is larger than on upper side) is conspicuous; apical area widely tinged with ochreous yellow. *Hind wing:* Inner-marginal fold less yellow, grey in tint, and smoother than rest of area.

♀. Like ♂ in ground colour and markings, but with very much less ochreous yellow suffusion, and that of a very dull and faint tint in both wings. *Hind wing:* Lower spots of discal series not obscured by hairy coating. Under side.—As in ♂, but rather duller. *Hind wing:* In one example a seventh minute vitreous spot in discal row, beneath 1st median nervule.

This *Pamphila* belongs to the group of *P. Mathias*, Fab. It is smaller than any of its close South African allies, *P. Borbonica* (Boisd.), *P. Fatuellus*, Hopff., and *P. inconspicua* (Bertol.) [=*P. Mohopaani* (Wallengr.)],

but larger than the Natalian *P. Monasi*, Trim. In shape of wings, and in size, shape, and disposition of the vitreous spots of the fore wings, it is nearest to *P. Fatuellus*, but resembles *Borbonica* in its minute vitreous disco-cellular fore wing spot and olivaceous yellow under side; while the olivaceous yellow on the upper side (though decidedly deeper and more ochraceous in colour), and the position and arrangement of the minute spots on the under side of the hind wings, agree more with those characters in *P. inconspicua*. The ♂ wants the linear discal sexual badge in the fore wings presented by the last-named species and *P. Mathias;* and on the whole the species will stand best between *Borbonica* and *Fatuellus*.

Mr. C. N. Barker brought this butterfly to my notice in May, 1891, forwarding two males and two females (one pair taken *in copulâ*), captured by him at Malvern, Natal, on a yellow leguminous flower during April, and two males in March, 1892.

There can be no doubt that this form, though well marked and quite distinct upon careful examination, has been overlooked, both in the field and in the cabinet, among its near relatives in the obscure group of *Pamphila*, to which it belongs. Mr. Barker wrote that he found it not uncommonly at Malvern, and that Mr. A. D. Millar had also met with it closer to D'Urban.

Hab. Malvern, Natal (*C. N. Barker*).

Explanation of Plate VIII.

Figs. 1 (♂), 2 (♀), *Lycæna Grahami*, n. sp. *Hab.* Dordrecht, Cape Colony.

Figs. 3 (♂), 4 (♂), *L. procera*, n. sp. *Hab.* Estcourt, Natal.

Figs. 5 (♂), 6 (♀), *L. Barkeri*, n. sp. *Hab.* D'Urban, Natal.

Figs. 7 (♂), 8 (♀), *Lycænesthes neglecta*, Trim. *Hab.* Malvern and Sinquasi River, Natal.

Fig. 9 (♂), *L. Millari*, n. sp. *Hab.* Estcourt, Natal.

Fig. 10 (♂), *L. minima*, n. sp. *Hab.* Verulam and Sinquasi River, Natal.

Fig. 11 (♂), *Pamphila Roncilgonis*, Plötz. *Hab.* Rikatla, Delagoa Bay.

Fig. 12 (♂), *P. detecta*, n. sp. *Hab.* Malvern, Natal.

IX. *Descriptions of some new genera and new species of* Halticidæ. By Martin Jacoby, F.E.S.

[Read February 8th, 1893.]

Crimissa opaca, n. sp.

Robust, convex, reddish fulvous, opaque; the last seven joints of the antennæ, the knees, tibiæ, and tarsi, black; thorax transversely convex, irregularly punctured; elytra very finely punctured, the interstices aciculate. Length, $5\frac{1}{2}$ lines.

Head impunctate, finely strigose behind the eyes, the frontal elevations very flat; apex of the mandibles black; the antennæ scarcely extending to the middle of the elytra, black, the lower four joints fulvous, the second joint slightly longer than the third one; thorax strongly transversely convex, the sides rounded, the anterior angles acutely produced, the surface closely and strongly punctured near the margins, more sparingly and finely on the disc; scutellum broader than long, smooth, its surface slightly concave; elytra opaque, dark fulvous, very minutely punctured and aciculate; the lower margins of the abdominal segments punctured and pubescent.

Hab. Brazil.

This species, of which I possess two specimens without precise locality, seems to me to be distinct from *C. cruralis*, Stål, on account of the reddish fulvous and opaque, not testaceous, colour, the much more strongly transverse and convex form of the thorax, and the very finely punctured and aciculate elytra, which show no traces of longitudinal smooth spaces as in *C. cruralis*, in which the elytral punctures are much stronger and without the connecting scratches.

Crimissa piceicollis, n. sp.

Piceous, the antennæ (the basal five joints excepted) black; thorax very convex, closely punctured near the margins; elytra pale flavous, opaque, finely and irregularly punctured. Length, $4\frac{1}{2}$ lines.

In shape this species agrees with the preceding, but differs in the piceous head, thorax, under side, and legs; also in having the first five joints of the antennæ fulvous instead of four. The thorax is of the same shape and punctuation as in *C. opaca*, but the elytra are more distinctly punctured, flavous, and without scratches.

Hab. Province of St. Paulo, Brazil.

A single specimen.

Crimissa nigro-ornata, Jac.

I am inclined to believe, judging from the description and figure given by the late Th. Kirsch of his *Proseicela tarsalis* (Berliner Ent. Zeitsch., 1883), that this species is wrongly placed in the *Chrysomelidæ* proper, and is identical with the above-named insect described by me in the P. Z. S., 1879. The figure lately published in Dresden (Coleoptera obtained by Dr. Stübel in South America) agrees almost entirely with the banded variety I have mentioned in my paper; moreover, the thorax and other particulars agree entirely with *Crimissa*, although I cannot be sure on this point until I have seen the type. I may add, however, that Kirsch particularly mentions the basal joint of the antennæ, which is characteristic of *Crimissa*, but not of the genus *Proseicela*.

Notozona Balyi, n. sp.

Flavous, the intermediate joints of the antennæ fuscous; thorax very minutely and sparingly punctured; elytra strongly punctate-striate, dark chestnut-coloured, a short longitudinal stripe at the base, two narrow transverse bands before and below the middle, and the apex, flavous. Length, 3—3½ lines.

Head with a few fine punctures, flavous; antennæ extending to more than two-thirds the length of the elytra, flavous, the intermediate joints more or less fuscous; thorax more than twice as broad as long, the sides narrowed in front, the anterior angles slightly thickened and oblique, the surface with a few fine punctures, flavous, the disc with a slight transverse depression near the middle of the posterior margin; scutellum flavous; elytra convex, regularly and strongly punctate-striate, chestnut-brown, with a short stripe within the humeral callus, a narrow transverse band before and another below the middle, as well as the apex, flavous;

under side and femora flavous, the tibiæ and tarsi dark fulvous claws bifid.

Hab. Upper Amazons.

Blepharida Holubi, n. sp.

Elongate, parallel, chestnut-brown, the antennæ and tarsi paler; thorax strongly transverse, finely and sparingly punctured with four deep perpendicular grooves; elytra deeply and regularly punctate-striate, the interstices convex, piceous, each interstice with numerous closely placed flavous spots. Length, $2\frac{1}{2}$ lines.

Head not perceptibly punctured, with a deep sinuate groove at some distance from the eyes, the inter-ocular space deeply punctured, labrum and palpi flavous, the latter slender; antennæ not extending to the middle of the elytra, flavous, all the joints rather short, the terminal ones slightly thickened; thorax more than twice as broad as long, the sides slightly and evenly rounded, the anterior angles subtuberculiform, the surface sparingly and finely punctured at the middle of the disc, the latter with a slight longitudinal groove, the sides with two short but deep longitudinal grooves placed opposite at the anterior and posterior margins respectively; scutellum fulvous, broader than long; elytra not broader at the base than the thorax, rather convex, without any basal depression, regularly and deeply punctate-striate, the interstices convex, piceous, the flavous spots very numerous and irregular, mostly of elongate shape, those near the base of larger size and more irregular shape; the posterior tibiæ deeply emarginate at the apex.

Hab. South Africa (*Holub*).

Although *B. Holubi* resembles in its general pattern most of its allies, the piceous colour of the elytra and the very numerous small flavous spots, together with the other details pointed out above, will distinguish it. I received a single specimen from the late Dr. Dohrn, which was obtained by Herr Holub, the well-known traveller in South Africa.

Blepharida Duvivieri, n. sp.

Dark fulvous, the antennæ paler; thorax deeply punctured near the base, with four deep longitudinal grooves; elytra very deeply punctate-striate, the interstices convex, covered with numerous small flavous spots. Length, 5 lines.

Of rather parallel shape, dark fulvous. The head nearly impunctate, flat; the antennæ not extending to the middle of the

elytra, pale fulvous, the third joint distinctly shorter than the fourth joint; thorax about twice as broad as long, the sides straight at the base, rather strongly rounded before the middle, the anterior angles oblique, the posterior ones acute, each furnished with a single hair, the surface deeply punctured near the base only, with a short deep longitudinal groove at each side of the basal margin, and a semicircular groove surrounding the anterior angles; elytra deeply and regularly punctate-striate, each with ten rows of punctures (including the short subsutural one), the second and third rows joined at their beginning, but not quite extending to the base, the fourth and fifth rows also joined and extending quite to the basal margin, the surface dark brown, interrupted by small elongate flavous spots, numbering about fifty on each elytron, and placed somewhat in three or four oblique rows. Under side and legs dark brown. The last abdominal segment of the male incised at each side, forming a subquadrate median lobe.

Hab. Gorontalo (*Rosenberg*).

A single specimen has been sent to me under the name of *B. flavopustulata*, Baly, from which species it is, however, distinct, as a comparison with the type contained in the British Museum has proved to me. The present species is larger, and of more elongate shape, and the elytral spots are much more numerous. In *B. flavopustulata* the labrum is flavous (not piceous as in this species), the clypeus is coarsely punctured, and the thorax is a little more than twice as broad as long; while the elytral interstices are plane and finely punctured instead of convex and impunctate, as in *B. Duvivieri*.

Blepharoides, n. gen.

Body elongate, broad, subparallel; palpi slender; antennæ subfiliform, the terminal joints slightly thickened; thorax transverse, without any grooves; elytra punctate-striate; tibiæ longitudinally sulcate, the posterior ones emarginate at the apex, the latter with a strong spur; the first joint of the posterior tarsi as long as the following two joints together, second joint very short; claws appendiculate; prosternum narrowly elongate and longitudinally grooved, its lower edge straight and dilated; the anterior coxal cavities closed.

The insect for which the present genus is proposed resembles *Podontia* and *Blepharida* in most structural characters, and in general appearance and coloration;

but differs from these genera in having no depressions or grooves on the thorax, and in possessing appendiculate instead of bifid claws. These differences seem to justify its separation from the allied genera.

Blepharoides flavitarsis, n. sp.

Piceous, the labrum, antennæ, and the tarsi flavous; thorax sparingly punctured on the disc, very closely and strongly at the sides; elytra strongly punctate-striate, the interstices costate, furnished with numerous small flavous spots. Length, $2\frac{3}{4}$ lines.

Of dark piceous general colour. The head finely and closely punctured near the eyes, its surface flattened, without depressions or tubercles, the anterior margin of the clypeus straight, labrum testaceous; antennæ flavous, scarcely extending beyond the base of the elytra, the third and fourth joints slender, equal to one another, and longer than the following joints, these slightly and gradually thickened; thorax rather more than twice as broad as long, the sides straight at the base, rounded before the middle, the anterior angles oblique, the sides densely and strongly, the middle sparingly and more finely, punctured, with a very shallow transverse depression near the base; scutellum small and narrow; elytra not wider at the base than the thorax, regularly and strongly punctate-striate, the interstices longitudinally costate at the sides. On each interstice a number of small flavous spots are placed, which are, however, almost absent at the sides, and vary in position on each elytron. Under side finely pubescent, tarsi flavous.

Hab. Sumatra.

On account of the absence of the thoracic grooves and the colour of the tarsi, *B. flavitarsis* cannot be mistaken for any nearly similarly coloured species.

Euphitrea foveicollis, n. sp.

Broadly ovate, rounded, fulvous, with a violaceous tint above; head and thorax very finely and closely punctured, the latter with a deep fovea anteriorly at each side; elytra very strongly and closely punctured, the lateral margin thickened anteriorly. Length, $3\frac{1}{4}$ lines.

Head extremely minutely punctured, deeply obliquely grooved above the eyes; clypeus thickened and widened between the antennæ, impunctate; palpi slender; antennæ fulvous, not extending to the middle of the elytra, all the joints, with the excep-

tion of the second one, of nearly equal size; thorax three times as broad as long, the anterior margin straight, the anterior angles produced outwards, the sides rounded, the posterior margin sinuate at the sides, the disc very finely and closely punctured, with a large fovea near the anterior angles, the surrounding edges of which are thickened, and the space behind very finely strigose; scutellum impunctate; elytra rounded and moderately convex, fulvous, with a distinct violaceous gloss, strongly and closely punctured, the interstices rather wrinkled, the lateral margin thickened anteriorly and accompanied by a row of deep punctures; elytral epipleuræ very broad, transversely wrinkled; abdomen closely punctured; tibiæ deeply sulcate; anterior coxal cavities closed.

Hab. India, Dunsiri Valley; in the collection of the Calcutta Museum and in my own.

From *E. Wallacei* and *E. micans*, Baly, the present species may be distinguished by the foveolate anterior portion of the thorax, and the violaceous tint of the upper surface.

Lactica suturalis, Jac.

Of this species, which has been described by me from Sumatran examples, I have received a specimen from the Indian Museum of Calcutta, without locality, which agrees in general with the type, but differs from it in having three longitudinal costæ at the sides of each elytron (the outer one the longest). This is probably a sexual (♀) character.

Lactica amazonica, n. sp.

Fulvous; thorax deeply transversely depressed, with straight sides, impunctate; elytra very finely punctured, black, with the basal margin and the anterior portion of the lateral margins obscure fulvous. Length, $2\frac{3}{4}$ lines.

Head impunctate, fulvous, without frontal elevations, the carina distinct, the clypeus very strongly swollen; antennæ long and robust, fulvous, the third joint one-half longer than the second, the fourth and following joint twice as long as the third one; thorax twice as broad as long, the sides perfectly straight, the anterior angles oblique, the base with a very deep transverse groove, limited at the sides by an equally deep perpendicular groove, the surface in front of the depression swollen, the rest of the disc impunctate, fulvous; elytra without basal depression, very finely and rather closely punctured, black, shining, the basal and lateral margins

narrowly fulvous, this colour being gradually shaded into the black of the elytra; under side and legs fulvous.

Hab. Upper Amazons; my collection.

Lactica rotundicollis, n. sp.

Pale testaceous; the thorax with evenly rounded sides, impunctate, the basal sulcus narrowly impressed; elytra very finely and closely punctured. Length, 3 lines.

Head impunctate, the frontal tubercles small but distinct; antennæ extending to one-third the length of the elytra, flavous, the third joint slightly longer than the fourth; thorax more than twice as broad as long, the sides evenly rounded, as well as the anterior angles, rather broadly margined, the base with a transverse impressed narrow groove and a similar perpendicular impression, impunctate; elytra rather parallel, finely and closely punctured; under side and legs pale flavous.

Hab. Gaboon.

Much smaller than *L. gabonensis*, Jac.; the thorax with rounded sides, of even width, and without distinct anterior angles; the basal sulcus in the shape of thin, impressed lines, but the enclosed space not depressed. A single specimen is contained in my collection.

Acrocrypta assamensis, n. sp.

Fulvous, with the basal joints of the antennæ and the legs black; the head and thorax very finely punctured; elytra strongly and closely punctate. Length, $2\frac{1}{2}$ lines.

Of broadly ovate and convex shape. The head very finely punctured between the eyes, the frontal elevations flat; palpi strongly incrassate; antennæ black, the basal two joints obscure fulvous below, the following five joints black, gradually dilated (the rest wanting); thorax more than twice as broad as long, widened at the middle, the posterior margin sinuate towards each side, the median lobe roundly produced, the anterior margin straight, the anterior angles obliquely thickened, the surface very minutely punctured throughout; elytra convex, much more strongly but as closely punctured as the thorax, the interstices also here and there impressed with minute punctures; under side fulvous; legs black, tibiæ with a strong spur, the first joint of the posterior tarsi as long as the following three joints together; claws appendiculate; anterior coxal cavities closed.

Hab. Assam.

Principally distinguished from its allies by the strong and close elytral punctuation, and the black legs.

Hyphasis unifasciata, n. sp.

Black, the thorax and the abdomen flavous; elytra very finely punctured, black, with a broad median transverse band, pale testaceous. Length, 2 lines.

Head black, impunctate, the frontal tubercles broad, distinct; eyes large, labrum testaceous; antennæ black, slender, the basal two joints more or less fulvous, shining, the third and fourth joints equal; thorax more than twice as broad as long, pale flavous, the sides rounded, the surface entirely impunctate; scutellum broad, black; elytra very finely punctured, black, the median pale band rather obscure, of equal width throughout; below black, the abdomen partly or entirely flavous.

Hab. Perak (*Doherty*); coll. Jacoby.

Manobia Dohertyi, n. sp.

Elongate, black, the basal two joints of the antennæ fulvous; thorax deeply transversely grooved, impunctate; elytra deeply depressed below the base, distinctly punctate-striate. Length, 1 line.

Of narrow and rather elongate shape, entirely black and shining. The head impunctate, the frontal tubercles small but distinct, the lower portion of the face rather produced; antennæ extending to the middle of the elytra, black, the lower two joints fulvous, the terminal joints thickened; thorax one-half broader than long, the sides straight, slightly narrowed towards the base, the anterior angles oblique, the surface with a deep sinuate transverse groove near the base, the interior of the groove punctured, the rest of the surface impunctate; scutellum small, transverse; elytra much broader at the base than the thorax, narrowed towards the apex, the base convex, bounded below by a transverse depression, regularly and distinctly punctate-striate, the interstices impunctate, slightly costate near the sides.

Hab. Perak (*Doherty*).

Allied to *M. nigripennis*, Jac., from Sumatra, but of more elongate shape, the clypeus without central ridge, and the elytral punctuation distinct to the apex. Three specimens, which were obtained by Mr. Doherty, are contained in my collection.

Manobia castanea, n. sp.

Subelongate, dark chestnut-brown, the antennæ and tarsi paler; thorax very finely punctured, deeply transversely sulcate; elytra feebly depressed below the base, finely punctate-striate. Length, 1 line.

Of the same shape as *M. Dohertyi*, and entirely dark brown. The head impunctate, the eyes very large, the clypeus rather concave, antennæ fulvous, the basal two joints thickened, the terminal joints scarcely dilated; thorax more than one-half broader than long, distinctly narrowed at the base, strongly transversely sulcate, the sulcus sinuate, the rest of the surface very finely punctured; elytra but feebly depressed below the base, finely punctate-striate, the punctures very fine posteriorly, the apex of the tibiæ and the tarsi pale fulvous.

Hab. Perak (*Doherty*).

I cannot look upon this species as a variety of the preceding one, as there are three specimens before me which all show the same differences in regard to colour and sculpture.

Psylliodes nigripes, n. sp.

Black, above metallic blue, the basal three joints of the antennæ fulvous; thorax rather closely punctured; elytra strongly punctate-striate, the interstices convex at the sides only, sparingly and finely punctured. Length, 1½ line.

Head with a few minute punctures, metallic blue, frontal elevations indistinct, labrum piceous, with a row of punctures; antennæ black, the lower three joints fulvous, the terminal joints distinctly enlarged and thickened, not quite extending to the middle of the elytra; thorax about one-half broader than long, the sides straight, the anterior angles oblique, forming another angle before the middle, the surface very finely and rather closely punctured; elytra slightly broader at the base than the thorax, strongly and regularly punctate-striate, the interstices flat and impunctate, slightly costate at the sides; under side black, the abdominal segments narrowly margined with testaceous, legs black, the posterior femora dark metallic blue.

Hab. New Guinea.

Larger than *P. chapiusi* and *P. cognata*, Baly; the elytra with the interstices flat and impunctate.

Psylliodes sumatrensis, n. sp.

Black, upper side metallic green, the three basal joints of the antennæ fulvous; thorax strongly and closely punctured; elytra distinctly punctate-striate, the interstices very finely punctured. Length, 1½ line.

Head remotely and finely punctured, without transverse groove, metallic green, the frontal elevations very narrow, oblique; labrum and palpi black; antennæ scarcely extending to half the length of the elytra, black, the lower three joints fulvous, the third joint shorter than the second; thorax one-half broader than long, the sides straight, the anterior angles oblique, the surface strongly and closely punctured throughout; elytra rather strongly punctate-striate, the interstices flat, very finely punctured; under side and legs black, the posterior femora stained with metallic green.

Hab. Sumatra.

Nearly allied to *P. difficilis*, Baly, from Japan, but the thorax less transverse, the antennæ much shorter, the posterior margin of the thorax not bisinuate, the surface more closely punctured, the elytral interstices flat throughout, and the general upper surface green instead of blue.

Liprus flavilabris, n. sp.

Dark piceous, with the labrum, antennæ, and the four anterior legs flavous; thorax bisulcate, impunctate; elytra deeply punctate-striate, the base strongly raised. Length, 1½ line.

Of nearly black colour. The head impunctate, the frontal elevations trigonate; labrum and palpi flavous; antennæ filiform, flavous, the terminal joints slightly and gradually thickened; thorax scarcely longer than broad, the sides deeply constricted below the middle, the surface impunctate, deeply transversely sulcate near the base, the anterior portion with a more feeble sulcus, the disc with a few whitish hairs; elytra with the basal portion convex, bounded below by a deep transverse depression, strongly punctate-striate, the interstices slightly convex, the sides perpendicularly depressed, the disc very sparingly pubescent; legs flavous, the posterior femora piceous.

Hab. Java.

This species, of which a single specimen is contained in my collection, differs from its congeners in the bisulcate and entirely impunctate thorax, as well as by its coloration.

Cacoscelis opacipennis, n. sp.

Under side dark metallic blue; the antennæ, tibiæ, and tarsi, black; head and thorax fulvous, impunctate; elytra dark blue or greenish, opaque, finely and closely punctured and minutely granulate. Length, 3 lines.

Slightly widened posteriorly. The head impunctate, the frontal tubercles obsolete, the clypeus triangularly raised, palpi black; antennæ extending beyond the middle of the elytra, black, the third and following joints equal; thorax transversely subquadrate, one-half broader than long, the sides slightly rounded, the surface impunctate, shining, pale fulvous, with some very obsolete irregular depressions at the sides; scutellum fulvous; elytra of a dark bluish or slightly greenish colour, opaque, very minutely granulate, and closely and finely punctured; under side dark metallic blue; tibiæ and tarsi closely pubescent, the first joint of the posterior tarsi as long as the following two joints together; claws appendiculate.

Hab. Cauca Valley and Amazons.

I possess two specimens of this species, which may be principally known by the sculpture of the elytra. In general shape and colour the insect closely resembles several species of *Cneorane* amongst the *Galerucinæ*, from which the thickened posterior femora at once distinguish it.

Sphæroderma bimaculata, n. sp.

Black; the thorax and elytra scarcely perceptibly punctured, the latter strongly rounded and convex, black; each with a round flavous spot at the base. Length, 1 line.

Head impunctate, scarcely grooved between the eyes, the frontal tubercles and carina entirely indistinct; palpi robust, the penultimate joint strongly thickened; antennæ not extending much beyond the base of the elytra, black, the basal three or four joints obscure fulvous, the second joint thickened, short; thorax more than twice as broad as long, the sides nearly straight, the anterior angles slightly oblique, the surface nearly impunctate, black; elytra not perceptibly punctured, strongly convex, black, the middle of the base of each with a round flavous spot, their epipleuræ very broad; posterior femora strongly incrassate, the tibiæ somewhat compressed and dilated, with a long and distinct spine; the first joint of the posterior tarsi as long as the two following joints together; claws appendiculate; prosternum narrow and the metasternum with a horseshoe-shaped plate.

Hab. Sumatra.

It is probable that this small species is the representative of a new genus on account of the differently structured metasternum, the more slender legs, and long tibial spine. I have, however, provisionally placed it in *Sphæroderma*, with which it agrees in shape.

Sebæthe marginipennis, n. sp.

Flavous, the apical joints of the antennæ fuscous; thorax dark fuscous, the lateral margins flavous; elytra finely punctured, nearly black, the lateral margins and a small spot before the middle of each elytron flavous. Length, 1½ line.

Head impunctate, the vertex fuscous, the lower portion flavous, frontal tubercles strongly raised, the carina raised into an acute ridge; antennæ extending beyond the middle of the elytra, the lower four joints flavous, the rest darker, the third joint one-half longer than the second, slightly shorter than the fourth joint; thorax rather more than twice as broad as long, with a rather broad flattened margin, the latter flavous, the disc nearly black, impunctate; elytra widened towards the middle, very finely but not very closely punctured, black, shining, the lateral margins narrowly, the apex more broadly, flavous; a small flavous spot is placed immediately before the middle on each elytron; under side and legs flavous, the posterior femora infuscate.

Hab. Sumatra.

Xenidea fulvicollis, n. sp.

Piceous; the head, antennæ, thorax, and the four anterior legs fulvous; thorax impunctate; elytra purplish, finely punctate-striate, the interstices at the sides costate. Length, 1½ line.

Head impunctate, fulvous; the eyes large, with a short longitudinal groove near the inner margin, the frontal elevations absent, the carina acutely raised; antennæ slender, fulvous, the apical joint fuscous; thorax nearly twice as broad as long, the sides straight, the anterior angles oblique, the posterior margin but slightly produced at the middle, the surface not perceptibly punctured, slightly wrinkled, with a very obsolete depression at each side near the base; scutellum piceous; elytra purplish blue, without any basal depression, rather finely punctate-striate, the interstices distinctly costate at the sides; under side piceous, the abdomen fulvous at the sides, as well as the legs; posterior femora [illegible]lish.

New Guinea.

Xenidea Balyi, n. sp.

Subquadrate-ovate, piceous; the antennæ (the 7th, 8th, and 9th joints excepted), and the four anterior legs, fulvous; thorax dark bluish, remotely punctured; elytra metallic purplish, strongly punctate-striate, the interstices rather convex. Length, $1\frac{3}{4}$ line.

Head obscure purplish, impunctate, the frontal tubercles in the form of narrow oblique ridges, the carina acutely raised; labrum and palpi fulvous; antennæ filiform, extending to the middle of the elytra, fulvous, the 7th, 8th, and 9th joints black, 2nd joint thickened, half the length of the 3rd; thorax nearly twice as broad as long, the sides straight, the anterior angles oblique, the posterior margin broadly produced at the middle, the base with an obsolete depression at each side, the rest of the surface remotely and rather strongly punctured; elytra with an obsolete depression below the base, very strongly punctate-striate, the interstices (especially near the sides) rather costate; posterior femora with a purplish gloss, posterior tibiæ strongly widened towards the apex, sulcate and armed with a spur.

Hab. New Guinea.

Distinct from any of the species described by Baly, by the colour of the antennæ, and the strongly punctured thorax.

CHALÆNOSOMA, n. gen.

Body oblong-ovate, metallic; antennæ filiform, the second and third joints short, equal, the fourth longer than the following joints; thorax strongly transverse, rather convex, the posterior margin rounded, the surface without depressions; elytra with a strong basal depression, irregularly punctured, their epipleuræ broad, extending to the apex; legs long and slender, the posterior femora but moderately thickened, all the tibiæ unarmed, the first joint of the posterior tarsi as long as the following three joints together, claws appendiculate, prosternum very narrow, the anterior coxal cavities closed.

On account of the unarmed tibiæ, a rare character amongst the numerous genera of *Halticidæ*, the closed coxal cavities and transverse thorax, *Chalænosoma* will find its place near *Chalænus*, from which the different structure of the antennæ and the much longer posterior first tarsal joint separates it.

Chalænosoma metallicum, n. sp.

Metallic green, with the antennæ, the tibiæ, and the tarsi more or less black; thorax extremely minutely punctured; elytra strongly

and irregularly punctate, bright metallic green, with a transverse band at the base, another at the middle, and a spot near the apex, purplish.

Var. (?). Antennæ and legs pale fulvous. Length, $1\frac{3}{4}$—2 lines.

Rather widened posteriorly. The head convex, metallic green, impunctate, the frontal tubercles narrowly transverse, bounded by a deep groove behind, clypeus triangularly thickened, labrum and jaws black; antennæ extending to about the middle of the elytra, the basal joints more or less obscure fulvous, the intermediate joints fuscous or black; thorax transversely convex, at least twice as broad as long, the sides rather rounded, the angles acute, the surface scarcely perceptibly punctured, bright metallic green; scutellum triangular, purplish; elytra with a deep depression below the base, strongly punctured within this depression, the rest of the surface less strongly but closely punctate, the purplish bands regular, narrow, but not quite extending to either margin, the subapical spot rather small.

Hab. India, Neilgherries.

It is possible that the variety from South India really represents a closely allied species, as the thorax is finely granulate, more distinctly punctured, and shows an obsolete transverse depression; the antennæ and legs are also fulvous, but there is no further difference.

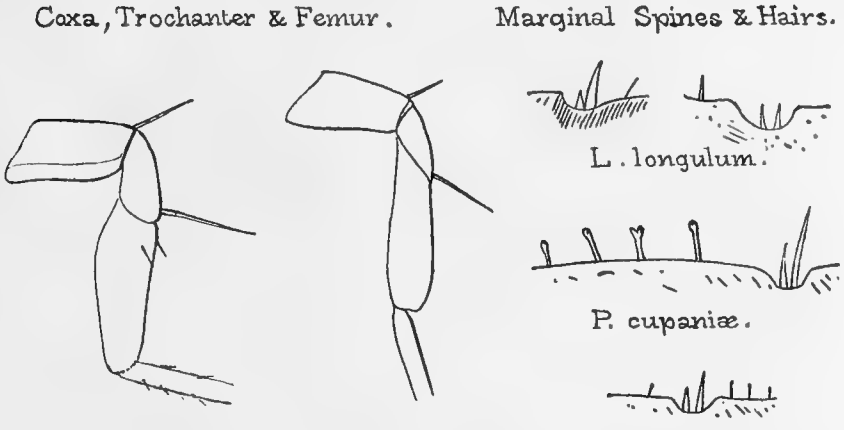
X. *Two new species of* Pulvinaria *from Jamaica.*

By Theodore D. A. Cockerell, F.Z.S., F.E.S.

[Read February 8th, 1893.]

The Coccid genus *Pulvinaria*, Targ., consists of about twenty-four described species, some of which are decidedly injurious to cultivated plants. Of these, eighteen are European, two or three inhabit North America, two are from Australia, and one from Mauritius. *P. cestri*, Bouché, was found in greenhouses, and its native country is uncertain. *P. camellicola* has been introduced in New Zealand, but Mr. Maskell, who has so carefully studied the *Coccidæ* of that country, has met with no native species there. In the neotropical region the genus has been unknown; until recently a new species was mentioned, but not named or described, from Montserrat ('Insect Life,' vol. iii., p. 408).*

Pulvinaria cupaniæ, n. sp.



Very abundant on the leaves of akee (*Cupania edulis*, Camb.) in Kingston, Jamaica. The females, with egg-sacs, on the under

* The occurrence of the genus in Jamaica has been referred to in 'Insect Life,' vol. iv., p. 333; and Journ. Instit. Jamaica, vol. i., pp. 55, 142, 143.

sides of the leaves, not clustered together. The green walking females without sacs are extremely abundant on the midrib. Length of ♀ with sac about 5 mm.; without sac, about 3 mm. long, and 2½ or less broad. Although the scales are green, they turn red-brown on being boiled in caustic soda.

The antennæ are of eight joints. The 3rd joint is distinctly the longest; the 4th next longest; the 5th and 2nd, about equal, next; the 6th, 1st, and 8th subequal, next longest; and the 7th shortest of all. The 1st joint is about as broad as long; the 2nd joint has one long and one very short hair; the 3rd has two very short ones; the 5th and 6th have each a long hair; the 7th has one or more; and the 8th five or six hairs, none apparently longer than itself. Femur rather longer than tibia; tibia about twice as long as tarsus. Tarsal knobbed digitules about as long as breadth of tarsus; the knobbed hairs are longer, but not *much* longer, and very slender. The tibia has a few shorter bristles. A long hair springs from the trochanter, and a shorter one from the distal end of the coxa. The scale, seen by transmitted light after boiling in dilute soda solution, shows, at least in places, very many round gland-spots, as in *Lecanium longulum*. The margins of the scale exhibit short hairs, which are distinctly knobbed, some apparently with a slight tendency to divide at the truncated ends. The margin is almost squarely incised at the junction of the segments, and from the incision springs a short spine; or sometimes two, one longer than the other.

This insect apparently suffers from a dipterous parasite, as on boiling some of the old females with egg-masses I found the empty puparia of a dipteron, similar to those I had previously found with *Dactylopius*. These puparia are chestnut-brown, subcylindrical, rough, with minute bristles or prominences, and show at the posterior extremity a pair of rather long spiracular horns, widely apart and diverging, with their ends bifid.

Pulvinaria urbicola, n. sp.

On the stems and under sides of the leaves of *Capsicum*, in Kingston, Jamaica; attended by ants. September, 1892.

♀. Length, including ovisac, over ¼ in.; width less than ⅛ in. Ovisac white, depressed, somewhat inclined to be longitudinally ribbed, parallel-sided, fairly firm. Scale shrunken so as to be broadly oval, olivaceous brown. A specimen found later (Dec. 18th) has the ovisac 9 mill. long and 2 mill. broad, distinctly ribbed.

♀ without ovisac, like the *hesperidum* group of *Lecanium*, oval, somewhat elevated, more or less transversely ridged, shiny, pale brown. Anal plates conspicuous, sometimes ochreous.

The edge of the scale has short simple hairs of the ordinary sort. There are also the four larger bristles where the segmentation should be, just as in *P. vitis* (as figured by Signoret). The posterior incision (as in *Lecanium*) is well pronounced, with the sides contiguous. In some individuals the cephalic portion of the scale is more or less separated by a lateral constriction from the rest. The tarsus is about two-thirds the length of the tibia, and the tibia about two-thirds the length of the femur. There are slender clubbed tarsal hairs, extending beyond end of claw, with the club very small. Claw with a small curved clubbed digitule. Antennæ with eight joints; the 3rd longest, then the 2nd, then the 1st, then the 4th, then 5, 6, and 7 subequal, then 8th shortest; 2nd joint with a very long hair; 5th joint with two long hairs; 8th with about seven long hairs.

Larva.—Active, oval, pale yellow, with dark or black eyes. The young larva has two caudal hairs, not so long as the greatest diameter of body; these hairs curve so as to cross near their ends. The sides of the posterior cleft are not contiguous in the larva.

Parasites.—The scales often show one to four holes, where parasites have escaped; and from the ovisacs project one or more pupa cases, evidently dipterous. These pupa-cases are colourless, with the antennal coverings separate, like horns, from the body; thus resembling the pupa of *Sciara*. The leg-coverings are blunt at the extremity, with a small sublateral bristle. In the scales of females which have not yet developed the ovisac, I find a dark vandyke-brown dipterous parasite, with long finely pubescent legs and a very large straight tibial spur. The tarsus does not show any joints, and, besides its covering of short hairs, it shows a row of eight short stiff bristles on its inner side. The femur is rather shorter than the tibia. It seems possible that the holes in the scales may have been due to a Chalcidid parasite, and the puparia in the ovisacs must be those of a dipterous inquiline (compare the notes in 'Entomologist,' 1892, pp. 180—182). The dipteron found in the females without ovisacs is no doubt a parasite, but it cannot be identified until specimens are reared.

Note on the relationships of Pulvinaria.

A *Pulvinaria*, before it has produced the cottony ovisac, is practically identical with *Lecanium*, and resembles the species of the group of *L. hesperidum*. Compare *Pulvi-*

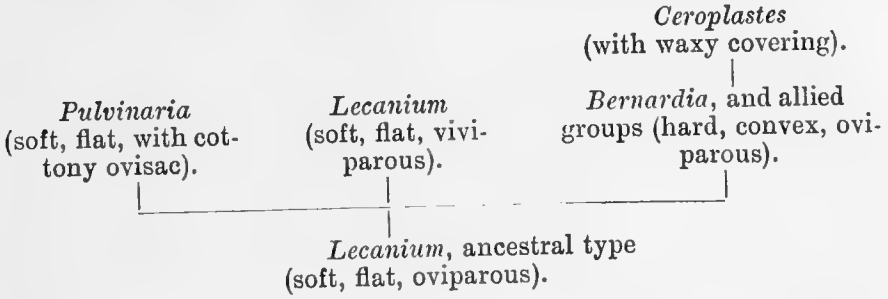
naria cupaniæ with *Lecanium longulum*, Dougl., for instance, and the similarity is very striking. The gland-spots, the marginal spines, the hairs upon the coxa and trochanter, all are closely similar; and the antennæ have the same number of joints.* The knobbed and truncated hairs on the margin of the scale of *P. cupaniæ* suggest the remarkable branched hairs of *Lecanium mangiferæ*, which were probably knobbed in an earlier stage of their evolution.

We have in Jamaica a rather problematical species, which I have called *Pulvinaria dendrophthoræ*, and it shows very well the difficulty of distinguishing a *Pulvinaria* from a *Lecanium*, when the former has no ovisac. This *P. dendrophthoræ* was found by Mr. Fawcett at Cinchona (5000 ft. alt.) on *Dendrophthora cupressoides*. Specimens were extremely numerous on the plant, and had all the appearance of a flat *Lecanium;* but I found a single example with a cottony ovisac, and hence referrred them to *Pulvinaria*. Nevertheless, it is impossible to say with perfect certainty that the single *Pulvinaria* was really of the same species, and, if it was not, it would be necessary to refer the specimens without ovisacs to *Lecanium!* Dr. Riley, to whom I sent only specimens without ovisacs, referred the species to *Lecanium*. These insects are greenish, the colour of the *Dendrophthora*, and resemble very much the females of *P. cupaniæ* at the same stage. The two pairs of spines on each side are very conspicuous, the anterior spine of each pair being considerably shorter than the posterior. The marginal hairs are more slender than in *P. cupaniæ*, yet they show a slight tendency to be knobbed. I do not doubt that when the species comes to be better known it will prove to be a true *Pulvinaria*, but it may be seen from these notes how slight are the characters of that genus.

Pulvinaria has no doubt been evolved from the flat type of *Lecanium*, which may be regarded as the most primitive form of the subfamily. The order of evolution seems to have been guided by the supreme necessity for protecting the eggs, which are known to be severely

* The characters of *L. longulum* here noted, except as to the antennæ, are not mentioned by Mr. Douglas in his original description (Ent. Mo. Mag., 1887), but were observed by me in specimens found in Antigua (*Barber*) and at Kingston, Jamaica.

attacked by parasites and predaceous enemies. The original, flat, unprotected type has been preserved in forms which are now *viviparous;* it has diverged on the one hand into *Pulvinaria*, which protects its eggs by a cottony ovisac; on the other into *Bernardia*, which has a hard scale firmly fixed down to the plant. And, as if this were not enough, *Bernardia* has given rise to *Ceroplastes*, in which the scale is covered with wax.



It follows from this view of the relationship that the tribe *Pulvinariini*, given in Mr. Ashmead's 'Generic Synopsis of the Coccidæ,' has no standing.

XI. *Notes on the Longicornia of Australia and Tasmania. Part I., with a list of the species collected by* Mr. J. J. Walker, R.N., F.L.S., *and descriptions of new forms.* By Charles J. Gahan, M.A., F.E.S., of the British Museum (Nat. Hist.).

[Read March 8th, 1893.]

This paper was commenced with the intention that it should be little more than a list of species and descriptions of new forms. In the course of its preparation, however, I experienced difficulties, arising partly from errors of synonymy and of other kinds which I found in the Catalogue of Gemminger and Harold, but more especially due to the inadequacy of the descriptions of many of the older authors, the result of which has been to make my task much longer than I expected, and to give to the paper a character somewhat different to that at first intended. The frequency of the errors I met with compelled me to take little on trust, and must be my excuse for burdening the text with so many references to the descriptions of species. A few notes that I have added with regard to genera and species will, I trust, be found useful by other workers on this difficult group.

The Longicorns collected by Mr. Walker in Australia and Tasmania reach a total of sixty-two species, and are those which are numbered in the text. Of these twelve are described as new, and one has been taken as the type of a new genus. A few other species, not included in Mr. Walker's collection, are also described for the first time.

PRIONIDÆ.

Eurynassa stigmosa, Newm.

Mallodon stigmosum, Newm., Ann. & Mag. Nat. Hist., vol. v., p. 15.

A single specimen, from Children's collection, now in the British Museum (and ticketed by Newman *Mallodon*

sticticus, ined.), is in all probability the type of the above species, which undoubtedly belongs to the genus *Eurynassa*. It may be distinguished from other species of the genus by the much smaller size of the nitid spaces on the pronotum of the male, and by the somewhat closer and more rugulose punctuation of the elytra.

The genus *Mallodon* will thus have to be omitted from the lists of Australian Longicorns.

Eurynassa australis, Boisd.

Mallodon australis, Boisd., Voy. de l'Astrolabe, Ent., ii., p. 465.

M. figuratum, Pasc., Trans. Ent. Soc. Lond., ser. 2, vol. v., p. 14.

Pascoe's description of *E. figurata* is so completely applicable to the *E. australis* of Boisduval, that it is impossible to doubt the identity of the two species.

Cnemoplites princeps, sp. n.

♂. Fusco-niger, prothorace supra valde dense subscabrosoque punctato, spatio medio trilobato, paullo elevato, nitido, sparsim punctato; scutello medio levi nitido, utrinque dense punctulato; elytris omnino dense intricateque ruguloso-punctatis; segmentis quatuor anticis abdominis transversim depressis et dense tomentosis, segmento quinto fovea tomentosa utrinque obtecto. Long. 58 mm.

Hab. Queensland.

Prothorax transverse; sides subparallel, armed with a series of small spines, of which that at the postero-lateral angle is larger and more prominent; anterior margin of the pronotum feebly trisinuate; the disk with a slightly raised, trilobed area, which may be easily distinguished from the rest of the upper surface by its nitid and less closely punctured appearance; the median lobe is smaller and directed towards the base; the lateral lobes are triangular in form, and diverge from one another anteriorly, and lying between them, just in front of their common median portion, there is a smooth depressed space; external to each of the lateral lobes there is a small nitid and sparsely punctured space in the form of a blunt tubercle. The elytra are intricately and rather more coarsely rugulose than in other species of the genus. The first four abdominal segments are (with the exception of a narrow transverse space at the posterior border of each) depressed

and covered with a thick tomentum over almost their whole ventral surface; just in front of each of the smooth spaces the tomentum is elongated to form a narrow transverse brush of fulvous hairs; the fifth ventral segment has a small rounded tomentose depression on each side, and its sinuately emarginate apex is also fringed with tawny setæ.

1. *Toxeutes arcuatus*, Fabr.

Prionus arcuatus, Fabr., Mant. Ins., i., p. 129.

Tasmania: Franklin, Hobart, and Launceston (*Walker*).

2. *Enneaphyllus æneipennis*, C. Waterh.

Ann. & Mag. Nat. Hist., ser. 4, vol. xix., p. 257.

Tasmania: Hobart and Franklin (*Walker*).

The thoracic spines of this species seem to vary considerably in size. They are quite rudimentary in some of the smaller males, and are rather long in some of the larger females; distinctly longer than in the two specimens which served as the types.

3. *Phaolus metallicus*, Newm.

Pœcilosoma metallicum, Newm., Ent. Mag., vol. v., p. 493 (♀).

Phaolus Macleayi, Pasc., Trans. Ent. Soc. Lond., ser. 3, vol. i., p. 569, pl. xxiii., fig. 3 (♂).

Iotherium metallicum, Pasc., *l. c.*, p. 569 (♀).

Tasmania: Hobart (♂ and ♀), (*Walker*).

This species, originally described from Tasmanian examples, has since been taken in S. Australia (*Bakewell*), Queensland (♂ and ♀), (*Challenger Expedition*), and, according to Pascoe, in Victoria and New South Wales. Mr. Pascoe has, in his last catalogue of Australian Longicorns, rightly placed the two forms as sexes of the same species; but the name *Phaolus* must, I think, be taken in preference to *Iotherium*, as it stands first on the page in which the two names were first proposed, and was founded on male examples.

CERAMBYCIDÆ.

4. *Pachydissus probatus*, sp. n.

Piceus, griseo-sericeo-pubescens; oculis supra valde approximatis, capite subtus bisulcato; prothorace supra intricate rugoso; spatio subcentrali levi haud distincte limitato; elytris apice fere

recte truncatis, utrisque bispinosis; antennis maris quam corpore paullo longioribus, articulis 3o, 4oque apice leviter nodosis, articulo 3o quam 4o fere duplo-, quam 1o distincte-longiori. Long. 21, lat. 6 mm.

Hab. Roebuck Bay, West Australia (*Walker*). One male example.

This species somewhat resembles *P. sericus*, Newm., but possesses characters that will enable it to be readily distinguished. The third and fourth joints of the male antennæ are only slightly nodose at the apex, scarcely more so, in fact, than in the females of *sericus;* the third joint is distinctly longer than the first, the second and third taken together are about twice the length of the fourth joint. The eyes are more approximate both above and below than in *P. sericus*. The under side of the head, though having the same number of transverse grooves as in *sericus*, presents a somewhat different appearance; the second groove (the one running between the eyes) is less clearly marked, and is separated from the post-ocular constriction or groove by a rather wide and somewhat punctate interval; the very narrow interval between the two anterior grooves is in the form of a sharp transverse ridge, the only sharp ridge that is to be seen crossing the under side of the head. (In *P. sericus* the interval between the second groove and the post-ocular constriction is much narrower, and frequently forms as sharp a ridge as that between the first and second grooves.) The prothorax is intricately and not strongly rugose above, with a median smooth space a little in front of the base; the sides are each furnished with two obtuse and very feeble tubercles. The apices of the elytra are transversely truncate, distinctly spined at each of the angles, with the outer spines somewhat stronger than those at the suture. This species approaches *P. intermedius*, Gahan, and *P. nubilus*, Pasc., in the relative proportions of the basal joints of the male antennæ; but its antennæ as a whole are much shorter, and do not surpass the apex of the elytra by more than about the last joint. It may be distinguished further by the feebler and more intricate wrinkling of the prothorax, which gives to the latter a somewhat rugose-punctate appearance.

5. *Pachydissus nubilus*, Pasc.?

Cerambyx nubilus, Pasc., Trans. Ent. Soc. Lond., ser. 3, vol. i., p. 558.

One female example was taken by Mr. Walker at Adelaide River in North Australia.

In a synopsis of the species of this genus (Ann. & Mag. Nat. Hist., ser. 6, vol. vii., Jan., 1891), I characterised *P. nubilus* from a male specimen taken at Port Essington in North Australia. My determination of the species was, however, made from Pascoe's description, and may possibly have been erroneous; though, up to the present, I have not seen another species to which his description will better apply.

Mr. Blackburn seems to me to have had a different species in view when he referred to *P. nubilus*, Pasc., in the Transactions Royal Soc. South Australia, vol. xiii, pt. 2 (Dec., 1890), p. 130; and it is probable also that the species to which he refers as the *Pachydissus australasiæ* of Hope is that which I characterised under the name of *P. nubilis*, Pasc. Hope's description is so short and indefinite that it applies equally well to three or four different species, and for this reason I omitted it altogether from my synopsis. One character, however, mentioned by Hope, *viz.*, "the third and fourth joints of the antennæ subglobose," seems to point to a species with rather short antennæ.

There is a species—represented in the British Museum collection by a male specimen from Port Essington—which is very likely to be the *Pachydissus australasiæ* of Hope, and which is only distinguishable from *P. sericus*, Newm., by the characters of the head. The eyes are larger and more approximated both above and below. The under side of the head has a single transverse groove in front, and a rather wide and shallow depression on the space between this and the post-ocular groove.

6. *Pachydissus*, sp.

Roebuck Bay. One female example.

Closely resembles the females of *P. sericus*, Newm.; but the under side of the head exhibits a different sculpturing, and the pronotum is without a distinct subcentral smooth space. I am unable to refer it with certainty to any of the described species.

The description of *Pachydissus boops*, Blackburn, so nearly fits the species named by me *Pachydissus brevicornis*, that the latter name must be considered a synonym. The synonymy will read as follows:—

Pachydissus boops, Blackb., Trans. R. Soc. S. Australia, vol. xiii., p. 128 (Dec., 1890) = *P. brevicornis*, Gahan, Ann. & Mag. Nat. Hist., Jan., 1891, pp. 25 and 27.

7. *Phacodes obscurus*, Fabr.

Callidium obscurum, Fabr., Mant. Ins., vol. i., p. 151.

Tasmania: Hobart and Franklin (*Walker*).

8. *Phacodes personatus*, Erichs.

Wieg. Archiv., 1842, i., p. 221.

Tasmania: Launceston (*Walker*).

This species does not appear under *Phacodes* in the Catalogue of Gemminger and Harold, but is quite erroneously placed as a synonym of *Bethelium signiferum*, Newm. The mistake has been copied by Masters in his List of Australian Coleoptera.

9. *Phacodes tenuitarsis*, Pasc.

Ann. & Mag. Nat. Hist., ser. 4, vol. viii. (1871), p. 270.

West Australia: Roebuck Bay (*Walker*), and Nicol Bay.

10. *Phacodes subfasciatus*, sp. n.

♀. Fusco-brunneus, cinereo fulvoque pubescens; prothorace quam latiori vix longiori, lateribus cinereo sat dense pubescentibus, disco pube grisea fulvaque sparsim vestito, medio vix evidenter carinato; elytris pube cinerea fulvaque punctis brunneis adspersis interrupta, vestitis, utrisque paullo pone apicem fascia subobliqua albido-pubescente; apicibus truncatis, haud spinosis; antennis medium elytrorum vix excedentibus. Long. 10 mm.

Hab. Roebuck Bay, North-west Australia (*Walker*).

Dark brown, with a pubescence which is for the most part ashy grey, but which, along the middle of the head and pronotum, alongside the suture, and near the apex of the elytra, is more or less tawny in colour. This pubescence is interrupted by the rather large scattered setigerous punctures, but is almost sufficiently thick, except in one or two places, to conceal the ordinary close punctuation of the elytra. At about the beginning of its posterior fourth, each elytron has a transverse or slightly oblique band formed of a denser and whiter pubescence than that on the rest of the surface. Immediately in front of and just behind this band,

the elytron is somewhat bared of pubescence, so that its dark derm and close punctuation are visible. The prothorax is widest at about the beginning of its posterior third or fourth, and from this point its sides very slightly and gradually converge towards the apex, but more strongly converge towards the base. Its length is scarcely greater than its greatest width. The disk is without tubercles, and bears an indication of a median raised line or carina. The elytra are not wider at the base than the widest part of the prothorax; their length is to that of the prothorax as about 5 to 2; their apices are transversely truncate and unarmed. The antennæ, which are without spines, scarcely extend beyond the middle of the elytra; the third joint is longer than the fourth, and about equal in length to the first or fifth.

This small species seems to have a relatively very large prothorax. Though the unique specimen, judged by the length of its antennæ and the form and length of the last joint, appears to be without doubt a female, yet its prothorax is as wide as the elytra, and considerably more than one-third as long.

11. *Phoracantha recurva*, Newm.

Entomologist, i., p. 4 (1840).

Roebuck Bay and Adelaide River (*Walker*).

This is a widely distributed species on the Australian continent. The British Museum collection contains examples from South Australia (*Davis and Bakewell*) and Queensland (*Challenger*), in addition to numerous specimens from North Australia. It contains also one example from King I. (*Prof. Spencer*), and one from Port Moresby in New Guinea (*Rev. W. Y. Turner*).

12. *Phoracantha quinaria*, Newm.

Entomologist, i., p. 3 (1840).

Tasmania: Hobart (*Walker*).

This species also appears to have a wide distribution in Australia. It occurs in South Australia (*Davis*), (type), and also in Queensland and West Australia, according to specimens in the British Museum collection. A small specimen from Melbourne appears to belong to the species.

13. *Phoracantha senio*, Newm.

The Entomologist, vol. i., No. i. (Nov., 1840), p. 4.

Coptocercus sexmaculatus, Hope, Proc. Zool. Soc., 1840, p. 51 ; Trans. Zool. Soc., vol. iii., 2 (1843), p. 195.

? Phoracantha gracilis, Perroud, Ann. Soc. Linn. Lyon, 1855, ii., p. 369.

A single example of this species was taken by Walker at Adelaide River, in North Australia. The species occurs also in South Australia (*Davis*), New South Wales (*Kirk*), Victoria, Queensland, and (if I am right in referring to it the *P. gracilis* of Perroud) in Tasmania. It is quite distinct from *Coptocercus biguttatus*, Donov., as a variety of which it is placed in the Catalogue of Gemm. and Harold.

The sheets containing Hope's description of *C. sexmaculatus* were not published until near the end of January, 1841,* so that Newman's name takes priority.

14. *Phoracantha synonyma*, Newm.

Ann. & Mag. Nat. Hist., vol. v., p. 19.

Freemantle, in West Australia (*Walker*). One example.

15. *Epithora dorsalis*, MacLeay.

Stenochorus dorsalis, MacLeay, King's Survey, ii., App., p. 451.

S. elongatus, Boisd., Voy. de l'Astrolabe, Entomologie, 2, p. 478.

Mallocera elongata, Casteln., Hist. Nat., ii., p. 424.

Stenochorus uniguttatus, Hope, Proc. Zool. Soc., 1840, p. 49 ; Trans. Zool. Soc., iii., p. 193, pl. xii., fig. 4.

S. rhombifer, Hope, *l. c.*, p. 49.

Phoracantha imbellis, Newm., The Entomologist, i. (1842), p. 352.

This species was taken by Mr. Walker at Hobart and Franklin in Tasmania, and at Port Adelaide in South Australia. Some of the smaller examples taken at Hobart resemble Newman's type in having the apical spines of the elytra reduced to the merest rudiments.

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* For this information I have to thank Mr. F. Waterhouse, the courteous Librarian of the Zoological Society.

But they do not differ in any other respect from examples in which these spines are more strongly developed.

Newman considered the *S. elongatus* of Boisduval to be distinct from the *S. dorsalis* of MacLeay, because the latter has "particularly described his insect as wanting the spines of the antennæ." Though this is the literal interpretation of MacLeay's expression, "articulis apice haud spinosis," it is just possible that the latter was meant to convey that the apical joints of the antennæ are without spines, which would be quite true of *S. elongatus*, Boisd.

16. *Allotisis unifasciata*, Hope.

Coptocercus unifasciatus, Hope, Proc. Zool. Soc., 1840, p. 51; Trans. Zool. Soc., vol. iii., p. 195, pl. 12, fig. 6.

One example, taken at Franklin in Tasmania.

17. *Coptocercus rubripes*, Boisd.

Stenochorus rubripes, Boisd., Voy. de l'Astrolabe, Entomologie, 2, p. 477.
Phoracantha allapsa, Newm., The Entomologist, i., p. 4.

Tasmania: Hobart (*Walker*); and Australia: Adelaide, Melbourne, and Swan River.

In the Catalogue of Gemminger and Harold, *Stenochorus assimilis*, Hope, and *S. Roei*, Hope, are also given as synonyms of this species. *S. Roei* probably was described from a small specimen of *rubripes*, Boisd.; but as Hope placed his *S. assimilis* in a different section—characterised by having, *inter alia*, the thorax spinose—I am forced to doubt the correctness of this part of the synonymy.

18. *Coptocercus validus*, sp. n.

Piceo-niger, fulvo sparse suberecteque setosus; prothorace quam latitudine basis paullo longiori, lateraliter in medio subspinoso, supra (præcipue versus latera) punctato et tenuissime griseo-pubescente, tuberculis quinque paullo elevatis, glabris, nitidis; elytris antice fortiter crebreque punctatis, punctis postice gradatim minoribus et minus dense positis; utroque elytro maculis tribus vel quatuor inter medium basimque et macula apicali fulvo-testaceis, apice bispinoso, spina externa validiore et longiore;

antennis (♀) quam corpore vix longioribus, articulis 3o ad 6um apice extus spinosis. Long. 25, lat. 7 mm.

Hab. Roebuck Bay, North-west Australia (*Walker*).

This species has, at first sight, a rather strong resemblance, owing to its general colour and pattern of marking, to *Phoracantha semipunctata*, *quinaria*, &c., but may be distinguished by its having the femora strongly clavate below the middle. The disk of the prothorax also is less flattened, and bears five smooth, slightly raised tubercles, the intervals between which are but sparsely punctured; the sides of the prothorax are rather thickly punctured, and each bears in the middle a rather short conical tubercle or spine.

This species, notwithstanding its robust form, seems to be, on the whole, best placed in *Coptocercus*. Between it and the long slender forms, such as *C. biguttatus*, there is a succession of species, in which there is a somewhat gradual elongation and narrowing of the prothorax, and of the body generally.

19. *Acyrusa tasmanica*, sp. n.

Rufo-testaceus, sparsissime setosus; prothorace nitido, vix punctato, antice posticeque sulcato-constricto, lateraliter in medio leviter tuberculato; elytris dense fortiterque et seriatim punctatis, supra paullo depressis, flavo-testaceis, fascia lata transversa versus apicem, suturaque et vitta brevi laterali, plus minusve infuscatis; articulo tertio antennarum sat longe spinoso; (♂) segmentis quatuor primis abdominis foveo tomentoso utrinque obtectis. Long. 11 mm.

Hab. Tasmania: Hobart (*Walker*), South-east Tasmania (*Atkinson*).

Head sparsely punctured. Prothorax nearly twice as long as its basal width, with a distinct transverse groove about half-way between the middle and the anterior margin, with a less marked but very strongly sinuate groove near the base; the disk shiny, almost impunctate, with a very narrow and almost obsolete elevation along the middle, and with a very feeble, but broader and more obtuse, elevation towards each side; sides of the prothorax sparingly punctured, each with a feeble median tubercle. Elytra strongly, closely, and seriately punctured from the base up to the beginning of the posterior dark brown band; thence to the apex more feebly and more sparsely punctured; the disk of each elytron slightly depressed along the middle; apices rounded and unarmed. Legs fulvous-testaceous. Antennæ longer than the body, setose,

basal joints subnitid, distinctly enough punctured; third joint with a moderately long and distinct, though slender, spine at its outer apex.

One male example was taken by Mr. Walker; a female example from South-east Tasmania, collected by Mr. E. D. Atkinson, was already in the Brit. Mus. collection. The tomentose depressions—a pair to each of the first four abdominal segments—are a distinctly sexual character, and are, as in almost every similar case known to me, peculiar to the male sex.

Sisyrium, *Pasc.*

In the 'Transactions' of the Royal Society of South Australia, vol. xv. (1892), pp. 57 *et seq.*, Mr. Blackburn has made some remarks upon this genus and allied forms, in which he questions the desirability of maintaining so many separate genera for what seem to be closely related species. Upon the latter point I am not at present prepared to express an opinion, as I have had no opportunity of examining more than a few of the species belonging to this group of Australian Longicorns. But I may state what I believe to be a false assumption against which workers on this group would do well to guard themselves. It is that the presence of tomentose depressions on the abdominal segments of certain species is a non-sexual character. I have just shown that in one species of the group (*Acyrusa tasmanica*) it certainly is a sexual character, and from my acquaintance with the Longicornia in general, I am convinced that it always is a sexual character, and, with very rare exceptions, is peculiar to the male sex. Lacordaire, suffering under the disadvantage of examining small series, failed to grasp this fact, and was consequently led into many errors which are likely to mislead those who trust too implicitly to his descriptions.

Mr. Blackburn has given a table of the species of *Sisyrium*, which is partly based upon the assumption that this character is common to both sexes, and cannot therefore be considered reliable.

Sisyrium stigmosum, Pasc.

Journ. Linn. Soc., vol. ix., p. 95, pl. 3, fig. 3.

Mr. Blackburn has evidently been mistaken with regard to this species. I have before me a male example which answers so well to Pascoe's description and figure, that I have not the least doubt as to its identity. The length of the prothorax is about (perhaps not quite) one-half greater than the greatest width. The male presents the additional character (not mentioned by Pascoe) of having a rounded tomentose depression on each side of both the third and fourth segments of the abdomen.

With one exception—and in this Mr. Blackburn is not likely to have erred—the description of *S. ventrale*, Blackb., closely applies to the present species. The exception is that the prothorax in *ventrale* is scarcely longer than broad.

I am, however, inclined to think that *S. sparsum*, Blackb., which strongly resembles *S. ventrale*, but in which the prothorax is one-third longer than broad, is identical with *S. stigmosum*, Pasc. The *Sisyrium vittatum* of Blackburn is, without doubt, as he himself suspected, a very distinct species, and need no longer be queried as a variety of *stigmosum*.

Sisyrium ibidionides, Pasc.

Obrium ibidionides, Pasc., Trans. Ent. Soc. Lond., ser. 2, vol. v., p. 26; Trans. Ent. Soc. Lond., ser. 3, vol. i., p. 559.

Igenia ibidionides, Pasc., Journ. Linn. Soc., vol. ix., p. 95.

In the first work cited Pascoe omitted an important character of this species which he supplies in the second, and which has some bearing upon the validity of his genus *Igenia*, of which it was subsequently taken as the type. The male (female according to Pasc.) has a median tomentose depression upon each of the first four abdominal segments. The first depression is rather small, the others are broad and transverse.

The prothorax in this species is much longer than broad.

20. *Sisyrium? plagiatum*, sp. n.

Setis suberectis sparse obtectum; capite pronotoque infuscatis; prothorace quam latiori distincte longiori, lateraliter in medio leviter tuberculato, supra sat dense punctato; elytris flavescentibus, fascia lata inter medium apicemque et plaga subquadrata utrinque ante medium fuscis, fortiter, sat dense et subseriatim punctatis, punctis paullo pone medium minutis; corpore subtus pedibusque flavescentibus, antennis obscure testaceis, quam corpore paullo brevioribus. Long. 8 mm.

Hab. Tasmania: Hobart and Launceston (*Walker*).

The prothorax is about one-fourth longer than its greatest breadth; it is feebly tubercled at the middle of each side, and slightly constricted both a little in front of and behind these tubercles; above it is rather thickly punctured, and is without definite smooth spaces. The elytra are rather strongly and thickly punctured from the base up to the beginning of the posterior dark brown band, with the punctures arranged in tolerably regular rows; beyond this point the punctures are much smaller, and towards the apex become obsolete; the yellow portion of the elytra between the post-median band and the ante-median plagæ is in the form of a transverse band, which is produced anteriorly along the suture, gradually narrowing in front until it joins the basal yellow portion.

The two examples taken by Mr. Walker are both females; so that, until the male sex is known, the species can only be provisionally placed in *Sisyrium*.

21. *Bethelium signiferum*, Newm.

———*signiferum*, Newm., The Entomologist, i., p. 10.
Callidium diversicorne, White, Voy. Erebus and Terror, xi. (1846), p. 20.
C. flavomaculatum, Blanch., Voy. au Pole Sud., Zool., iv., p. 273, t. 16, fig. 8.

Tasmania: Hobart and Franklin.

The *Callidium diversicorne* of White, which is here placed as a synonym, is to be found in the Catalogue of Gemminger and Harold under the genus *Ceratophorus*, to which it is in no way allied. The locality (New Zealand) given by White, is probably erroneous.

22. *Bethelium Blackburni*, sp. n.

Fusco-ferrugineum, sparse setosum; abdomine elytrisque piceo-nigris, nitidis, his utrinque fasciis duabus angustis flavescentibus, una ante medium angulata, altera pone medium obliqua, suturam nec attingentibus; prothorace basi angustato, disco crebre sed fere obsolete punctulato; elytris a basi usque ad fasciam posteriorem dense punctato, deinde ad apicem fere impunctatis; antennis quam corpore vix longioribus, articulo 3o quam 1o vel 4o manifeste longiori, articulis 5o—9um subæqualibus, utrisque quam tertio vix brevioribus. Long. 9 mm.

Hab. Tasmania: Hobart (*Walker*).

In general form, structure of the prothorax, &c., this species resembles *B. signiferum*, Newm., but may be easily distinguished by the markings on the elytra. These consist of two narrow yellow bands on each side, one of which, placed nearly midway between the base and the middle of the elytron, is distinctly angulate; the other, just behind the middle, runs obliquely inwards and forwards across the elytron from its outer margin, but does not reach the suture; the whole of the elytron in front of this band is thickly and distinctly punctured, that portion between it and the apex is very minutely and very sparsely punctulate. The antennæ differ from those of *signiferum* in that the joints succeeding the fourth are each rather shorter instead of longer than the third. The prothorax also is slightly longer in proportion. The single example of this species, taken by Mr. Walker, probably belongs to the female sex.

The British Museum collection contains a specimen from Australia very similar to the one just described, but with the prothorax and elytra more reddish in colour, the posterior band of the elytra somewhat broader, the femora less abruptly clavate, the antennæ slightly longer, and having the third joint furnished at its outer extremity with a rather long slender spine. This specimen doubtless belongs to a distinct species, but it would be going too far, I think, to consider it generically distinct.

I have named the above species in honour of the Rev. Mr. Blackburn, who is doing such excellent work in extending our knowledge of the coleopterous fauna of Australia.

The description of *Bethelium tricolor*, Blackb., applies so well to *Ectosticta simillima*, White, that I strongly suspect the identity of the two species. The latter was

considered by Lacordaire to be a variety of *Ectosticta cleroides*, White, and as such it is to be found in the Catalogue of Gemminger and Harold; but, though closely allied, it seems to be sufficiently distinct; the antennæ are shorter, and the punctuation of the prothorax is much less evident. The eyes in *Ectosticta* are much less strongly faceted than in *Bethelium*, and are a little more deeply emarginate; the other differences between the two genera are exceedingly slight, so that, even if *Ectosticta* is to be retained as a distinct genus, there can be no good reason for keeping it separated by a long interval from *Bethelium*.

23. *Ceresium*, sp.

One example, taken at Troughton Island, N. Australia.

Resembles *C. unicolor*, Fabr., but with the femora less strongly thickened, and with the prothorax somewhat differently punctured.

24. *Callidiopsis scutellaris*, Fabr.

Callidium scutellare, Fabr., Syst. Eleuth., ii., p. 338.
—— *piceum*, Newm., The Entomologist, i., p. 9.

Tasmania: Hobart and Launceston (*Walker*).

25. *Callidiopsis præcox*, Erichs.

Stenocorus præcox, Erichs., Wieg. Archiv., 1842, i., p. 220.

Tasmania: Hobart, Launceston, and Franklin (*Walker*).

26. *Phlyctænodes pustulosus*, Newm.

Ann. & Mag. Nat. Hist., vol. v. (1840), p. 20; Blanch., Voy. Pole Sud., Zool., iv., p. 262, pl. 16, fig. 4.

Tasmania: Hobart (*Walker*); South Australia (*Bakewell*), and New South Wales.

27. *Phlyctænodes fasciatus*, sp. n.

Niger opacus; elytris fusco-cyaneis subnitidis, fascia flava angusta transversa paullo pone apicem; prothorace lateraliter in medio obtuse tuberculato, supra subobsolete quadri-nodoso; elytris crebre sat fortiterque punctatis, utrisque lineis duabus paullo ele-

vatis; articulo tertio antennarum quam quarto vix longiori et quam primo vel quinto breviori. Long. 12 mm.

Hab. Tasmania: Hobart (*Walker*).

Head black, with the cheeks fulvous; the front closely but very feebly punctulate; prothorax black and opaque, distinctly but rather bluntly tubercled on the middle of each side, and with four very feeble and almost obsolete tubercles above. Elytra dark brown, with a distinct bluish, submetallic tint; crossed by a narrow yellowish band at a short distance in front of the apex; closely and rather strongly punctured from the base up to the posterior border of the yellow band, the small space between the latter and the apex being almost impunctate. Body underneath dark brown, legs somewhat darker.

28. *Tessaromma sericans*, Erichs.

Meropachys sericans, Erichs., Wieg. Archiv., 1842, i., p. 221.

Tasmania: Hobart (*Walker*).

29. *Tessaromma undatum*, Newm.

Ann. & Mag. Nat. Hist., vol. v., p. 20; Lacord., Gen. des Coléop., pl. 84, fig. 5.

Meropachys MacLeayi, Hope, Proc. Zool. Soc., 1840, p. 52.

Tasmania: Hobart (*Walker*). Occurs also in South Australia, Victoria, and Queensland.

The *Meropachys tristis* of Hope (Proc. Zool. Soc. 1840, p. 53), which is unknown to me, will probably be found to be a variety of *T. undatum*, Newm., as was suggested by Lacordaire. It certainly is not identical with the *Saperda tristis* of Fabr. (Syst. Ent., p. 186, and Syst. Ent., iv., App., p. 453), as would appear from the Catalogue of Gemminger and Harold. The latter species is from New Zealand, and has been referred by Broun to Lacordaire's subgenus *Ambeodontus*. *Cerambyx pullus*, Newm. (The Zoologist, 1851, App., p. cxxviii), is, I believe, identical with it.

The *Necydalis tristis*, Fabr. (Mant. Ins., i., p. 170), which is quoted under *Phlyctænodes* in the same Catalogue, is quite foreign to the group, and seems to have been accidentally substituted for the *Saperda tristis* just referred to. Nothing is left of the type-specimen but a

portion of the abdomen, so that it is impossible for me to refer it to its true position, a clue to which, however, may be obtained from Olivier's description.

PIESARTHRIUS, *Hope.*

Trans. Zool. Soc., vol. i., p. 107 (1834); Proc. Zool. Soc., 1840, p. 55.

=*Petalodes*, Newm., The Entomologist, 1840, p. 9 (=*Anatisis*, Pasc.).

The species serving as the type of this genus seems to have been founded upon a unique specimen belonging to the female sex. The male was subsequently described by White under the name of *Petalodes plagiatus*. I have not seen females of *Petalodes laminosus*, Newm., but the characters of the male are such that there need be no hesitation in considering this species congeneric with *P. marginellus*, Hope.

The three species of the genus at present known may be arranged as follows :—

Piesarthrius marginellus, Hope.

Proc. Zool. Soc., 1840, p. 55; Trans. Zool. Soc., vol. iii., p. 200, pl. 12, fig. 1 (♀).

Petalodes plagiatus, White, Ann. & Mag. Nat. Hist., ser. 3, vol. ii., p. 354 (♂).

Piesarthrius laminosus, Newm.

Petalodes laminosus, Newm., The Entomologist, vol. i., p. 9, fig. (♂).

Piesarthrius Frenchi, Blackb.

Anatisis Frenchi, Blackb., P. Lin. Soc. New South Wales, ser. 2, vol. iv., p. 789.

This fine species is represented in the Brit. Museum collection by a male example from the neighbourhood of Torres Straits. It also occurs in Queensland.

30. *Strongylurus ceresioides*, Pasc.

Journ. Linn. Soc., vol. ix., p. 308.

TASMANIA : Launceston (*Walker*). One example.

31. *Uracanthus*, sp.

One damaged specimen from Roebuck Bay, N.W. Australia.

Uracanthus triangularis, Hope.

Proc. Zool. Soc., 1833, p. 64; Trans. Zool. Soc., vol. i., p. 108 (1834), pl. 15, fig. 4.

= *Stenochorus angustatus*, Boisd., Voy. de l'Astrolabe, Entom., ii., p. 475 (1835).

= *Mallocera angustatus*, Casteln., Hist. Nat., ii., p. 425.

The *Stenochorus angustatus* of Boisduval and Hope, here placed as a synonym, stands under *Epithora* in the Catalogue of Gemminger and Harold (p. 2820).

32. *Rhinophthalmus nasutus*, Shuck.

Stephanops nasutus, Shuck., Ent. Mag., vol. v. (1838), p. 510; Saund., Trans. Ent. Soc. Lond, ser. 2, vol. i., pl. 4, fig. 4.

Tasmania: Hobart (*Walker*), and also Australia.

The description and figure of *Macrones elongaticeps*, Blanch. (Voy. Pole Sud., Zool., iv., p. 306, pl. 17, fig. 20), prove conclusively that this species cannot be identical with the above; so that the synonymy given in the Catalogue of Gemminger and Harold is incorrect.

33. *Rhinophthalmus marginipennis*, Fairm.

Stephanops marginipennis, Fairm., Le Naturaliste, 1879, p. 75.

One example taken at Adelaide River, North Australia.

34. *Pterostenus suturalis*, Oliv.

Stenocorus suturalis, Oliv., Ent., iv., No. 69, p. 29, pl. 3, fig. 29.

Tasmania: Hobart and Launceston. West Australia: Fremantle.

The examples from Fremantle belong to a variety which has not been described under any of the names given as synonyms of the species in the Catalogue of Gemminger and Harold. In this variety the head and thorax are entirely black, and the dark blue-black sutural vitta spreads out behind to cover the whole of the apical

fourth or fifth of the elytra; a short and narrow marginal band is also present; the under side is of a fine lustrous dark green or bluish colour; the legs and antennæ black. A form similar to this in the pattern of the dorsal vitta, but with the head, thorax, legs, and antennæ of a dull testaceous colour, is represented in the Brit. Mus. collection by specimens taken at King George's Sound.

A further very distinct variety embraces some of the examples taken by Mr. Walker at both Hobart and Launceston in Tasmania. In these the head, thorax, and legs are testaceous, the antennæ are somewhat darker; while the antennæ are entirely of a rather pale fulvous colour. This variety is not to be distinguished by any structural characters from those referred to above; it occurs also in South Australia, one or two specimens from which locality exhibit a small dark spot at the tip of the elytra, and have the thorax and posterior part of the head of a brownish testaceous colour.

Without having seen the type of *Pterostenus quietus*, Newm., I can only suggest that this species may also be a variety of *P. suturalis*. Such characters given for the species as do not relate to colour apply equally as well to *suturalis*.

It is strange that in the references to the genus *Pterostenus*, Lac. (= *Stenoderus*, Latr.), no mention seems to have been made of a curious character presented by the head. This consists of a small, somewhat oblong, depression placed on each side just anterior to the cheek, and guarded in front by a flat blade-like process which extends along its middle and projects freely above. A similar depression and process are present on each side of the front of the head in the genus *Syllitus*.

Stenoderus maculicornis, Saund., does not possess this character, and in other respects also differs from the remaining species of the genus. It would be better placed in *Aphiorrhyncus*.

35. *Syllitus rectus*, Newm.

Stenoderus rectus, Newm., The Entomologist, vol. i. (1841), p. 95.

Tasmania: Hobart (*Walker*). Occurs also in South Australia (*Davis*, type), and in Queensland ('*Challenger*').

Though placed in the Catalogue of Gemminger and Harold as a variety of *S. grammicus*, Newm., this species is in reality one of the most distinct species of the genus.

Head and prothorax rufous; elytra dark brown, each with three yellowish white lines, two of which mark the two dorsal costæ, the third the raised outer margin. The inner costa runs almost quite parallel to the suture for its entire length, and ends just a little in front of the extreme apical point, where it is joined by the hinder extremity of a lateral raised line, which starts from the shoulder, and is of a brownish colour, scarcely different from the general tint of the elytra. The second dorsal costa runs nearly parallel to the first, and does not extend quite so far behind.

This is the only species of the genus known to me in which the dorsal costæ bear this relation to one another.

36. *Syllitus grammicus*, Newm.

Stenoderus grammicus, Newm., Ann. & Mag. Nat. Hist., vol. v. (1840), p. 21.

To this species I refer some examples taken by Mr. Walker at Launceston in Tasmania. In this I am guided by Newman's description, and by the fact that they agree with examples from South Australia which were ticketed *S. grammicus* by Adam White. Two of the characters mentioned by Newman are distinctly shown, *viz.*: (1) the inner costa, towards the middle of its length, is deflected towards the suture, the second costa towards the lateral margin; (2) the inner costa is shorter than the second. The sides of the prothorax are not fuscous, as described by Newman; while the three white lines of each elytron consist of the two inner costæ, and the raised outer margin; both the sutural margin and the third (or lateral) raised line being scarcely distinguishable in colour from the rest of the elytron. The antennæ of the male do not quite reach to the apex of the elytra, while those of the female are still shorter.

37. *Syllitus fulvipennis*, sp. n.

Rufo-testaceus; prothorace dense punctulato, lateraliter pone medium obtuse tuberculato, ante medium leviter constricto, supra medio paullo ante basin leviter impresso; elytris fulvis, crebre punctulatis, utrisque lineis tribus elevatis, quarum duabus dorsalibus flavo-albidis, medio distincte divergentibus, interna

breviori; antennis (♂) quam corpore paullo longioribus, (♀) corpori longitudine æqualibus. Long. 8—9·5 mm.

Hab. Cassini in West Australia (*Walker*).

This species is scarcely to be distinguished from the preceding except by the greater length of the antennæ. These are in the male distinctly longer than the body, and in the female reach quite up to, or even slightly beyond, the apex of the elytra. The first costa of each elytron is almost equidistant from the suture throughout the whole of its length, it approaches it slightly, but almost imperceptibly, near the middle; the second costa, however, distinctly bends outwards near the middle, and, posteriorly, it is continued beyond the first costa, and is directed towards the sutural side of the apex.

38. *Syllitus* sp.?

In a specimen taken by Mr. Walker at Roebuck Bay, the antennæ are so damaged that is impossible to form an opinion as to their relative length; in coloration the specimen agrees with those from Cassini, just described, but it may be distinguished from them by the stronger divergence of the two discal costæ of each elytron towards the middle of their length; not only does the outer costa distinctly bend outwards, but the inner one also is decidedly deflexed towards the suture, which it closely approaches. The intervening space of each elytron between the most divergent portion of the costæ is marked by an incipient rounded spot caused by a difference in the punctuation and the greater transparency of the elytron at this point. This character is much more strongly pronounced in an example from Queensland in the British Museum collection. In this example, which probably represents a distinct species, the two costæ of each elytron are very strongly bent away from one another near the middle, and in the space between there is a very distinct rounded white spot. These forms cannot, however, be satisfactorily characterised as new species until fresh specimens are seen.

39. *Enchoptera apicalis*, Saund.

Trans. Ent. Soc. Lond., ser. 2, vol. i., p. 77, pl. i., fig. 7.

Tasmania: Launceston (*Walker*).

40. *Mecynopus cothurnatus*, Erichs.

Wieg. Archiv., 1842, i., p. 223, pl. 4, fig. 10.

One example taken at Hobart in Tasmania.

41. *Esthesis cingulata*, Kirby.

Molorchus cingulatus, Kirby, Trans. Linn. Soc., vol. xii., p. 472.

Tasmania: Hobart and Launceston (*Walker*).

42. *Distichocera par*, Newm.

Proc. Zool. Soc., 1851, p. 78.

Tasmania: Hobart (♂ and ♀), (*Walker*).

All the examples of this species that I had previously seen were from Australia.

43. *Omophæna tæniata*, Pasc.

Journ. Linn. Soc., vol. ix., p. 93.

Tasmania: Hobart (*Walker*). One example.

The specimen taken by Mr. Walker agrees very well with Pascoe's type. The latter is ticked Australia without any more precise indication of locality. In a specimen from South-west Australia, in the British Museum collection, the testaceous bands of the elytra are not of uniform width throughout; they cover the whole width of the elytra at the base, and become gradually narrower as they pass backwards to end just before the apex. In another specimen the elytra are almost entirely fulvo-testaceous. But in other respects both of these specimens agree very well with the form described by Pascoe.

44. *Ochyra coarctata*, Pasc.

Ann. & Mag. Nat. Hist., ser. 4, vol. viii. (1871), p. 274, p. 13, fig. 3.

Tasmania: Launceston (*Walker*).

45. *Homæmota Walkeri*, sp. n.

Viridi-olivacea; sparsissime setosa; supra pube viridi-fulvescente, subtus pube grisescente, tenuiter vestita; capite antice plus minusve testaceo; pedibus antennisque fusco-testaceis; utroque elytro prope basin sat valde obtuseque tuberculato, et ad

medium fascia obliqua alba eburnea paullo elevata ornato; antennis quam corpore fere sesqui-longioribus. Long. 9, lat. 2·75 mm.

Hab. Tasmania: Launceston (*Walker*).

Dark green, inclining to olivaceous. Head somewhat testaceous in front, thinly furnished with a pubescence which varies from an ashy colour in front to a fulvous green above. Prothorax longer than broad, very narrow in the basal fifth or sixth, thence to the apex subglobular, regularly enough convex above, clothed with a rather dense fulvous green pubescence, which leaves some sparse punctures visible on the anterior part of the sides. Elytra impunctate, with a thin fulvous green pubescence, which is wanting over a triangular area in the median depressed portion of each elytron; this area, which has its base on the outer margin and its apex at the suture, is crossed obliquely by a slightly raised ivory-white fascia, which almost touches the elytral margin at its outer end, and is a little more distant from the suture at its inner extremity; between the median depression and the base each elytron has a distinct but rather blunt tubercle or crest. Body underneath with a greenish grey pubescence; hind margins of abdominal segments glabrous, brownish testaceous; legs and antennæ testaceous brown, very feebly pubescent; clubs of femora darker in colour and with a greenish tint.

This species is very distinct both in colour and structure from the two previously described; but the structural differences are not sufficiently great to be considered of generic importance.

46. *Amphirhoë decora*, Newm.

The Entomologist, vol. i., p. 24.

Tasmania: Launceston; and South Australia.

47. *Purpuricenus quadrinotatus*, White.

Cyclodera quadrinotata, White, Stokes's Discoveries in Australia, vol. i., p. 510, pl. 2, fig. 6 (♂).

C. Angasii, White, Cat. Longic. Brit. Mus., vol. i., p. 140; Angas's South Australia Illustrated, pl. 50, fig. 17 (♀).

Purpuricenus australicus, Thoms., Class. des Céramb., p. 203.

This species was taken by Mr. Walker at Roebuck Bay, in North-west Australia; and also at Damma Island, in the Malay Archipelago. It was previously

represented in the British Museum collection by examples from each of the following localities :— West Australia, South Australia, Queensland, North Australia, Murray Island, Cornwallis Island, and New Guinea.

The males vary considerably in size; the smaller examples having a length of only 12 mm., the larger attaining a length of 23 mm. In the smaller males the antennæ are very short, scarcely surpassing the body in length, and their terminal joint is but little longer than the tenth; while in the largest males the antennæ are about twice as long as the body, with the last joint about twice as long as the third.

The markings on the elytra are somewhat variable. The anterior black plaga of each elytron may be altogether wanting (this is the case with a female specimen from Queensland), it may be entirely surrounded by fulvous, or may have extended inwards to border the suture, or, as in some of the larger male examples, the black may have extended over nearly the whole elytron, leaving fulvous only a basal spot at the side of the scutellum, a sutural spot a little behind the middle, and a marginal band, dilated at the shoulder and at its hinder extremity near the beginning of the posterior third.

LAMIIDÆ.

48. *Dorcadida Walkeri*, sp. n.

♂. Nigra subopaca; pube aurea sparsissime obtecta; prothorace lateraliter in medio valde spinoso, supra granuloso et bituberculato; inter tuberculos area media rhomboidali subrugulosa haud granulosa; scutello late triangulari aureo-pubescente, medio glabro, nitido; elytris tuberculis sex magnis ante medium munitis, lateribus usque ad medium divergentibus deinde valde convergentibus, apicibus oblique truncatis, leviter divaricatis; humeris obliquis, extus leviter prominentibus, carina laterali transversim rugulosa haud granulosa; abdomine nigro, nitido, lateraliter pube aurea minute maculato; antennis quam corpore paullo longioribus, sparse setosis, fuscis, articulis 5o ad 11um fusco-pubescentibus, basi anguste cinereis. Long. 13, lat. (ad. hum.) 5 mm.

Hab. Hobart, in Tasmania (*Walker*).

Head irregularly punctured, broadly and not deeply concave between the antennal tubercles. Prothorax narrowed from front to base, a little longer than its greatest width, armed on the middle of each side with a rather strong tubercle, granular at the base,

and terminating in a smooth blunt spine; pronotum granular, furnished with two blunt tubercles, between which is a comparatively smooth rhomboidal area bounded by a line of golden pubescence, and with a similar line proceeding in the middle, both before and behind, from its anterior and posterior angles. Elytra dull black, almost impunctate; each with a very distinct lateral carina, proceeding from the slight prominence at the outer corner of the oblique shoulder, and extending up to the outer apical angle; this carina is transversely rugulose; basal half of each elytron with three large conical tubercles, the first and third of which are in nearly the same longitudinal line, and nearer to the suture; the second is nearer to the lateral carina, and is placed on the line of a feeble sinuous ridge, which starts from a small tubercle at the base, ends a little before the apex, and is joined beyond the middle by another very short ridge, which passes back from the third tubercle. The very sparse golden pubescence of the elytra is aggregated to form small spot-like or ring-like patches. The abdomen is black and glossy, with two minute patches of golden pubescence close to the hind margin on each side of the first four segments. Antennæ a little longer than the body, dark brown, sparsely setose, the basal joints punctured, the fifth and succeeding joints clothed with a short close dark brown pubescence, with a narrow ashy ring at the base of each. The length of the antennæ, and the absence of a median depression on the last abdominal segment, show that the single type-specimen is a male. The intercoxal process of the first abdominal segment also is similar in form to that of the male of *D. bilocularis*, that is, it gradually narrows from behind up to an obtuse point in front.

I have described this species somewhat fully, as it differs very much in some of its characters from *D. bilocularis*, White, and may eventually have to be taken as the type of a new genus.

49. *Microtragus senex*, White.

Stokes's Discoveries in Australia, vol. i., p. 511, pl. 2, fig. 7.

Two examples from Roebuck Bay, one of which closely resembles the type. The second example is larger, with the prothorax more coarsely but less closely punctured, and with the anterior fuscous plaga of each elytron placed somewhat farther back from the base. The antennæ are relatively somewhat shorter, so that the

specimen is probably a female, and the differences mentioned may be only sexual.

50. *Monohammus mixtus*, Hope.

Proc. Ent. Soc. Lond., 1841, p. 48.

Taken at Adelaide River and Roebuck Bay by Mr. Walker. The species occurs also in many other parts of Northern Australia, and in some of the neighbouring islands. There are examples also in the British Museum from Hong-Kong and from Java, which do not seem to me to be distinct.

51. *Zygocera lugubris*, Pasc.

Trans. Ent. Soc. Lond., ser. 3, vol. i., p. 541.

One example taken at Hobart in Tasmania, which very closely resembles an Australian specimen named by Mr. Pascoe. This species may possibly be identical with *Zygocera canosa*, Erichs.

Ancita, *Thoms.*

Syst. Ceramb., p. 63 (1864).

= *Hebecerus*, Thoms., Essai. Class. Céramb., p. 343 (1861), nec. Kolenati (1845).

= *Hebesecis*, Pasc., Journ. Ent., vol. ii., p. 353 (1865).

The characters of *Ancita*, as detailed by Thomson and Lacordaire, apply in every respect to the species included by these authors in the genus *Hebecerus*, Thoms. To one who was dependent upon the descriptions only, *Ancita* would appear to be essentially distinguished from *Hebecerus* by the possession of a broad open cicatrix at the apex of the scape of the antennæ. This difference, however, does not really exist, inasmuch as all the species of *Hebecerus* also have the apex of the scape provided with a broad incomplete cicatrix, which is limited towards the inner and lower border by an oblique and tolerably distinct carina.

Hebesecis was proposed by Pascoe as a substitute for the preoccupied name of *Hebecerus*; but *Ancita*, having in the meantime been characterised, must on grounds of priority become the name of the genus.

52. *Ancita marginicollis*, Boisd.

Acanthocinus marginicollis, Boisd., Voy. de l'Astrolabe, Ent., p. 490, pl. 9, fig. 12.

Examples of this species were taken by Mr. Walker at Hobart and Launceston in Tasmania. The species appears to be rather common in Australia, especially in the southern portion of the continent.

53. *Ancita sparsa*, Pasc.

Hebesecis sparsa, Pasc., Journ. Linn. Soc., vol. ii., p. 354; Journ. Linn. Soc., vol. ix., p. 81.

Taken by Mr. Walker at Hobart and Launceston in Tasmania, and at Fremantle and Cape Leeuwin in West Australia. The Tasmanian examples agree with some from South Australia, and differ from those from West Australia (which in other respects they almost exactly resemble) by having an interrupted pubescent white line along the middle of the pronotum. But as portions of the pubescence are very liable to be rubbed away, little importance need be attached to this difference.

Prosoplus, *Blanch.*

Voy. au Pol. Sud., Zool., iv., p. 290 (1853).

= *Micracantha*, Montrouz., Ann. Soc. Ent. France, ser. 4, vol. i., p. 271 (1861).

= *Prosacanthus*, Fauvel, Bull. Soc. Linn. de Normandie, vol. vii., p. 163 (1863).

= *Aegomomus*, Pasc., Trans. Ent. Soc. Lond., ser. 3, vol. iii., p. 59 (1864).

= *Atyporis*, Pasc., *l. c.*, p. 67.

With the exception of *Aegomomus*, Pasc., which is considered a synonym of *Micracantha*, all the above are placed as distinct genera in the Catalogue of Gemminger and Harold. Pascoe distinguishes *Atyporis* from *Aegomomus* by characters that seem to me to be of merely specific importance. Two described species only are mentioned by Blanchard as entering his genus *Prosoplus*. One of these—*P. sinuatofasciatus*, Blanch.—is closely allied to, if not one of, the species which Pascoe included in *Atyporis*; while the other—*Acanthocinus hollandicus*, Boisd.—appears to be very nearly allied to, or even identical with, the following species.

54. *Prosoplus Banksi*, Fabr.

Lamia Bankii, Fabr., Syst. Ent., p. 176 (= *Coptops Banksi*, Munich Cat.).

? Acanthocinus hollandicus, Boisd., Voy. de l'Astrolabe, Ent., p. 491.

Coptops abdominalis, White, Ann. & Mag. Nat. Hist., ser. 3, vol. ii., p. 273.

Aegomomus insularis, Pasc., Trans. Ent. Soc. Lond., ser. 3, vol. iii., p. 65.

Micracantha nutans, Sharp, Trans. Ent. Soc. Lond., 1878, p. 209.

This species was taken by Mr. Walker at Jones's Island, North-west Australia, and also at Damma Island, in the Malayan Archipelago. It occurs also at Port Darwin and Port Essington, in North Australia, in various islands of the Malayan Archipelago, and extends to the Philippines. Examples from the Sandwich Islands, described under the name of *Micracantha nutans* by Dr. Sharp, do not seem to me to be specifically distinct.

The males of this, as of nearly all the species of the genus, have the anterior coxæ each provided with a small spur. This character, so far as the present genus is concerned, seems to have been noticed only by Olivier, who, in his description of a species* from the Island of Bourbon, nearly related to but distinct from *P. Banksi*, states that the anterior femora are armed at the base with a small spine. The spine, however, arises from the coxa close to its anterior and distal edge.

55. *Prosoplus* sp.

One example taken at Port Darwin.

The species is much smaller and more uniformly pubescent than *P. Banksi*, Fabr., and does not exhibit pale bands on the elytra.

56. *Symphyletes pedicornis*, Fabr.

Lamia pedicornis, Fabr. Syst. Ent., p. 170.

Roebuck Bay, North-west Australia (*Walker*); occurs also in North Australia, and extends to New Guinea.

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* *Prosoplus dentata*, Oliv. (*Lamia*) = *Coptops dentata*, Oliv., of the Munich Catalogue.

57. *Symphyletes variolosus*, Pasc. ?.

Journ. Ent., i., p. 340.

Roebuck Bay (*Walker*). One example.

58. *Platyomopsis regularis*, sp. n.

Pube grisescente et brunneo-ferruginea obtecta, maculis duabus pronoti macula elytrorum utrinque et maculis postice brunneo-ferrugineis sat distinctis; elytris dimidio antico seriatim sat regulariterque tuberculatis. Long. 17, lat. 7·5 mm.

Hab. Roebuck Bay, North-west Australia (*Walker*). One female example.

Each elytron bears five distinct rows of tubercles, each row consisting of an unbroken series extending from the base up to, or a little beyond, the middle. The tubercles of the three inner, or dorsal, rows are larger and more acute, and distinctly conical in form, those of the two outer rows are smaller and more closely approximated to each other. External to and close to the outer series there is a short row of three or four small tubercles, while there are also a few small tubercles along the lateral margin. A large and distinct conical tubercle is placed just above the outer margin at a short distance behind the base. The elytra are seen to be punctured between the dorsal rows of tubercles; they are truncate at the apex, with the outer angles briefly mucronate.

This species may be distinguished from *P. obliqua*, Donov., by the more distinct antero-lateral and the feebler dorsal tubercles of the prothorax, and especially by the stronger and more regular tuberculation of the basal half of the elytra, and the distinct tubercle close to each of the antero-lateral angles. The colour of the pubescence is also somewhat different. A rather light grey predominates on the upper portion of the head, the anterior part of the prothorax, the apical portion of the elytra, and along the whole of the medio-ventral surface. The rest is of a rather dark rust-colour, with two spots on the pronotum, a spot on each side of the elytra, and a few spots posteriorly, somewhat darker and tolerably distinct.

Penthea, *Casteln.*

Lacordaire has fallen into a remarkable error with regard to the sexual differences that are to be observed in the species of this genus. One of the characters of

the genus, by which, he says, it may be easily recognised, is that the second abdominal segment is occupied, in *both sexes*, by two large transverse and tomentose depressions. This character he emphasizes in a foot-note, where he adds :—" I find it in both sexes of all the species (five in all) which I have under observation." As a matter of fact, however, they are the males only which are furnished with these tomentose depressions, so that in this respect the genus does not differ from many other genera of the same group, such as *Daxata*, *Depsages*, *Rhytiphora*, and *Niphona*. The female differs from the male not only by the absence of these depressions, but by having the last abdominal segment more elongated and impressed with a slight groove along the median ventral line.

The presence of tomentose depressions on certain of the abdominal segments of the male is not very unusual amongst the Longicorns. It is common enough in the *Niphoninæ*, where they are borne anteriorly, one on each side on the second abdominal segment, but are sometimes so narrow as to be almost entirely concealed by the fringe of setæ, which comes off from the hind margin of the first segment. They are similarly placed, when present, in the *Mesosinæ;* and this fact, when considered along with other points of affinity, is an additional argument in favour of those arrangements in which the *Niphoninæ* are placed close to, or included in, the *Mesosinæ*.

In the genus *Xylorrhiza*, and in other genera included in the same group, there are three pairs of somewhat oval or rounded tomentose depressions on the abdomen of the male, a pair to each of the three intermediate segments.

59. *Rhytiphora mista*, Newm. ?.

The Entomologist, vol. i., p. 362.

To this species I refer with doubt three examples taken in Tasmania.

The female differs from the female type of *mista* in having slightly longer and slenderer antennæ; but this is the only difference of any importance that I can find. They might, however, equally as well be placed in *Rhytiphora caprina*, Newm.

Without seeing a much larger series, I can scarcely

venture to decide whether we have here to deal with three distinct forms, or with only one somewhat variable species.

Rhytiphora leucospila, sp. n.

Niger, fulvo-cinereo tenuiter pubescens ; elytris maculis minutis albis numerosis obtectis, versus basin sparsim granulosis ; apicibus fere recte transversimque truncatis, angulis brevissime sat obtuseque dentatis ; antennis nigris cinereo-annulatis. Long. 21—22·5, lat. 8 mm.

Hab. Queensland.

Head with a yellowish grey pubescence in front, interrupted by a median glabrous line, which extends back to the occiput ; with a distinct pale fulvous patch on each cheek, and a smaller spot on the base of each mandible. Prothorax transverely ridged above ; its pubescence greyish, with some transverse lines of a pale fulvous colour. Elytra with a very faint greyish or fulvous grey pubescence, which scarcely veils the black colour of the derm, and with numerous small white spots, of which most of those towards the base have a small granule at their anterior end. The body underneath has a pubescence, which in some parts is pale tawny, in others almost ashy in colour, and interrupted by numerous minute black points ; the legs are somewhat similarly clothed. The posterior fringes of the abdominal segments are more distinctly fulvous ; that of the first segment in the male is rather long, and to some extent covers over the transverse tomentose depression at each side of the second segment.

This species has some resemblance to *R. rugicollis*, Dalm., but may be distinguished by the darker colour of the derm, and the less numerous but somewhat larger and more distinct pubescent white spots on the elytra ; the granules of the elytra are also less numerous ; the prothorax has fewer transverse ridges, and is less uniformly pubescent.

60. *Pentacosmia scoparia*, Newm.

The Entomologist, vol. i., p. 361.

Tasmania : Launceston (*ex. coll. Simpsoni*).

The two examples obtained by Walker from the collection of Mr. Simpson agree well with the type-specimen from Port Philipp, in Victoria.

61. *Illæna exilis*, Erichs. ?.

Wieg. Archiv. fur Natur., 1842, i., p. 225.

Two examples taken by Mr. Walker at Launceston, in Tasmania, agree well with a specimen which was considered by Chevrolat to belong to the above species. But the characters given by Erichson do not very well apply, so that his species may possibly be distinct. In the insects before me the prothorax has, instead of a small tubercle, an acute but rather minute spine at the middle of each side; this spine does not stand straight out from the side, but is directed obliquely upwards, so that its presence might be easily overlooked; the elytra, instead of being sparsely punctured, are very closely but not strongly punctured on the deflexed sides, and are densely enough and somewhat seriately punctured above, with the punctures becoming obsolete or invisible on the posterior third or fourth. The first, third, and fourth joints of the antennæ are subequal in length, the third being scarcely appreciably longer than either the first or fourth.

If this species is the true *Illæna exilis* of Erichson, as in all probability it is, Mr. Blackburn is perfectly justified in considering the genus *Neissa* of Pascoe to be identical with *Illæna*. The characters given for the former genus exactly fit the present species.

Allomicrus, gen. nov.

Head rather broadly concave between the antennal tubercles; front transverse; eyes sudivided. Antennæ a little longer than the body; first joint obconical, the third and fourth subequal in length, each scarcely longer than the first, the fifth to tenth gradually diminishing in length, the eleventh slightly longer than the tenth. Prothorax subcylindrical, longer than broad, strongly constricted at the base, furnished with a conical tubercle at the middle of each side. Elytra with the sides subparallel in the anterior two-thirds of their length, thence gradually narrowing to the apex; each with a feebly raised and subelongate basal tubercle, which is bounded on the outside by a slight depression that passes obliquely backwards from above the shoulder towards the sutural region. Legs moderately long, subequal; femora with a rather abrupt oval or club-like thickening towards their outer extremity, and a short stalk at the base; claws of tarsi divaricate; inter-

mediate tibiæ with a very feeble sinuation on their outer border towards the distal extremity.

This genus, which is represented by one of the smallest species of Longicornia known to me, seems best placed towards the end of Lacordaire's subgroup of the *Exocentrides*. Some of its characters point to an affinity with the *Cyrtinides*.

62. *Allomicrus exiguus*, sp. n.

Niger, sparsissime setosus; elytris nigro-fuscis; antennis fuscis articulorum basibus testaceis; femorum basibus pallide testaceis. Long. 2·5, lat. 0·5 mm.

Hab. Albany, in West Australia (*Walker*).

The prothorax is distinctly longer than broad, with the basal fourth much narrower than the anterior three-fourths; and with a small but distinct conical tubercle near the middle of each side, whose posterior border is somewhat longer than the anterior, and slopes gradually back to the front end of the basal constriction. The upper surface of the prothorax is closely and finely punctulate, and is faintly impressed by a transverse groove at about one-fourth of its length from the anterior magin. The elytra are dark brown, nitid in places, and in other parts exhibiting faint indications of a greyish pubescence; they are thickly enough punctured in and between the two oblique depressions, which pass back, one on each side, from the shoulders towards the sutural region, but elsewhere seem very sparingly punctured. The various parts of the body, and the legs and antennæ, are very scantily furnished with suberect setæ.

XII. *On stridulation in ants.* By Dr. David Sharp, M.A., F.R.S., F.L.S., &c.

[Read March 8th, 1893.]

Plate IX.

The question whether ants possess definite organs for the production of sound has been discussed by Landois, Lubbock, and one or two others, but no very extensive or decisive evidence has yet been brought forward on the subject. My object in this paper is to point out that many kinds of ants possess very perfect special stridulating organs, and that these are not only of very great delicacy, but are accompanied with such perfect articulations as to render it probable that the insects by their aid can produce a considerable variety of sounds, and have in all probability much power of modulating these.

Landois, in a scarce book called 'Thierstimmen,' announced, in a few words in 1874, that an ant he called *Ponera quadridentata* possesses a true stridulating organ, and he added that this is also the case with *Lasius fuliginosus;* shortly afterwards Lubbock, alluding to Landois' discovery, sketched a structure in *Lasius flavus* that he thought might possibly be connected with production of sound. About the same time Swinton mentioned that he had heard sound produced by *Mrymica ruginodis*, and gave a rough sketch of what he thought was the organ for its production. These cases are all that I know of, except a brief allusion by Prof. Forel to a structure in a Madagascar Ponerid, *Leptogenys falcigera*, which, he remarks, may possibly be an organ of stridulation.

The structure first alluded to by Landois in *Ponera quadridentata* is doubtless a true stridulating organ; but what he described in *Lasius fuliginosus*, and what Lubbock sketched in *Lasius flavus*, are not stridulating organs, but are merely the sculpture that exists on articulating abdominal surfaces in ants generally. Al-

though these surfaces are not stridulating organs, I think it quite possible they may be used by friction for producing rustling sounds of considerable variety, though at present there is no evidence to that effect. The figure given by Swinton is altogether erroneous; he in part indicates the spot where the stridulating organ in *Myrmica* is really situated, but, instead of figuring the sculpture that is actually there, he has delineated a striation that does not exist; he has, in fact, transferred the general sculpture to the spot from which it is in reality absent, being replaced by the stridulating surface. Swinton's figure was reproduced by MacCook, and thus obtained a currency which is to be regretted, as it may probably have misled observers. He was no doubt in part deceived by insufficient glasses, for the stridulating surface in *Myrmica* is so beautifully formed and so delicate that it appears smooth and polished until a high power and a proper light are applied so as to resolve the lines.

Entomologists who have discussed this subject have mostly stated that no purposeful sounds audible to human ears are produced by ants, though some cases have been recorded in which sound was produced by the ants striking their heads in concert on a foreign substance, such as a dry leaf. It is no doubt true that the stridulation of most of the species of ants that occur in Europe cannot be directly detected by the human ear, but this is not by any means true for all ants. Mr. R. C. Wroughton, who has within the last few weeks published an excellent paper on the ants of India, discusses Lubbock's statement that ants produce no sounds that are audible to us; saying, "I am almost certain, however, that I have heard such sounds. When one of the large brown paper nests of *Cremastogaster rogenhoferi* is violently and suddenly disturbed, the ants swarm out in thousands, wagging their abdomens in the manner so characteristic of *Cremastogaster* when excited; at such times a distinct hissing sound is audible, as if a red-hot cinder had been plunged into water. I had always accounted for this by supposing it was caused by the material of the nest under the feet of the ants, and a similar though fainter sound, which may be heard when a large nest of *Camponotus* or *Polyrhacis spinigera* is disturbed, by the rubbing together of the bodies of the

ants, who are all in violent movement at once. The passage from Lubbock, quoted above, however, leads me to think that this is not so, but that the audible noise is the sum of the individual stridulations of countless ants. The tail-wagging of *Cremastogaster* would account for the sound made by them being louder, though they are so much smaller than *Camponotus* or *Polyrhacis*.* I had asked Mr. Aitken to make some experiments to check the results I thought I had obtained. Members will no doubt recognise his hand in the following characteristic note, which fully supports my contention:—'I do not need to experiment. The roar raised by a squadron of *Lobopelta*, if you poke at them with a straw, does not require to be listened for with your hand to your ear. I should like, however, to know something about the organs by which it is produced. Military drums, I should think.'"

The evidence of two such good naturalists as Messrs. Wroughton and Aitken is very valuable, and I am glad to be able to bring forward a more direct and conclusive demonstration, by describing and figuring the organs, and by saying that I have been able to make them work so as to produce audible results. By operating with the stridulating organs of several species of *Atta*, a quite audible sound is produced. A very distinct sound is also heard when the appropriate movements are made with *Dinoponera grandis* and *Paltothyreus commutatus*, and I have also been able to hear an extremely faint sound by working with the abdomen of a species of *Pseudomyrma*.

I will now give descriptions of the stridulating organs in several species of ants selected from various divisions of the family, and will conclude with a summary dealing with some of the points of particular interest.

The stridulating organ consists of a series of delicate lines placed on the middle of the base of the dorsum in the 3rd abdominal segment, and in addition to this of a special development of the posterior edge of the previous segment. Between these two parts there is a co-adaptation.

* *Camponotus* and *Polyrhacis* do not stridulate; they belong to the subfamily Camponotides, in which group there are no stridulating organs.—D. S.

Although these structures do not exist in the Camponotides, it will be convenient to give a description of the condition of the corresponding spots in this group.

Before passing to the descriptions, I should like to express my thanks to Mr. Salvin for supplying me with some specimens from Guatemala; to Mr. Champion for others collected by Mr. J. J. Walker in Australia and Tasmania; and to Prof. Forel, of Zurich, for supplying me with the names of some of the species alluded to.

Camponotides.—*Camponotus cruentatus* (worker major). Pyrenees. The sculpture on the retracted and covered parts of the segment is quite free from setæ, and becomes coarser and more distant as the base is approached; it is, in fact, similar in nature to the sculpture in the Ponerides, with the exception of the absence of the stridulating band, and with this great difference, that the sculpture of the exposed portion passes gradually into that of the covered portion, whereas in Ponerides there is an abrupt line of demarcation between the two.

Camponotides.—*Lasius flavus* (worker). A very short space or ring extending all along the base of the segment is covered with rather coarse irregular lines. The line of demarcation between this and the general surface of the dorsal plate is abrupt, and there is an extreme difference of texture between the space uncovered and that covered by the overlapping part of the preceding segment.

L. fuliginosus (worker). England. As in *Camponotus* and *L. flavus*, there is no stridulating organ; the ring of sculpture at the base of the segment is finer than it is in *L. flavus*, and the line of demarcation between the general sculpture and that of the basal ring is not so abrupt.

Ponerides.—*Dinoponera grandis* (worker). Amazons The retractile portion of the third segment is covered with a beautiful sculpture of transverse slightly irregular and broken up lines, very densely packed; in the middle of the dorsum there is a narrow band of finer, longer, and perfectly parallel lines. The edges of this band are extremely irregular in outline; this arises from the fact that the stridulating lines have a reflecting power different to that of the contiguous sculpture, and these two textures pass into one another irregularly. In some places the lateral lines are prolonged into the stridulating

band, in other places the lines of the stridulating band project into those of the neighbouring sculpture. These conditions show conclusively that the stridulating band is formed out of the general sculpture of the segment by this becoming more regular, finer, and denser. In the two individuals examined there is considerable difference in the outlines of the band, and in one the striæ and sculpture seem to be finer than in the other. The hind margin of the preceding segment is delicate, and is slightly crenulated so as to be irregular in outline; but the crenulations are absent from the part which lies over the file of straight lines, so as to make this part perfectly regular, and to correspond exactly with the file. Pl. IX., figs. 1 & 2.

Ponerides.—*Paltothyreus commutatus*, Rog. Amazons. In the middle of the dorsum of the retracted part of the third abdominal segment there is a longitudinal band of fine, perfectly parallel, lines; these lines extend over the greater part of the length of the retractile portion of the segment; the sculpture of the adjacent parts consists of coarser, more distant, and less regular lines, which are broken up into comparatively short pieces.

Ponerides. — *Ponera contracta* (worker). England. The sculpture of the retracted portion of the segment is in this species remarkably coarse and distant, while in the middle there is a band of extremely fine lines, so different from the rest of the sculpture that it would not be believed to be a modification thereof. In this species the band is more "differentiated" than in any other Ponerid I have observed; by this I mean that there is a greater and more abruptly limited difference between it and the adjacent parts. Fig. 3.

Ponerides. — *Ponera* ? sp. (worker). Hobart. Very rough sculpture: worker. The apical part of the retractile portion of the segment consists of lines of deep rather coarse sculpture, which are but very little broken up or irregular; nearer to the base the segment is very much more densely and finely striate; in the middle of the dorsal region these striæ leave a broad space, which appear highly polished and smooth, but which, on examination with a high power, can be seen to be very densely covered with perfectly regular, densely-packed, lines.

Independently of the extremely fine striation this species is remarkably different from *Dinoponera*, on

account of the broad space over which the lines extend; the limiting line between the retractile and the other part of the segment is also peculiar, consisting of a ring of deep depression. The scraping ridge on the hind margin of the post-nodular segment is also remarkable, being very fine and definite, and standing out in very evident contrast to the rugosities contiguous. Altogether this is a very remarkable apparatus. The structures are in several respects similar to what exist in the *Myrmicides*, the shape of the band, its glossy surface, and the structure of the scraping organ being all Myrmicid. Fig. 4.

Ponerides.—*Diacamma vagans*, Sm., ♀. Hong Kong. The retractile part of the second post-nodular segment is evenly covered with a dense, fine, reticulate structure, without any trace of a differentiated surface for stridulating. The hind margin of the preceding segment can hardly be considered to form a scraper, as it is scarcely more than a slightly projecting membranous edge that is somewhat minutely crenulate.

As a sound producer, this is probably the most inferior Ponerid I have seen.

Ponerides?.—*Cerapachys* (*Eusphinctus*), n. sp. (worker, quite blind). Baudin Island. The retractile portion of the second post-nodular segment is covered with a coarse sculpture similar to that of *Ponera contracta*, but there is no trace of any stridulating band; neither is there any differentiated stridulating edge or scraper on the preceding segment.

This is a most peculiarly formed ant, the abdomen being of very unusual construction, each abdominal segment being so formed that the limits so far as which it may be drawn into the preceding are exactly defined. If it possess a sound-making power, this probably exists on several of the segments, each of which has its hind margin turned directly downwards, and tightly grasping the retractile portion of the following segment, so that when all the segments are drawn rapidly backwards and forwards together or successively, a sound of a grating character may possibly be produced.

I look on this as a very peculiar and yet very little evoluted form of ant. I have had a brief communication made to me about it by Prof. Forel, from which I judge this to be an ant the peculiarities of whose external

structure are greatly in need of elucidation. I have great doubts whether it ought to be placed in the Ponerides.

Ponerides ?. — *Myrmecia*, sp. ?. The second post-nodular segment has a broad neck, which is perfectly cylindrical; this neck is completely different in sculpture from the rest of the segment (and also usually in colour, resembling in this latter respect the previous segment by which it is covered). The sculpture is a beautifully developed system of transverse lines; they are everywhere the same on all parts of the neck, except that on the ventral surface they are a little coarser and less regular. The hind margin of the post-nodular segment has so minute a scraping edge that it can only be satisfactorily detected by separating the segment.

I have examined several species of this most interesting genus of ants—the "bull-dog ants" of Australia; they are all similar, with some slight distinctions in the sculpture. The condition is not that of a differentiated stridulating organ, as the lines are not perfectly regular, and cover the whole surface. Nevertheless, I think it probable that the parts may act as a sound-producing organ, by, after the manner of the Ponerides, retracting and extending the segment; the very fine minute scraping edge striking against some of the lines here and there notwithstanding their slight irregularities.

Ponerides. — *Amblyopone obscura* (worker). The retractile portion of the post-nodular second segment is very sharply defined, and is covered with a system of symmetrical sculpture, which, though it extends chiefly in the transverse direction, does not form straight lines. The scraper on the hind margin of the preceding segment exists, and its hind margin possesses apparently some excessively minute crenulations.

Although there is no definite stridulating organ in this insect, I should think the parts act as if there were one, and with the result of producing a sound of a much less perfect character. The female is like the worker in these respects. This is an insect of extreme insect. During an examination I have lately made of the external skeleton in ants, I came to the conclusion that this was the most primitive of the existing ants known to me, and also that it should form a separate subfamily on account of the imperfect differentiation of the node. On communicating my view to Prof. Forel, he informs me that

he has already come to a similar conclusion himself, and has recently made some remarks on the subject in the 'Transactions' of the Society of Naturalists at Bremen.

Perhaps I may be excused for calling attention to the interest that would attend the certain identification of the male of the insects of this genus.

Odontomachides.—*Odontomachus ruficeps*, Sm. (worker). Australia. The retractile portion of the second post-nodular segment is elongate, being quite equal in length to the exposed portion; it is covered with a dense very fine transverse sculpture of only a partially rectilinear character, but in the middle of the front portion of the retractile part there is a band, or rather a cone, of excessively fine perfectly regular lines. The scraping edge of the preceding segment is in this species provided with a peculiar structure, the sharp edge just over the band being a little more turned downwards, so that it rakes more vertically over the lines; besides this the hind margin just in front of the band is thickened, and deviates minutely from a straight line; perhaps this is correlative with the turning down of the edge attached to it.

Odontomachides.—*Anochetus ghiliani* (worker). Gibraltar. The retractile portion of the second post-nodular segment is covered with a coarse somewhat irregular sculpture (like that of *Ponera contracta*), and there is no stridulating band.

The great difference in abdominal structure between this and the *Odontomachus ruficeps* is remarkable in the case of two genera considered to be so closely allied. *Anochetus ghiliani* has the retractile portion of the second post-nodular segment not half so long as the exposed portion, and the two parts are separated by a well-marked constriction of the true *Ponera* kind, this division being absent in the *Odontomachus*.

Myrmicides.—*Myrmica scabrinodis* (worker). England. The base, or neck, of the segment behind the second node is quite short, and is at the sides covered with sharply raised, quite irregular, rather short, transverse lines; in the middle there is a broad space appearing perfectly smooth and polished, but which, under a high power, proves to be very regularly covered with straight, very fine ridges. The perfect regularity of these fine lines is highly remarkable. The edge, on the hind

margin of the second node, by which these lines are scraped is excessively thin.

Myrmicides. — *Aphænogaster barbara* (worker). E. Pyrenees. The neck formed by the base of the segment behind the second node is short, but it is prolonged forwards somewhat in the middle of the dorsal region, so as to be longer there. The whole of the median part is covered by excessively fine lines, very densely packed, uninterrupted, and quite straight. The surface at the sides of the neck has a very minute, dense, quite different sculpture.

Female.—Malta. The surface covered by the fine lines is very much less, and the lines are many of them largely interrupted, as might happen when a diamond making a very fine scratch on glass missed its hold of he glass now and again.

Myrmicides. — *Sima*, sp. Fremantle, W. Australia. The neck of the segment is rather long, and there is a stridulating band on the middle; the striæ on the front part are coarser than the neighbouring sculpture, and on the apical part are much finer; there is an abrupt line of demarcation between the coarse and fine lines.

This species is unique amongst those I have examined in having the stridulating band divided into two parts, one consisting of coarse, the other of fine, lines; a stridulating performance by this insect might produce very extraordinary effects. The fact that the basal lines are coarser than the neighbouring sculpture is without any parallel in the other ants I have examined, and appears to indicate that the division of the stridulating band into two parts is of importance. Possibly a sound from this insect might begin as a sort of roar, and in the middle of its utterance suddenly change to a sort of squeak; on the other hand, by using at one time the anterior part, at another the posterior part of the file, two different and even abruptly contrasted sets of sounds might be produced. Fig. 5.

Sima rufo-nigra (worker).—East India. The sculpture of the neck of the first segment behind the second node is rather coarse, and in the middle of the dorsal region it becomes striæ; these are not, however, very regular, and on the front part of the neck are coarse, while on the apical part they become finer and more regular; this is in opposition to the neighbouring sculpture, which

is a little coarser on the apical than it is on the basal part. The female differs but little from the worker.

Myrmicides.—*Pseudomyrma*, sp. (worker). Guatemala. The lines in this species are excessively fine, but the structure in other respects appears similar to *Sima rufonigra*. In working with a specimen of this species taken from spirit, I detected an excessively minute sound when the appropriate movements were made.

Myrmicides.—Gen. ?, sp. (female). Amazons. The segment behind the second node forms on the dorsal aspect a well-marked scutellum; its surface is very peculiar, the outer layer of the integument being colourless and transparent, so that the structure and colour of the inner layer are seen through the outer one, and render the external condition of this latter very difficult to distinguish. It appears, however, that at the sides there is a rough irregular but very fine sculpture, and in the middle a broad oval space, which is very finely and regularly striate. I think the lines in this insect are finer and closer than in almost any other; the length of the exposed part of the scutellum is about five-eighths of a millimetre, and, as a rough estimate, I should say there are nearly 200 lines on it, which would be at the scale of 7000 or 8000 to the inch. Fig. 6.

The perfect transparency of the stridulating surface in this species is very remarkable; the inferior layer of the derm can be seen through the outer, even at the sides of the neck, but the outer surface, on which the lines are situated, is quite transparent, and the layer beneath seems to be of cellular structure. The conditions seem to indicate that this part of the skeleton may be more resonant or give a purer note than ordinary chitine would.

Myrmicides.—*Atta cephalotes* (worker major). Amazon Valley. (Undissected specimen). The portion that can be exposed of the neck of the segment following the second node is not extensive, and is quite dull, owing to being covered with densely placed transverse but somewhat irregular and interrupted lines; along the middle there is a slightly raised space, and this is covered with quite regular, much coarser, and more sharply elevated lines; the surface of the neck of the segment is very strongly curved, the convexity being in two directions, as in a convex lens.

Worker minor. — Amazon Valley. Similar to the major, with the exception that the sculpture is much finer, and the lines of the stridulating band less elevated.

Winged female. — Demerara. (Dissected specimen). The neck of the segment is very short—indeed, it scarcely exists except in the dorsal region; in this latter part the sculpture on it is very fine and dense, and on the middle there is a band of stridulating lines, which are finer than in the worker. The scraping band on the hind margin of the second node is very prominent all across the dorsum of the segment. The size of this individual is enormous in comparison with the workers, and yet the stridulating lines are finer.

Male.—Demerara. (Dissected specimen). The neck of the segment is almost absent, even the dorsal region scarcely prolonged enough to form a scutellum. The sculpture on the surface of the dorsal region is very fine and densely sculptured, and on the middle forms densely placed and regular fine lines of considerable length in the transverse direction; the surface on which the lines are placed is slightly convex in the transverse direction. The second segment of the node is provided behind with a ridge, that is comparatively little prominent at the sides, but is very much so in the middle, and is curvate so as to correspond with the slight convexity of the surface on which the stridulating lines are placed.

Atta, sp. ?.—Guatemala. I have experimented with a number of specimens in spirit entrusted to me by Mr. O. Salvin, and I find that the various forms of workers produce quite audible sounds; there are, however, some individuals which I have failed with; my repeated efforts to produce sound by causing the parts to execute the appropriate movements having been quite unsuccessful. A female stridulates more loudly than any ant I have examined. Fig. 7.

In the case of this interesting genus of ants—the leaf-cutting ants of books of travel—I have found more audible sounds produced than in any other ant. The function of the worker majors of these creatures has been a mystery, Bates having quite failed to detect any use for them. The fact that they are endowed with sound-producing organs renders it possible that they may be individuals whose deficiencies in other respects may make them more sensitive in the matter of sounds.

But this is, of course, a mere suggestion, and still leaves it doubtful what the use of the enormous heads of these individuals can be. Before attempting to answer that question dissections should be made to see what is the condition of the nerve centres in the head, as this might prove instructive.

Myrmicides.—*Cryptocerus atratus* (worker). Amazons. In this insect the neck of the post-nodular segment is short and not prolonged in the middle; the whole of the upper surface of the neck is densely and finely sculptured with a short transversely linear sculpture, without any stridulating lines on it. There is no scraping ridge on the hind margin of the node.

In this insect there is apparently no means for producing sound by the action of these parts.

Ecitonini.—I have examined workers of several species of *Eciton*, and find that they have no stridulating organ, the sculpture being uniform all over the dorsum of the neck of the segment.

The organs of stridulation consist of a file, *i.e.*, a series of perfectly regular, straight lines placed on the middle of the dorsal region of the third abdominal segment, and of a scraping instrument placed on the hind margin of the preceding segment. The file is slightly raised, and a little curved transversely.

These organs appear to be absent in the Camponotides and Dolichoderides; in the Ponerides and Myrmicides they are usually present, but are sometimes absent, and I think it probable that one group of Myrmicides (Cryptocerini) will be found to be quite destitute in this respect.

The file or stridulating bands appears, in the case of the Ponerides, to be a development from the sculpture of the parts. The condition of this band, as seen in *Dinoponera grandis* and in *Paltothyreus* (?) *commutatus*, shows that the sculpture has only to become on some spot more regular and denser, and the surface slightly raised to transform the general sculpture into a rudimentary stridulating band. A tension acting transversely on the spot, supposing the materials not to be absolutely rigid, might be, I should think, capable of effecting the transformation. The scraping ridge is merely a development of the chitinous membrane by which the second segment is bordered behind; this

becomes more rigid and prominent, and at the spot where it is placed over the band, more perfectly regular, and so forms a sharper and truer edge.

The stridulation in Ponerides is performed by drawing out the third segment, and at the same time slightly depressing the hind part of the second segment so that the edge of this scrapes over the band; the beautiful articulations of the node allow this latter part of the operation to be performed with the utmost delicacy, and permit the touch of the scraper on the band to be greatly raised. In the Myrmicides the operation appears to be carried on in a different manner. The scraper is more developed, and is placed on the hind margin of the second node; this apparently is held rigid, and the upper surface of the following segment is thrown against it, so as to bring the band into contact with the scraper; a very slight vibration of the hind body will then bring about some stridulation.

It is by no means clear that in the Myrmicides the stridulating band is merely a development from the general sculpture; it is in some cases excessively different from this, and the striation has the appearance of being developed on a glassy surface poured out on the ordinary surface. The scraping ridge is not a direct continuation of the hind margin of the segment, but is placed on a lower plane. There is, however, one Ponerid known to me, fig. 4 (Tasmania), in which these parts are in an intermediate condition. Either that is a Ponerid in which this organ has been formed as in the Myrmicids, or it is a greater development of the Ponerid structure in the direction of the Myrmicids.

There is great diversity between the different species; this may possibly produce results as great (comparing small things with large) as that between the voices and song of different species of birds. There is evidently considerable difference between the sexes and castes of the same species, and I think also between individuals of the same caste, but this I have not properly tested; and it will, indeed, probably be found to be very difficult to judge of the value of minute differences of structure as producing diversity in the vibrations; if, however, I have correctly interpreted the phenomena I have observed in *Atta cephalotes*, I must conclude that small structural differences may be accompanied by great distinctions in

results ; and this independently of any differences in the muscular apparatus, which may be considerable or not, this point not having been at all examined.

It is impossible to examine a series of these structures, to note their peculiarities and the perfection that is attained in some of them, without concluding that they must be of considerable importance in the organisation of the creature. Whether they form a definite means of communication I cannot even guess, though I can quite see that investigation might probably prove them to be capable of producing a considerable variety of sounds in the case of one of the higher species.

It is true, as I have already stated, that these organs of stridulation do not exist in the great division Formicides of the older authors (the Camponotides and Dolichoderides of Forel) ; but nevertheless it appears quite possible that the same parts in those insects may be able to produce a considerable variety of sounds of a rustling nature by rubbing together, with a variety of movement, the sculptured surfaces of two overlapping parts, or by dragging a semimembranous border over a wrinkled surface ; and the examination of *Camponotus cruentatus* seems to increase the probability of this supposition.

The striation of the file in ants is similar to what it is in such Coleoptera as the Longicornia and Ipsini, though it is finer and more delicate in the ants. In this latter group the delicacy of movement given to the parts of the stridulating apparatus by the perfection of the joints at the nodes greatly increase the probability that a considerable variety in the sound may be produced. The fact that in *Sima*, sp. the band is divided abruptly into two very different parts strongly supports the idea that variety in the sound is of importance, as well as the mere making of a noise.

Perhaps I may be allowed to remark in concluding that I consider organs of hearing in insects and the sounds produced by the creatures to be a more promising field of research than the organs of sight, owing to its greater simplicity. If we could invent some means of hearing the sounds produced by ants, it might do much towards solving the question of their means of communication and recognition. I may, too, say a word of caution against the supposition that "hearing" in ants

means the same thing as "hearing" in man. The organs of the higher senses in insects are so profoundly different from those of man, and the nerve communications and centres are so fundamentally distinct, that a particular sound to an insect may be a totally different thing to what it is to us; hence, though it is known that ants are deaf to many sounds we hear, it is none the less probable that they may hear where we are deaf. Very little is at present known as to the organs of hearing in insects other than Orthoptera, and when they are known we may be sure that there will still be great difficulty for us in realising what an insect really hears. Still, I think the difficulties will not be so great as they are in the case of the ocular organs and sense of sight.

Explanation of Plate IX.

Fig. 1. Portion of the dorsum of the articulating neck of third abdominal segment of *Dinoponera grandis* (worker), showing the stridulating file and contiguous sculpture.

Fig. 2. Hind margin of second abdominal segment of *Dinoponera grandis*, showing the margin crenulated, except at *a*, which passes over and scrapes the file.

Fig. 3. Dorsal surface of articulating neck of third abdominal segment of *Ponera contracta*, showing the articulating file and contiguous sculpture.

Fig. 4. Stridulating organ of Ponerid from Tasmania, showing the file on third segment, and the edge (displaced) *a*, of the second segment that scrapes the file (worker).

Fig. 5. File of *Sima ?*, from Australia (worker).

Fig. 6. File of Myrmicid, from Amazons Valley (♀).

Fig. 7. File of *Atta*, sp., from Guatemala (worker).

XIII. *Descriptions of new species of Chilian Lepidoptera.*

By William Bartlett-Calvert, F.E.S.

[Read March 29th, 1893.]

Since the publication of my last descriptions of new species, I have been able to obtain a few more from Araucania and Valdivia. I have submitted specimens of the greater part of these to Mr. A. G. Butler, who, after having compared them with the species of Chilian Lepidoptera already contained in the British Museum, wrote to me telling me that they were all new, and asking me at the same time to conserve the same numeration in the descriptions as on the specimens sent to him. I have now the pleasure of submitting these descriptions, and should the publication of these numbers seem strange, it is due to the arrangement between Mr. Butler and myself, and for which I ask indulgence.

In respect to No. 12, *Neorumia ? gracilis*, Mr. Butler tells me that it will form a new genus; but, as entomological literature in Chili is very scarce, I have not the means of making a good description, and so brother entomologists at home will excuse me for having only half done my work. I am not quite sure whether *Erosina strigata* is a true *Erosina* or not, but it is evidently very near the genus.

The following are the species :—

Erosina strigata, n. sp.

Alis anticis ochraceis, in dimidio basali obscurioribus, linea arcuata albido-fusca; nebula subapicali et striis in triente externo fumosis; posticis silaceis immaculatis; infra ochraceis pallidioribus immaculatis. Ex. alar. 30 mm.

Hab. Colina, mense Januario.

Fore wings above ochraceous, the basal half being darker, and separated from the outer half by an arched brown line, white-bordered on the outer side, and internally slightly clouded with a smoky brown, of which colour are also the large subapical patch and the striæ of outer third; fringe alternately white and

black; hind wings above and all the wings below of a pale ochraceous colour, entirely without markings; thorax pale ochre; abdomen above and below shining ochraceous.

Neorumia gigantea, n. sp.

Alis supra sulphureis splendidis; anticis margine anteriore in triente basali castaneo albo-nebuloso, in parte apicali macula fusca et macula biocellata subapicali alba fusco-cincta; posticis, fusco maculatis; infra, aureis, anticis in triente basali, maculaque apicali et linea quinque-maculata transversa purpurea, margine interiore albo; posticis ut in pagina superiore. Ex. alar. 43 mm.

Hab. Araucania, Februario et Valdivia, Martio.

Wings on the upper side of a shining sulphur-yellow, the fore wings with the basal third of costa chestnut-brown, clouded with white on the inner side, a quadrate brown spot at apex, and below this two white-centred irregular brown rings, the lower one being the larger; from this spot to the centre of inner margin are four brown spots on the nervules, a brown spot at end of cell, and another at apical third of costal margin; all the wings sparsely brown speckled; hind wings with two transverse series of brown spots from costal to abdominal margin, the inner one at basal third, the outer one across the disc; fringe of all the wings golden; thorax pale yellow; abdomen ochraceous; wings below of a more golden yellow than above, and with almost the same markings; the fore wings at basal third and five transverse spots running from a large apical pyriform spot, which is purplish brown; inner margin whitish; pectus pale salmon-colour; venter golden; antennæ white above, brown below.

Neorumia lutea, n. sp.

Alis supra luteis, anticis maculis xi fuscis; posticis quinque-punctatis fuscis; infra, anticis, luteo-aureis, margine interiore subalbidis, linea maculaque subapicali obliqua fuscis; posticis sulphureis maculis septem transversis. Ex. alar. 25 mm.

Hab. Araucania, Februario.

Wings above gamboge-yellow, the hind wings slightly paler; fore wings with eleven small brown spots arranged in two transverse lines, the inner one composed of three at basal third, and the outer series across the disc; the two costal spots of this series run inwards, and so form an angle; the hind wings with five spots across the disc from abdominal margin to apex; on the under side the fore wings are of a golden yellow, slightly clouded at the base,

and with the discal line of spots as on upper side; interior margin whitish; hind wings pale yellow, with a discal series of seven spots, and a blackish spot at end of cell; thorax, body, and venter yellowish; pectus and legs smoky; antennæ pale brown.

12. *Neorumia? gracilis*, n. sp.

Alis, anticis in tertio basali et externo sulphureis, in medio fuscis; margine anteriore flavo; posticis, sulphureis fuscescenti maculatis; infra, sicut supra sed pallidioribus. Ex. alar. 22 mm.

Hab. Araucania et Valdivia, Februario.

Fore wings in basal and external thirds yellow, and in the centre smoky brown, with blackish spots on the nervules; the costal margin yellow, with two large brown quadrate spots, one at apical third, and the other at basal third; the hind wings as in *lutea;* below the wings have the same aspect as above, but much paler; antennæ brownish.

17–18. *Hoplosauris cinereus*, n. sp.

Alis anticis, in tertio basali et externo cinereis, medio nigro-fuscescentibus; in tertio basali linea transversa fuscescente, in externa angularum tortuosa; posticis omnino sordide albis; infra, cinereo-striatis, macula nigra discoidali. Ex. alar. ♂ 20 mm., ♀ 25 mm.

Hab. Araucania, Februario.

Primaries above of an ashy hue, crossed by three darkish lines on basal third, the outer one very slightly inarched, the outer third crossed by two very irregular dark lines, and a white zigzag one near outer margin; the centre of the wing is occupied by a very conspicuous brownish belt, crossing the wing from costal to inner margin, where it is slightly constricted; this belt is crossed by several darker lines, and on the costal margin has a large black-bordered grey patch, which terminates just below the cell; in the female this patch is larger, and forms an open U shape; outer margin black bordered; fringe white, with a dark stripe through the centre; hind wings dirty white without markings; under side of a dirty white or ash colour, crossed by darker undulated lines corresponding to those of the upper side; a black spot at end of cell; in the female the under surface of hind wings is slightly striated; the body of male is long and slender, that of the female thicker, and not projecting beyond the wings.

13. *Siona alba*, n. sp.

Alis supra albidis; anticis dense nigro-punctatis, macula fumosa subapicali; posticis immaculatis; infra, anticis subalbidis nebula apicali fumosa et nigro-punctata in margine anteriore; posticis albidis, dense punctatis fumosis, margine exteriore lato ejusdem coloris; macula discoidali nigra. Ex. alar. 30 mm.

Hab. Araucania, Februario.

Wings on the upper side of a shining silvery white, the primaries densely black-speckled, more especially on the costal margin, a large smoky subapical patch; hind wings without markings; below the fore wings are whitish, with a large smoky patch (in some examples this patch is of a reddish hue), which occupies the apex; the costal margin black-speckled; hind wings white, very minutely speckled with brown, the outer fourth being of a smoky brown colour, with a few black spots on the nervules of inner border; a black spot at upper end of cell; antennæ reddish; thorax and body dirty white.

Rhopalodes esmeralda, n. sp.

Alis anticis supra viridibus, margine anteriore albomaculato et exteriore nigro, fimbriis albis et nigris; posticis albo-roseis lineis angulosis transversis roseis, margine exteriore flavo; infra, anticis roseis, margine interiore albido, apice nigro, macula subapicali sulphurea, lineis tribus notata, margine exteriore in dimidio inferiore aureis; posticis pallide flavis, linea transversa et macula apicali roseis. Ex. alar. 31 mm.

Hab. Valdivia, Martio.

Primaries on the upper side of a dull sap-green, the costal margin white-spotted, outer margin black; fringe alternately black and white; hind wings of a faint rosy white, crossed just beyond the middle by an angulated rosy stripe, and a rose-coloured nebula on the disc; outer margin very pale yellow; fringe white; thorax and body whitish; below, the fore wings are of a dull rose colour, with the inner margin whitish yellow; a large black apical patch enclosing a pale triangular yellow one on costal border; this patch is crossed by three dark lines; the lower half of external margin is of a golden hue, rather wider on its upper extremity between the radials that leave the lower end of cell; hind wings of a pale yellow and rosy tints combined, with the transverse line of upper side and a large cellular spot of a dark dull rose colour; pectus and venter dirty white; legs and antennæ brownish.

5. *Pseudaleucis Oyarzuni*, n. sp.

Alis anticis fumosis, irregulariter trilineatis, dimidio basali pallidiore, apice bipunctato; posticis fumosis, albidis, linea transversali obscuriore; infra ejusdem coloris supra; linea obscuriore velut: omnino fusco-maculatis, macula discoidali nigra. Ex. alar. 32 mm.

Hab. Araucania, Februario.

Fore wings on the upper side of a smoky brown, inclining to a fawn colour, the basal half being slightly lighter; the wing is crossed by three irregularly angulated lines; the one at basal fourth is biangulated, and the outer one across the disc is inarched at its lower extremity, the space between this line and the central one forming a band slightly darker than the ground colour; just below the apex are two small black spots; the hind wings are smoky white, crossed in the middle by a dark line; thorax brownish; body sordid white; below, the wings are of the same colour as on upper surface, with a dark transverse line across outer third; the hind wings densely brown-speckled, with a black spot at the end of cell; body below smoky brown; legs brownish; tarsi dirty white.

26. *Asestra Igguierdoi.*

Alis anticis supra ochreis nebulosis splendidis; nigro-punctatis, in margine anteriore leviter; maculaque basali nigra; maculis 5 transversalibus nigris, in angulo externo majore, linea transversali arcuata alba, macula discoidali nigra; posticis flavis splendentibus macula nigra, margine abdominali subalbido; alis infra flavis; anticis, macula arcuata discoidali et linea transversali nigra lata; posticis, puncto nigro discoidali. Ex. alar. 39 mm.

Hab. Principue in prov. Santiago, et Araucania in mense Februario.

Primaries on the upper side of an ochraceous tint, shining and slightly clouded, sparsely black, speckled on costal margin; a large black spot at basal third near inner margin, a darkish transverse band across the wing through the cell, and a black spot in the cell; five black fusiform discal spots, two close together on upper radial, and the other three near outer angle, the two nearest the angle being the largest; just on the inner edge of these spots is a whitish arched line from costa to inner margin, where it terminates in a black spot; hind wings of a shiny pale yellow, with a row of black spots across the disc, the second from the apex being very large and pear-shaped; abdominal border whitish; fringe on fore wings brassy, on hind wings pale yellow, changing to golden towards

abdominal angle; wings below pale ochraceous, the fore wings with a black crescent at outer end of cell, and a broad black band across the disc, constricted in the centre, and again gradually widening as it nears the inner margin; hind wings with a minute spot at end of cell; head blackish; thorax, body, and legs dirty white.

27. *Boarmia valdiviana*, n. sp.

Alis anticis supra castaneo-fumosis, quarto basali et medio sordidis, linea transversa dentata nigra, in margine anteriore latiore, maculaque nebulosa et linea nigra in margine externo; posticis, medio ferrugineo-luteis, in duas partes linea transversa nigra divisis; margine abdominali et externo fuscis; infra, luteis nigro-maculatis; anticis in parte basali et margine externo fuscis, macula in dimidio marginis anterioris et macula discoidali nigris; posticis, macula discoidali, linea transversa et margine exteriore nigrescentibus. Ex. alar. 44 mm.

Hab. Valdivia, mensibus Februario et Martio.

Primaries above of a dark chestnut colour, the basal fourth and centre of a very dirty white, the basal part limited by a dark biangulated line bordered by white on its inner side; the second fourth forms a wide band across the wing, narrowing towards inner margin; next comes the whitish central band, which appears at first sight like a clay pipe, the bowl of which is on the costal margin; a black dash at the end of cell; a black line across the disc, wide on the costa, and irregularly angled and arched on its outer side, which is bordered by a white stripe; from the largest of the angles towards apex is a large greenish nebula, and below this a large blackish one; on external border from apex to outer angle a black crenulated line; all the wing black-speckled; fringe smoky, with the base white; posterior wings in the centre of a ferruginous yellow, divided by a transverse black line; base, abdominal and outer margins very dark brown; wings below of a dark dirty yellow, inclining to ferruginous, and greatly black-speckled; fore wings at base and external margin smoky; drawing of upper side faintly repeated; hind wings with a black cellular spot and transverse line of same colour; outer border blackish; body smoky brown; legs blackish, tarsi with white bands on upper side; antennæ blackish.

15–16. *Microclysia Philippii*, n. sp.

15. ♂. Alis supra cervinis, antice lineis duabus transversis angulosis ad marginem anteriorem, in tertio basali et in tertio externo rectis; posticis, linea diagonali a margine abdominali ad

marginem anteriorem currente ; infra, fere velut supra. Ex. alar. 33—34 mm.

16. ♀. Alis supra, bitriente basali cervino, extus luteis, lineis duabus transversis fuscis, interiore tortuosa, externa recta; infra, omnino luteis utraque macula discoidali nigra ; anticis, lineis duabus transversis et apice fuscis. Ex. alar. 37 mm.

Hab. Araucania, Februario.

♂. Wings above of a beautiful fawn colour, the primaries with two yellow lines across the wings, the inner one abruptly angled at costal margin, and bordered on its outer side by a dark ferruginous stripe ; the outer line almost imperceptibly incurved and bordered on its inner side by a reddish line, which touches the outer border of cell, in which is a dot of the same colour; hind wings with a diagonal line from near centre of abdominal margin to costa (this line if prolonged would come midway between those on fore wings) ; below the wings present almost the same appearance as above, excepting that the outer line of fore wings is contiguous to that of hind wings ; thorax, abdomen, and antennæ pale buff.

♀. Wings above in basal two-thirds of the same colour as in male, but rather darker and slightly black-speckled ; primaries crossed just before the middle by a darker angulated line; a black spot in cell ; the outer third of both wings orange-yellow, separated at inner two-thirds by a dark brown stripe ; apex ferruginous, and a nebula of same colour at outer angle on fore wings ; below the wings dull orange, inclining to ochreous, the drawings on upper side not quite so marked ; black cellular spots ; hind wings very sparsely black-speckled near base.

28. *Microclysia Paulseni*, n. sp.

♂. Alis supra fuscescentibus ; anticis lineis duabus transversis, quarum basali fusca, externa obliqua albida ; infra fulvis, dense nigro-maculosis, anticis linea transversa angulosa in tertio externo ; posticis, margine abdominali albo et macula discoidali nigra. Ex. alar. 42 mm.

♀. Alis supra purpure-fuscis, anticis in medio albido-maculosis ; linea basali transversa tortuosa et linea externa nigra ; posticis in margine anteriore albidis, lineis duabus transversis nigris; infra, britriente basali sordide albido, fusco maculato ; apice niveo ; margine posteriore albido, tertio externo obscuriore ; fascia omnino sicut supra. Ex. alar. 45 mm.

Hab. Araucania, Januario et Februario.

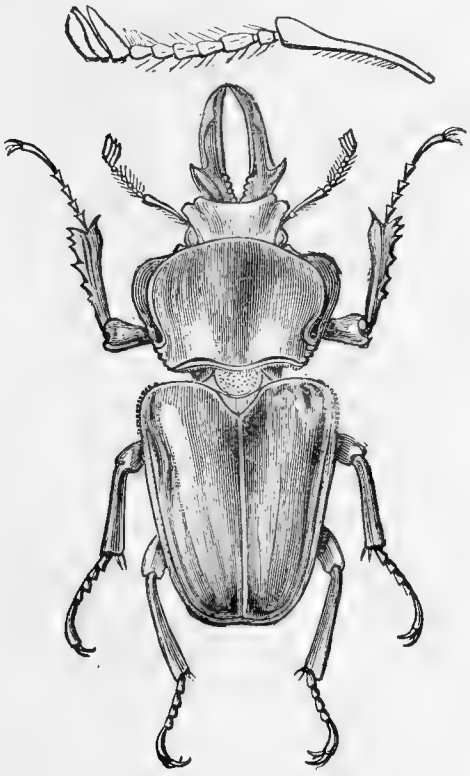
Fore wings above brownish, crossed by two lines, one at basal third regularly angulated, and of a blackish hue, the one across the disc straight and inangled near costa, and of a yellowish white colour; a black spot at the end of cell, surrounded by a ferruginous nebula; hind wings rather lighter, and with only one line from centre of abdominal margin to end of cell, and an almost imperceptible one (seen only with a lens) on the disc; below the wings are of a more brownish colour, densely black-speckled; the fore wings with the line across the disc angled instead of straight, as on upper surface; apex whitish, as also internal margin; the spot and ferruginous nebula as above; hind wings, a black dot in cell, a crenulated whitish line across the disc; abdominal border whitish; antennæ slightly pectinated.

Mr. Butler, in his description of the genus *Microclysia*, says "antennæ simple," so that perhaps this species will have to be transferred to another genus, though otherwise there is no difference, the female having the antennæ simple.

♀. Wings above of a fine purplish brown, crossed by two black stripes, the basal one irregularly angulated, the outer one straight, but, as in male, inangled near costa; between these stripes the wing is white, very densely spotted and clouded with brown; a crenulated black line from costa near apex to external angle; apex whitish; hind wings with the costal margin white; two black transverse lines across the wing; inner one straight, the outer one crenulated; thorax brownish; body whitish; antennæ whity brown; below with the inner basal two-thirds white, spotted and clouded with brownish; fore wings with the apex snow-white; internal border whitish, both fore and hind wings with the outer third of a dark shining purplish brown; the rest as on upper surface, excepting the abdominal border, which is whitish.

XIV. *On a new species of the genus* Phalacrognathus, *McLeay*. By John W. Shipp, of the Oxford University Museum. Communicated by Dr. D. Sharp, M.A., F.R.S.

[Read March 29th, 1893.]



This gorgeous insect was purchased by the late Prof. Westwood from Boucard, was labelled as a new species by him, and placed in the Hopeian Collection. It is perhaps the most beautiful Lucanid yet described.

Phalacrognathus westwoodi.

♂. Colour very brilliant metallic-green. Head short, rather wide, slightly emarginate in front; two slight carinæ extend from the anterior angles towards centre of depression, rather excavated on disc, sparingly punctured at sides, nitid, and of a bright

metallic-green colour. Mandibles rather lengthened, curving upwards at apex, not scalloped on the inner edge, a large horn on the outer edge near the base, pointing outwards, and a smaller vertical one near the apex, very evenly crenulate on the inner edge near the base; black, with a splash of metallic-green colour at base. Antennæ black, club 3-jointed. Trophi pitchy, with yellow pubescence. Thorax of a dull bronzy green, impunctate on disc, but with a few very fine punctures on the lateral margins. The sides towards the anterior extremity are very strongly emarginate, rounded, and dilated upwards, with a rounded depression towards the posterior extremity of the lateral margins; the posterior half of the lateral margins being strongly crenulate, with about twelve teeth on each margin, narrower in front than behind, bisinuate on both; base rather strongly emarginate. Scutellum of a roundish triangular form, sparingly punctured; the dorsal surface of metathorax is very strongly and thickly punctured, slightly pubescent. Elytra as long as the head and thorax together (mandibles included), wider at base than apex: of a most brilliant golden green colour at the sides, changing to a lovely crimson and coppery hue on disc; glabrous, and impunctate. The lateral margins are strongly emarginate and deeply crenulate for some distance behind the shoulders, impunctate, but with a few sparse punctures on the emarginated sides; two very shallow and almost obsolete striæ are noticed on each side of suture. Femora same colour as body, changing to a crimson hue in centre. Anterior tibiæ with a slight metallic-green colour on outer margin; widened at apex, deeply toothed with seven teeth externally, and one tooth on the under side at apex; the indentations between the points are slightly crenulate; the under sides are of a pitchy black colour. Posterior tibiæ and tarsi black, sparsely punctured, and without the teeth that are present in the ♀; tarsi furnished on the under side with a few brownish hairs. Under surface resembles the upper surface in colour. Prosternum shows a narrow keel between the fore legs, and the mesosternum is shortly pointed and concave on its anterior face; pygidium very thickly punctured, and under surface covered with a light golden pubescence, and sparingly punctured. Long. corp. 26 lines ($2\frac{1}{6}$ in.).

Hab. North Australia (*Boucard*, 1889); in Mus. Hope, Ox. Univ. Museum.

The genus *Phalacrognathus* was founded by McLeay (Trans. Linn. Soc. of New South Wales, 1885, x., p. 474) on a single ♀ sent to him by French from N. Australia, the ♀ being described by him as *Lamprima muelleri* on

p. 181, the ♂ being described on p. 474, with a description of the genus. The generic characters which he gives as separating it from the genus *Lamprima* are as follows:—"Mandibles very long, porrect, and curving upwards, smooth, glabrous, and unarmed on the lower and inner edges. Basal joint of antennæ scarcely clavate, and as long as the other joints combined. Fore tibiæ of ♂ without a foliate spur." To this must be added:—"♂ differs from ♀ in having no tibial spurs to the medial and hind tibiæ. The ♀ is more densely punctured than the ♂, and the anterior coxæ are separated and do not touch."

As the trophi have not yet been examined, I cannot say whether it differs from *Lamprima* in those characters.

P. westwoodi, mihi, differs from *muelleri*, McLeay, in the following particulars:—Form broader, anterior sides of lateral margin of thorax more emarginate and curved upwards, increnulate and smooth; teeth at the inner base of mandibles are more even, and the inner edge of mandibles is straight. The posterior margin of thorax is more evenly marked.

A. Mandibles in ♂ long, curved, with two horns, one at base and one at apex, short, as long as head and thorax together. Bright vivid golden green; femora very much thickened, sides deflexed at apex, anterior coxæ not united. Elytra narrower at apex, thickly punctured in ♀, glabrous and smooth in ♂. Scutellum roundish triangular. Posterior tibiæ armed with two spines in ♀, simple in ♂; ♂ has no foliate spur to anterior tibiæ.

AA. Thorax with a very rounded and dilated emargination on apical half of lateral margin; apical half, crenulate. Posterior lateral margin crenulate, inner edge of mandibles smooth, not indented, and the teeth at base of inner margin even .. .. *westwoodi*, Shipp.

BB. Thorax with a very slight rounded, scarcely dilated, emargination on apical half of lateral margin deeply crenulated; inner edge of mandibles not smooth, slightly indentated. The teeth at the base of inner margin uneven .. *muelleri*, McLeay.

XV. *On species of* Chrysopa *observed in the Eastern Pyrenees; together with descriptions of, and notes on, new or little-known Palæarctic forms of the genus.* By Robert McLachlan, F.R.S., &c., Treas. Ent. Soc.

[Read April 12th, 1893.]

In the month of July, 1886, I had the privilege of being the guest of our esteemed colleague Mons. René Oberthür at his villa at Vernet-les-Bains (Dép. des Pyrénées Orientales). This small town, noted for its thermal springs, is admirably situated for the requirements of an entomologist; the district is sufficiently near the sea to have a Mediterranean element in its fauna, sufficiently elevated to have its summer heat tempered, and close enough to the Spanish frontier to have a real mixture of Peninsular forms not found elsewhere in France. My captures of Neuroptera in nearly all families were considerable, but in no respect were they proportionally richer than in the genus *Chrysopa*, species of which abounded near the town, and more especially in terraced abandoned vineyards, where, as is usual elsewhere, I found the Ash trees (*Fraxinus excelsior*) harboured the larger number. During my short stay of more than a week over 150 examples were captured; these were roughly examined soon after my return,* but until now they had remained, without more critical notice, in a store-box. A more careful scrutiny reveals at least ten species, some being of considerable interest; and as practically nothing whatever has been written on these insects so far as regards that particular part of Europe, I propose to give a list of the species observed with comments, as a small contribution towards a knowledge of the local fauna.

I have alluded to Ash as the most productive tree for

* Exhibited at the meeting held on Sept. 1st, 1886, see Proc. Ent. Soc., 1886, pp. xlii—xliii; the provisional list of species there given has been slightly modified and augmented.

many species of *Chrysopa;* such is my experience. Next to Ash comes Lime (*Tilia*). The inference is that such trees furnish the Aphides, or Coccids, on which the larvæ feed; but many species frequent any kind of deciduous tree indiscriminately, varying only in degree of abundance. A few affect conifers (and especially *Abies excelsa*) almost exclusively, their prey evidently being attached to the same trees. And I am convinced that a small number (e. g., *C. phyllochroma*) are probably attached to herbaceous plants. These remarks of course apply to European forms. The foregoing notes on habits are incidental only, and not specially connected with the Eastern Pyrenees.

The few descriptions of new or little-known forms, here given, partly concern the species of the Eastern Pyrenees, and are partly the outcome of a general review of my Palæarctic collection. To the small band of entomologists who have attended critically to this genus it is needless to state that if the difficulties connected with the determination of isolated specimens be great, they often increase in direct proportion to the number of specimens.

List of Species captured at Vernet-les-Bains, and Vicinity (Pyrénées Orientales).

Chrysopa perla, L.—Tolerably common.

C. Walkeri (Brauer), McLach., n. sp., see p. 229.—Very common.

C. septempunctata, Wesm.—About ten examples exhibiting no variation.

C. aspersa, Wesm.—Very abundant, and very variable, as elsewhere. There can be little doubt that this should take the name of *prasina*, Burm., but as there is just a shade of suspicion that more than one species is included in the varying forms of "*aspersa*," I think it better to leave the matter as given in my article in Ent. Month. Mag., xxiii., pp. 33—36.

C. Picteti, McLach. (=*thoracica*, Ed. Pict., nom. præocc., *cf.* Ent. Month. Mag., xvii., p. 63).—One somewhat doubtful example.

C. lineolata, McLach. (=*clathrata*, Ed. Pict., nec Schnd.), see p. 232.—Eight examples.

C. flavifrons, Brauer.—Most abundant and very vari-

able. As stated elsewhere, I think it probable that several of Ed. Pictet's species will eventually be merged into *flavifrons* as varieties.

C. viridana, Schnd. — Very abundant. A most charming species when alive, the bright green being set off by the striking yellow or whitish dorsal line. Like most others it soon fades.

[*C. tenella*, Schnd.—Two examples occurred at Cauterets (Hautes Pyrénées), but the species was not observed at Vernet.]

C. flava, Scop.—Not uncommon.

C. vulgaris, Schnd.—Tolerably common.

New or little-known Palæarctic Species.

Chrysopa Walkeri (Brauer, in Mus.), n. sp.

Of the size and form of *C. perla*, L., Schneid., but the general coloration is *full green* (not blue-green). Head with a slight yellowish tinge, strongly marked with shining black as follows:—a more or less triangular spot on each side of the posterior margin touching each eye, and sometimes connected by a narrow line on the posterior margin, or sometimes this line is broken up into spots (or it may be virtually obsolete); on the middle of the vertex near the posterior margin (and sometimes touching it) are two contiguous spots, often united, but varying much in size (and occasionally obsolete); extending from the middle of the vertex forwards is a ⅄-shaped mark, the branches of which are often thickened towards their tips (or origin), connected by a stalk between the base of the antennæ, and again, *on the front*, with two crescentic (◡◡) marks below the base of the antennal sockets, and there is frequently a fine line at the origin of the basal joint; on the front are two large round-oval spots on each side, one on the genæ, the other on either side of the clypeus. Palpi for the most part black, pale at the base and at the articulations. Antennæ pale brownish, the second joint wholly shining black. Pronotum hairy, its sides broadly black, which colour is more or less divided, by the transverse groove, into two spots on either side. Meso- and meta-notum with a large (but varying) crescentic black spot on either side, in which is usually a black pupil. On the pectus there is a large median black spot on the prosternum and mesosternum (between the legs), and the coxæ are more or less black. Legs green, the tarsi brownish. Abdomen green, largely varied with black (not describable from dry individuals). In the anterior wings the longitudinal nervures are green, but the transverse nervules

mostly black, those below the sector interrupted with pale or wholly pale in their lower half, and those between the two rows of gradate nervules wholly pale. In the posterior wings the neuration is for the most part pale, excepting the costal and gradate nervules, and those (in part) between the radius and sector.

In 1867 two examples from Mehadia in Hungary (*J. Mann*) were sent to me by Dr. Brauer under the name here retained, and this name has found its way into catalogues and lists; but the species is now described for the first time. At Vernet-les-Bains it was very common, and easy to recognise on the wing on account of its peculiar green, and in this respect easy to distinguish from *C. perla* (which occurred with it, but more sparingly), the latter being very conspicuous on the wing by its blue-green "shimmer."

The two species (*Walkeri* and *perla*) are no doubt closely allied, but very distinct; the black markings on the head, &c., are less pronounced in *Walkeri*, and in it the ⅄ is always open posteriorly, whereas in *perla* it is closed. In this respect *Walkeri* somewhat resembles the North American *upsilon*, A. Fitch, which is a smaller species, and there is analogy with the European *dorsalis*, Burm.

Chrysopa intima, n. sp.

Closely allied to *C. Walkeri*. Differs principally as follows:—

The spots on the top of the head touching each eye are never connected by a line along the posterior margin of the head; the two spots on the middle of the vertex near the posterior margin are neither connected nor contiguous, but always distant, so that the distance between them is not much less than that between each of them and the spot touching the eye; the two branches of the ⅄ are rather more divergent. The palpi are paler. On the pronotum, instead of the broad black margins, are three black spots on either side (the lowest sometimes indistinct on account of retraction), and the markings on the meso- and meta-nota resolve themselves into distinct spots. The pectus and pleuræ *entirely without markings*, save a spot in the centre of the prosternum.

Siberia and Amurland; Irkoutsk (*Jakowlef*), Pokrofska (*Gräser*). Japan (*Lewis*, *Pryer*).

Formerly I used to consider the Asiatic examples above noticed were *C. Walkeri*, but it seems to me that the characters here given indicate a species, or at any rate

a very striking local form. The examples from Japan do not seem to differ from those from the mainland. I have not seen the true *C. Walkeri* from Asia, but *C. perla* occurs both in Siberia and Japan.

Chrysopa nana, n. sp.

Head and thorax whitish (or yellowish) grey above, with a very broad black marginal band on either side extending the whole length of the thorax (and probably of the abdomen also), sometimes with a short median fine black line on the anterior portion of the pronotum; face with a black line on either side extending along the genæ and clypeus; palpi lined with black externally; antennæ yellowish grey, sometimes with a blackish line on the basal joint externally; pleuræ and pectus varied with grey and blackish. Legs yellowish grey, with short fine black hairs; a black ring at the insertion of the coxæ, and another immediately before the apex of the femora (more extended on the posterior); tibiæ visibly compressed and somewhat dilated, with a blackish spot on the anterior and intermediate slightly before the middle externally; tarsi slightly testaceous; claws minute, simple. Wings long-oval, narrow, subobtuse; neuration with sparse black hairs; in the anterior pair the neuration is yellowish (or whitish), costal nervules 17—18, black, pale in the centre, the black portion dilated into a line at the confluence with the subcosta, and a similar dilatation (with clouding of the membrane) takes place at the axillæ of all the connections of the nervules with the nervures, giving the wing a peculiarly irrorated appearance, and there is a large and distinct oblong black spot on the third nervule in the space between the lower cubitus and the post-costa; neuration open, most of the cellules large and hexagonal; upper portion of third cubital cellule oval, the dividing veinlet extending beyond the superposed nervule; pterostigma obsolete, the pterostigmatic space without nervules; three nervules in both gradate series, the outer series close to the margin; in the posterior wing the black irrorations are less evident. Expanse of wings, $16\frac{1}{2}$—$18\frac{1}{2}$ mm.

Asia Minor (Adana) and Persia (Shahrud). Four examples in my collection. [Also Algeria, see Postscript.]

This striking little species is amongst the smallest known in the genus, and is remarkable for the black irroration of the otherwise transparent wings. Its affinities are probably with *C. Genei*, which is sometimes nearly as small, but has broader wings. In the

latter, and in some other species, there is a tendency to the flattened and dilated tibiæ above alluded to. In the example from Shahrud the basal joint of the antennæ appears to be blackish beneath.

[Postscript. Since this paper was read, I received from my friend the Rev. A. E. Eaton twelve examples of *C. nana*, taken by him on June 3rd, 1893, at Biskra, Algeria, sitting on oil-lamps in the Jardin opposite the station from 8 to 10 p.m. In this long series the black irrorations on the wings are still more strongly marked (no doubt due, to some extent, to the specimens being comparatively fresh). The expanse of wings varies from $14\frac{1}{2}$ to 19 mm. In the anterior wings there are more frequently 2 than 3 gradate nervules in the inner series (sometimes only one), but nearly always 3 in the outer (occasionally only 2). Mr. Eaton remarks that "its eyes were a sort of metallic blue-black, not coppery like those of other species."]

Chrysopa lineolata, McLach., Ent. Month. Mag., xvii., p. 64 (= *C. clathrata*, Ed. Pict., nec Schneider).

I have before me eight examples from Vernet-les-Bains, and one of Ed. Pictet's types of "*clathrata*" from Granada. That author also records it from Eaux Bonnes in the Pyrenees. As his diagnosis is simply translated from that of Schneider, and as my own remarks (*loc. cit.*) are scarcely sufficient, I give a more detailed description:—

Yellowish green, the head (including face) distinctly more yellow. On the vertex is a large obtusely triangular concave space, the raised margins of which are often (not always) tinged with ferruginous (or reddish brown); no spot between the antennæ; face frequently (not always) with a bilunate reddish brown transverse line placed considerably below the insertion of the antennæ, and there is a small spot (usually darker, almost blackish) on the genæ; palpi pale, slightly marked with brownish externally. Antennæ pale, frequently with a reddish line on the basal joint externally. Pronotum narrowed in front: in strongly marked specimens there is a sublateral ferruginous band on either side, not touching the lateral margins, which is continued on the mesonotum, and often on the metanotum likewise (but these sublateral bands are very variable, and in some examples the only indication

of them on the pronotum is an angulated mark on either side). Legs pale; tarsi testaceous; claws dilated at base. Abdomen pale, with short whitish pubescence. Wings: anterior pair with a minute blackish spot at the base of the costal margin; neuration pale, the nervules with a black point or space at either end, the gradate nervules (5—6 inner, 6—7 outer) wholly black; all the neuration bearing rather long and distinct blackish hairs: in the posterior wings most of the neuration below the sector in the lower half (excepting the gradate nervules) is wholly pale. Expanse, 24—31 mm.

The relationship of this species with *C. flavifrons*, Brauer, is evident, and it may be scarcely more than a condition of that somewhat Protean insect; those individuals, in which the reddish markings on the pronotum are reduced to an angulated indication, especially recall *flavifrons*. It is advisable that a re-examination be made of the single type of *C. granadensis*, Ed. Pict.

Two papers dealing with the results of examinations of Ed. Pictet's Spanish *Chrysopæ* have been published; the first by Hagen in the Stett. Ent. Zeitung for 1866, and the second by myself in the Ent. Month. Mag., vol. xvii., 1880. The conclusions arrived at were not quite the same, and I think we both erred on the side of insufficient knowledge of the range of variation in the species of this genus.

Chrysopa guadarramensis, Ed. Pict., Névrop. d'Esp., 65, pl. vi., figs. 1—4.

I have arrived at the conclusion that this species, originally described from one female, is quite distinct from *C. flava*, Scop., with which I had provisionally united it as a slight variety, and that three examples (one male, two females), taken by the Rev. A. E. Eaton in the Appenino Pistojese, Central Italy, are identical therewith, the most striking feature being that the two series of gradate nervules are entirely and conspicuously black; tolerably well indicated in Ed. Pictet's figure. The costal margin of the anterior wings is precisely as in *C. flava* in both sexes, and the male has the same incrassated nervules in the costal area. There is a very striking difference in the anal parts of the male, and in connection with these I have become aware of a serious error in a short article by me on the differences

of *C. flava* and *C. vittata*, published in the Ent. Month. Mag., vol. xx., pp. 161—163. I there alluded to the examples from Central Italy, and my characters of the male appendages were drawn up from the male from that locality (and therefore presumably *guadarramensis*), and do not apply to the true male of *flava*, in which the appendages are much more like those of *vittata*, the chief difference being that the inferior appendage in *flava* is obtuse, and carries a tuft of hair at the apex, whereas in *vittata* it is acute and very sharply upturned.*

This matter is of serious import, because it proves that two species differing in nothing but what is usually considered an unessential colour character (*flava* and *guadarramensis*), so far as general characters are concerned, yet differ remarkably in the structure of the appendages of the male.† It so happens that in the group to which *flava* and its allies belong (and which also includes *pallida*, Schnd.) is almost the only one in which the male appendages are prominent and easily discernible in dry individuals. Whether an examination of these parts in living or freshly-killed examples in species of other groups might throw light on the puzzling variations (so assumed) of some species, remains to be proved.

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* *C. guadarramensis* has no relationship to *C. 7-punctata*, with which *pallens*, Ramb., is identical. This is mentioned on account of the comparison drawn in Pictet's description.

† I have again alluded to the subject in the Ent. Month. Mag., 1893, pp. 108—109.

XVI. Dicranota; *a carnivorous Tipulid larva*. By Prof. Louis Compton Miall, F.R.S. Communicated by the Rev. Canon Fowler, M.A., F.L.S., &c.

[Read May 10th, 1893.]

Plates X., XI., XII. & XIII.

Introduction.

Many dipterous insects are hitherto known only in their final or winged state. The imperfect condition of our knowledge of the earlier stages is apt to be very embarrassing to the naturalist who comes across some dipterous larva whose habits or structure excites his curiosity. To fill this gap, one of the most considerable in Entomology, will require the efforts of more than one generation of students. The present sketch, which will, I hope, be followed by others, may, in the present dearth of information, be of some use to those who occupy themselves with this branch of Natural History.

An excellent general account of the family (*Tipulidæ*),* to which *Dicranota* belongs, will be found in part iv. of Baron Osten Sacken's 'Diptera of North America;'† and

* The family of *Tipulidæ*, which is often made to include all the Tipulariæ or Diptera Nemocera, is here used only for Latreille's *Tipulariæ terricolæ* or Meigen's *Tipulariæ rostratæ*.

† Smithsonian Misc. Coll., vol. viii. (1869). See also 'Studies on *Tipulidæ*,' by the same author. Part I. *Tipulidæ longipalpi*, 1886; Part II. *Tipulidæ brevipalpi*, 1887. (Berliner Entomolog. Zeits., Bde. xxx. xxxi.).

to save space I will suppose that the reader is possessed of the information contained therein.*

Mr. R. H. Meade, of Bradford, to whom I am indebted for identifying the fly of *Dicranota*, which was reared in captivity, tells me that the species is *D. bimaculata*, Schummel. "Nothing," he adds, "has been recorded concerning their life-history." Van der Wulp† gives a similar account, "Van de gedaantewisseling is niets bekend."

Habitat and Life-history.

I have found the larvæ of *Dicranota* plentiful on the muddy banks of a little stream near Leeds, known as the Meanwood Beck, and on the margin of a muddy pond at Adel, near Leeds. They bury themselves in the gravel and mud, and are sometimes fished out of the bed of a stream. Full-grown larvæ are about $\frac{3}{4}$ in. long,‡ and of a dirty white colour. They creep with ease and rapidity through mud or gravel, and rarely expose themselves to view. They can also swim about in water with a looping movement. Now and then they leave the water altogether. They prey upon *Tubifex rivulorum*, and the peculiar crochets of this little worm, as well as the hæmoglobin from its blood-vessels, may often be seen in the alimentary canal of the larvæ.§

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* Besides the descriptions of Tipulid larvæ mentioned by Osten Sacken (*loc. cit.*, p. 4), the following (since published) are worth attention:—

Ptychoptera. Hammond, in Journ. Micr. and Nat. Sci., vol. 3 (1884). Some necessary corrections of Lyonnet's account.

Ctenophora. Weyenbergh, Beitr. z. Anat. u. Hist. d. Hemicephalen Dipteren-larven d. Gattung Ctenophora. Haarlem (1872).

Tipula. Hammond, in Science Gossip (1875). Excellent anatomical figures of the larva.

Dixa (*Tipulidæ ?*). Meinert, De eucephale Myggelarver (1886).

Brief notices of larvæ and pupæ of a number of *Tipulidæ* are given by Beling in Abh. der k. k. zool. bot. Gesellsch. (1873, 1878, 1886). The last of these papers contains a systematic index.

† Diptera Neerlandica, p. 388 (1877).

‡ A little more when fully extended.

§ Other examples of carnivorous dipterous larvæ (not to mention the many cases of parasitic larvæ) are furnished by *Mochlonyx* (preying upon *Cypris*, *Daphnia*, &c.), *Corethra* (*Daphnia*), *Tanypus* (Entomostraca), *Vermileo* (small insects), *Melithreptus* (*Aphis*), *Syrphus* (*Aphis*), *Pipiza* (*Aphis*), and *Mydas fulvipes* (insects). For the literature of these see Brauer, Zweiflügler d. kais. Mus. zu Wien., iii.; in Denkschr. d. kais. Akad. d. Wiss., Bd. xlvii. (1883).

They are capable of enduring a long fast. Before I knew their mode of life, I kept them in small vessels filled with earth and water, and found that they lived and moved about actively for several weeks without their customary food.*

The pupal stage is passed in damp earth, not beneath water. As usual in insects of like habits, the pupa creeps to the surface shortly before the time has come for the emergence of the fly, and it is provided with a special armature to enable it to do so (see p. 249). The larvæ can be found at all seasons of the year, and it is therefore likely that there is a continual succession of flies during the warmer months.

I have frequently found a large number of *Gregarinæ* in the stomach of the larva. The species resembles *Stylorhynchus longicollis*, St.,† from the intestines of *Blaps mortisaga*, but the epimerite or snout is not so long. These parasites are probably introduced as spores together with the contents of the alimentary canal of *Tubifex*. In this worm the most extraordinary variety of organisms can be seen with a high microscopic power —Diatoms, Infusoria, and a crowd of germs and spores, which may easily include those of a *Gregarina*. The *Gregarina* is apparently hatched in the stomach of *Dicranota*, for all sizes may be obtained from a single larva.

The fly is well known to systematic entomologists, and need not be described here. Of the eggs and the process of egg-laying, I know nothing as yet.

External Features of the Larva.

The larval head is very elongate and half immersed in the prothorax, within which it can be completely retracted. The antennæ are small and single-jointed; they stand out from the dorsal surface of the head, just behind the mandibles, and in front of the eye-spots. The mandibles are stout and curved, bearing sharp teeth. The inner margin bears a fan-like bunch of

* The larva may naturally be looked for in places where *Tubifex* is plentiful, but whether it is common or not can only be ascertained when naturalists in different parts of the country have searched for it. The fly, as I learn from Mr. Meade, is said to be rare.

† Bütschli's Protozoa, Taf. xxxvii., fig. 2.

setæ, which helps to close-in the side of the mouth. Beneath the mandibles are the long maxillary palps, each of which is provided with a sensory pit (?), a small filament, and a sensory spot.

The submentum (pharyngeal plate of Meinert)* is divided by a median cleft, and its fore edge is armed with six sharp teeth. Above it is a slightly bilobed plate, the mentum (labium of Meinert and other authors), which bears fine prominences along its free edge. The labrum is flexible, and armed only with very minute points. The top of the head is defended by a chitinous shield, which becomes very strong behind. From this shield descends, in the hinder two-thirds of the head, a median chitinous septum, which gives origin to muscles, and especially to the powerful muscles of the mandibles. Behind the antennæ are two structureless patches of pigment, the eye-spots.

The head is succeeded by the usual twelve segments. The first of these (prothorax) is at first sight double, being transversely divided by a well-marked fold. This is, however, merely a crease, and results from the frequent retraction of the head. The rudiments of the imaginal legs and wings show which are the real thoracic segments of the advanced larva.

The 6th, 7th, 8th, 9th, and 10th segments bear paired retractile processes, which resemble the pseudopods of caterpillars, and end in triple crowns of chitinous hooks. Beneath these are many regular rows of still smaller hooks, which form transverse rings. The terminal surface, enclosed by a circle of hooks, is inclined a little backwards in the two foremost pairs of pseudopods, a little forwards in the others. The pseudopods can be retracted completely by means of their attached muscles (fig. 13). Pseudopods of this sort (with much variety in details) occur in many creeping dipterous larvæ. In the tube-dwelling larvæ of *Chironomus* and *Tanypus* they are reduced to two pairs, *viz.*, a prothoracic and an anal pair,† while in certain terricolous (*Tipula*) or natatory (*Culex*) dipterous larvæ they disappear altogether.

The 12th segment bears three pairs of appendages,

* Eucephale Myggelarver, fig. 94, *c* (*Tanypus*).

† In tube-dwelling larvæ of *Tineina* the pseudopods may in like manner be reduced to insignificant rudiments.

all below the spiracles. The posterior pair are very long and tapering, and extend far beyond the rest of the body. Each encloses a good-sized trachea. On the under side of the same segment are two pairs of appendages, each consisting of a base and two joints. The anus opens between the anterior pair.

Such caudal appendages are usual in the larvæ of *Tipulidæ*, and occur also in some other Nemocera. I have to thank Baron Osten Sacken for the following remarks on this subject:—

"The caudal appendages of the larvæ of *Tipulidæ* which I have observed are of two kinds:—

"1. Processes *above* the stigmata. These are found in the larvæ of *Tipula*, *Pachyrrhina*, and of some (not all) of the *Ctenophoræ*.* There are usually two pairs, sometimes three. They can be contracted at pleasure, and when contracted they serve to protect the stigmata. They are often strengthened by small horny patches on the posterior side. The larva of *Dicranota* has no processes of this kind.

"2. Processes *below* the stigmata. These may be either in front of or behind the anus. In the monograph of 'North American Diptera,' iv., p. 7 (1869), I mentioned soft, digitiform, retractile processes, which I had noticed in some larvæ of an unknown North American Tipulid; they were inserted in three pairs in front of the anal aperture, and resembled those figured by Réaumur (vol. iv., pl. xiv., fig. iv.); later, in my studies on *Tipulidæ* (ii., p. 166, Berl. Ent. Zeit., 1887), I considered them as 'branchial appendages.' Your *Dicranota* larva also has three pairs of appendages, all of which, as you discovered, contain branching tracheæ. The difference lies in the fact that in your larva the two anterior pairs of appendages are jointed, and one pair is placed in front of the anus; while the third pair, placed some distance behind, is caudal."†

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* *C. pectinicornis* and *C. bimaculata* have them, but *C. atrata* (subgenus *Xiphura*) has not. (Studies on *Tipulidæ*, pt. i., p. 173.)

† "Since my publication of 1869 many descriptions and figures of larvæ of *Tipulidæ* have been published, which show a variety of appliances for breathing under water.

"In 1875 Grobben (Herzbildung von Ptychoptera, Sitz. d. Acad. d. Wiss., Bd. lxxii.) gave the name of tracheal gills ('kiementracheen') to a pair of appendages at the base of the breathing-tube of the larva of *Ptychoptera* (fig. 1, kt.).

The larva of *Dicranota* tends to confirm the view that the appendages of the last segment of Tipulid larvæ are branchial. Rather large tracheæ, breaking up into a crowd of fine branches, are distributed to the three pairs of appendages (fig. 25). These processes are at least as well supplied with tracheæ as the lateral appendages of the larva of *Sialis*, or *Bervsus*,* or the tail-plates of *Agrionidæ*, which are universally regarded as tracheal gills.

The fore part of the body of the larva is covered with fine close-set hairs, pointing backwards. These are more conspicuous than elsewhere along two broad bands which occupy most of the dorsal and ventral surfaces. On the intervening lateral bands the hairs become more scanty. Where the abdominal feet begin, in segment 6, the hairs become more scanty, and a narrow transverse patch of skin, which encloses each pair of pseudopods, is completely bare. The hairs are probably useful in locomotion.†

In many of its external features the larva of *Dicranota* resembles that of the nearly allied *Pedicia rivosa*, L. Both belong to the same section (*Amalopina*) of the *Tipulidæ brevipalpi*, and they are similar in size, colour,

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"Special attention should be bestowed upon the *plumed* appendages at the hinder end of the aquatic larva of *Elliptera omissa*, described by Mik (Wien. Ent. Zeits., 1886, p. 337, tab. vi., figs. 2—7); and to the apparently similar appendages of the aquatic larva of *Limnophila fascipennis*, described by Beling (Verh. Zool. Bot. Gesells., 1886, p. 197), and figured by Brauer in his Zweifl. Wien. Mus. (tab. i., fig. 6). Are these appendages gills? or are they merely adapted for holding a globule of air when the larva dives, as in the larvæ of *Stratiomyidæ*? A similar globule of air is figured by Fritz Müller at the fringed tail of a larva of *Psychoda* (Entomol. Nachrichten, 1888, p. 273).

"Among the larvæ figured by the older authors, that of *Phalacrocera replicata*, described by DeGeer (tom. vi., p. 351, pl. 20, fig. 5), is of special interest. It has long filaments, some of them forked, all over the body. 'The usually very exact DeGeer does not describe any stigmata,' says Schummel (Limnobia, p. 206). The larva has been found several times since, but, so far as I know, the nature of these filaments has never been investigated. Engel (Entomol. Nachrichten, 1884, p. 260) found it in a lake on old stems of *Ranunculus fluitans*, but he gives no further details. Grube (Jahresb. f. Vaterl. Kultur, 1867, p. 59) has a short description of it."—(Note by Baron Osten Sacken.)

* Schiödte, De Met. Eleuth., i., pl. v., fig. 13.

† Osten Sacken, *loc. cit.*, p. 6.

and habitat. The chief difference observed in comparing Beling's description of the larva of *Pedicia rivosa* with the larva of *Dicranota* was that the abdominal feet of *Pedicia* are said to be borne upon segments 8, 9, 10, and 11; while those of *Dicranota* are borne upon segments 6, 7, 8, 9, and 10. The pupa of *Pedicia* is said to be devoid of spines and hairs, while that of *Dicranota* has spiny plates upon the dorsal surface of the abdomen. No anatomical account of the larva or pupa of *Pedicia* is known to me.

The Larval Epidermis.

The cells of the epidermis form a single layer beneath the cuticle. Among these are set, at moderately regular intervals, much larger isolated cells, with striated protoplasm and enormous nuclei (giant-cells). Processes from these large cells pass through pore-canals in the cuticle (fig. 12).

The Nervous System of the Larva.

None of the ganglia lie in the head. The brain, with the subœsophageal and prothoracic ganglia, lies in the fore part of the mesothorax; the mesothoracic ganglion occupies the hinder part of the same segment; the metathoracic ganglion is in the middle of the metathorax, and the 1st abdominal in the fore part of the 1st abdominal segment.* There are seven more abdominal ganglia in segments 5, 6, 7, 8, 9, and 10. The two last ganglia lie close together in the 10th segment.

The Body-wall and Cœlom of the Larva.

The muscles of the body-wall are arranged in an outer annular and an inner longitudinal set. The annular muscles are very numerous, and may be attached to the cuticle at several points.

The fat-body consists of two crumpled semi-cylindrical sheets, which extend almost throughout the body, and

* This is the position of the ganglia when the head is retracted. A rather considerable shifting of the anterior ganglia is caused by the protraction or retraction of the head. The nerve-cord is very loosely attached and mobile. The limits of the prothorax are not easily ascertained by mere external inspection, as this segment is deeply constricted about the middle of its length. Observation of the places where the imaginal legs form is necessary to determine the thoracic segments with certainty.

surround the alimentary canal. They represent the inner or splanchnic layer of the *Chironomus* larva. A pair of large œnocytes* occurs about the middle of the dorsal surface of each segment, just beneath the skin. There are also visible here and there some large spherical bodies lying in the cœlom, of which I can give no account. The pericardial cells are described in connection with the heart.

The Alimentary Canal of the Larva.

The alimentary canal is a nearly straight tube of unequal diameter. It consists of a narrow œsophagus, a long and thick-walled stomach, and a narrow intestine. As usual, the œsophagus and intestine have a chitinous intima, which in each case is thrown into numerous and sharp longitudinal folds. The œsophagus extends from the mouth to the metathorax.† It is wide where it joins the mouth, but quickly narrows and forms henceforth a tube of nearly uniform calibre. A dilation, which is variable in position and probably temporary in duration, is often to be seen in the lower part of the œsophagus. The chitinous lining of the funnel-shaped commencement of the œsophagus is set with many small backward-pointing prominences. Further back the chitinous lining becomes folded to such an extent as almost to obliterate the cavity. The muscles are annular and close-set. In good transverse sections a thin epithelial layer with nuclei can be made out. The œsophagus bulges for a short distance into the stomach, its chitinous lining being distinguished plainly from the villous epithelium which succeeds. The stomach has a lemon-yellow colour. It extends from the metathorax to the 9th segment. Its diameter, which much exceeds that of either œsophagus or intestine, is greatest in front, gradually diminishing to a constriction two-thirds of the way along, and then slightly enlarging again. The narrowest part of the tube has only half the diameter of the widest. The longitudinal muscles become external

* Wielowiejski, Ueb. d. Blutgewebe d. Insekten, Zeits. f. Wiss. Zool., Bd. xliii.

† The contractions and relaxations of the muscles of the head and œsophagus may draw the junction of the œsophagus and stomach backwards or forwards more than the length of one segment from the normal position.

in the stomach; they are separated by spaces about equal to their own diameter. The annular muscles are internal and close-set.

The epithelium of the stomach exhibits a very different appearance, according to the degree of secretory activity. I have compared my preparations with the descriptions and figures of Balbiani* and Gehuchten,† which are important aids to the interpretation of the digestive epithelium of Arthropods. A prolonged experimental inquiry is still required for the complete elucidation of the subject, and this can only be carried on by a student well practised in delicate methods of physiological research. Meanwhile, I offer such notes as I have made on the digestive epithelium of the *Dicranota* larva.

The epithelium of the stomach is essentially a single layer of cells thrown into folds, which are very numerous and well marked in the anterior two-thirds, but subside towards the intestine. Indistinctness of the component cells often renders it hard to make out the folds. The cells are much narrowed at one or both ends, and closely applied to one another for the greater part of their length. The nucleus lies in the widest part of the cell, at any level from the base of the epithelium. A fasciculate arrangement of the cells, such as Balbiani describes in *Cryptops*,‡ is not uncommon (fig. 16).

The epithelium varies greatly as to its extension into the lumen of the tube. In some cases irregular extensions of the cells almost fill the cavity, especially at the cardiac end. When this happens, the boundaries of the cells become indistinct, or altogether invisible, and the protoplasm contains many rounded and highly refractive vesicles and granules (fig. 20). Transparent, granular prominences, such as those figured by Gehuchten§ in the "phase of active secretion," are sometimes abundant (figs. 15, 19).

Under some conditions there may be seen at the base of the epithelium of the stomach numerous large, nearly spherical cells (fig. 16), which resemble the mucous or

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* Etudes anatomiques et histologiques sur le tube digestif des Cryptops. Arch. de Zool. exp. et gén., 2e sér., tom. viii. (1890).

† Rech. histol. sur l'appareil digestif de la larve de la *Ptychoptera contaminata*, 1e partie. La Cellule, tom. vi. (1890).

‡ *Loc. cit.*, fig. 26.

§ *Loc. cit.*, figs. 67 to 92.

calyciform cells of authors,* but I have been unable to ascertain what becomes of them, or to throw light upon their function.

A striated seam now and then appears in fresh preparations, but does not occur in any of my sections.

Larvæ containing food in the stomach often show extremely copious filamentous masses, apparently formed by a coagulable fluid secretion (fig. 17). The filaments may lie side by side in long wavy bands, or may cohere into a dense mass enclosing fragments of food. Stronger filaments, apparently due to fusion of smaller ones, *seem* at times to issue from the sinuses of the folded epithelium. In some cases at least the epithelium shows a notable diminution of thickness when the filaments are abundant. I have not found the transparent vesicles abundant in any section which shows a plentiful filamentous substance. On the whole I am inclined to believe that the filaments originate in the salivary glands, and not in the stomach.

Undeveloped nucleated cells can be found towards the base of the epithelium, and I have seen several of the stages of development figured by Balbiani.†

The facts suggest that a digestive fluid is secreted by the cells, and accumulate in their interior as vesicles or drops; that it collects in the prominences upon the free ends of the cells; further, that during or after the period of discharge the cells contract and pass into a resting-stage.

The facts (1) that the stomach is often completely emptied; (2) that the epithelium varies greatly according to the phase of secretion, indicate that the larva of *Dicranota* is well adapted for the study of the secretory changes which take place in a digestive epithelium.

The origin of the filamentous masses is not perfectly cleared up. Certain facts, such as the *apparent* emergence of strands of filaments from the epithelial sinuses of the stomach, and the shrinkage of the epithelium when the filaments are abundant, have led me at times to suppose that they are secreted by the stomach. But the salivary glands contain a fluid which, when coagulated by alcohol, cannot be distinguished from the denser

* Balbiani, *loc. cit.*, p. 43, and authors there cited.

† *Loc. cit.*, fig. 30.

masses of the filamentous substance. Moreover, the salivary fluid is not known to be used for other than digestive purposes. While admitting that the point is not proved, I am inclined to believe that the filaments are secreted by the salivary glands, and that during the life of the larva they are semi-fluid.

At the junction of the œsophagus and the stomach the longitudinal fibres emerge from beneath the annular fibres of the œsophagus in the manner described by Balbiani.* The two epithelia come abruptly into contact without any transition (fig. 18).

Beyond the stomach the straight intestine extends to the anus; its wall is lined with longitudinally folded cuticle, and, except when food is passing, the cavity is obliterated. The longitudinal muscles are numerous in the intestine, and external to the annular muscles, as in the stomach. The intestinal epithelium contains comparatively few nuclei of unusually large size. Close to the anus the intestine dilates a little, and here the annular muscles become crowded. This section corresponds to the rectum of the fly, but is small, almost rudimentary, in the larva.

There is a pair of salivary glands of moderate size, filled with a clear fluid, coagulable by alcohol. The epithelium of these glands, as in the larvæ of *Musca*, *Chironomus*, and *Simulium*, is remarkable for its large nuclei. The paired salivary ducts unite behind the head to form a common duct, which opens into the mouth. I believe that the saliva has in this larva a purely digestive function; at least, I do not know that threads are ever emitted from the mouth. There are four long Malpighian tubules, given off, as usual, from the beginning of the intestine.

The straightness of the alimentary canal, and the absence of the large diverticulum found in the vegetable-feeding larvæ of *Tipula* and *Ctenophora*, are obvious adaptations to a carnivorous diet.

The Circulatory Organs of the Larva.

The dorsal vessel, enclosed in a wide pericardium, occupies the usual position, extending from the last segment to the brain.

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* *Loc. cit.*, p. 17.

The pericardium is irregularly quadrilateral in transverse section, especially in the hinder part of the body, where it attains its greatest diameter. Thirteen pairs of alary muscles are attached to it, *viz.*, two pairs to segments 5—10, both included, and one pair behind these. At the hinder end of the body an elliptical orifice, placed ventrally, admits blood from the body-cavity. Just in front of this the pericardium is attached to the intestine. The dorsal wall of the pericardium is also incomplete behind, and the blood, well aërated by the numerous tracheæ which supply the 12th segment and its appendages, may be seen to enter both above and below in a full stream. Extensions of the pericardial cavity occupy the bases of the alary muscles, and some, if not all, of these extensions lodge large cells in pairs. The pericardial wall consists of fibres, irregularly arranged but chiefly longitudinal, and overlaid by a multitude of small cells.

The hinder part of the dorsal vessel is of larger diameter than the rest, and exhibits one (or perhaps three) valvular inlets, but no distinct heart can be defined. At its extreme posterior end is a median inlet, flanked on each side by pocket or semilunar valves. A little further forwards, near the hinder end of the 10th segment behind the head, is a pair of ostia, or what look like them, though no blood corpuscles have been seen to enter here. The vessel is constricted at intervals, but shows no distinct chambers. Its wall consists largely of transverse fibres. In the œsophageal region a pair of ganglia are applied to the sides of the dorsal vessel, as in some other dipterous larvæ.

The blood is colourless; its corpuscles are numerous, minute, and elliptical.

The Respiratory Organs of the Larva.

The larva of *Dicranota*, like all other Tipulid larvæ, except that of *Trichocera*,* has only one pair of spiracles. These are situated upon two rounded prominences on the dorsal surface of the 12th segment, and look backwards and upwards. The structure of the spiracle is generally similar to that of some other dipterous larvæ (e. g., *Ctenophora*). The external orifice is surrounded

* Osten Sacken, *loc. cit.*, p. 5.

by a circular or slightly oval rim, composed of rather more than twenty scales. From this rim descends a cone or plug, with a thick and solid chitinous wall. Outside the cone is a chamber with a transparent chitinous wall, the vestibule. The cavity of the vestibule is crossed by many radiating and branched chitinous fibres, which spring from its outer wall. The stronger fibres are attached to the inner cone, but many of the smaller branches fail to reach it. There are no openings into the vestibule from without which I have been able to discover. Perhaps such exist, but I have looked for them in vain. The attached trachea leads from the lower end of the vestibule. A cylinder of epithelium, continuous with the tracheal epithelium at one end, and with the epidermis at the other, invests the outer surface of the vestibule. In the angle between this epithelium and the ordinary epidermis, I have found a zone of large cells forming a circular fold around the mouth of the spiracle. This closely resembles the rudiment of the anterior imaginal spiracle of *Musca*.* From the spiracles lead two good-sized tracheæ, which run along the dorsal surface of the body, giving off large branches to the body-wall and viscera. Segmentally arranged branches unite and give off ventral trunks, which supply the nerve-cord and other parts.

The larva comes occasionally to the surface of the mud to breathe, and thrusts out the hinder end of its body. As both spiracles and tracheal gills are carried upon the last segment or segments, it is of interest to notice that the larva projects its tail sometimes into air and sometimes into water. They may be seen lying for a considerable space of time in either condition without any sign of uneasiness. When submerged, an air-bubble can often be seen attached to each spiracle. If prevented from leaving the water, they can live a long time, perhaps indefinitely, without visible inconvenience.

It is, I think, instructive to compare the larva of *Dicranota*, with respect to its power of storing up oxygen, with the similarly situated *Chironomus* larva. Both are found in mud saturated with water, and so charged with decaying vegetable matter that it cannot

* *Cf.* Lowne on the Blow-fly, pt. i., fig. 11, 3 (1890).

be supposed to contain free oxygen. In each case the supply of oxygen can only be renewed with some difficulty. The *Chironomus* larva has a closed and rudimentary tracheal system, but abundance of hæmoglobin in its blood. The *Dicranota* larva has if not an open, at least an efficient, tracheal system distended with air, and no hæmoglobin in its blood.

The reproductive organs of the fly develop early, as in all Diptera Nemocera with whose life-history we are acquainted.* The testes lie in the 9th segment of the larva, and form elongate capsules, giving off, when sufficiently advanced, vasa deferentia from the inner side of the hinder end. No division of the testes into follicles is apparent. I have more than once found it filled with ripe spermatozoa mixed with spermatoblasts, and this in larvæ by no means ready for pupation. The vasa deferentia are received into glandular vesiculæ seminales, which open by distinct lateral outlets in the last segment.† The common ductus ejaculatorius of the fly does not exist in the larva. Invaginations of the external genital appendages of the male fly may be found upon the under side of the fore part of the last segment. In female larvæ the ovary may be found full of large polygonal multinucleate bodies, which probably represent the follicles of the ova (fig. 31). The oviduct is at first a solid cord, apparently ending free behind. The early development of the sexual products points to the necessity of laying fertilised eggs as soon as possible after the imago becomes free. In Lepidoptera (*Bombyx mori*)‡ and other insects, as well as in *Dicranota*, the spermatozoa have been observed to ripen during the larval stage.

The Pupa.

The pupa, as in other *Tipulidæ*, is provided with a pair of prothoracic respiratory trumpets. These expand towards the tip, and are flattened from before backwards. The margin is sharp-edged. Within each

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* Schneider (Zool. Beiträge, i., p. 260) goes so far as to say that this is the case with all male Diptera. With respect to the great majority of male Diptera, no information is as yet accessible.

† This has already been observed in dipterous larvæ. See Palmen's Paarige Ausführungsgänge d. Geschlechtsorgane bei Insecten, p. 20.

‡ H. Meyer, Zeits. f. wiss. Zool., Bd. i., p. 175.

respiratory trumpet lies an expanded trachea, which fits loosely to the chitinous integument, except along the external, the superior, and part of the internal margin, where the two structures blend. Along the junction is a regular row of small oval apertures. These are so small, and it is so difficult to see them except through a layer of cuticle, that I have been unable to decide whether or not there is a transparent membrane across each aperture. However this may be, the openings no doubt serve for the admission of air to the trachea. Even if they are completely pervious, their minute size must constitute an effective provision against the entrance of water or dirt.

The hinder end of the abdomen of the pupa is moulded upon the corresponding segments of the imago, and indicates the sexual modifications. The female pupa is distinguished at once by the long, triangular valves of the ovipositor. On the dorsal surface are a number of roughened plates. These are armed with rather strong and dense spines. The first two abdominal segments have no such plates; the 3rd has a single plate in the fore part of the segment, the lateral extremities being most spiny; the 4th has two plates, anterior and posterior, most spiny laterally; the 5th and 6th are similar, but here the median part of the plates is the most spiny; the 7th segment bears only one plate, the lateral extremities being the most spiny. The remaining segments have no spiny plates, being modified for reproductive functions. A similar provision of spines upon the pupal integument, usually taking, as in this case, the form of incomplete rings, is so common among insects as hardly to require exemplification. Every entomologist will recollect the spiny rings of the pupæ of the Clear-wings, the Goat-moth, the Wood-leopard, and the Swifts. Very many dipterous pupæ (*Tipula*, *Limnobia*, *Bibio*, &c.) offer examples of the same contrivance. The roughening of the mobile abdomen in such cases gives it a sufficient hold of the wood or earth in which the pupa lies to enable the insect to creep to the surface before the final change takes place, thus avoiding the damage to gauzy or plumed wings, which would inevitably result if the moth or fly emerged in the narrow gallery, or below the surface of the ground.

Five pairs of fleshy pseudopods project from the ven-

tral surface of the pupa. These are used to assist the movements of the pupa through the mud. They are not unlike the pseudopods of the larva, but bear no hooks; they are carried on corresponding segments. I find that a pupa extracted from its burrow and laid upon damp mud readily travels about, and in no long time establishes itself in a convenient position just beneath the surface.

As in many other aquatic Diptera, the pupa is notably smaller than the larva. In *Dicranota* it is only $\frac{3}{8}$ in. long, about half the length of the larva.

The Fly.

I have only slightly examined the anatomy of the fly. The alimentary canal is less voluminous than in the larva, and most of the abdomen is occupied by the reproductive organs. The large gluten-glands of the female lead me to suppose that the eggs are enveloped in a slimy mass or egg-rope, and laid in water.

Development of the Fly.

As usual in Diptera, the external organs of the fly first become discernible in the larva, and originate in invaginations of the larval epidermis. I have observed nothing unusual in the development of the wings and legs. The invaginations for the imaginal head form on each side of the median septum of the larval head (see p. 238), and extend downwards around the œsophagus. From these primary folds secondary invaginations for the mouth-parts are given off. The rudiments of the compound eyes form close to the septum, but on the outer wall of the invagination; the rudiments of the imaginal antennæ are behind them. The arrangements of the cephalic invaginations is considerably simpler in *Dicranota* than in *Chironomus*.* There is no folding-in of the larval epidermis at the junction of the head and thorax, and the invaginations extend backwards only for a short distance beyond the larval head.

I have to thank my friend Mr. Hammond, of the Linnean Society, for making a number of drawings for

* Miall and Hammond, Linn. Trans., 2nd series, vol. v., 1892.

this paper, some from my own preparations, others from living larvæ. Mr. Hammond has also revised most of my statements, correcting errors, and adding further particulars. The account of the pericardium and dorsal vessel is mainly taken from his notes. Mr. Norman Walker, Assistant in the Biological Department of the Yorkshire College, has been most zealous in procuring specimens and cutting microscopic sections.

Explanation of Plates X., XI., XII. & XIII.

(Figs. 1—31 relate to the larva.)

PLATE X.

Fig. 1.—Larva of *Dicranota*, ventral aspect, × 8. The numerals indicate the numbers of the body segments, exclusive of the head.

Fig. 2.—Head, dorsal view. *at*, antenna; *oc*, eye-spot; *s*, median chitinous septum; *mn*, mandible; *mxp*, maxillary palp; *lbr*, labrum. × 50.

Fig. 3.—Head, ventral view. *sm*, submentum; *mt*, mentum; *pr*, prothoracic integument enclosing the posterior half of the head; *or*, cephalo-thoracic orifice occupying the posterior ventral surface of the head. × 50.

Fig. 4.—Mandible, × 150.

Fig. 5.—Maxillary palp, × 150.

Fig. 6.—Setæ from external cuticle, × 200.

Fig. 7.—A pseudopod, with the terminal circles of hooks, × 50.

7 *a*. Detached hooks, one from each circle, × 300.

Fig. 8. Head retracted, × 50.

Fig. 9.—Twelfth segment, dorsal view, showing the spiracles, × 25.

Fig. 10.—Twelfth segment, ventral view, showing the branchial appendages, × 25.

Fig. 11.—Alimentary canal. *œs*, œsophagus; *sg*, salivary gland *st*, stomach; *Mp*, Malpighian tubules; *i*, intestine

PLATE XI.

Fig. 12.—Giant-cell of epidermis, perhaps a unicellular mucous gland ; *n*, nucleus ; *p*, elongate process, passing through the cuticle. × 350.

Fig. 13.—Pseudopods in section, with their attached muscles. *a*, extended ; *b*, retracted. × 20.

Fig. 14.—Transverse section through prothorax and retracted head. The wall of the prothorax shows the cuticle, a number of giant-cells, and annular muscles with multiple insertions. In the middle of the section is the larval head, with its muscles and median chitinous septum. *œs*, œsophagus ; *sd*, salivary duct ; *am*, annular muscles ; *ii*, their insertions ; *gc*, giant-cells ; *cs*, chitinous median septem ; *o*, *r*, the cephalo-thoracic orifice extends between these two points. The epidermis, with the exception of the giant-cells, is too delicate to be shown in this drawing.

Fig. 15. — Part of wall of stomach, showing external longitudinal and internal annular muscles. The epithelium is granular, and partly withdrawn from the muscular layer. A number of vesicles or transparent prominences appear along the free border. × 200.

Fig. 16.—Epithelium from fore end of stomach, showing folds or fasciculi. The large spherical cells towards the base of the epithelium are perhaps mucous cells, but I have no certain information as to their function (see p. 243). × 200.

Fig. 17.—Epithelium of stomach, moderately folded on one side, and slightly on the other. The lumen is filled with filamentous substance. × 80.

Fig. 18.—Junction of œsophagus and stomach in longitudinal section. *œs*, œsophagus, with its epithelium and chitinous lining, *c* ; *tr*, transverse or annular muscles of œsophagus ; *b*, *b*, blood-spaces of Gehuchten ; *lm*, longitudinal muscles of stomach ; when these are followed from section to section they are found to emerge from beneath the annular muscles of the œsophagus. Observe the abrupt change from the œsophageal epithelium to that of the stomach. × 200.

Fig. 19.—Isolated epithelial cells of stomach, with transparent prominences (phase of active secretion). × 350.

Fig. 20.—Granular epithelium, with minute vesicles. The cell-walls are not visible. × 350.

PLATE XII.

Fig. 21.—Spiracle of larva in side view, as transparent object. × 100.

Fig. 22.—Do., in longitudinal section. *f*, fold of epithelium surrounding the mouth of the spiracle. × 100.

Fig. 23.—Surface view of spiracle. × 100.

Fig. 24.—Fore part of body, showing part of retracted head, *h*; the brain, *b*, and anterior ganglia, the salivary glands, *sg*, and their ducts, and the tracheæ. × 20.

Fig. 25.—Hind part of body, showing the tracheæ distributed to the branchial appendages and their connection with the spiracles. × 20.

Fig. 26.—Posterior end of dorsal vessel and pericardium from beneath. The elliptical ventral opening, *vo*, in the pericardial wall is seen towards the bottom of the figure. Upon the inner outline, which is that of the heart, can be seen the terminal inlet, with its pocket valves, *pv*, and further forward a constriction, which possibly conceals a pair of ostia. The spiracles and longitudinal tracheal trunks appear on each side of the pericardium; *al*, alary muscle. × 50.

Fig. 27.—Part of fore end of dorsal vessel, with pericardial cells attached. × 100.

PLATE XIII.

Fig. 28.—Dorsal vessel and pericardium, general view. *br*, brain. × 8.

Fig. 29.—Do., in side view, with outline of body, × 8. The pericardium is seen to be attached to the intestine at the point *x*.

Fig. 30.—Nervous system of larva. The head is considerably retracted. × 5.

Fig. 31.—Part of ovary of female larva in longitudinal section, showing the multinucleate follicles of the ova. *od*, oviduct. × 350.

Fig. 32.—Pupa, side view. The dorsal abdominal plates should all be shifted one segment further back. They are actually carried on the same segments as the pseudopods. × 6.

Fig. 35.—Pupa, ventral view. × 6.

Fig. 34.—Respiratory trumpet of pupa, in section. At *a* the pores for admission of air are shown in surface view. × 50.

Fig. 35.—Transverse section through respiratory trumpet, passing through a pore (diagrammatic). The cuticle and tracheal lining are detached, except in the neighbourhood of the pores.

XVII. *On a lepidopterous pupa* (Micropteryx purpurella) *with functionally active mandibles.* By Dr. Thomas Algernon Chapman, M.D., F.E.S.

[Read May 10th, 1893.]

Thirty years ago Mr. Stainton exhibited the pupa of *Micropteryx* (*purpurella ?*) to this Society, and figured it in the 'Entomologist's Annual.' His description of it is very good, and I believe absolutely correct so far as it goes. The paragraph that is most vague says :—"Below the eyes and above the palpi appears a brown knob, which may possibly represent the tongue; it bears numerous bristles; immediately beneath it are two large brown projections, the use of which I am utterly at a loss to conjecture; they expand towards the tips, which are scalloped obliquely."

Since this date nothing of importance has appeared on the subject, so far as I can ascertain. Mr. Charles Healy describes the emergence in the 'Entomologist's Monthly Magazine,' first number, p. 20; yet, though a minute and careful observer, he appears to have failed to note the use of the jaws in emergence, and no doubt many entomologists have made observations such as my friend Dr. Wood has often repeated to me, that the empty pupa-case lies on the surface of the soil after the moth has emerged, and is a curious bit of shrivelled membrane not at all like a pupa-case. But no one appears to have arrived at the surely very obvious conclusion, that the "two large brown projections" of Stainton are the mandibles, still less to have observed the use made of them by the pupa.

That a lepidopterous pupa should have jaws, in other than the obsolete form in which all (?) lepidopterous pupæ have them, is remarkable enough. That they should be of such immense size proportionately to the insect, and should be functionally active, seems at first sight incredible, though the still more remarkable fact

remains, that active and powerful as they are, there are no visible means of working them, as they are pupal structures, used only immediately before the emergence of the imago, and have no corresponding imaginal parts attached to them. Yet all this may be easily observed by anyone who will get the necessary material,—by no means difficult to do,—and take the trouble to watch it from 6 to 7 a.m.

The pupa has all its appendages apparently quite separate and unfused together in any way, and the abdomen is thus not only unattached to legs and wings, but preserves freedom of movement in all its segments. The head and thoracic segments are equally free to move on each other, and do so, especially the head, during emergence. Yet, when the pupa is quiescent, *i. e.*, removed from its cocoon some time before emergence, it does not move these segments when irritated, but only the abdominal ones.

The toughness and density of the cocoon, and the great delicacy of the pupal skin, are remarkable, and probably bear such a relationship to each other that the one may be said to compensate for the other. The only portions of the pupa-skin at all solid are the labrum (Stainton's brown knob), which carries six long hairs on either side, and the jaws and an oval hoop, to which they are articulated.

The front of the head carries two long hairs on either side (the antenna-basal hairs that occur throughout so large (all?) a number of Heterocerous pupæ). The antennæ cross the prothorax in a free loop, and pass downwards into the usual position between the wings and legs, but being quite unfixed or fixed by mere contact, and not by fusion of surface even in the slightest degree, it happens (as Stainton found in his specimens) that one or both antenna have not unfrequently a position on the wing or over the legs.

The brown knob or labrum, with its six long bristles on either side, is a large solid piece, containing no imaginal structure, but doubtless serving by its hairs as a tactile organ during the exit of the pupa, and by its solidity assisting the action of the jaws, probably both as a solid base to act from and as attaching the parts to the imago. Beneath these are the jaws, great curved organs, proceeding first directly forwards, then by a

sweep of a quarter of a circle becoming directed to the other side, and, crossing the jaw of the other side, proceeding transversely till the extremity projects rather beyond the margin of the opposite side of the pupa; the shaft is enlarged at either end, proximally with three projections or knobs for articulation; at the other end into a large truncate knob, the margins of whose flat extremity are armed with three or four large teeth, and many smaller ones, reminding one in appearance, as they certainly resemble in function, the fore paws of a *Gryllotalpa* or *Cicada* pupa. The inner margin of the shaft is armed by a row of nine or ten teeth, flat, sharp, and leaflet-like.

The maxillæ are very inconspicuous, but carry the very large maxillary palpi, which pass directly outwards transversely to the margin of the pupa, and then return to the centre line, the returning portion ventral, and perhaps a little posterior to the outward half. It appears to be quite free throughout its length, but is not moved during pupal existence. The position is the same as in Heterocerous pupæ that possess it, but in them it is closed in by the neighbouring parts, except the front of the terminal segments.

The labial palpi are large organs, passing forwards when the head is raised at an angle to each other of 70° or 80°, and reaching quite in front of the jaws (when closed), and used apparently as tactile agents during emergence; but that they actually possess any freedom of movement of their own, I am not inclined to believe.

The legs and wings lie in much the usual positions that these parts occupy in other pupæ, but with the less definiteness due to the fact that they are not fused together, and any of them may be lifted away from the others, though the insect itself is unable to do so, except during emergence, when certain distortions, due to the partial withdrawal of the parts, occur.

The side of each abdominal segment has a long hair, nearly as long as the diameter of the pupa, and there are shorter ones dorsally.

When the pupa is ready for emergence, the head of the imago, the chitinous plates of the thorax, and the legs and wings, become black. The plates of the abdomen remain nearly colourless, as do the membranes between the thoracic plates. It is worthy of note that the

1st abdominal segment in this matter declares itself to be truly a 4th thoracic segment, presenting similar chitinous plates to those on the 3rd thoracic, though rather smaller, and with more intermediate membrane, and not at all like the simple colourless plate of the 2nd and following abdominal segments.

The oval hoop that carries the jaws, and is so obvious in the cast pupa-skin, is not very evident before emergence; it appears to have several oblique bars, but its actual form is difficult to fully grasp, and without figures hopeless to describe to any purpose.

It may be well to mention that *purpurella* only spends some five or six weeks above ground as imago, ovum, and larva; the rest of the year is spent buried in the soil, chiefly as a resting larva, and for a few weeks as a pupa. To insure its safety, it buries itself deeply, and spins a cocoon of remarkable strength for so small an insect. The depth is probably usually $\frac{1}{2}$ in. to 2 in., but 8 in. to 10 in. are reported by persons who have reared them, but probably supplied them with light open soil; this is proportionally as though, say *Acherontia atropos*, were to go down 15 or 20 ft. It is to enable it to escape from this hard cocoon and the superincumbent earth that the active jaws come into use.

I ought not to omit to state the comparative size of the mandibles, which is great, so as to be comparable with, say, those of *Lucanus cervus* ♂, rather than with those of any lepidopterous larva; the length of the pupa is about 4 mm., its greatest width about 1·3, the width of the head about 0·9, whilst the length of each mandible is about 0·7 mm.

When in the cocoon the empty larva-skin is tucked away under the extremities of the leg and wing-cases, and between them and the abdominal segments. In the curved attitude of the pupa in the cocoon there is certainly more room for it here than elsewhere, and so it probably gets here rather readily by the movements of the pupa.

Micropteryx purpurella emerges about 6 to 7 a.m., and on the mornings of March 10th, 11th, and 12th, and on several occasions afterwards, I had the pleasure of observing some specimens do so. I had sorted out the cocoons from the sand in which they had been made, and had them lying loose in a jar on the surface of some

damp sand. The first thing to be seen was some movement at one end of the little cocoon, and on picking it out and observing it through a glass, though they are not so small as to prevent a good deal being seen without artificial aid, there is observed to be a rather ragged hole in the end of the cocoon, and the jaws of the pupa are seen actively opening and closing; by the time the cocoon is spotted and taken out, the opening of the cocoon is practically finished, and the head of the pupa very shortly emerges. The pupa now rests a little, and then again elevates the head and works the jaws, the object being in all probability one that is, under the circumstances, unnecessary, *viz.*, to make its way through the earth above the cocoon. In raising the head the face is lifted right away from the front of the pupa, and is directed very much forward, and moves from side to side with both an angular and rotatory movement, and seems indeed to be as free to move as the head of a *Carabus* or an earwig; the jaws work to and fro, opening till they can pass each other and shutting again, sometimes with the right one in front of the left, sometimes with the left in front. The maxillary palpi lie just behind them, folded back closely, quite inert, in the ordinary position they occupy in the "incomplete" pupa; but the labial palpi are strongly porrected, and perhaps move to some extent, and seem at least to be in active use, no doubt to guide the action of the jaws in some degree. The long hairs of the vertex and labrum are also, no doubt, of much use for this purpose.

Following, or rather along with, this action of the head and jaws, the pupa further protrudes from the cocoon, the next stage setting free the prothoracic or first pair of legs, that is, the pupa is half out of the cocoon and the first pair of legs are clear of it to their extremities, and it is now seen that they are not adherent to any other part of the pupa; the prothorax, with its legs, being freely movable on the head at one side, and on the mesothorax on the other, but the legs are fixed in their own cases, in the flexed attitude common to pupal legs, and do not move either in their own joints or on the prothorax. It results, that the stiff and imprisoned legs, in some of the movements, are raised to an angle of 90° from their position of pupal rest, and instead of resting down against the other appendages,

are pointed directly forwards. In the movements of the head it is now seen that the antennæ form a great free loop across the prothorax, and are indeed but slightly attached to the wings, and some become free there also, forming no impediment whatever to the movements of the head. In different individuals there is a variety as to whether the pupa shall rest here for its further emergence, a few doing so; a further, rather larger, number progress a little more, and emerge with a few abdominal segments still within the cocoon, but the majority free themselves entirely from the cocoon before progressing any more. Still, the movement by which they leave the cocoon is much the same in character, if not, indeed, the actual exertion, by which the moth emerges from the pupa-case, which up to the present is unbroken. At this point again a rest is often taken, the rests corresponding, no doubt, with the emergence of the pupa, first from its cocoon, and secondly from the overlying earth.

The pupa is now, in most instances, in full view, and one recognises at once that the movements that are now taking place, and those we have so far been watching, are very unlike those we are used to in seeing a moth or butterfly emerge from the pupa, not so much in themselves as in the participation in them of the pupal skin, and resemble much more the moulting of a larval skin, the pupal skin partaking of the movement of the contained moth as the larval skin does, and even the 2nd and 3rd thoracic segments bearing the wings have a certain amount of movement on each other. The prothoracic pupal skin becomes widely stretched as the movements of the moth forces a larger bulk into the head, and the first legs show the front of the pupa to be stretched, and they take up the porrected attitude already described. In the meantime the abdomen has been progressing in its pupal skin, which is here very flimsy, the tracheæ are seen drawn out of the spiracles, and passing forwards from the spiracles of the pupal skin to those of the moth, and a portion of pupal skin is empty and shrivelled at the anal extremity.

The pupal skin now splits down the back of the thorax, sundry long thoracic hairs protruding. Except the head, wings, legs, and some thoracic plates, the moth is still white and colourless, and the hairs clothing the

abdomen, though dark, seem very sparse. The splitting of the pupa allows the head and 1st thoracic segment very shortly to assume a more normal attitude, but during this period the prothorax of the moth is stretched so as to show its still very larval structure, *viz.*, it is largely white, colourless membrane, the spiracle with the tracheæ drawing out of it is very distinct, close to this is a not much larger rounded tubercle (supra spiracular ?), carrying a bundle of long hairs, and dorsally a narrow plate (as usual on larvæ), also carrying long hairs.

The splitting of the pupa-case takes place along the dorsum of the 1st and 2nd thoracic segments, and slightly encroaches on the head ; it does not, however, affect the 3rd thoracic segment, nor apparently does any lateral branching of the opening occur. The curious sausage-like rolls of the 3rd and 4th (1st abdominal) thoracic segments lie flattened and empty, as does also the curious wattle of similar structure that projects over the face. My first idea of the use of these, that they formed a sort of elastic cushion or base, by which the pressure necessary to open the cocoon was conveyed, protecting the moth to some extent from it, seems therefore to be unfounded. As soon as the real emergence of the moth from the pupa begins, and the first indication of this is the sliding of the abdominal pupal pellicle backwards, all movement of the jaws ceases.

The emergence of the moth takes place by the usual vermicular movements. When it has partially occurred the legs, being actually quite free from each other, look curiously dislocated, the pupal legs (or rather leg-cases) being displaced by the partially extracted imaginal legs. The expansion of the wings takes place *pari passu* with the emergence, and it often happens that the wings are fully expanded, except their extreme tips, whilst these tips are still included in the pupal wing-cases ; and whilst it seems to be normal for the wings to be freed before the abdomen completely escapes from the pupa, it often happens that the abdomen is first free, and is then curled round and used to shove off the pupal case from the wings. As soon as the moth is free from the pupal skin, the wings are practically fully expanded, but the moth crawls to a position suitable for hanging its wings backwards, as moths do as soon as the wings

are expanded, and this it immediately does for a brief period.

In working the jaws, the pupa moves its head up and down to the right and to the left, and with also some oblique twisting motion; the action of the jaws suggests some energy. Their movements and their size relative to the pupa might be illustrated by likening them to a man's arm crossed over his chest, as their position of rest, and (the elbows being stiff) the arms are then to be opened till they can be crossed again with the upper one undermost, very much the movement of a cabman warming his fingers, though less rapid. The hands are not relatively large enough to represent the expanded digging extremities of the jaws, whilst the fingers are too long for the teeth with which they are armed; so that the illustration must not be pushed too much into detail.

When the pupa is reposing after breaking through the cocoon, the lightest touch by a needle-point either of the jaws, the labial palpi, or the long hairs of the head or labrum, at once causes them to work, one might say most intelligently, with the obvious object of breaking down some impediment in front, the head reaching in turn as far forwards and as far to either side as possible. I ought to note that of the points arming the end of the jaw, one, the largest, is quite curved into hook form, pointing backwards, and seems specially designed for gripping and tearing the cocoon.

How are these jaws worked? They and the corneous labrum in front of them are empty of any imaginal parts, and with the corneous ring-like base to which they are articulated, they are cast with the pupal skin a few minutes after they have been used; nor does the imaginal head contain any muscles adequate to move them with the force they display; nor does it present anything I can recognise as jaws, though there are some papillæ that probably represent them.

In the imago examined as soon as the head is free, there is a white smooth area above the maxillæ and between the eyes, which becomes afterwards darker and difficult to find, and, I believe, becomes smaller. This area is therefore probably expanded during emergence, much as the forehead of some *Muscidæ* is (*Musca*, *Exorista*, &c.), and I can imagine no way in which the

jaws can be worked than by fluid pressure acting in some way on their bases or on their contents, either by the contraction and expansion of this area, or of fluid acting through the mouth and imprisoned by the pressure of this area against the chitinous ring.

Walter (Jenaische Zeitschrift, 1885, p. 760) describes certain chitinous ridges as representing the jaws in the imago of *Micropteryx*, partly led thereto by the analogy of *Eriocephala*, and partly, no doubt, by the fact that a chitinous ridge in this situation is a jaw, if it is any true mouth-part; and I am not prepared to say that he is in error in doing so; whilst my own observations were not made with sufficient accuracy, owing, I think, as much to my own inexperience in such matters as to the inherent difficulties attending them; but it appeared to me that these chitinous ridges were rather borders to the pale soft area already referred to, and formed a margin into which the hard ring carrying the jaws was fitted.

The whole question, however, of how these jaws are worked will form an interesting research for some micro-anatomist. I fear my own training leaves me unequal to carrying the matter much farther. I am, however, thoroughly satisfied on two points—1st, that there are no muscles attached to these jaws; 2nd, that there are no imaginal jaws within them, whose movements compel those of the pupal ones.

If we are to accept, as I suppose we must, these creatures as veritable Lepidoptera, then the whole character of the pupa, as especially displayed in the emergence of the moth and the character of the moth itself at that epoch, are only slightly less remarkable than is the possession of active jaws.

The pupal case, except portions of the head, and the wing and leg cases, is very soft and delicate, and shrivels up as the moth emerges, much as a larval skin does; no joint even of the limbs seems quite soldered, but those of the segmental incisions are quite as freely movable as in a larva, and the intersegmental membrane is, notably on the prothorax, stretched by the moth inside pressing forwards, just as a larval skin is; and similarly the first indication that emergence has made any progress is the appearance of some shrivelled empty pupal skin at the anal extremity, and the shrivelling up

of the whole pupa-case after the moth has emerged, as well as the splitting for dehiscence being only one dorsal slit, are quite parallel with larval ecdysis, not with pupal, anywhere else in Lepidoptera to which my knowledge extends. The moth itself also, as regards much of the integument, especially the chitinous plates of the abdomen, is white and colourless till after emergence. In all these respects the analogy is much closer with Coleoptera than with the mass of Lepidoptera.

I must call attention to an error of nomenclature into which I have fallen, having applied the names *Micropteryx* and *Eriocephala* in precisely the reverse way to their proper meanings. *Micropteryx* is the name for the subject of these remarks—*purpurella*, and the *purpurella* group, the "Higher" *Micropteryges* of Walter and others —the tree-feeders, leaf-miners, and leaf-piercers—jawless as imagines, but not as pupæ. *Eriocephala* is the name for the *Calthella* group, the "Lower" *Micropteryges* of Walter—the pollen eaters, with simple ovipositors and active jaws (as imagines); the larvæ moss-feeders, with twenty-two legs. The names are so applied in Stainton's monograph.

I may here call attention to an error into which I fell in my recent paper on pupa, *viz.*, as to the pupæ of *Pyrales*. I stated these to be without maxillary palpi; I find, however, that they exist in not a few *Pyrale* pupæ; and further, that of the non-Macro section of the *Obtectæ* most groups have one or more characters that are more developed in and more diagnostic of the *Incompletæ;* such as the possession of maxillary palpi, of a pre-prothoracic element, and even in having the glazed eye attached to this on dehiscence in rare instances.

I am indebted to my friends Mr. Bankes and Mr. Tutt for the information that the pupa of *Endromis versicolor* emerges from its cocoon before the escape of the moth. As Mr. Bankes hopes to further investigate this curious instance of an "Incomplete" habit resorted to by a Macro, I will content myself with this mere mention of the habit.

I notice also that Scudder states that the pupæ of the Sphingid genus *Macrosila* emerge from the earth for the escape of the moth, using for the purpose certain flanges in the spiracular region. These exceptions (by reversion?) require a modification of my statement that no

Macro pupa possesses this habit, though certain details, both of structure and habit, differentiate these cases of Macros from the ordinary habit of *Incompletæ*. Mr. J. E. Robson also calls my attention to the habit of the pupa of *Lasiocampa rubi* of travelling up and down in its cocoon in order to make the most of available sunshine.

All these cases seem to me to be re-acquirements, by Macros that had long lost them, of the primæval habit of *Incompletæ*.

I have observed in some Macros a structural point, giving strong confirmation to the idea that the Macros are a much younger form than the Micros. In some species the male pupa has a more marked incision between the 7th and 8th abdominal segments than the female has, even at times looking as if this articulation admitted of movement. This is never the case, but it appears to prove unquestionably an ancestry with the 7th segment "free" in the male to a later period than in the female.

XVIII. *A list of the Lepidoptera of the Khasia Hills.* Part I. By Colonel Charles Swinhoe, M.A., F.L.S., &c.

[Read March 29th, 1893.]

For the past three years I have received monthly consignments of Lepidoptera from the Khasia Hills, captured by the native collectors of the Rev. Walter A. Hamilton, and, as he employs several collectors, this list ought to be fairly complete, and I have thought it worthy of publication, because there seem to have been fewer Lepidoptera recorded from the Khasia Hills than from almost any other locality in India.

The new species in the Rhopalocera are, as might be expected, but few; in the Heterocera there are very many. I have followed Moore's classification in the *Euplœinæ* and *Satyrinæ*, de Nicéville's in the *Nymphalinæ* and *Lycænidæ*, and Watson's classification of the *Hesperidæ* (P. Z. S., 1893, p. 3), to whom I have submitted all my new species of *Hesperidæ* for examination, being the latest classification recognised by Indian lepidopterists. In the *Pierinæ* (which are very limited), and the *Papilioninæ*, I have followed the arrangement in my own museum. In the Heterocera, I have followed Hampson's classification of the Sphinges, Bombyces, Noctues, and Deltoides, and Meyrick's classification of the Geometers and Pyrales, altering the order in which they run to suit the present knowledge of the subject.

Part I. RHOPALOCERA.

Family NYMPHALIDÆ.

Subfamily LIMNAINÆ.

Genus Tirumala, *Moore*.

1. *Tirumala limniace* (Cram.), Pap. Exot., i., pl. 59, f. D, E (1775).

2. *Tirumala septentrionis* (Butler), Ent. Mo. Mag., xi., p. 163 (1874).

Genus Limnas, *Hübn.*

3. *Limnas chrysippus* (Linn.), Syst. Nat., p. 471 (1758).

Genus Salaturia, *Moore.*

4. *Salaturia genutia* (Cram.), Pap. Exot., iii., pl. 206, f. c, d (1779).

Genus Parantica, *Moore.*

5. *Parantica melanoides*, Moore, P. Z. S., 1883, p. 247.

Genus Caduga, *Moore.*

6. *Caduga melaneus* (Cram.), Pap. Exot., i., pl. 30, f. d (1775).

7. *Caduga tytia* (Gray), Lep. Ins. Nepal, p. 9, pl. 9, f. 2, ♂ (1833).

Subfamily EUPLŒINÆ.

Genus Crastia, *Hübn.*

8. *Crastia core* (Cram.), Pap. Exot., iii., pl. 266, f. e, f, ♂ (1780).

Genus Penoa, *Moore.*

9. *Penoa alcathoë* (Godart), Enc. Méth., ix., p. 178 (1819).

10. *Penoa deione* (Westwood), Cab. Or. Ent., p. 76, pl. 37, f. 3 (1848).

Common. Some of the examples received have the apical portions of the fore wings streaked with pale lilac-blue, as in the mimetic form of the black female of *Euripus halitherses*, which also appears to be common in the Khasia Hills, and which is a very perfect mimic of *E. deione*.

This form of ♀ *E. halitherses* I have also from Sikkim, but the Sikkim forms of *P. deione*, in so far as I have seen, never have these streaks, a character which is very interesting, and probably ancestral, having lasted in the mimic longer than in the protected insect.

Genus Trepsichrois, *Hübn.*

11. *Trepsichrois linnæi*, Moore, P. Z. S., 1883, p. 286, pl. 29, f. 4, ♀; pl. 30, f. 1, ♂.

Genus Danisepa, *Moore.*

12. *Danisepa rhadamanthus* (Fabr.), Ent. Syst., iii., p. 42, ♂ (1793).

Genus Pademma, *Moore.*

13. *Pademma klugi* (Moore), Cat. Lep. E. I. C., i., p. 130, ♂ ♀ (1857).

Var. *angusta*, Moore, P. Z. S., 1883, p. 306.
Var. *imperialis*, Moore, *l. c.*, p. 307.
Var. *regalis*, Moore, *l. c.*

14. *Pademma hamiltoni*, var. nov.

♂. Black. Fore wings shot with brilliant blue throughout; a row of white spots near the outer margin, sometimes complete, and sometimes only four or five in the upper portion of the wing; a row of double smaller spots close to the margin, always complete, the two rows of spots sometimes white, and sometimes tinged with blue. Hind wings black, with two similar rows of single spots, the inner row larger than the outer row, and more or less elongate. Interior portions of both wings without spots. Expanse of wings, $3\frac{6}{10}$ in.

Many examples received. No doubt only a varietal form of *P. klugi*, but apparently a constant form with very little variation.

15. *Pademma crassa* (Butler), P. Z. S., 1866, p. 278.

16. *Pademma uniformis*, Moore, P. Z. S., 1883, p. 308.

Genus Isamia, *Moore.*

17. *Isamia splendens*, Butler, P. Z. S., 1886, p. 272, ♂.

Genus Stictoplœa, *Butler.*

18. *Stictoplœa binotata*, Butler, Journ. Linn. Soc. Lond., Zool., xiv., p. 302 (1878).

Very common. In Trans. Ent. Soc., 1892, p. 247, Mr. L. de Nicéville sinks this species into a synonymn of *S. harrisii*, Felder, and states that he has

received *S. harrisii*, *S. binotata*, *S. regina*, *S. crowleyi*, and *S. hopei*, all from the Khasia Hills, from the Rev. W. A. Hamilton, and makes some uncalled-for remarks about stay-at-home naturalists, because Mr. Moore has (very properly I and many others consider) given names to these extremely rare forms.

It is the old senseless dispute as to what is a species and what is a variety. When any one describes a new insect he has to give it a name *for the sake of convenience;* in writing this I quote Mr. de Nicéville's own words in naming a varietal form of the female of *Euripus halitherses* (see p. 20, vol. ii., Butt. of India). It is impossible to know whether the insect is a new species, or a new variety, or a new local form; the letters n. sp. are used for want of a better term. Let Mr. de Nicéville invent a new term, and no doubt it will be readily adopted.

As the Rev. W. A. Hamilton had been collecting for me for the past two years, I wrote and asked why I had not received from him any of the forms referred to, and in reply he states:—" My collectors sent me about three hundred *Euplœas*. I sent them to Mr. de Nicéville to name them for me, and to keep what he wanted; he kept twenty or thirty, and returned the rest to me; they are all *Euplœa binotata;* the supply is unlimited."

I think if Mr. de Nicéville had written that out of three hundred *S. binotata* received by him from the Rev. W. A. Hamilton he got the seven or eight specimens exhibited when his paper was read at the Society's meeting, representing the various extremely rare varietal forms described by Mr. Moore, it would have been fairer.

Amongst the many thousands of butterflies received from the Rev. W. A. Hamilton, the only *Stictoplœa* I have ever received is *E. binotata*, and all perfectly typical. *E. harrisii* I have a series of, all from Burma; and it is undoubtedly a good local form. The other forms referred to must be extremely rare. Though I have collected for nearly twenty years, and have paid over £400 to collectors in India for Lepidoptera sent me during the past three years, I have never seen a single specimen of any of the forms referred to, except the type-specimens; that they are probably varietal forms may be true—no one disputes it; that they are very properly named should also be beyond dispute. Without the names the present

discussion would be impossible, a very instructive discussion, no doubt, but one entirely spoilt by the style Mr. de Nicéville has chosen to adopt; it does not help science, and only tends to bring systematic work into contempt, and is a great blot on his otherwise excellent work.

Subfamily SATYRINÆ.

Genus ANADEBIS, *Butler.*

19. *Anadebis himachala* (Moore), Cat. Lep. E. I. C., i., p. 234 (1857).

Genus VIRAPA, *Moore.*

20. *Virapa anaxias* (Hew.), Exot. Butt., iii., p. 86, Myc., pl. 4, f. 25, 26, ♂ (1862).

Genus GARERIS, *Moore.*

21. *Gareris sanatana* (Moore), Cat. Lep. E. I. C., i., p. 231 (1857).

Mycalesis gopa, Felder, Reise Nov. Lep., iii., p. 501 (1867).

I have received both the above seasonal forms.

Genus ORSOTRIÆNA, *Wallengren.*

22. *Orsotriæna medus* (Fabr.), Syst. Ent., p. 488 (1775).

Mycalesis runeka, Moore, Cat. Lep. E. I. C., i., p. 234 (1857).

Both forms received.

Genus CALYSISIME, *Moore.*

23. *Calysisime perseus* (Fabr.), Syst. Ent., p. 488, ♀ (1775).

Papilio blasius, Fabr., Ent. Syst., Suppl., v., 426, 488, 489 (1798).

Not received by me, but recorded in Moore's Lep. Indica as in Mr. Crowley's collection from the Khasia Hills.

24. *Calysisime mineus* (Linn.), Syst. Nat., i., 2, 768 (1767).

Papilio drusia, Cram., Pap. Exot., i., pl. 84, f. C, D, ♀ (1775).

P. otrea, Cram., Pap. Exot., iv., pl. 314, f. A, B ♀ (1780).

25. *Calysisime visala* (Moore), Cat. Lep. E.I. C., i., p. 230 (1857).

Genus Pachama, *Moore.*

26. *Pachama mestra* (Hew.), Exot. Butt., ii., p. 79, Myc., pl. 1, f. 2 (1862).

Common.

Genus Samanta, *Moore.*

27. *Samanta malsara* (Moore), Cat. Lep. E.I. C., i., p. 231 (1857).

Samanta rudis, Moore, Trans. Ent. Soc.., 1880, p. 166, ♂.

The dry season form only has been received, *S. rudis.*

28. *Samanta nicotia* (Doubl.), Hew., Gen. D. L., p. 394, pl. 66, f. 6, ♀ (1851).

Samanta langii, de Nicé., Butt. of India, i., p. 130 (1883).

Recorded from the Khasias by de Nicéville, but not received by me from that locality.

29. *Samanta misenus*, de Nicé., Journ. Bo. Nat. Hist. Soc., 1889, p. 164, pl. A, f. 8, ♂.

Many examples from Shillong only.

Genus Kabanda, *Moore.*

30. *Kabanda malsarida* (Butler), Cat. Satyr. B.M., p. 134, pl. 3, f. 14 (1868).

Mycalesis khasiana, Moore, P. Z. S., 1874, p. 566.

Both forms received.

Genus Neorina, *Westwood.*

31. *Neorina westwoodi*, Moore, Lep. Ind., i., p. 226, p. 74, f. 2, 2 A, ♂ ♀ (1892).

Genus Rangbia, *Moore.*

32. *Rangbia scanda* (Moore), Cat. Lep. E. I. C., i., p. 218 ♂ (1857).

33. *Rangbia latiaris* (Hew.), Exot. Butt., iii., *Debis*, pl. 1, f. 4, ♂ (1862),

Genus Debis, *Doubl.*

34. *Debis kansa*, Moore, Cat. Lep. E. I. C., i., p. 220 (1857).

35. *Debis sinorix*, Hew., Exot. Butt., iii., *Debis*, pl. 3, f. 19, 20, ♂ (1863).

36. *Debis mekara*, Moore, Cat. Lep. E. I. C., i., p. 219 (1857).

37. *Debis chandica*, Moore, *l. c.*

38. *Debis vindhya*, Felder, Wien. Ent. Monats., iii., p. 402, ♂ (1859).

Genus Lethe, *Hübn.*

39. *Lethe europa* (Fabr.), Syst. Ent., p. 500 (1775).

40 *Lethe dyrta* (Felder), Reise Nov. Lep., iii., p. 497, ♀ (1867).

41. *Lethe rohria* (Fabr.), Mant. Ins., ii., p. 45 (1787).

42. *Lethe hyrania* (Kollar), Hüg. Kasch., iv., 2, 449, pl. 17, f. 1, 2, ♂ (1844).

43. *Lethe dinarbas* (Hew.), Exot. Butt., iii., p. 77, *Debis*, pl. 3, f. 15, ♂ (1863).

Genus Tansima, *Moore.*

44. *Tansima verma* (Kollar), Hüg. Kasch., iv., 2, 447, pl. 16, f. 1, 2 (1844).

Recorded from the Khasias, but not received by me.

Genus Sinchula, *Moore.*

45. *Sinchula sidonis* (Hew.), Exot. Butt., iii., p. 77, *Debis*, pl. 3, f. 16, ♂ (1863).

Genus Zophoessa, *Westwood.*

46. *Zophoessa sura*, Doubl. & Hew., Gen. D. L., pl. 61, f. 1 (1849).

Genus Blanaida, *Kirby.*

47. *Blanaida bhadra* (Moore), Cat. Lep. E. I. C., i., p. 227 (1857).

48. *Blanaida khasiana*, Moore, Trans. Ent. Soc., 1881, p. 306.

Recorded from the Khasias ; not received by me.

Genus Patala, *Moore.*

49. *Patala yamoides*, Moore, Lep. Ind., i., p. 307, pl. 94, f. 4 ♂ (1892).

Genus Orinoma, *Doubl.*

50. *Orinoma damaris*, Doubl. in Gray's Lep. Ins. Nep., p. 14, pl. 7, f. 2, 2a (1846).

Genus Ypthima, *Hübn.*

51. *Ypthima methora*, Hew., Trans. Ent. Soc., 1864, p. 291, pl. 18, f. 20, 21, ♀ .

52. *Ypthima baldus* (Fabr.), Syst. Ent. App., p. 829 (1775).

53. *Ypthima newarra*, Moore, P. Z. S., 1874, p. 567.

54. *Ypthima lycus*, de Nicé., Journ. Bo. Nat. Hist. Soc., iv. (3), p. 165 (1889).

Shillong.

55. *Ypthima sakra*, Moore, Cat. Lep. E. I. C., i., p. 236 (1857).

56. *Ypthima austeni*, Moore, Lep. Ind., ii., p. 69, pl. 109, f. 3, 3a, ♂ ♀ (1892).

Shillong.

57. *Ypthima mahratta*, Moore, Journ. As. Soc. Beng., liii. (2), i., p. 1 (1884).

Genus Ragadia, *Westwood.*

58. *Ragadia crisilda*, Hew., Exot. Butt., iii., Euptychia et Ragadia, f. 5, 6, ♀ (1862).

Common.

Genus Callerebia, *Butler.*

59. *Callerebia orixa*, Moore, P. Z. S., 1872, p. 555.

Twelve examples from Cherra Punji.

Genus Melanitis, *Fabr.*

60. *Melanitis leda* (Linn.), Syst. Nat., i., 2, 773, 151 (1767).

61. *Melanitis ismene* (Cram.), Pap. Exot., i., pl. 26, f. A, B (1775).

62. *Melanitis aswa*, Moore, P. Z. S., 1865, p. 769.

63. *Melanitis bela*, Moore, Cat. Lep. E. I. C., i., p. 223 (1857).

64. *Melanitis duryodana*, Felder, Reise Nov. Lep., iii., p. 464 (1867).

Subfamily ELYMININÆ.

Genus ELYMNIAS, *Hübn.*

65. *Elymnias undularis* (Drury), Ill. Ex. Ent., ii., pl. 10, f. 1, 2, ♂ (1773).

66. *Elymnias malela* (Hew.), Ex. Butt., iii. (Mel.), pl. 1, f. 6, 7 (1863).

Common.

67. *Elymnias timandra*, Wallace, Trans. Ent. Soc., 1869, p. 326.

Common.

68. *Elymnias chelensis*, de Nicé., Journ. Bo. Nat. Hist. Soc., 1890, p. 200, pl. D, f. 3.

Three examples from Shillong.

Genus DYCTIS, *Boisd.*

69. *Dyctis patna* (Westw.), Gen. D. L., p. 405 (note), pl. 68, f. 2 (1851).

70. *Dyctis vasudeva* (Moore), Cat. Lep. E. I. C., i., p. 238 (1857).

Subfamily MORPHINÆ.

Genus AMATHUSIA, *Fabr.*

71. *Amathusia portheos*, Felder, Reise Nov. Lep., iii., p. 461 (1865).

One male. Shillong.

Genus DISCOPHORA, *Boisd.*

72. *Discophora tullia* (Cram.), Pap. Exot., i., pl. 81, f. A, B (1775).

Common.

Genus Enispe, *Westwood.*

73. *Enispe euthymius*, Doubl., Ann. Mag. N. H., xvi., p. 179 (1845).

74. *Enispe cycnus*, Westw., Gen. D. L., ii., p. 330 (1851).
Four males and two females. Shillong.

Genus Æmona, *Hew.*

75. *Æmona amathusia* (Hew.), Trans. Ent. Soc, 1867, p. 566.
Shillong.

Genus Thaumantis, *Hübn.*

76. *Thaumantis diores*, Doubl., Ann. Mag. N. H., xvi., p. 234 (1845).

Genus Clerome, *Westw.*

77. *Clerome arcesilaus* (Fabr.), Mant. Ins., ii., p. 28 (1787).
Common, and very variable on the under side. In describing *C. kirata* from Padang, Perak, and Borneo, Journ. Bo. Nat. Hist. Soc., vi. (3), p. 344, pl. F, f. 3, ♂ (1891), Mr. de Niceville says *C. arcesilaus* has the hind wing concolorous throughout, and that the bands are so narrow as to be lines; but this is really not always the case; two of my Khasia Hill specimens are not concolorous in the hind wing below, and have bands and not lines; I have specimens from Java, Celebes, Nias, Perak, Tenasserim, and India, and though the coloration below is fairly uniform in most specimens, the bands are of all sorts of widths, and it is very difficult to say where *arcesilaus* ends and *kirata* begins; though no doubt the extreme forms are distinct, and deserve separate names.

78. *Clerome assama*, Westw., Trans. Ent. Soc., 1856, p. 184.
Common.

Subfamily Acræinæ.

Genus Pareba, *Doubl.*

79. *Pareba vesta* (Fabr.), Mant. Ins., ii., p. 14 (1787).
Many examples.

Genus Telchinia, *Hübn.*

80. *Telchinia violæ* (Fabr.), Syst. Ent., p. 460 (1775).

Subfamily NYMPHALINÆ.

Genus ERGOLIS, *Boisd.*

81. *Ergolis merione* (Cram.), Pap. Exot., ii., pl. 144, f. G, H (1777).

82. *Ergolis ariadne* (Linn.), Syst. Nat., i., 2, 778, 170 (1767).

Genus EURIPUS, *Westw.*

83. *Euripus halitherses*, Doubl. & Hew., Gen. D. L., ii., p. 293, pl. 41, f. 2, ♂ (1850).

Many females, in the mimetic forms of *Euplœa rhadamanthus*, *E. deione*, and *E. alcathoë*.

Genus CUPHA, *Billberg.*

84. *Cupha erymanthis* (Drury), Ill. Ex. Ent., i., pl. 15, f. 3, 4 (1770).

Genus ATELLA, *Doubl.*

85. *Atella sinha* (Kollar), Hüg. Kasch., iv., 2, 438, 1 (1848).

86. *Atella phalanta* (Drury), Ill. Ex. Ent., i., pl. 21, f. 1, 2 (1770).

87. *Atella alcippe* (Cram.), Pap. Exot., iv., pl. 389, f. G, H (1782).

Genus CETHOSIA, *Fabr.*

88. *Cethosia cyane* (Drury), Ill. Ex. Ent., i., pl. 4, f. 1, ♀ (1770).

89. *Cethosia biblis* (Drury), *l. c.*, f. 2, ♂.

Genus CYNTHIA, *Fabr.*

90. *Cynthia erota* (Fabr.), Ent. Syst., iii., 1, 76, 237 (1793).

There are two seasonal forms of female in the Khasia Hills which differ widely from each other; the wet season form is the large well-known greenish grey insect; the dry season form of female is, however, small, as a rule smaller than the male, more or less ferruginous ochreous in colour like the male on the outer portions, pale bluish grey on the inner portions, with a very broad almost unmarked pure white band across both wings; some of

these females are quite yellow, and very nearly of the same colour as the males, and with very short blunt tails.

Genus Helcyra, *Felder.*

91. *Helcyra hemina*, Hew., Trans. Ent. Soc., 1864, p. 245, pl. 15, f. 1.

Genus Sephisa, *Moore.*

92. *Sephisa chandra* (Moore), Cat. Lep. E. I. C., i., p. 200, pl. 6 A, f. 4, ♂ (1857).

Genus Apatura, *Fabr.*

93. *Apatura namouna*, Doubl., Ann. Mag. N. H., xvi., p. 178 (1845).

94. *Apatura parvata*, Moore, Cat. Lep. E. I. C., i., p. 202, pl. 6 A, f. 6, ♂ (1857).

Common.

95. *Apatura parysatis*, Westw., Gen. D. L., ii., p. 305 (1850).

Genus Hestina, *Westw.*

96. *Hestina nama*, Doubl., Ann. Mag. N. H., xvi., p. 232 (1845).

Genus Herona, *Westw.*

97. *Herona marathus*, Doubl. & Hew., Gen. D. L., ii., p. 294, pl. 41, f. 3 (1850).

Genus Precis, *Hübn.*

98. *Precis iphita* (Cram.), Pap. Exot., iii., pl. 209, f. C, D (1779).

Genus Junonia, *Hübn.*

99. *Junonia asterie* (Linn.), Syst. Nat., ed. x., p. 472 (1758).

100. *Junonia almana* (Linn.), *l. c.*

The above two are, as pointed out by me in P. Z. S., 1885, p. 128, different forms of one and the same species, probably seasonal forms, as suggested by de Niceville in Butt. of Ind., ii., p. 68 (1886). I possess a series, taken in Bombay, showing a perfect gradation from one to the other.

101. *Junonia lemonias* (Linn.), Syst. Nat., ed. x., p. 473 (1758).

102. *Junonia hierta* (Fabr.), Ent. Syst. Suppl., p. 424 (1798).

103. *Junonia orithyia* (Linn.), Mus. Ulr., p. 278 (1764).

Genus Rahinda, *Moore*.

104. *Rahinda hordonia* (Stoll), Suppl. Cram. Pap. Exot., pl. 33, f. 4, 4 D (1790).

105. *Rahinda plagiosa* (Moore), P. Z. S., 1878, p. 830.

Genus Neptis, *Fabr.*

106. *Neptis radha*, Moore, Cat. Lep. E. I. C., i., p. 166, pl. 14 A, f. 4 (1857).

One example. Shillong.

107. *Neptis miah*, Moore, Cat. Lep. E. I. C., i., p. 164, pl. 14 A, f. 1 (1857).

108. *Neptis ananta*, Moore, Cat. Lep. E. I. C., i., p. 166, pl. 14 A, f. 3 (1857).

Four examples.

109. *Neptis viraja*, Moore, P. Z. S., 1872, p. 563, pl. 32, f. 6.

Shillong. Two examples of this distinct species, which I have also got from North Kanara.

110. *Neptis cartica*, Moore, *l. c.*, p. 562.

Common.

111. *Neptis carticoides*, Moore, Trans. Ent. Soc., 1881, p. 309.

Two males and one female. Shillong and Cherra Punji.

112. *Neptis vikasi*, Horsfield, Cat. Lep. E. I. C., pl. 5, f. 2, 2 A (1829).

Common.

113. *Neptis harita*, Moore, P. Z. S., 1874, p. 571, pl. 66, f. 8.

Two males and one female. Shillong.

114. *Neptis adara*, Moore, P. Z. S., 1878, p. 830.

Shillong. Two males, identical with my Rangoon and Mergui examples. Very closely allied to, and hardly separable from, *N. varmona*, Moore.

115. *Neptis kamarupa*, Moore, P. Z. S., 1874, p. 570.

116. *Neptis astola*, Moore, P. Z. S., 1872, p. 560.

Several specimens.

117. *Neptis emodes*, Moore, P. Z. S., 1872, p. 561.

Common, and very doubtfully distinct from the preceding.

118. *Neptis khasiana*, Moore, P. Z. S., 1872, p. 562, pl. 32, f. 7.

Apparently a rare species; only three received from Shillong.

119. *Neptis cacharica*, Butler, Trans. Ent. Soc., 1879, p. 3.

Shillong. One example, like type; a distinct and good species.

120. *Neptis adipala*, Moore, P. Z. S., 1872, p. 563, pl. 32, f. 8.

121. *Neptis nandina*, Moore, Cat. Lep. E. I. C., i., p. 168, pl. 14 A, f. 7 (1857).

Neptis soma, Moore, P. Z. S., 1858, p. 9, pl. 49, f. 6.

122. *Neptis yerburii*, Butler, P. Z. S., 1886, p. 360.

The Himalayan type of *nandina* and the Sikkim type of *soma* are identical: the insects that have been in Indian collections heretofore under the name of *nandina* are identical with Butler's type of *yerburii*, which is a perfectly distinct and well-separated species.

123. *Neptis susruta*, Moore, P. Z. S., 1872, p. 563, pl. 32, f. 4.

124. *Neptis ophiana*, Moore, P. Z. S., 1872, p. 561.

Genus Cirrhochroa, *Doubl.*

125. *Cirrhochroa aoris*, Doubl. & Hew. Gen. D. L., i., p. 158, pl. 21, f. 2, ♂ (1848).

126. *Cirrhochroa mithila*, Moore, P.Z.S., 1872, p. 558.

127. *Cirrhochroa jiraria*, n. sp.

♂. Of a uniform very pale fulvous above. Fore wings in some specimens absolutely without markings, except for a pale brown sinuous (not dentated) submarginal line; another similarly coloured line, less sinuous, and close to the margin; apex with a brown patch; in some specimens there is a slight indication of the medial line and streak across the cell. Hind wing with medial and discal transverse sinuous brown lines with black spots between them in the interspaces; a submarginal and another line close to the margin very indistinct; all the lines more or less sinuous, and not dentated as in *C. aoris*. Under side very pale uniform fulvous, with faint indications of the usual median band, and a few black points on the outside of the band on the hind wings only. Expanse of wings, $2\frac{8}{10}$ in.

Shillong and Cherra Punji.

A good series received; all males. Allied to *C. aoris*, but seems to be very distinct. Can easily be distinguished by its peculiarly pale coloration, its small size, and absence of markings.

Genus Pseudergolis, *Felder.*

128. *Pseudergolis wedah* (Kollar), Hüg. Kasch., iv., 2, 437, 1 (1848).

Genus Stibochiona, *Butler.*

129. *Stibochiona nicea* (Gray), Lep. Ins. Nepal., p. 13, pl. 12, f. 1 (1846).

Genus Hypolimnas, *Hübn.*

130. *Hypolimnas bolina* (Linn.), Syst. Nat., ed. x., p. 492 (1758).

131. *Hypolimnas mysippus* (Linn.), Mus. Ulr., p. 262 (1764).

Genus Argynnis, *Fabr.*

132. *Argynnis niphe* (Linn.), Syst. Nat., ed. xii., i., 2, 785, 208 (1767).

133. *Argynnis rudra*, Moore, Cat. Lep. E.I.C., i., p. 157 (1857).

134. *Argynnis childrene*, Gray, Zool. Misc., i., p. 33 (1831).

Genus Dichorragia, *Butler*.

135. *Dichorragia nesimachus* (Boisd.), Cuv., Regn. Anim. Ins., ii., pl. 139 *bis*, f. 1 (1836).

Genus Penthema. *Westw.*

136. *Penthema lisarda* (Doubl.), Ann. Mag. N. H. (1), xvi., p. 233 (1845).

Genus Parthenos, *Hübn.*

137. *Parthenos gambrisius* (Fabr.), Mant. Ins., ii., p. 12 (1787).

Genus Neurosigma, *Butler*.

138. *Neurosigma siva* (Westw.), Gen. D. L., ii., p. 291 (1850).

Genus Lebadea, *Felder*.

139. *Lebadea attenuata* (Moore), P. Z. S., 1878, p. 829.

Many of both sexes; quite typical and indistinguishable from the Tenasserim and Mergui examples in my collection.

Genus Limenitis, *Fabr.*

140. *Limenitis austenia* (Moore), P. Z. S., 1872, p. 560, pl. 32, f. 1.

Recorded from the Khasias; not received by me.

141. *Limenitis danava*, Moore, Cat. Lep. E. I. C., i., p. 180, pl. 6*a*, f. 2, ♂ ♀ (1857).

142. *Limenitis daraxa*, Doubl., Hew. Gen. D. L., ii., p. 276, pl. 34, f. 4 (1850).

143. *Limenitis zayla*, Doubl., *l. c.*, pl. 35, f. 4.

144. *Limenitis zulema*, Doubl., *l. c.*, pl. 34, f. 1.

145. *Limenitis dudu*, Westw., Gen. D. L., ii., p. 276, (1850).

Genus Moduza, *Moore*.

146. *Moduza procris* (Cram.), Pap. Exot., ii., pl. 106, f. E, F (1777).

Genus Athyma, *Westw.*

147. *Athyma perius* (Linn.), Syst. Nat., ed. x., p. 471 (1758).

148. *Athyma asura*, Moore, Cat. Lep. E. I. C., i., p. 171, pl. 5*a*, f. 1 (1857).

149. *Athyma opalina* (Kollar), Hüg. Kasch., iv., 2, 427 (1848).

Cherra Punji. One example.

150. *Athyma kanwa*, Moore, P. Z. S., 1858, p. 17, pl. 51, f. 2.

Shillong. One example of this very distinct species.

151. *Athyma pavara*, Moore, Cat. Lep. E. I. C., i., p. 173, pl. 5A, f. 4 (1857).

Cherra Punji. One example.

152. *Athyma orientalis*, Elwes, Trans. Ent. Soc., 1888, p. 354, pl. 9, f. 4, ♂.

Shillong. A fair series of both sexes; appears to be a good constant form.

153. *Athyma ranga*, Moore, Cat. Lep. E. I. C., i., p. 175, pl. 5*a*, f. 6 (1857).

154. *Athyma selenophora* (Kollar), Hüg. Kasch., iv. (2), p. 426, pl. 7, f. 1, 2, ♂ (1848).

155. *Athyma zeroca*, Moore, P. Z. S., 1872, p. 564.

156. *Athyma cama*, Moore, Cat. Lep. E. I. C., i., p. 174, pl. 5*a*, f. 5, ♂ ♀ (1857).

157. *Athyma inara*, Doubl., Hew. Gen. D. L., ii., pl. 34, f. 3 (1850.)

Athyma inarina, Butler, Ann. Mag. N. H. (5), xvi., p. 304 (1885).

A very common, widely spread, and in the male a very variable species. I have received it in quantities from Sikkim, Buxar, Khasias, Rangoon (taken in April and November), and from Karwar in North Kanara on the S.W. coast, taken in August, 1887 and 1892, October, 1889, 1890, and November, 1890. I have it in almost every gradation from typical *inara* to typical *inarina*.

Genus Symphædra, *Hübn.*

158. *Symphædra nais* (Forst.), Nov. Sp. Ins. Cent., i., p. 73 (1771).

In Mr. Hamilton's list, but not received by me.

159. *Symphædra teuta* (Doubl.), Hew. Gen. D. L., ii., p. 291, pl. 44, f. 2, ♂ (1850).

Shillong. Common.

160. *Symphædra recta* de Nicé., Butt. of India, ii., p. 188 (1886).

Shillong. A large series of both sexes.

161. *Symphædra khasiana*, n. sp.

♂. Differs from *S. dirtea*, Fabr., on the upper side in its darker coloration, being almost black, and in the fore wings being unmarked, except for a pure white subapical point; occasionally an indication of one or two subcostal ochreous spots, and in the greenish outer marginal fascia being reduced to a few spots or streaks. On the under side the coloration is also very dark, in some specimens nearly black, smeared here and there with reddish ochreous.

♀. Differs very materially from all the specimens of *dirtea* from the different localities I have examined. On the upper side the spots, instead of ochreous, are as white as they are in *S. cyanipardus*, and the hind wing has the same clear blue submarginal band enclosing large black spots, with pure white patches on each side; on the under side the coloration of the hind wings, instead of being bluish grey, is pale brownish ochreous, with pale ochreous spots. Expanse of wings, ♂ $3\frac{3}{10}$, ♀ 4 to $4\frac{3}{10}$ in.

Shillong and Cherra Punji.

I have in my own collection examples of *S. dirtea* from Thoungyan, Meplay, Donat Range, several parts of Burma, besides from Nias, Perak, Sumatra, and Borneo; and though they vary somewhat *inter se*, they maintain the well-known characteristics of typical *S. dirtea;* whereas the Khasia Hill form is characteristic in itself in both sexes, and very constant in all the specimens of the long series I have received.

162. *C. cyanipardus*, Butler, P. Z. S., 1868, p. 613.

Common.

Genus Euthalia, *Hübn.*

163. *Euthalia derma* (Kollar), Hüg. Kasch., iv. 2, 436, 2 (1848).

Common.

164. *Euthalia nara* (Moore), Trans. Ent. Soc., 1859, p. 78, pl. 8, f. 1, ♀.

Recorded by de Nicéville from the Khasias; not received by me.

165. *Euthalia sahadeva* (Moore), *l. c.*, p. 80, pl. 8, f. 3, ♂.

Shillong. One example.

166. *Euthalia franciæ* (Gray), Lep. Ins. Nepal, p. 12, pl. 14 (1846).

Common.

167. *Euthalia lepidea* (Butler), Ann. Mag. N. H. (4), i., p. 71 (1868).

Common.

168. *Euthalia telchinia* (Mén.), Cat. Mus. Pet. Lep., ii., p. 100, pl. 9, f. 3, ♂ (1857).

Common.

169. *Euthalia appiades* (Mén.), *l. c.*, p. 120, pl. 9, f. 4, ♂.

Common. At p. 350, Journ. Bo. Nat. Hist. Soc., 1891, Mr. L. de Nicéville enters into a long argument to show that *E. appiades*, and a number of what he admits to be local races, are specifically the same. It is the same never-ending argument as to what is or is not a species. If he admits they are local races, it is quite sufficient, and each deserves a name, "for the sake of convenience." In describing *E. khasiana*, I overlooked *E. adima*, Moore, and I am obliged to Mr. de Nicéville for pointing out my error; but what *E. adima* has to do with *E. appiades*, except that it is a local form of the commoner and widely-spread parent species, I cannot understand. It is undoubtedly a good local form; so also is *E. sedeva*, ♀, Moore, = *E. balarama*, ♂, Moore. This is confined to Buxar, in so far as my experience goes; and because *E. appiades* is a widely-spread parent species, that does not prevent *E. sedeva* from being a good local form. As to the intergrades between *E. adima* and *E. appiades*, all I can say is that although

I have over two hundred thousand specimens of Lepidoptera in my museum, have collected for twenty years, and have *E. appiades* from Sikkim, Buxar, Burma, Assam, and the Khasias, I have never seen an intergrade; and if one or two have been found, they will prove nothing. Intergrades are found now and again, though no doubt very rarely, between all sorts of allied forms.

170. *Euthalia adima* (Moore), Cat. Lep. E. I. C., i., p. 194 (1857).

E. khasiana, Swinhoe, Ann. Mag. N. H., 1890, p. 354. Shillong.

171. *Euthalia jhanu* (Moore), Cat. Lep. E. I. C., i., p. 192 (1857).

Common. The male of *E. jahnu* above is very like *E. adima;* they can at once be separated by the under side, on account of the blue suffusion in the latter, but the females are very difficult to discriminate. I have received a long series, containing many males of both species, and also many females, all apparently identical, except that what I believe to be the females of *E. adima* are of a lighter colour.

172. *Euthalia kesava* (Moore), Trans. Ent. Soc., 1859, p. 67, pl. 3, f. 5, ♂ ♀.

173. *Euthalia garuda* (Moore), Cat. Lep. E. I. C., i., p. 186, pl. 6, f. 2, 2*a*, larva and pupa (1857).

174. *Euthalia phemius* (Doubl.), Gen. D. L., ii., pl. 41, f. 4, ♂ (1850).

Adolias sancara, Moore, Cat. Lep. E. I. C., i., p. 105, ♂ (1857).

175. *Euthalia jama* (Felder), Reise, Nov. Lep., iii., p. 431 (1866).

176. *Euthalia lubentina* (Cram.), Pap. Exot., ii., pl. 155, f. C, D, ♂ (1777).

177. *Euthalia merilia*, n. sp.

♂. Upper side of both wings olive-brown, the basal half of the wings dark brown, the edges of the dark portion irregular, but not toothed, as are the outer edges of the medial band of *E. garuda;*

outer half of the wings pale olive greyish brown, a submarginal darker band on fore wings, and brown dots on hind wings, as in *garuda*, the cell markings being also similar; two indistinct upper whitish lunulate spots on outer edge of the dark portion on the fore wings in one example, obsolete in others. Under side of a uniform pale brownish ochreous, outer margin of both wings with a greyish band; all markings quite obsolete in one specimen, a band of indistinct ochreous discal dots in others. Expanse of wings, $2\frac{1}{2}$ in.

Cherra Punji. Three examples. Nearly allied to *E. eriphylæ*, de Nicé., Jo. Bo. N. H. Soc., 1891, p. 353, pl. F, f. 7, ♂. No doubt, like that species,it is a varietal form of *E. garuda*, Moore, but is sufficiently distinct to deserve a name.

178. *Euthalia delmana*, n. sp.

♂. Upper side very dark olive-brown. Fore wings with a black bar in the cell near the base, and a broad similar band beyond middle of cell; the basal half of both wings very dark, nearly black, leaving the pale spaces in the cell of fore wings like large pale spots; outer portion of both wings paler than the basal portions, but without much contrast; a blackish somewhat irregular discal band across both wings; cilia of both wings pure white in parts. Under side of a uniform greyish olive-brown, as dark as in the under side of *E. telchinia* ♂, but of a greenish, not ochreous, tint; the abdominal marginal area of hind wings decidedly greenish; fore wings with two black lines across cell near the base, a medial bent line joined above to an outer black circular mark at end of cell, an indistinct blackish shade beyond the cell, a discal band of brown spots ending with a large spot in the interno-median interspace, and a small white streak at apex. Hind wing with the usual cell-markings, an indistinct pale brown band just beyond the middle, and an equally indistinct discal row of brownish spots. Expanse of wings, $2\frac{4}{10}$ in.

One example. Cherra Punji.

Above it somewhat resembles *E. vasanta*, Moore, from Ceylon; below it more nearly resembles the coloration and markings of *E. telchinia*, Mén., but is much smaller in size, and differently shaped, the apex of fore wings and anal angle of hind wings being more acute.

Genus Pyrameis, *Hübn.*

179. *Pyrameis cardui* (Linn)., Syst. Nat., ed. x., p. 475 (1758).

180. *Pyrameis indica* (Herbst.), Naturs. Schmett., vii., p. 171, pl. 180, f. 1, 2 (1794).

Genus Vanessa, *Fabr.*

181. *Vanessa canace* (Linn.), Syst. Nat., ed. xii., i., 2, 779, 173 (1767).

Genus Symbrenthia, *Hübn.*

182. *Symbrenthia hippoclus* (Cram.), Pap. Exot., iii., p. 46, pl. 220, f. c, d ♂ (1779).

183. *Symbrenthia khasiana*, Moore, P. Z. S., 1874, p. 569.

Recorded from the Khasias; not received by me.

184. *Symbrenthia hypselis* (Godart), Enc. Méth., ix., Suppl., p. 818 (1823).

Symbrenthia cotanda, Moore, P. Z. S., 1874, p. 569, pl. 66, f. 9, ♂.

Symbrenthia sinis, de Nicé., Journ. Bo. Nat. Hist. Soc. (3), vi., p. 357, pl. f, f. 9, ♂ (1891).

I have six males and one female from Java, and a number from Sikkim and the Khasias. The ground colour of the under side is not constant; two of my Javan examples are identical in coloration with Khasia Hill examples; the blotchings of the Javan specimens are as a rule darker than in the Indian examples, but this cannot be called a specific character, and is not sufficient, in my opinion, to establish even a local form, and therefore I do not think *S. sinis* can stand: if the Indian form could be separated from the Javan, it would have to stand under the name of *S. cotanda*, but that also is not a good form. Two Javan examples correspond fairly with Moore's figure; *S. hypselis*, wherever found, is undoubtedly a variable species both above and below.

Genus Rhinopalpa, *Felder.*

185. *Rhinopalpa fulva*, Felder, Wien. Ent. Mon., iv., p. 399 (1860).

Genus Cyrestis, *Boisd.*

186. *Cyrestis thyodamas*, Boisd., Cuv. Regn. An. Ins., ii., pl. 138, f. 4 (1836).

Common.

187. *Cyrestis cocles* (Fabr.), Mant. Ins., ii., p. 7 (1787).

The form *C. earli*, Distant, appears to be just as common in the Khasias as the typical form. I have many intergrades.

188. *Cyrestis risa*, Hew., Gen. D. L., ii., p. 262, pl. 32. f. 4 (1850).

Genus Kallima, *Westw.*

189. *Kallima limborgii*, Moore, P. Z. S., 1878, p. 828.

This form of the *C. inachis* group is the common form in the Khasias. I have received a long series identical with Moore's type from Tenasserim, none of them being typical *K. inachis*.

Genus Doleschallia, *Felder.*

190. *Doleschallia polibete* (Cram.), Pap. Exot., iii., pl. 234, f. D, E (1779).

Genus Eulepis, *Moore.*

191. *Eulepis eudamippus* (Doubl.), Ann. Soc. Ent. Fr. (2), i., p. 218, pl. 8 (1843).

192. *Eulepis athamas* (Drury), Ill. Ex. Ent., i., p. 5, pl. 2, f. 4 (1770).

193. *Eulepis bharata* (Felder), Reise, Nov. Lep., iii., p. 438 (1867).

Charaxas arja, de Nicé. (nec Felder), Butt. of India, ii., p. 278 (1886).

Genus Haridra, *Moore.*

194. *Haridra marmax* (Westw.), Cab. Or. Ent., p. 43, pl. 21, ♂ ♀ (1848).

195. *Haridra lunawarra* (Butler), Lep. Exot., p. 90, pl. 37, f. 2, ♂ ♀ (1872).

196. *Haridra aristogon* (Felder), Reise. Nov. Lep., iii., p. 445 (1867).

197. *Haridra corax* (Felder), *l. c.*, p. 444.

198. *Haridra khasiana* (Butler), Lep. Ex., p. 98, pl. 37, f. 6, ♂ ♀ (1872).

The most distinct of the *hierax* group, the basal coloration of the upper side being bluish grey, slightly tinged with fulvous in the females; the fulvous suffusion is very slight.

199. *Haridra hierax* (Felder), Reise, Nov. Lep., iii., p. 442 (1867).

200. *Haridra hipponax* (Felder), *l. c.*, p. 443.

Very closely allied to, if not identical with, the preceding; in *hierax* the white band above is suffused with fulvous, but this character varies, and in other respects both forms in both sexes above and below are similar.

201. *Haridra pleistoanax* (Felder), *l. c.*

Also doubtfully distinct, the spots on the broad black outer band being apparently the only distinguishing character; and this is also variable, some examples having more spots than others.

202. *Haridra khimarala* (Butler), Lep. Ex., p. 97, pl. 37, f. 1, ♂ ♀ (1872).

Uniformly darker than the above, but otherwise but doubtfully distinct.

203. *Haridra hindia* (Butler), *l. c.*, p. 99, pl. 37, f. 5, ♂ ♀.

A uniformly pale species; a much brighter and paler fulvous than the others, with spots on the black band as in *pleistoanax*, but with a very different shade of colour; the females are particularly pale. I have a long series of both sexes; they are very uniform in appearance, and I think this is a good species.

204. *Haridra jalinder* (Butler), *l. c.*, p. 88, pl. 37, f. 4, ♂ ♀.

Looks like a dark form of *pleistoanax*.

I give the above as I find them; that they are all good species I do not believe. I have long series in both sexes of all except *H. kimarala*, of which I have received only one male and two females; they are easier to separate in the females than in the males, except in the case of *hierax* and *hipponax*, in which the males can be separated, but the females are very similar to each other.

Family LEMONIIDÆ.

Subfamily LIBYTHÆINÆ.

Genus LIBYTHÆA, *Fabr.*

205. *Libythæa myrrha*, Godart, Enc. Meth., ix., p. 171 (1819).

206. *Libythæa rohini*, Marshall, Journ. As. Soc. Beng., xlix. (2), p. 428 (1880).

Recorded from the Khasias; not received by me.

Subfamily NEMEOBINÆ.

Genus DODONA, *Hew.*

207. *Dodona ouida*, Moore, P. Z. S., 1865, p. 771.

208. *Dodona adonira*, Hew., Ex. Butt., iii., *Dodona*, pl. 1, f. 1, 2, ♂ (1866).

Several examples.

209. *Dodona longicaudata*, de Nicé., Proc. As. Soc. Beng., 1881, p. 121.

Recorded from the Khasias; not received by me.

210. *Dodona egeon* (Doubl.), Hew., Gen. D. L., ii., p. 422, pl. 59, f. 2 (1851).

211. *Dodona eugenes*, Bates, Journ. Linn. Soc., Zool., ix., p. 371 (1867).

Genus STIBOGES, *Butler.*

212. *Stiboges nymphida*, Butler, P. Z. S., 1876, p. 309, pl. xxii., f. 1, ♀.

Recorded from the Khasias; not received by me.

Genus ABISARA, *Felder.*

213. *Abisara fylla* (Doubl.), Gen. D. L., ii., p. 422, pl. 59, f. 3, ♂ (1851).

214. *Abisara neophron* (Hew.), Ex. Butt., ii., *Sospita*, pl. 1, f. 3 (1861).

215. *Abisara chela*, de Nicé., Journ. As. Soc. Beng., iv. (2), p. 252, pl. 11, f. 7, ♂ (1886).

Genus ZEMEROS.

216. *Zemeros flegyas* (Cram.), Pap. Exot., iii., pl. 280, f. E, F (1780).

Family LYCÆNIDÆ.

Genus GERYDUS, *Boisd.*

217. *Gerydus boisduvali* (Moore), Cat. Lep. E. I. C., i., p. 19, pl. 1 A, f. 1 ♀ (1857).

Genus ALLOTINUS, *Felder.*

218. *Allotinus drumila* (Moore), P. Z. S., 1865, p. 777, pl. 41, f. 12, ♀.

Recorded from the Khasias; not received by me.

219. *Allotinus multistrigatus*, de Nicé., Journ. As. Soc. Beng., lv. (2), p. 253; pl. 11, f. 11, ♂, 2 ♀ (1886).

Recorded from the Khasias; not received by me.

Genus PORITIA, *Moore.*

220. *Poritia hewitsoni*, Moore, P. Z. S., 1865, p. 775, pl. 41, f. 10, ♂.

Genus NEOPITHECOPS, *Distant.*

221. *Neopithecops zalmora* (Butler), Cat. Fabr. Lep. B. M., p. 161 (1869).

Also both varieties, *N. horsfieldii*, Distant, and *N. gama*, Moore.

Genus SPALGIS, *Moore.*

222. *Spalgis epius* (Westw.), Gen. D. L., ii., p. 502 (1852).

As Mr. de Nicéville, Butt. of Ind., iii., p. 54, states that this insect has never been recorded from Bombay, I may here state that I took it in Kolgaum and Kolaba in January, 1888, both places in the Thana District, close to Bombay.

Genus TARAKA, *de Nicé.*

223. *Taraka hamada* (Druce), Cist. Ent., i., p. 361 (1875). Shillong.

Genus MEGISBA, *Moore.*

224. *Megisba malaya* (Horsfield), Cat. Lep. E. I. C., p. 70 (1828).

Genus CHILADES, *Moore.*

225. *Chilades laius* (Cram.), Pap. Exot., iv., p. 62, pl. 319, f. D, E, ♀ (1780).

Genus Cyaniris.

226. *Cyaniris marginata*, Moore, P. Z. S., 1883, p. 523, pl. 48, f. 6, ♂.

————————, de Nicé., Journ. As. Soc. Beng., lii. (2), p. 70, pl. 1, f. 9, ♂ (1883).

Common.

Undoubtedly in this species, as in several others in both the papers above referred to, Mr. Moore ought to have priority, because, although Mr. de Nicéville's paper may have been published a few days earlier, he used Mr. Moore's MS. names, unfortunately omitting to give Mr. Moore the credit for them.

227. *Cyaniris victoria*, n. sp.

♂. Upper side dull pale bluish grey; centres of both wings whitish. Fore wings with a brown band, attenuated hindwards. Hind wing with a brown marginal line, and in some examples pale grey submarginal lunules. Under side greyish white, with a dull glazed appearance; markings very faint and indistinct. Fore wing with a mark across end of cell, and a discal row of pale lunules or transverse streaks. Hind wing with a subcostal dot near base, another below it in middle of wing; a subcostal dot towards apex, terminating a discal outwardly curved irregular row of streaks, very indistinct, and often invisible.

♀. Upper side darker than the males; marginal band blacker, deeper, especially at the apex, and running along costa; internal space whiter, as also is cilia, and a dark costal band. Under side coloured and glazed like the male; markings more distinct, the discal streaks more or less joined together. Expanse of wings, ♂ $1\frac{1}{10}$, ♀ $1\frac{3}{10}$ in.

Shillong. Ten males and four females.

Above something like a faded dry season form of *C. jynteana*, Moore; the under side like nothing I know of. I have submitted these insects to all the best Indian lepidopterists in England, and all agree that it is a good and new species; they came in one batch, April, 1892, and I have never received any since.

228. *Cyaniris albocæruleus* (Moore), P. Z. S., 1879, p. 139.

A number of examples. The female of this insect appears to be variable; one example in my collection

from Dhera Dhoon has the marginal border of fore wing above of the typical form, not reaching posterior angle, but neither does it extend along the costa. The only female I have received from the Khasias has also the marginal black band diffuse at the first median branch, and not reaching the hinder angle; whereas Mr. de Nicéville records specimens from Masuri and Sikkim with the band wide at the angle.

229. *Cyaniris transpectus* (Moore), P. Z. S., 1879, p. 139.
Cyaniris latimarga, Moore, P. Z. S., 1883, p. 523, pl. 48, f. 9, ♂.

A common species in the Khasias. I think de Nicéville is right in stating that the above two are seasonal forms of each other. I have received many of both sexes from Mr. Hamilton, taken at different times of the year; some of the females of *latimargo*, the rainy form, have the hind wings nearly all black, completely covering and hiding the black marginal spots and submarginal lunular band, and with only a small dull whitish or pale space in the upper disc; the males are identical with Moore's type.

230. *Cyaniris puspa* (Horsfield), Cat. Lep. E.I C., p. 67 (1828).

Common.

231. *Cyaniris chennellii*, de Nicé., Journ. A. S. B., lii. (2), p. 72, pl. 1, f. 10, ♂ (1883).

Many males and one female.

232. *Cyaniris placida*, Moore, P. Z. S., 1883, p. 523, pl 48, f. 5, ♂.
————, de Nicé, Journ. A. S. B., lii. (2), p. 68, pl. 1, f. 8 (1883).

Many examples.

233. *Cyaniris jynteana*, Moore, P. Z. S., 1883, p. 524, pl. 48, f. 10, ♂.
————, de Nicé., Journ. A. S. B., lii. (2), p. 69, pl. 1, f. 7, ♂, 7 A, ♀ (1883).

Common, in both wet and dry season forms.

234. *Cyaniris dilectus* (Moore), P. Z. S., 1879, p. 139.

Shillong. Apparently rare; only thirteen examples received.

235. *Cyaniris limbatus* (Moore), P. Z. S., 1879, p. 139.

Recorded from Shillong by de Nicéville, Butt. of India, iii., p. 109; not received by me. I received all the *Lycænidæ* collected by Mr. Hamilton for two years and more, and cannot but think there is some mistake in this record; in a carefully kept record of many years I find I have never obtained this species, except from Ceylon and the South of India.

Genus Zizera, *Moore.*

236. *Zizera maha* (Kollar), Hüg. Kasch., iv. (2), p. 622 (1848).

At p. 116, Butt. of India, vol. iii., de Nicéville states that *Z. ossa*, Swinh., P. Z. S., 1885, p. 132, pl. 9, f. 11 ♂, 12 ♀, described from Bombay, is evidently the dry season form of *Z. maha*. Surely this is jumping to a wonderful conclusion; that it is a southern or local form of *Z. maha* is probably true, but to make it a dry season form of *maha* you must first prove that *maha* is to be found in Bombay. I collected in Bombay for nearly twenty years,—my written record runs back for fifteen years,—yet I never took *maha* in Bombay; but *ossa* is a common form, of which I have taken great numbers in every month from September to June in Poona and Bombay; Mahableshwur, 5000 ft. (where you might expect to find *maha*, if it existed in the South), in May; Ahmednagar, September; and have received it from the Anamalli and Nilgiri Hills; the tint of colour is quite different.

237. *Zizera karsandra* (Moore), P. Z. S., 1865, p. 505, pl. 31, f. 7, ♀.

238. *Zizera gaika* (Trimen), Trans. Ent. Soc. (3), i., p. 403 (1862).

Several examples.

239. *Zizera sangra* (Moore), P. Z. S , 1865, p. 772, pl. 41, f. 8, ♂.

Lycæna indica, Murray, Trans. Ent. Soc. Lond., 1874, p. 525, pl. 10, f. 2 ♂, 3 ♀.

The only difference between *sangra* and *indica* is that the type of the former is without the twin spots of the discal row near the hinder margin on the fore wings below, but this is not a constant character.

Genus Lycænesthes, *Moore*.

240. *Lycænesthes emolus* (Godart), Enc. Méth., ix., p. 656 (1823).

Many specimens.

241. *Lycænesthes lycænnia*, Felder, Verh. zool.-bot. Ges. Wien., xviii., p. 281 (1868).

Common.

Genus Niphanda, *Moore*.

242. *Niphanda cymbia*, de Nicé., Journ. A. S. B., lii. (2), p. 76, pl. 9, f. 8 ♂, 8 A ♀ (1883).

Shillong. Two males.

Genus Talicada, *Moore*.

243. *Talicada nyseus ?* (Guerin), Delless, Voy. l'Inde, p. 78, pl. 22, f. 1, 1 A (1843).

I call this insect *nyseus* doubtfully; it is figured from the Khasias by de Nicéville in Butt. of Ind., iii., pl. 26, f. 179, but is certainly not typical. Guerin's *nyseus*, which is common in Southern India, have all the three black bands on the under side of the fore wing joined together, making the outer third black, with two bands of white spots; whereas in the Khasia form the third band is well separated. I have a large series of each kind; the difference is certainly greater and far more constant than the difference between *Symbrenthia hypselis* and *S. sinis*, and I propose to call it *T. khasiana;* it is apparently in great numbers.

Genus Everes, *Hübn.*

244. *Everes parrhasius*, Fabr., Ent. Syst., iii. (1), p. 289 (1793).

This may belong to the variable species *argiades*, Pallas, as stated by de Nicéville, who appears to have

worked the matter out very carefully and well; but all the examples I have received from the Khasias, where it seems to be very common, are all typical *parrhasius*.

245. *Everes kala*, de Nicé., Butt. of India, iii., p. 139, pl. 26, f. 181 (1890).
Six examples.

Genus Nacaduba, *Moore*.

246. *Nacaduba macropthalma* (Felder), Verh. zool.-bot. Ges. Wien., xii., p. 483 (1862).
Common.

247. *Nacaduba viola* (Moore), Ann. Mag. N. H. (4), xx., p. 340 (1877).
One male.

248. *Nacaduba pavana* (Horsf.), Cat. Lep. E. I. C., p. 77 (1828).
Shillong. Three males.

249. *Nacaduba atrata* (Horsfield), Cat. Lep. E. I. C., p. 78 (1828).
Lampides prominens, Moore, Ann. Mag. N. H. (4), xx., p. 341 (1877).
Common.

250. *Nacaduba cœlestis*, de Nicé., Journ. A. S. B., lv. (2), p. 366, pl. 17, f. 11 ♂ (1886).
Shillong. Seven examples.

251. *Nacaduba ardates* (Moore), P. Z. S., 1874, p. 574, pl. 67, f. 1.
Common.

252. *Nacaduba dana*, de Nicé., Journ. A. S. B., lii. (2), p. 73, pl. 1, f. 15 ♂ (1883).
Shillong. Two examples.

Genus Jamides, *Hübn.*

253. *Jamides bochus* (Cram.), Pap. Exot., iv., p. 210, pl. 391, f. c, d ♂ (1782).
Common.

Genus Lampides, *Hübn.*

254. *Lampides elpis* (Godart), Enc. Méth., ix., p. 654 (1823).

255. *Lampides alexis* (Stoll), (nec Scopoli), Suppl. Cram. Pap. Exot., v., pl. 38, f. 3, 3 c ♂ (1790).

Hesperia adrianus, Fabr., Ent. Syst., iii., i., p. 280 (1793).

Genus Catochrysops, *Boisd.*

256. *Catochrysops strabo* (Fabr.), Ent. Syst., iii., i., 287, 101 (1793).

Common.

257. *Catochrysops lithargyria* (Moore), Ann. Mag. N. H. (4), xx., p. 340 (1877).

Shillong. Six males and three females; the peculiar shade of blue coloration in both sexes makes it very distinct. I have also received it from Palawan, N. Borneo.

258. *Catochrysops cnejus* (Fabr.), Ent. Syst., Suppl., p. 430 (1798).

Common.

259. *Catochrysops contracta* (Butler), P. Z. S., 1880, p. 406, pl. 39, f. 3 ♂.

Shillong. Two or three examples. This may be, as suggested by de Nicéville, a dwarfed form of the preceding, but it is always of a more brilliant blue coloration. It is curious that the allied form, *C. pandava*, so widely spread throughout the Indo-Malayan Region, has never been recorded from the Khasias.

Genus Tarucus, *Moore.*

260. *Tarucus plinius* (Fabr.), Ent. Syst., iii., i., 284, 92 (1793).

Although I received, I believe, all the *Lycænidæ* (except a few rare examples sent to Mr. de Nicéville) that Mr. Hamilton's collectors brought in for a period of nearly two years, I received only a few specimens of this species, and none of any other species of this genus.

Genus Castalius, *Hübn.*

261. *Castalius rosimon* (Fabr.), Syst. Ent., 523, 341 (1775).

Common.

262. *Castalius ananda*, de Nicé., Journ. A. S. B., lii. (2), p. 75, pl. 1, f. 11, 11 A, ♂ ♀ (1883).

Shillong. Five examples.

263. *Castalius elna* (Hew.), Ex. Butt., v., *Lycæna*, pl. 1, f. 8 ♀ (1876).

Common.

Genus Polyommatus, *Latreille.*

264. *Polyommatus bœticus* (Linn.), Syst. Nat., xii., i., 2, 789, 226 (1767).

Genus Iraota, *Moore.*

265. *Iraota timoleon* (Stoll), Suppl. Cram. Pap. Ex., v., pl. 32, f. 4, 4 D ♀ (1790).

Several examples, amongst them two very curious male varieties; the upper side in one has very little blue colour; in the other it is quite as blue as any of them; but the under sides of both have the hind wings of a uniform dark rich chestnut colour, without any of the usual white markings.

Genus Surendra, *Moore.*

266. *Surendra quercetorum* (Moore), Cat. Lep. E. I. C., i., p. 42, pl. 1 A, f. 7 ♂ (1857).

Very common.

Genus Arhopala, *Boisd.*

267. *Arhopala pirithous* (Moore), P. Z. S., 1883, p. 531.

The common Khasia Hill form of the *Centaurus* group.

268. *Arhopala adorea*, de Nicé., Butt. of India, iii., p. 238, frontispiece, f. 139 ♂ (1890).

Recorded from the Khasias; not received by me.

269. *Arhopala ænea* (Hew.), Ill. D. L. Lep., p. 14, *e*, pl. 3, *c*, f. 55, ♂ (1869).

Recorded from the Khasias; not received by me. I have several examples from Sikkim.

270. *Arhopala bazalus* (Hew.), Cat. Lyc. B. M., p. 8, pl. 4, f. 37, 38, ♀ (1862).

Recorded from the Khasias; not received by me.

271. *Arhopala singla*, de Nicé., Journ. A. S Beng., liv. (2), p. 119, pl. 2, f. 8 ♂, 7 ♀ (1885).

Shillong. Four males and one female.

272. *Arhopala teesta* (de Nicé.), Journ. A. S. B., lv. (2), p. 253, pl. 11, f. 3, ♂ (1886).

Shillong. One example.

273. *Arhopala fulgida* (Hew.), Ill. D. L. Lep. Lyc., p. 11, pl. 5, f. 31, ♂ (1863).

Recorded from the Khasias; not received by me. I have many examples from Sikkim.

274. *Arhopala diardi* (Hew.), Cat. Lyc. B. M., p. 9, pl. 5, f. 41, 42, ♀ (1862).

Cherra Punji. One male.

275. *Arhopala camdeo* (Moore), Cat. Lep. E. I. C., i., p. 41, pl. 1*a*, f. 6, ♀ (1857).

Shillong. Two examples, both females.

276. *Arhopala opalina* (Moore), P. Z. S., 1883, p. 531, pl. 49, f. 1, ♂.

Recorded from the Khasias; not received by me.

277. *Arhopala moelleri* (de Nicé.), Journ. A. S. B., lii. (2), p. 80, pl. 9, f. 4, 4 *a*, ♂ ♀ (1883).

Recorded from the Khasias; not received by me.

278. *Arhopala peramuta* (Moore), Cat. Lep. E. I. C., i., p. 42 (1857).

Shillong and Cherra Punji. Several examples.

279. *Arhopala paramuta* (de Nicé), Journ. As. Soc. Beng., lii. (2), p. 81, pl. 9, f. 7 ♂, 7 *a* ♀ (1883).

Shillong. Three examples.

Genus Curetis, *Hübn.*

280. *Curetis gloriosa*, Moore, P. Z. S., 1883, p. 522, pl. 48, f. 1, ♂.

Shillong. One male example of this large-sized species of the *thetys* group.

281. *Curetis bulis* (Doubl.), Hew. Gen. D. L., ii., p. 473, pl. 75, f. 5, ♂ (1852).

Curetis discalis, Moore, P. Z. S., 1879, p. 138.

Many examples. No doubt, as de Nicéville says, there are plenty of intermediates between the two typical forms, showing that it is a variable species.

Genus Zephyrus, *Dalman.*

282. *Zephyrus khasia*, de Nicé., Butt. of India, iii., p. 301 (1890).

Recorded from the Khasias; not received by me.

Genus Ilerda, *Doubl.*

283. *Ilerda epicles* (Godart), Enc. Méth., ix., p. 646 (1823).

Many examples; apparently very plentiful.

284. *Ilerda androcles* (Doubl.), Hew. Gen. D. L., ii., pl. 75, f. 2, ♂ (1852).

A male in my museum from the Khasias, received from Mr. Moore; and a female from Shilling, received from Col. Marshall, but not received from Mr. Hamilton.

Genus Arrhenothrix, *de Nicéville.*

285. *Arrhenothrix penicilligera*, de Nicé., Butt. of India, iii., p. 337, pl. 28, f. 214, ♂ (1890).

Shillong and Cherra Punji. Many males and two females. Two of the males have the apical black band of fore wings above somewhat narrower than in the others; the blackish apical band of the hind wings is also absent or very much reduced, the white discal

band below is just as narrow as in the others; and this is the only apparent superficial difference to distinguish these two insects from the Javan *Dacalana vidura*, Horsfield; and were it not for the difference in the number of the subcostal nervules of fore wing, pointed out by de Nicéville, it would be impossible to believe they were distinct insects. These two were taken at Shillong in May, and I imagine are only the dry season form of *penicilligera*.

Genus Camena, *Hew.*

286. *Camena ctesia*, Hew., Ill. D. L., p. 48, pl. 20, f. 1, 2, ♂ (1865).

Common.

287. *Camena cleobis* (Godart), Enc. Méth., ix., p. 634 (1823).

Shillong. One male example. I have this species also from Sikkim (*Möwis*), and from Karwar in N. Kanara (*Aitken*).

288. *Camena deva* (Moore), Cat. Lep. E. I. C., i., p. 46 (1857).

Shillong. Three males. They vary somewhat from each other in the breadth of the black apical band. I have this insect from Ceylon and from Karwar, North Kanara.

289. *Camena ister* (Hew.), Ill. D. L. Lep., p. 43, pl. 19, f. 15, 16, ♀ (1865).

Camena carmentalis, de Nicé., Journ. Bo. Nat. Hist. Soc. (3), vii., p. 335, pl. H, f. 10, ♂ (1892).

Shillong. One example, a female, which corresponds with Hewitson's description, and also very closely with de Nicéville's description, of *carmentalis*, which I have no doubt is the male of *ister*.

290. *Camena cotys* (Hew.), Ill. D. L., p. 43, pl. 19, f. 19, 20, ♂ (1865).

Shillong. One male.

291. *Camena cippus* (Fabr.), Ent. Syst., v., Suppl., p. 429 (1798).

Shillong. One example.

Genus Mota, *de Nicéville.*

292. *Mota massyla* (Hew.), Ill. Diurn. Lep. Suppl., p. 7, pl. 3, f. 87, 88, ♂ (1869).

Shillong. One example.

Genus Aphnæus, *Hübn.*

293. *Aphnæus syama* (Horsf.), Cat. Lep. E. I. C., p. 107 (1829).

Common.

294. *Aphnæus himalayanus*, Moore, Journ. A. S. B., liii. (2), p. 26 (1884).

Common.

295. *Aphnæus orissanus*, Moore, *l. c.*, p. 27.

Shillong. One male and two females. Probably, as suggested by de Nicéville, it is only a var. of *syama*.

Genus Tajuria, *Moore.*

296. *Tajuria maculata* (Hew.), Ill. D. L. Lep., p. 47, pl. 21, f. 29, 30, ♀ (1865).

Common.

297. *Tajuria diæus* (Hew.), *l. c.*, p. 45, pl. 20, f. 27, 28, ♂, 26, ♀.

Recorded from the Khasias; not received by me.

298. *Tajuria melastigma*, de Nicé., P. Z. S., 1887, p. 460, pl. 40, f. 1, ♂.

Recorded from the Khasias; not received by me.

299. *Tajuria jangala* (Horsf.), Cat. Lep. E. I. C., p. 113, ♀ (1829).

Common.

300. *Tajuria megistia* (Hew.), Ill. D. L. Lep. Suppl., p. 5, pl. Suppl., 3, f. 77, 78, ♂ (1869).

Cherra Punji. Several males and two females. The females are blackish brown above, with a patch of blue in the middle of the interno-median interspace of fore wings, slightly extended into the base of the interspace above. Under side exactly as in the male.

301. *Tajuria thyia*, de Nicé., Journ. Bo. Nat. Hist. Soc. (3), vii., p. 336, pl. H, f. 11, ♂ (1892).

Recorded from the Khasias; not received by me.

302. *Tajuria illurgis* (Hew.), Ill. D. L., Suppl., p. 10, pl. 4, f. 37, 38 ♂ (1869).

Shillong. One example.

Genus Thecla, *Fabr.*

303. *Thecla leechii*, de Nicé., Journ. Bo. Nat. Hist. Soc. (3), vii., p. 335 (1892).

Recorded from the Khasias; not received by me.

Genus Suasa, *de Nicéville.*

304. *Suasa lisides* (Hew.), Ill. D. L., p. 33, pl. 14, f. 28, 29, ♂ (1863).

One male from Shillong, one female from Cherra Punji. The female has no blue colour on the hind wings; large brown spots above the tails, succeeded by two white spots; on the under side the submarginal band of curved lines on the hind wing is very prominent, and the black spots at apex and near tails large.

Genus Hypolycena, *Godart.*

305. *Hypolycena erylus* (Godart), Enc. Méth., ix., p. 633 (1823).

Common.

Genus Cliaria, *Moore.*

306. *Cliaria othona* (Hew.), Ill. D. L., p. 50, pl. 22, f. 17, 18, ♂ (1865).

Common.

307. *Cliaria kina* (Hew.), *l. c.*, Suppl., p. 13, pl. 5, f. 32, ♂, 33, 34, ♀ (1869).

Shillong. One male. I have it also from Napal.

308. *Cliaria cachara* (Moore), P. Z. S., 1883, p. 527, pl. 49, f. 6, ♂.

Shillong. Three males. A perfectly distinct species. I have it also from the North Cachar Hills.

Genus Zeltus, *de Nicéville.*

309. *Zeltus etolus* (Fabr.), Mant. Ins., ii., p. 66 (1787).

Common.

Genus Charana, *de Nicéville.*

310. *Charana mandarinus* (Hew.), Ill. D. L. Lep., p. 28, pl. 11, f. 6, 7, ♀ (1863).
Shillong. One male.

Genus Cheritrella, *de Nicéville.*

311. *Cheritrella truncipennis*, de Nicé., P. Z. S., 1887, p. 456, pl. 39, f. 4, ♂, 3, ♀.
Shillong. One example.

Genus Ticherra, *de Nicéville.*

312. *Ticherra acte* (Moore), Cat. Lep. E. I. C., i., p. 47, ♀ (1857).
Common.

Genus Cheritra, *Moore.*

313. *Cheritra freja* (Fabr.), Ent. Syst., iii., 1, 263, 19 (1793).
Common.

Genus Horaga, *Moore.*

314. *Horaga sikkima*, Moore, P. Z. S., 1883, p. 525.
Recorded from the Khasias; not received by me.

315. *Horaga onyx* (Moore), Cat. Lep. E. I. C., i., p. 30 (1857).
Two examples from Cherra Punji.

Genus Catapœcilma, *Butler.*

316. *Catapœcilma elegans* (Druce), P. Z. S., 1873, p. 350, pl. 32, f. 12, ♀.
Common.

Genus Loxura, *Horsfield.*

317. *Loxura atymnus* (Cram.), Pap. Exot., iv., p. 82, pl. 331, f. D, E (1780).
Common.

Genus Yasoda, *de Nicéville.*

318. *Yasoda tripunctata* (Hew.), Ill. D. L. Lep., p. 26 (1863).
Shillong. One male.

Genus Lehera, *Moore.*

319. *Lehera eryx* (Linn.), Mant. Plant., p. 537 (1771).
Shillong. Two females.

Genus Deudorix, *Hew.*

320. *Deudorix epijarbas* (Moore), Cat. Lep. E. I. C., p. 32 (1857).
Common.

321. *Dendorix gætulia*, de Nicé., Journ. Bo. Nat. Hist. Soc. (3), vii., p. 338, pl. H, f. 12, ♂ (1892).

Cherra Punji. One example.

Genus Zinaspa, *de Nicé.*

322. *Zinaspa todara* (Moore), P. Z. S., 1883, p. 530.

Rapala distorta, de Nicé., P. Z. S., 1887, p. 641, pl. 40, f. 6, ♀.

One example. I have this species also from Sikkim; it is identical with Moore's type.

Genus Rapala, *Moore.*

323. *Rapala varuna* (Horsfield), Cat. Lep. E. I. C., p. 91 (1829).

Common. De Nicéville does not include this as an Indian species in his Butt. of India. I have, however, many examples of both sexes, received from Mr. Hamilton; and a long series from Java, received from Major Holtz from Lawang. The two are absolutely identical; and I have compared both at the British Museum. I have one example also from Port Blair, received from Wimberley.

324. *Rapala sphinx* (Fabr.), Syst. Ent., p. 520 (1775).

Shillong. Three males identical with the Javan form, which I have from Lawang. It is much larger than *varuna*, and quite differently coloured above, being a beautiful insect, shot with brilliant blue.

325. *Rapala buxaria*, de Nicé., Journ. A. S. B., lvii. (2), p. 285, pl. 14, f. 13, ♂ (1888).

Common; many examples received. The only female received is brown above, suffused with purplish, with a dark brown broad apical border; the coloration below is yellower than in the male, much the tint of the female of *R. petosiris*, but slightly paler, markings similar to the male; transverse bands more red, red mark outside the spot above the tail bright red. I do not think I can be mistaken, on account of the peculiar cut of the insect, which bears a striking resemblance to the male, and was received in the same lot.

326. *Rapala tara*, de Nicé., *l. c.*, p. 284, pl. 14, f. 11, ♂.

Shillong. Several examples, all males. One has the under side much darker coloured than the rest, more

of a reddish chestnut colour, but in every other respect it is identical with the others.

327. *Rapala schistacea* (Moore), P. Z. S., 1879, p. 140.
Common.

328. *Rapala orseis* (Hew.), Ill. D. L. Lep., p. 23 (1863).
Dendurix grisea, Moore, P. Z. S., 1879, p. 140.
Several examples.

329. *Rapala rosacea*, de Nicé., Journ. A. S. B., lvii. (2), p. 285, pl. 14, f. 12, ♂ (1888).
Shillong. Three males.

330. *Rapala nissa* (Kollar), Hüg., Kasch., iv. (2), p. 412, pl. 4, f. 3, 4 (1848).
The commonest *Rapala* in the Khasias, and very variable in respect to the red spot on the fore wings above.

331. *Rapala refulgens*, de Nicé., Journ. Bo. Nat. Hist. Soc. (3), vi., p. 376, pl. F, f. 18 (1891).
Recorded from the Khasias; not received by me.

332. *Rapala petosiris* (Hew.), Ill. D. L. Lep., p. 22, pl. 9, f. 30, 31, ♂ (1868).
Common.

Genus BINDAHARA, *Moore*.

333. *Bindahara phocides* (Fabr.), Ent. Syst., iii., 1, 282, 85, ♀ (1793).
Shillong. One example.

Genus SINTHUSIA, *Moore*.

334. *Sinthusia grotei* (Moore), P. Z. S., 1883, p. 527, pl. 49, f. 5, ♂.
Shillong. Three examples.

Family PAPILIONIDÆ.

Subfamily PIERINÆ.

Genus TERIAS, *Swains*.

335. *Terias harina*, Horsf., Cat. Lep. E. I. C., p. 137 (1829).
Common.

336. *Terias læta*, Boisd., Sp. Gen., i., p. 674 (1836).

337. *Terias purræa*, Moore, P. Z. S., 1882, p. 252.

338. *Terias hecabe* (Linn.), Mus. Ulr., p. 249 (1764).

Genus Colias, *Fabr.*

339. *Colias fieldii*, Mén., Cat. Mus. Petr. Lep., i., p. 79, pl. 1, f. 5 (1855).

Genus Ixias, *Hübn.*

340. *Ixias evippe*, ♂ (Drury), Ill. Ex. Ent., i., pl. 5, f. 2 (1773).

Papilio pirithons, ♀, Fabr., Syst. Ent., p. 483 (1775).

Common.

341. *Ixias pyrene*, ♂ (Linn.), Mus. Ulr., p. 241 (1764).

Papilio œnippe, ♀, Cram., Pap. Exot., ii., pl. 105, f. c, d (1779).

Common. There appear to be two seasonal forms, one smaller than the other, the male having hardly a trace of the black macular marginal band to the hind wings above.

Genus Hebomoia, *Hübn.*

342. *Hebomoia glaucippe* (Linn.), Mus. Ulr., p. 240 (1764).

Common.

Genus Dercas, *Boisd.*

343. *Dercas verhuellii* (Hoev.), Tijd. Nat. Gesch., v., pl. 8, f. 3, 4 (1838).

Common.

344. *Dercas wallichii* (Doubl.), Proc. Ent. Soc. Lond., v., p. 47 (1849).

Many examples.

345. *Dercas urania* (Butler), P. Z. S., 1865, p. 458, pl. 26, f. 5.

Several examples. Kirby puts it as a synonym of the preceding, but I think it must be a good species, having never seen any intermediates.

Genus Catopsilia, *Hübn.*

346. *Catopsilia pyranthe* (Linn.), Mus. Ulr., p. 245 (1764).

347. *Catopsilia ilea* (Fabr.), Ent. Syst., Suppl., p. 426, (1798).

Differs from *pyranthe* in having a narrow black marginal border to fore wings above, composed of lunules

below the apex, decreasing in size hindward, and extending only to the first median interspace; sometimes an indication of a lunule in the interno-median interspace; the female has also a lunulated marginal border, broader than in the male, and extending in a thin line to the hinder margin; it is probably a seasonal form of *pyranthe*.

348. *Catopsilia thisorella* (Boisd.), Sp. Gen., i., p. 609 (1836).

Generally smaller than either of the two preceding; the male usually with no black border, never with more than an indication of it; the female with a pale border, very narrow and lunulate; this may also be a seasonal variety of *pyranthe;* but I have in my museum long series of all three, and each appears to be very constant in these characters.

349. *Catopsilia philippina* (Cram.), Pap. Exot., iv., pl. 361, f. c, d (1782).

Callidrias gnoma, Butler, Lep. Exot., i., p. 43, pl. 16, f. 1—4 (1870).

350. *Catopsilia catilla* (Cram.), Pap. Exot., iii., pl. 229, f. d, e (1782).

Genus Metaporia, *Butler*.

351. *Metaporia agathou* (Gray), Zool. Misc., p. 33 (1832).

Very common.

Genus Pontia, *Fabr*.

352. *Pontia xiphia* (Fabr.), Sp. Ins., ii., p. 43 (1781).

Common.

Genus Huphina, *Moore*.

353. *Huphina phryne* (Fabr.), Syst. Ent., p. 473 (1775).

354. *Huphina nama* (Doubl.), List B. M., i., p. 28 (1844).

355. *Huphina amba* (Wallace), Trans. Ent. Soc. Lond. (3), iv., p. 340 (1867).

Genus Appias, *Hübn*.

356. *Appias zelmira* (Cram.), Pap. Exot., iv., pl. 320, f. c, d (1782).

Common.

357. *Appias nero* (Fabr.), Ent. Syst., iii., p. 153 (1793).
Many examples.

Genus Catophaga, *Hübn.*

358. *Catophaga darada* (Feld.), Reise, Nov. Lep., p. 142 (1865).

One pair. Felder's type came from the Khasia Hills. I have two pairs also from Palene, Burma, taken in June, 1887, which are identical with my Khasia examples.

Genus Hyposcritia, *Moore.*

359. *Hyposcritia lalage* (Doubl.), Gray, Zool. Misc., p. 76 (1842).

Common.

360. *Hyposcritia pseudolalage* (Moore), P. Z. S., 1879, p. 142.

Several examples. Shillong and Cherra Punji.

361. *Hyposcritia mahana* (Moore), Ann. Nat. Hist., 1877, p. 48.

Common.

362. *Hyposcritia indra* (Moore), P. Z. S., 1857, p. 103, pl. 44, f. 5, ♀.

Shillong. Three examples.

Genus Prioneris, *Wallace.*

363. *Prioneris thestylis* (Doubl.), Gray, Zool. Misc., p. 76 (1842).

Common.

364. *Prioneris clementhe* (Doubl.), Ann. Nat. Hist., xvii., p. 23 (1846).

Common.

Genus Delias, *Hübn.*

365. *Delias ithiela* (Butler), Ann. Nat. Hist. (4), iv., p. 542 (1869).

Common.

366. *Delias descombesii* (Boisd.), Sp. Gén., i., p. 465 (1836).

Several examples.

367. *Delias agostina* (Hew.), Ex. Butt., i., *Pier.*, pl. 1, f. 1, 2 (1852).

Very common.

368. *Delias hierte*, Hüb., Zutr. Ex. Schm., f. 77, 78 (1818).

369. *Delias passithoë* (Linn.), Syst. Nat., i., 2, 755 (1767).

Cherra Punji. One pair.

Genus Eronia, *Boisd.*

370. *Eronia avatar*, Moore, Cat. Lep. E. I. C., i., p. 61, pl. 2 *a*, f. 1 (1857).

Subfamily PAPILIONINÆ.

Genus Ornithoptera, *Boisd.*

371. *Ornithoptera rhadamanthus*, Boisd., Sp. Gen., i., p. 180 (1836).

Many examples.

372. *Ornithoptera cerberus* (Felder), Reise, Nov. Lep., i., p. 19 (1865).

Common.

Genus Teinopalpus, *Hope.*

373. *Teinopalpus imperialis*, Hope, Trans. Linn. Soc., xix., p. 131, pl. 11, f. 1, 2 (1843).

Shillong and Cherra Punji.

Apparently a common insect in the Khasias. This butterfly for years in India went under the name of the Senechal *Papilio*, because it seemed to be confined to the Senechal Hill at Darjeeling, and the males may be observed flying from there across the opening to the hill opposite; the females used to be very scarce, and at one time for eight consecutive years there was no record of a female being taken, and I gave that excellent collector, Mr. Paul Möwis, of Darjeeling, fifty rupees for the first taken at the end of these eight years; in the Khasia Hills Mr. Hamilton's collectors seem to have hit upon the home of these females, and he has obtained a good number of recent years, of which he has sent me about forty.

Genus Achillides, *Hübn.*

374. *Achillides arcturus* (Westw.), Ann. Nat. Hist., ix., p. 37 (1842).

375. *Achillides paris* (Linn.), Mus. Ulr., p. 184 (1764).

Genus Sarbaria, *Moore*.

376. *Sarbaria ganesa* (Doubl.), Gray, Zool. Misc., p. 73 (1842).

Genus Sainia, *Moore*.

377. *Sainia protenor* (Cram.), Pap. Exot., i., pl. 49, f. A, B (1779).

378. *Sainia rhetenor* (Westw.), Arcana, Ent., i., pl. 16, f. 1 (1842).

A good number of both sexes.

Genus Pangerana, *Moore*.

379. *Pangerana varuna* (White), Entom., i., p. 280 (1842).

Genus Iliades, *Hübn.*

380. *Iliades agenor* (Linn.), Mus. Ulr., p. 194 (1764).

Papilio androgeos, Cram., Pap. Exot., 1, pl. 91, f. A, B (1779).

Papilio achates (Cram.), *l. c.*, ii., pl. 182, f. A, B.

Apparently very common in all its varieties; some of the tailed females have the elongated white spots on the hind wings reduced to two or three thin streaks, and some of the tailless specimens have white patches near the anal angle of the hind wings, covering one-third of the wing-space.

Genus Byasa, *Moore*.

381. *Byasa philoxenus* (Gray), Zool. Misc., p. 32 (1831).

382. *Byasa dasarada* (Moore), Cat. Lep. E. I. C., i., p. 195 (1857).

383. *Byasa bootes* (Westw.), Ann. Nat. Hist., ix., p. 36 (1842).

Shillong and Cherra Punji. Eleven males, one female.

Genus Charus, *Moore*.

384. *Charus helenus* (Linn.), Mus. Ulr., p. 185 (1764).

Apparently a rare species in the Khasias; two examples from Shillong only received.

385. *Charus chaon* (Westw.), Arcana, Ent., ii., pl. 72, f. 1, 1* (1845).

Common.

Genus Menelaides, *Hübn.*

386. *Menelaides aristolochæ* (Fabr.), Ent. Syst., p. 443 (1775).

Genus Laertias, *Hübn.*

387. *Laertias polytes* (Linn.), Mus. Ulr., p. 186 (1764).

Genus Meandrusa, *Moore.*

388. *Meandrusa evan* (Doubl.), Ann. Nat. Hist., xvi., pp. 235—304 (1845).

Many males, and thirteen females.

Genus Dabasa, *Moore.*

389. *Dabasa gyas* (Westw.), Arcana, Ent., i., pl. 11, f. 1 (1841).

Many males, and seventeen females.

Genus Pazala, *Moore.*

390. *Pazala glycerion* (Gray), Zool. Misc., p. 32 (1831).

Fifteen males from Shillong.

Genus Pathysa, *Reakirt.*

391. *Pathysa agetes* (Westw.), Arcana, Ent., ii., pl. 55, f. 1, 2 (1853).

Several hundreds, all males; the females of this *Papilio* must be very rare; I have never seen one.

392. *Pathysa antiphates* (Cram.), Pap. Exot., i., pl. 72, f. A, B (1779).

Common.

393. *Pathysa anticrates* (Doubl.), Ann. Nat. Hist., xviii., p. 371 (1846).

In great numbers. The closely allied and widespread form *P. nomius* I have never received from the Khasias; it is, no doubt, more or less a southern form, but I have several examples from Anadra, at the foot of Mount Aboo, which is much further north than the Khasia Hills, and one would have expected to get it from the latter locality also.

Genus Dalchina, *Moore*.

394. *Dalchina cloanthus* (Westw.), Arcana Ent., i., pl. 11, f. 2 (1841).

395. *Dalchina sarpedon* (Linn.), Mus. Ulr., p. 196 (1764).

Genus Zetides, *Hübn*.

396. *Zetides eurypylus* (Linn), Mus. Ulr., p. 216 (1764).

Several examples.

397. *Zetides bathycles* (Zinck.), Nova Acta Nat. Cur., xv., p. 157, pl. 14, f. 6, 7 (1831).

Many examples.

398. *Zetides axion* (Felder), Verh. zool.-bot. Ges., xiv., p. 305 (1864).

Five males.

399. *Zetides agamemnon* (Linn.), Mus. Ulr., p. 202 (1764).

Genus Opheides, *Hübn*.

400. *Opheides erithonius* (Cram.), Pap. Exot., iii., pl. 232, f. A, B (1782).

Genus Chilasa, *Moore*.

401. *Chilasa dissimilis* (Linn.), Mus. Ulr., p. 301 (1764).

402. *Chilasa panope* (Linn.), Syst. Nat., i. (2), p. 782 (1767).

Genus Isamiopsis, *Moore*.

403. *Isamiopsis telearchus* (Hew.), Trans. Ent. Soc., 1852, p. 22, pl. 6, f. 3.

Eleven males and one female.

The female, which is now, I believe, in the collection of Messrs. Godman and Salvin, did not differ from the other sex; it certainly had no resemblance to the insect described and figured by de Nicéville in Journ. Bo. Nat. Hist. Soc., 1889, p. 169, pl. A, f. 5.

404. *Isamiopsis slateri* (Hew.), Ex. Butt., ii., Pap., pl. 4 (text), (1859).

Five males and one female.

405. *Isamiopsis danisepa* (Butler), Ann. Mag. N. H. (5), xvi., p. 343 (1885).

Cherra Punji. One male.

Genus Tamera, *Moore.*

406. *Tamera castor* (Westw.), Ann. Nat. Hist., ix., p. 37 (1842).

Genus Cadugoides, *Moore.*

407. *Cadugoides agestor* (Gray), Zool. Misc., p. 32 (1831).

408. *Cadugoides epycides* (Hew.), Ex. Butt., ii., Pap., pl. 6, f. 16 (1864).

Genus Paranticopsis, *Wood-Mason.*

409. *Paranticopsis xenocles* (Doubl.), Gray, Zool. Misc., p. 74 (1842).

410. *Paranticopsis macareus* (Godt.), Enc. Méth., ix., p. 76 (1819).

411. *Paranticopsis megarus* (Westw.), Arcana Ent., ii., pl. 72, f. 2 (1845).

Genus Leptocircus, *Swains.*

412. *Leptocircus curius* (Fabr.), Mant. Ins., ii., p. 9 (1787).

Family HESPERIDÆ.

Subfamily HESPERIINÆ.

Genus Calliana, *Moore.*

413. *Calliana pieridoides*, ♂, Moore, P. Z. S., 1878, p. 687, pl. 45, f. 2 ; ♀, de Nicé., Journ. Bo. Nat. Hist. Soc. (3), vi., p. 377, pl. G, f. 25 (1891).

Several males and one female from Shillong.

Genus Capila, *Moore.*

414. *Capila jayadeva* (Moore), Cat. Lep. E. I. C., i., p. 248 (1857).

Capila jayadeva, Moore, P. Z. S., 1865, p. 785, pl. 42, f. 3.

Four males and two females from Shillong and Cherra Punji.

Watson, in his classification of the *Hesperidæ*, P. Z. S., 1893, p. 31, states that the neuration of the genus *Pisola* is the same as *Calliana*, from which it only differs in having no tuft on the hind tibiæ in the male; de Nicéville, on the other hand (Journ. Bo. Nat. Hist. Soc. (3), vii., p. 347 (1892)), says that it has this tuft of hairs, and for want of this knowledge Moore has mixed *Pisola zennara* and *Capila jayadeva* together. Though I feel

obliged to protest against the aggressive tone adopted by de Nicéville in this, as on almost all occasions when criticising the work of his contemporaries, I am bound to admit the general correctness of his conclusions. It is a pity he does not say upon the examination of how many specimens of both sexes of both species he grounds his conclusions; in my own collection are several undoubted males of *Capila jayadeva*, Moore, a specimen corresponding to Moore's description of the female, but which has the tuft of hairs on the hind tibiæ; the abdomen is broken, but the specimen is undoubtedly that of a male. But again I have a specimen corresponding to Moore's description of *Pisola zennara*, which I believe is a male; though an old example, it is complete, and I have often thought that instead of two Indian species in these two genera there are three.

Genus Crossiura, *de Nicé.*, Journ. Bo. Nat. Hist. Soc., 1892, p. 350.

415. *Crossiura pennicillatum*, de Nicé., *l. c.*, p. 351, pl. J, f. 1 ♂, 2 ♀.

Shillong. Two males.

Genus Satarupa, *Moore.*

416. *Satarupa sambara* (Moore), Cat. Lep. E. I. C., i., p. 246 (1857).

Very common.

Genus Daimio, *Murray.*

417. *Daimio bhagava* (Moore), P. Z. S., 1865, p. 781.

Many examples.

418. *Daimio phisara* (Moore), Journ. As. Soc. Beng., 1884, p. 50.

Shillong. Two examples.

The above two are very doubtfully distinct species.

419. *Daimio narada* (Moore), *l. c.*, p. 51.

Many examples.

Genus Sarangesa, *Moore.*

420. *Sarangesa dasahara* (Moore), P. Z. S., 1865, p. 787.

Shillong. Four examples.

A widely spread species; I have it from Sikkim, Rangoon, and South Kanara.

Genus Coladenia, *Moore.*

421. *Coladenia fatih* (Kollar), Hüg. Kasch., iv. (1), p. 454, pl. 18, f. 5, 6 (1848).

Fifteen examples.

Genus Achalara, *Scudder;* Lobocla, *Moore.*

422. *Achalara liliana* (Atkinson), P. Z. S., 1871, p. 216, pl. 12, f. 2.

Common.

Genus Celænorrhinus, *Hübn.*

423. *Celænorrhinus badia* (Hew.), Ann. Mag. N. H. (4), xx., p. 322 (1877).

One example.

424. *Celænorrhinus chamunda* (Moore), P. Z. S., 1865, p. 788.

Shillong. Two examples.

425. *Celænorrhinus leucocera* (Kollar), Hüg. Kasch., iv. (1), p. 454, pl. 18, f. 3, 4 ♀ (1848).

Many examples.

426. *Celænorrhinus putra* (Moore), *l. c.*

Several examples.

Differs from *leucocera* in the absence of the small white streak close to the costa on the upper side of the broad macular discal band; the large white spots are closer together, and more evenly placed, and the fore wing is slightly narrower and more produced.

427. *Celænorrhinus aurivittata* (Moore), P. Z. S., 1878, p. 843, pl. 53, f. 2.

Three examples from Cherra Punji.

428. *Celænorrhinus pyrrha*, de Nicé., Journ. Bo. Nat. Hist. Soc., iv., p. 181, pl. B, f. 11 ♀ (1889).

Recorded from the Khasias; not received by me.

429. *Celænorrhinus nigricans* (de Nicé.), Journ. As. Soc. Beng., liv. (2), p. 123, pl. 2, f. 6 ♀ (1885).

Shillong. Two examples. This species appears to have been omitted by Watson in his classification.

Genus Odina, *Mabille*.

430. *Odina decoratus* (Hew.), Desc. Hesp., p. 17 (1867).
One example from Shillong.

Genus Tagiades, *Hübn.*

431. *Tagiades ravi* (Moore), Cat. Lep. E. I. C., i., p. 246 (1857).
Tagiades kasiana, Moore, Journ. As. Soc. Beng., 1884, p. 51.
Many examples.

Watson keeps these distinct, but I cannot see by what character they can be separated. Moore's type of *ravi* came from Penang; his *kasiana* is said to be paler, and the under side of the hind wing more intensely grey; the spots above smaller. I have before me eleven males, five females, from the Khasias; one male, three females, from the Andamans; two males, one female, from Orissa; one male, two females, from Rangoon. The Andaman specimens have the white on the under side of hind wings most restricted; the others are about equal in that respect. The size of the spots above in all of them vary; the Orissa and Rangoon examples are much the palest; one very pale female from the Khasias, the rest quite as dark as any of the others; one female from the Khasias with no subapical spots.

432. *Tagiades atticus* (Fabr.), Ent. Syst., iii., i., p. 339 (1793).
Goniloba menaka, Moore, Cat. Lep. E. I. C., i., p. 246 (1857).
Very common.

433. *Tagiades gana* (Moore), P. Z. S., 1865, p. 180.
One example.

434. *Tagiades pralaya* (Moore), Cat. Lep. E. I. C., i., p. 246 (1857).
Several examples.

Genus Darpa, *Moore*.

435. *Darpa hanria*, Moore, P. Z. S., 1865, p. 781, pl. 42, f. 2.
One example from Shillong.

Genus Ctenoptilum, *de Nicé.*

436. *Ctenoptilum vasava* (Moore), P. Z. S., 1865, p. 786.
Many examples.

Genus Odontoptilum, *de Nicé.*

437. *Odontoptilum angulata* (Felder), Verh. zool.-bot. Ges., xii., p. 488 (1862).
Achlyodes sura, Moore, P. Z. S., 1865, p. 786.
Many examples.

Genus Caprona, *Wallengren;* Abaratha, *Moore.*

438. *Caprona ransonnetii* (Felder), Verz. zool.-bot. Ges. Wien., 1868, p. 284.
One example from Shillong.

Genus Pyrgus, *Hübn.*

439. *Pyrgus galba* (Fabr.), Ent. Syst., iii., i., 352, 337 (1793).
Shillong. One example.
Watson makes this genus Section C of the genus *Hesperia*, but as *Hesperia* has a tuft of hairs on the hind tibiæ and *Pyrgus* has not got this subgeneric character, I do not see why Hübner's name should be sunk.

Subfamily PAMPHILINÆ.

Genus Iambrix, *Watson.*

440. *Iambrix salsala*, Moore, P. Z. S., 1865, p. 786.
Shillong. Two males and one female.

Genus Aeromachus, *de Nicé.*

441. *Aeromachus stigmata* (Moore), P. Z. S., 1878, p. 694.
Very common.

442. *Aeromachus jhora* (de Nicé.), Journ. As. Soc. Beng., 1885, p. 122, pl. 2, f. 12 ♂.
Shillong. One example.

Genus Sebastonyma, *Watson.*

443. *Sebastonyma dolopia* (Hew.), Desc. Hesp., p. 27 (1868).
Many examples.

Genus Arnetta, *Watson.*

444. *Arnetta atkinsoni* (Moore), P. Z. S., 1878, p. 693, pl. 45, f. 10.
Shillong. Two examples.

445. *Arnetta khasiana* (Moore), P. Z. S., 1878, p. 693.
Common.

Genus Isma, *Distant.*

446. *Isma isota*, n. sp.

♂. Allied to *I. cephala*, Hew., and *I. cephaloides*, de Nicé. Above it differs from *I. cephala* in having only two subapical white spots instead of three, the top one being absent; the discal spots similar, but smaller, the lowest one near the hinder margin being merely a white point; the two discal spots on the hind wing are also smaller, and consequently wider apart. On the under side the fore wings have similarly disposed spots; the outermost spot near the outer margin a mere white point, and no indication of the white spot near the hinder margin; the ground colour of the wing is of a uniform blackish brown, with the costal and apical areas broadly yellowish; the hind wing is of a uniform yellowish throughout, with the spots as above, the spot nearest the hinder margin not bifid, *i.e.*, divided by the vein, as in *cephala*. Expanse of wings, $1\frac{3}{10}$ in.

Shillong. One example.

I at first put it with *cephala*, not liking to describe a unique specimen; but it is so clearly distinct either from *cephala* or from de Nicéville's description of *cephaloides*, that it is worth describing.

Genus Zographetus, *Watson.*

447. *Zographetus satwa*, de Nicé., Journ. As. Soc. Beng., 1883, p. 86.
Common.

Genus Metapa, *Moore.*

448. *Metapa aria* (Moore), P. Z. S., 1865, p. 784.
Common.

442. *Metapa sasivarna* (Moore), *l.c.*
Common.

449. *Metapa shalgrama*, de Nicé., Journ. As. Soc. Beng., 1883, p. 85.

Shillong. Three males. I have this from the Karen Hills, and one example received recently from Port Blair, Andaman Islands, received from Mr. Wimberley, which is also identical with the Karen Hills example identified by de Nicéville.

Genus Erionota, *Mab.*

450. *Erionota thrax* (Linn.), Syst. Nat., i., 2, p. 794 (1767).

Several examples.

451. *Erionota acroleuca* (Wood-Mason & de Nicé.), Proc. As. Soc. Beng., Aug., 1881, p. 143.

Hesperia hiraca, Moore, Trans. Ent. Soc. Lond., 1881, p. 313, ♀.

Teligonus lara, Swinhoe, Ann. Mag. N. H., 1890, p. 365.

Shillong. Two examples. I have this insect from the Andamans, the Nikobars, Makasser, Celebes, and from Nias, and am inclined to believe there is more than one species; the Celebes insect is, however, identical with those from the Khasias.

Genus Gangara, *Moore.*

452. *Gangara thyrsis* (Fabr.), Syst. Ent., p. 532 (1775).

Shillong. One example.

Genus Padraona, *Moore.*

453. *Padraona dara* (Kollar), Hüg. Kasch., iv., p. 455 (1844).

Pamphila mæsa, Moore, P. Z. S., 1865, p. 509, pl. 30, f. 9.

Several examples.

Genus Telicota, *Moore.*

454. *Telicota bambusæ* (Moore), P. Z. S., 1878, p. 691, pl. 45, f. 11, 12, ♂ ♀.

Four males and five females from Shillong.

455. *Telicota siva* (Moore), P. Z. S., 1878, p. 692.

Very common.

Watson has omitted this common species in his classification; I only put it here provisionally; he has also omitted the allied form *T. brahma*, Moore, P. Z. S., 1878, p. 691.

Genus Chapra, *Moore.*

456. *Chapra mathias* (Fabr.), Ent. Syst., Suppl., p. 433 (1798).

Four examples.

457. *Chapra agna* (Moore), P. Z. S., 1865, p. 791.
Two examples from Shillong.

458. *Chapra prominens*, Moore, P. Z. S., 1882, p. 261.
Common.

Genus Parnara, *Moore*.

459. *Parnara bada* (Moore), P. Z. S., 1878, p. 688.
Several examples.

460. *Parnara guttata* (Bremer & Gray), Schm. N. Chinas, p. 10 (1853).
Pamphila mangala, Moore, P. Z. S., 1865, p. 792.
Four examples from Shillong.

Genus Baoris, *Moore*.

461. *Baoris unicolor*, Moore, P. Z. S., 1883, p. 533.
One example.

462. *Baoris sikkima*, Swinhoe, Ann. Mag. N. H., 1890, p. 362.
Many examples of both sexes.

Why de Nicéville and Watson should insist upon clubbing all the different Indian species of this genus into one under the name of Hewitson's Philippine type *oceia*, it is difficult to understand, when they give specific rank to the numerous forms of *Parnara* recently described by the former; *oceia*, *sikkima*, *scopulifera*, and *unicolor* differ far more widely from each other than do the species of *Parnara* referred to, and are every bit as constant in their specific characters. Hewitson described a Philippine insect as *oceia*, and subsequently put every Indian Hesperid in his collection with the long brush of hairs on the upper side of the hind wing over his Philippine insect. Hewitson did the same thing with many others of his species,—witness *Halpe beturia*, as pointed out by Watson, P. Z. S., 1893, p. 110,—but it does not make them all one species. I have now before me seventeen examples of *sikkima*, being five males, two females, from Sikkim, six males, four females, from the Khasias, all identical with the type-specimens; three males and one female *unicolor*, one from the Khasias, the others from Sikkim, all identical with the type; five males, one female *scopulifera*, all from the Andamans,

and all identical with the type. I have examined many others in other collections; sometimes one or another of the minute hyaline spots are absent, but in so far as the general characters are concerned, by which these species have been very properly separated, I have seen no intermediates.

Genus Caltoris, nov.

Differs from *Baoris* in the male being without the sexual tuft of long hairs on the upper side of the hind wing, attached along the upper margin of the cell, and directed downwards across the cell.

463. *Caltoris kumara* (Moore), P. Z. S., 1878, p. 687.

Three examples from Shillong.

464. *Caltoris austeni* (Moore), P. Z. S., 1883, p. 533.

Common; I have received many specimens.

465. *Caltoris assamensis* (Wood-Mason & de Nicé.), Journ. As. Soc. Beng., 1882, p. 65.

Very common. This species varies much in size.

466. *Caltoris pagana* (de Nicé.), P. Z. S., 1887, p. 465, pl. 40, f. 7 ♂.

Many examples.

467. *Caltoris onchisa*, n. sp.

♂ ♀. Brown. Fore wing with two spots at end of cell, one above the other, and a whorl of five spots, commencing with a largish one near the base of the first median interspace; in the female there is another small spot above, but attached to the submedian vein a little beyond the middle. Hind wings without markings; cilia testaceous, with a brown base; outer portions white on hind wings, except at apex. Under side brown, with a reddish hue; colour uniformly dark throughout; spots as above, except that the male has the spot on the submedian vein of fore wings, and the female has a large suffused patch which fills the interspace. Both sexes with a peculiar pale outwardly curved subapical fascia on fore wings. Expanse of wings, ♂, $1\frac{6}{10}$ in., ♀, $1\frac{8}{10}$ in.

One pair. Shillong.

Near *C. farri*, Moore, but quite distinct; the pale subapical fascia on hind wings below is very distinctive.

468. *Caltoris toona* (Moore), P. Z. S., 1878, p. 689.
Many examples.

469. *Caltoris eltola* (Hew.), Ex. Butt., iv., Hesp., pl. 4, f. 40 (1869).
Very common.

470. *Caltoris colaca* (Moore), P. Z. S., 1877, p. 594, pl. 58, f. 7.
Two examples from Shillong.

471. *Caltoris bevani* (Moore), P. Z. S., 1878, p. 688.
Five examples. Shillong.

472. *Caltoris plebeia* (de Nicé.), P. Z. S., 1887, p. 466, pl. 40, f. 2 ♂.
Two examples. Shillong.

473. *Caltoris tulsi* (de Nicé.), Journ. As. Soc. Beng., liii. (2), p. 86, pl. 10, f. 1 ♂ (1883).
Two males and one female. Shillong.

474. *Caltoris sarala* (de Nicé.), Journ. Bo. Nat. Hist. Soc., 1889, p. 173, pl. B, f. 6 ♀.
One male. Shillong.

475. *Caltoris parca* (de Nicé.), *l. c.*, p. 174, pl. B, f. 10 ♀.
Recorded from the Khasias; not received by me.

Genus Halpe, *Moore*.

476. *Halpe moorei*, Watson, P. Z. S., 1893, p. 109.
Common.

This insect, as pointed out by Mr. Watson, has heretofore been in Indian collections as *H. beturia*, Hew., because Hewitson put an Indian insect in his collection with his Celebes type over the name *beturia*. *Moorei* is a very widely-spread Indian species. I have it from Sikkim, Andamans, Calcutta, Madras, Bombay, Bangalore, North Kanara, and the Khasias.

477. *Halpe homolea* (Hew.), Descr. Hep., p. 29 (1868).
Halpe sikkima, Moore, P. Z. S., 1882, p. 407.
Many examples; corresponding in all respects with Sikkim specimens. In the Sikkim, as well as the

Khasia examples, the variation referred to by Elwes, Trans. Ent. Soc. Lond., 1888, p. 453, is observable, the cell-spot in the fore wings above being sometimes absent, and sometimes there is a small white dot above the two subapical spots; and in some specimens the cell-spot is reduced to a dot, but the discal elongated spots and the two usual subapical spots do not seem to vary in size.

478. *Halpe aucma*, n. sp.

♂. Closely allied to the preceding; of the same uniform brown colour above; fore wings with no cell-spot, two discal spots less than half the size of these spots in *H. homolea*, the lower the larger, and slightly excavated on the outer side, as obliquely placed as in *H. gupta*, de Nicé.; three subapical spots, the uppermost one very minute. Hind wings uniformly coloured, not paler in the centre, as in *homolea;* cilia grey, patched with brown in the fore wings. Under side darker than in *homolea;* spots of fore wings as above; otherwise the markings of both wings are of the same character as in *homolea*, but more suffused and less distinct. Expanse of wings, $1\frac{4}{10}$ in.

One example. Shillong.

479. *Halpe marta*, n. sp.

♂. Closely allied to *homolea*, similarly coloured, but without the paler shade in centre of hind wings. Fore wings shorter; discal spots much shorter, the bottom one nearly square, slightly excavated on the outer side, not nearly so obliquely placed, consequently the cell-spot, which is present and small, is not above its inner end, but well to the inner side of the wing; subapical spots two, and nearly of equal size, as in *homolea;* cilia similar. Under side darker; spots on fore wing as above. Wings with similar markings, but not nearly so diffused with yellow atoms, and the markings on hind wings very obscure. Expanse of wings, $1\frac{4}{10}$ in.

One example. Shillong.

480. *Halpe wantona*, n. sp.

♂. Allied to *homolea.* Wings similarly coloured, with the paler space in the centre of hind wings; discal and cell-spots as in *marta;* subapical spots all very small, the upper one very minute; cilia of fore wings not patched either above or below, but brown with pale tips, palest towards hinder angle; cilia of hind wings grey. Under side: fore wings with spots as above, the usual subapical band of yellow spots slightly recurved and not uniform; otherwise the general coloration and markings much as in *homolea*,

but the markings on the hind wings are very obscure. Expanse of wings, $1\frac{3}{10}$ in.

Shillong. One example.

481. *Halpe perara*, n. sp.

♂. Dark brown; cell-spots minute; discal spots two, also very small, placed somewhat as in *H. sitala*, de Nicé., the lower spot excavated on its outer side; in the type-specimen the lower spot is the smaller, in the other specimen it is slightly the larger; subapical spots two, small, nearly round, the lower slightly the larger. Hind wings unmarked; cilia of both wings grey, with brown patches. Under side dark brown, slightly paler than on the upper side. Fore wings with spots as above; a slight indication of a third upper subapical spot; a submarginal yellowish grey indistinct band of suffused spots extending below the middle. Hind wings with slight suffusion of yellowish atoms, which form two indistinct incomplete bands, the first broad and before the middle, the second discal, and composed of small indistinct spots; palpi beneath, face and pectus covered with yellowish grey hairs; abdomen with fine transverse grey bands. Expanse of wings, $1\frac{4}{10}$ in.

Shillong. Two examples.

This insect above looks somewhat like *Halpe ceylonica*, Moore; below it is more of the *homolea* character.

482. *Halpe teliga*, n. sp.

♂. Allied to *H. moorei*, Watson. Upper side dark brown. Hind wings paler in the centre. Fore wings with two spots in the cell, one above the other, and conjoined, the upper the smaller; discal spots two, slightly larger than the cell-spots, the upper the smaller, both excavated on the outer side, the spots larger than in *moorei*, but similarly placed; subapical spots three, minute, and of equal size. Hind wings unmarked; cilia of both wings grey, with brown patches. Under side pale chocolate-brown. Fore wings with the markings much as in *moorei*. Hind wings with some whitish subcostal marks; a white discal band divided by the veins, as in *moorei*, but broader than is usual in that species, and just below this band, and nearly touching it, is another band of four round pure white spots, and between this and the margin are two bands of larger brown spots, the inner one edged outwardly with whitish, the other one touching the whitish marginal edge: palpi beneath and thorax with yellowish grey hairs; abdomen white, with two longitudinal rows of brown spots. Expanse of wings, $1\frac{4}{10}$ in.

Shillong. One example.

The under side of this species is very distinctive, with its pretty chocolate marbled appearance.

483. *Halpe cerata* (Hew.), Ent. Mo. Mag., 1876, p. 152.

Shillong. Many examples. The white markings below are more pronounced in Khasia Hill examples than in those from Sikkim, the spots being larger.

484. *Halpe gupta*, de Nicé., Journ. As. Soc. Beng., 1886, p. 255, pl. 11, f. 1 ♂.

Shillong. Many examples.

485. *Halpe zema* (Hew.), Ann. Mag. N. H. (4), xix., p. 77 (1877).

Shillong and Cherra Punji. Many examples.

486. *Halpe hyrie*, de Nicé., Journ. Bo. Nat. Hist. Soc. (3), vi., p. 388, pl. G, f. 34 (1891).

Shillong. One example.

487. *Halpe aina*, de Nicé., *l. c.* (3), iv., p. 176, pl. B, f. 8 ♂ (1889).

Shillong. One example.

Genus Notocrypta, *de Nicé.*

488. *Notocrypta restricta* (Moore), Lep. Ceylon, i., p. 178 (1881).

Shillong and Cherra Punji. Many examples. A widely distributed species. I have it from many Indian localities, including the Andamans, where it appears to be commoner than the local form *paralysos* of Wood-Mason and de Nicéville, which is also omitted by Watson in his classification. I have several examples of *paralysos*, received from Wimberley, identical with a specimen named for me by de Nicéville; they appear to me to be identical with *feisthamelii*, Boisd. = *alysos*, Moore.

Genus Udaspes, *Moore.*

489. *Udaspes folus* (Cram.), Pap. Exot., i., pl. 74, f. 7 (1779).

Common.

Genus Astictopterus, *Felder.*

490. *Astictopterus olivascens*, Moore, P. Z. S., 1878, p. 692.

Several examples.

491. *Astictopterus kada*, n. sp.

♂ ♀. Upper side of a uniform dark brown, with a pinkish tinge; cilia of both wings paler pinkish brown. Fore wings with three subapical white spots, the middle spot generally the largest; in some examples the upper spot is very minute, in others it is nearly as large as the lowest spot; no other markings above. Under side pinkish brown. Fore wings suffused with dark brown, except in the upper half of the outer marginal space; subapical spots as above. Hind wings much paler pinkish brown; costal space suffused with brown; an indistinct irregular brown band before the middle, another broader and more complete discal. Expanse of wings, ♂ $1\frac{4}{10}$, ♀ $1\frac{4}{10}$—$1\frac{7}{10}$ in.

Shillong. Five males and five females.

Allied to *A. olivascens*, Moore, but the three prominent subapical white spots of fore wings, and the peculiar pale pinkish brown colour of the hind wings below, are very distinctive.

Genus Koruthailos, *Watson*.

492. *Koruthailos butleri* (Wood-Mason and de Nicé.), Journ. As. Soc. Beng., liii. (2), p. 98, pl. 10, f. 3 ♂ (1883).

Shillong. One example.

Genus Kerana, *Distant*.

493. *Kerana diocles* (Moore), P. Z. S., 1865, p. 787.

Several examples. Shillong and Cherra Punji.

Genus Pithauria, *Moore*.

494. *Pithauria murdava* (Moore), P. Z. S., 1865, p. 784.

Common.

495. *Pithauria stramincipennis*, Wood-Mason and de Nicé., Journ. As. Soc. Beng., 1886, p. 388, pl. 15, f. 5 ♂.

Common.

Genus Unkana, *Distant*.

496. *Unkana semamora* (Moore), P. Z. S., 1865, p. 791.

Shillong. One example. Though a male it has the opaque white spot in the submedian interspace, which de Nicéville says is a specific character by which his *U. watsoni* can be distinguished; it corresponds, however, in all other respects with Moore's type of *semamora*.

Genus Ismene, *Swainson.*

497. *Ismene ataphus,* Watson, P. Z. S., 1893, p. 126.
Many examples. Shillong and Cherra Punji.

498. *Ismene jaina,* Moore, P. Z. S., 1865, p. 782.
Shillong. Several examples.

499. *Ismene amara,* Moore, *l. c.*, p. 783.
Shillong. One male.

Genus Burara, nov.

Differs from the genus *Ismene* in the absence of any androconia patch or streaks on the fore wing of the male.

500. *Burara vasutana* (Moore), P. Z. S., 1865, p. 782.
Common.

501. *Burara harisa* (Moore), *l. c.*
Several examples. Shillong and Cherra Punji.

502. *Burara gomata* (Moore), *l. c.*, p. 783 ♂.
Shillong. One pair.

Genus Hasora, *Moore.*

503. *Hasora badra* (Moore), P. Z. S., 1865, p. 778.
Several examples. Shillong and Cherra Punji.

504. *Hasora anura,* de Nicé., Journ. Bo. Nat. Hist. Soc., iv., p. 170, pl. B, f. 5 ♂, 1 ♀ (1889).
Snillong. Several examples.

505. *Hasora vitta* (Butler), Trans. Ent. Soc., 1870, p. 498.
Shillong. Several examples. The type of this species came from Sarawak; it is a common Indian species. I have both sexes from Sikkim, several places near Bombay, and the Khasias identical with my Bornean examples, and with the Sarawak type in the B. M. It has been mixed up in Indian collections with the commoner Indian *Parata alexis,* Fabr., but can easily be distinguished by the subapical white spot on upper side of fore wings, and the entire absence of the very characteristic subgeneric sexual character of *Parata,* i. e., an oblique glandular streak of laxly raised scales below the cell in the fore wings above.

Genus Parata, *Moore.*

506. *Parata chromus* (Cram.), Pap. Exot., iii., pl. 284, f. E ♂ (1782).

Two males. Shillong.

507. *Parata alexis* (Fabr.), Syst. Ent., p. 533 (1775).

Very common.

Genus Bibasis, *Moore.*

508. *Bibasis sena* (Moore), P. Z. S., 1865, p. 778.

Common.

Genus Badamia, *Moore.*

509. *Badamia exclamationis* (Fabr.), Syst. Ent., p. 530 (1775).

Common.

Genus Rhopalocampta, *Wallengren:* Choaspes, *Moore.*

510. *Rhopalocampta benjamini* (Guérin), Deless. Souv. Voy. Ind., ii., p. 79, pl. 22, f. 2, 2A (1843).

Several examples. Shillong and Cherra Punji.

Note.—Watson states, P. Z. S., 1893, p. 90, that the genus *Cyclopides* is confined to Africa, but he unfortunately does not state where the common Indian insect *Cyclopides subvittatus*, Moore, P. Z. S., 1878, p. 692 = *subradiatus*, Moore, p. 693, should be placed.

The types of all the new species will as usual be presented to the British Museum.

PS.—Since the printing of the earlier sheets of this paper, I have determined another species of the genus *Euthalia*, which is quite new to English collections.

Euthalia duda, Staud., Ex. Schm., 1886, p. 152, pl. 53.

Shillong. One male.

XIX. *Description of a new genus and species of* Papilionidæ *from Mexico.* By Osbert Salvin, M.A., F.R.S., &c.

[Read October 4th, 1893.]

Baronia, gen. nov.

Allied to *Papilio*, and with the arrangement of the median nervure and its branches with relation to the lower disco-cellular of the primaries similar; the subcostal, however, has only two branches instead of four, the first arising at a distance from the end of the cell, about equal to its width, and the second the same distance beyond; the usual third branch from the end of the cell is wanting, as well as either the first or second before the end of the cell; the upper disco-cellular is short, and the middle disco-cellular about twice as long as the lower. *Antennæ* very short, less than the first median segment of the primaries, with a comparatively long thick club. *Palpi* very short, hardly perceptible amongst the long hairs on either side of the haustellum. *Frontal scales* long and hair-like, but drawn downwards between the eyes, and not pro-erect as in *Papilio*. *Legs* with short spiny joints; a distinct epyphisis on the anterior tarsi.

Baronia brevicornis, sp. n.

Wings brown; fringe between the nervules narrowly white; primaries with three arched series of oval ochraceous spots—the first with four spots, one in the cell, the fourth near the inner margin; the second with seven, all beyond the cell, those between the median branches and at the anal angle quite small; the third with four subapical spots; secondaries with the costal two-thirds of the cell and beyond it nearly to the costa yellow ochre; three spots forming a triangle beneath the cell, the longest forming the base below the first median branch, and the smallest (the apex) above the second branch, and a discal row of six spots also yellow ochre. Beneath as above, but paler; the subapical series of spots on the primaries and an additional submarginal row silver; secondaries with all the spots silver, the discal row larger and more elongated, and a submarginal row near the anal angle. Primaries slightly produced, the apex rounded, the outer margin

slightly concave; secondaries rounded, neither the apical nor the anal angles prominent, and no trace of a tail.

Female.—Like the male, but larger, the spots near the costa of the primaries whitish, and an additional series of four small yellow-ochre submarginal spots; secondaries with the yellow-ochre marks much more extensive, and even confluent in places; an additional submarginal row of ochre spots. Beneath with the spots of the apex of the primaries and those of the secondaries silver.

Hab. Western Mexico: Sierra Madre del Sur, near Chilpancingo, at an altitude of about 4500 ft. (*O. T. Baron*).

We are indebted to Mr. Baron for a pair of this interesting species, which, with a few other individuals, were captured by himself in the months of June and July a few years ago. The shortness of the antennæ and the peculiar neuration of the wings at once show that it cannot be referred to any known genus of *Papilionidæ*.

XX. *Formicides de l'Antille St. Vincent. Récoltées par* Mons. H. H. Smith. *Décrites par le* Dr. Auguste Forel, Professeur à l'Université de Zürich. Communicated by Dr. D. Sharp, M.A., F.R.S., on behalf of the Committee for Investigating the Fauna and Flora of the West Indian Islands.

[Read October 4th, 1893.]

[The Hymenoptera dealt with in this memoir were collected by Mr. H. H. Smith, who was sent to the West Indies by Mr. F. D. Godman, F.R.S., to assist the Committee appointed by the British Association and the Royal Society to investigate the Fauna and Flora of the Antilles. The descriptions by Professor Forel are in the French language, the portions in English being the notes made by Mr. Smith at the time of the capture of the specimens. These notes are given in full, as it is thought that the precise localities in which the species were met with may be of interest to local naturalists. The numbers attached to these notes are those under which Mr. Smith transmitted his specimens, and are referred to in connexion with Dr. Forel's descriptions.—D. S.]

Cette collection de fourmis a été récoltée avec le plus grand soin. M. H. H. Smith a pris la peine de prendre autant que possible les différents sexes et de séparer toujours les individus de la même fourmilière dans un tube à part. De plus il a recueilli des observations biologiques importantes qui donnent une grande valeur au résultat de ses chasses.

1ere Sous-famille CAMPONOTIDÆ, *Forel.*

1ère Tribu CAMPONOTII.

Genre Camponotus, *Mayr.*

1. *Camponotus ruficeps*, Fabr., ☿ major et minor; ♀ (No. 2).

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(2). Forest or open places, 3000 ft. to sea-level; pretty common. Formicarium under bark of dead standing

trees or stumps ; sometimes at roots of Bromeliæ growing on trees, and occasionally under stones on dry ground. Several hundred individuals are found in a formicarium. When disturbed they are active and pugnacious. The workers minor are often seen on trees and foliage during the day, but I believe that the species is mainly nocturnal.

(2*a*). Collected at various places, 3000 ft. to seashore.

(2*b*). Seashore ; southern end of the island at the "Villa" Estate. Oct. 14th. Many ants were found under a block of coral lying on the sands, but I could find no young ; and perhaps this was not a nest.

(2*c*). Bowwood Valley, near Kingstown, 800 ft. Oct. 21st. Formicarium under stone ; open, dry hill-side.

(2*d*). Richmond Estate ; open valley. Oct. 31st. Formicarium in a rotten stump.

(2*e*). "Villa" Estate ; southern end of island. Nov. 20th. A small colony in a curled dried leaf in rubbish on the ground ; shady place by seashore.

(2*f*). Hermitage Estate, Cumberland Valley, 1000 ft. Open hill-side ; lower side of a log. Formicarium was in a hollow of the log, about $3 \times 2 \times 2$ in., apparently made by the ants ; the opening of the cavity was walled in by a thin fabric of wood-fibre, pretty strong ; through the middle of this was a hole for exit. The colony was small (about 100 workers). I could find no male nor female, and no other chambers were discovered.

(2*g*). Windward side ; sea-coast near Georgetown. Jan. 3rd. On bushes.

2. *Camponotus auricomus*, Roger, ☿ et ♀ (No. 8). Variété.

Longue de 4, 8 à 7 mill. avec le devant de la tête, les scapes et le 1er article des funicules rougeâtres, tandis que le reste des funicules, le thorax et l'écaille sont noirs.

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(8). Very common on foliage of bushes, &c. ; open places or dry thickets, below 1000 ft. All parts of the island.

(8*a*). Near Châteaubelais (leeward). August. Thickets not far from seashore ; on bushes. The formicarium is made in rotten wood, or rarely under stones, the ants apparently choosing that which has been riddled by termites. It is of considerable extent, and may contain

several hundred ants, with a few females. The ants, when disturbed, run over the intruders actively, but hardly attempt to bite.

(8 *b*). Open Valley, Richmond Estate (leeward). Near sea-level. Oct. 31st. Formicarium in a rotten stump.

3. *Camponotus sharpi*, n. sp. (No. 1).

☿ major. L. 12 mill. Longueur d'un scape 3 mill., d'un tibia postérieur 3, 4 mill. Tête (sans les mandibules) longue de 3, 2 et large de 3, 3 mill. Mandibules assez courtes, armées de 6 dents, fortement courbées près de l'extrémité, éparsément ponctuées, luisantes sur leur pourtour, très finement réticulées et mates au milieu.

Aspect et forme générale absolument identiques au *C. atriceps*, F. Sm., r. *ustulatus*, Forel, mais les tibias et les pattes sont plus grêles et sont absolument dépourvus de poils dressés, ce qui le distingue de l'espèce *atriceps* et le rattache au groupe *maculatus*. La tête est entièrement et densément réticulée—ponctuée et mate (luisante derrière et sur les côtés chez l'*atriceps*). La ponctuation superposée est abondante, effacée et relativement fine; il n'y a pas les grosses fossettes allongées qu'on trouve sur les angles postérieurs de la tête de l'*atriceps* r. *ustulatus*. Thorax et abdomen luisants, finement ridés-réticulés en travers.

De longs poils fauves, grossiers et dressés sur l'abdomen, le dos du thorax et, en moins grand nombre, sur la tête. Ces poils sont analogues à ceux de l'*atriceps*, mais moins abondants, et font défaut aux pattes et aux antennes. Une pubescence jaunâtre, fine et adjacente, fort éspacée sur tout le corps, les pattes et les antennes. D'un jaune roussâtre testacé. Tête, tarses et funicules roussâtres. Abdomen brun, avec des parties roussâtres nuageuses. Scapes, mandibules et lisière antérieure de la tête d'un brun assez foncé. La couleur est plus vive que chez l'*atriceps* r. *ustulatus*. Les tibias sont à peine déprimés et absolument dépourvus de petits piquants. La forme de la tête, du corps, de l'épistome, des arêtes frontales, etc., est identique à celle de l'*atriceps*.

☿ *minor*, L. 5, 8 à 8 mill. (les ☿ *minima* ont été prises seules avec une ♀ qui commençait une fourmilière). Tête à peu près rectangulaire, non rétrécie derrière les yeux. Couleur plus pâle que chez la ☿ major; scapes, mandibules et tarses d'un brun

jaunâtre. Tête brunâtre derrière, jaunâtre devant. Tête assez mate, plus réticulée-ridée.

♀. L. 14 à 16 mill. Ecaille fortement et largement échancrée. Les poils dressés sont parfois très épars sur le corps. Ailes faiblement teintées de jaunâtre. Nervures et tache marginale d'un jaune roussâtre. Tête en trapèze. Du reste comme la ☿ major.

♂. L. 7 mill. Ecaille échancrée. Quelques poils dressés fauves sur le dessus du corps. Pattes et antennes sans poils dressés. D'un jaune brunâtre, testacé. Tête et abdomen d'un brun noirâtre. Ailes comme chez la ♀.

Cette espèce est extrêmement voisine de l'*atriceps* et du groupe américain du *C. maculatus*. Sa pilosité et ses tibias plus grêles la distinguent du premier, ses tibias dépourvus de piquants, son épistome fortement échancré au milieu, sa grosse tête, les gros poils fauves du dessus du corps, les mandibules courtes, de 6 dents, la distinguent du second, en particulier des races *simillimus* F. Smith, et *fuscocinctus* Emery qui lui ressemblent d'ailleurs.

Le *C. pullatus*, Roger, est plus petit, noir, et a le thorax réticulé-ponctué. L'*opaciceps*, Roger, a des poils dressés aux pattes. Le *melanocephalus*, Roger, a la tête très luisante et noire et l'épistome sans carène. L'*inæqualis*, Roger, a 7 dents aux mandibules et la tête chagrinée.

Cependant à l'avenir, on devra probablement rattacher le *C. sharpi* comme race a l'*atriceps* ou au *maculatus*.

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(1). Pretty common below 1500 ft.; forest or open situations. The formicarium is commonly in dry brush or vines, well above the ground, the ants occupying the hollows of sticks, which they apparently excavate; sometimes it is under dry bark, or at the roots of Bromeliæ growing on trees. The colony may consist of many hundred individuals, the workers major somewhat less numerous than the workers minor. The species is nocturnal; unless the nest is disturbed, the ants are never seen in the daytime, but just at sunset they come out to forage; and I have frequently taken them on foliage when beating at night. When the formicarium is disturbed, the ants swarm out quickly, and are very pugnacious. The workers major and minor fight equally well, and both, I believe, engage in carrying the young to a place of safety. Though they fight well, they seem unable to find the aggressor in the daytime, unless they

stumble against him; once found, they lay hold of the clothes, or whatever they can get at, and cling so firmly that I have sometimes found them still attached after an hour or more. I have never found the males and females in a colony; probably they keep to the inner passages of the nest.

(1*a*). Near Lot 14 Estate (windward), 500 ft. Open place; banks of a stream, at the foot of a Bromelia on a rotten tree. May.

(1*b*). Near Wallibou (leeward), Oct. 9th. Sea-coast thicket, under the dry bark of a standing rotten tree.

(1*c*). Forest, à Morne Garou, 1500 ft. A female, found alone in the hollow end of a dead vine hanging from a tree. No eggs could be found. Oct. 27th.

(1*d*). Fitz-Hugh Valley (leeward), 500 ft. Shady place, in a small cavity of a log. Only two workers seen with the female. Evidently a new colony. Nov. 4th.

2me Tribu FORMICII.

Genre PRENOLEPIS, *Mayr.*

1. *Prenolepis longicornis*, Latr., ☿ ♀ ♂. (No. 17).

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(17). A common species about houses and open places, not far from sea-level. The formicarium is subterranean and extensive, with passages half an inch in diameter to the open ground above, or under stones. The colony contains many hundreds or thousands of individuals. The winged forms and larvæ are often exposed by turning over stones, but the ants carry them rapidly to lower parts of the nest, six inches or more below the surface. The workers are very active and bold; when foraging they run jerkily from side to side. They are especially fond of dead animal matter. When working over insects I have often been amused, as well as annoyed, to observe the boldness of these little foragers. If an ant discovers one of the insects she seizes it at once, and tries to drag it from the table. If I brush her off, she dodges around and behind the precious morsel, and seizes it again. Driven quite away, she runs to some shelter, but returns almost immediately, trying to drag the insect even from my fingers; and nothing short of mutilation or death will effectually stop her. One ant will drag away a load ten times as large and heavy as herself, always walking

backwards, and pulling the prize after her. If it is too heavy for her unaided efforts, she runs for other foragers. As soon as she finds a companion she communicates her excitement with a touch of the antennæ, and both return to drag off the prize. I have seen perhaps a hundred of these ants dragging a dead lizard across the floor; the lizard was about five inches long, and the ants dragged it more than a foot in ten minutes. I never saw these ants stop to feed on a discovered morsel; the first impulse is always to drag it away. They work during the day, and also, it would seem, at night. Apparently they require water, and they may be found in water jars and tumblers drinking. They can also make their way over the surface of still water; so that food placed in a dish which is set in a plate of water is not always protected. I have seen about fifty of these ants dragging a large cockroach about three feet up a perpendicular smooth-plastered wall.

(17 *a*). Thicket by the seashore near Wallibou (leeward). Oct. 8th. Large colony under a stone. The males were numerous, females less so.

(17 *b*). Golden Grove House (leeward). Oct. 29th. 400 ft. above the sea. Apparently there are several colonies above the house. Great numbers of the workers, with larvæ, were found under a stone, collected in crevices of the lower surface; tunnels extended below to six inches or more.

(17 *c*). Near Kingstown. Oct. 17th. Large formicarium under a stone; open hill-side, 500 ft. above the sea.

(17 *d*). Seashore thickets near Châteaubelais (leeward). September. Beaten from vines.

(17 *e*). Windward side. Open land near sea-level at Grand Sable, Jan. 3rd. From several nests under stones. The species is common on the windward coast.

2. *Prenolepis fulva*, Mayr., r. *pubens*, n. st. (No. 53 *a* à 53 *e*).

☿. L. 2, 8 à 3, 4 mill. Ne se distingue guère de la *P. fulva* typique que par sa pubescence plus faible, de sorte que l'abdomen et la tête sont assez luisants et par sa couleur plus foncée, d'un brun roussâtre, avec les mandibules et les côtés de la tête et du thorax rougeâtres, les pattes et les antennes d'un jaune brunâtre. La taille est plutôt plus grande.

♀. L. 4, 7 mill. Plus petite que la *P. fulva* in sp. Ailes

un peu moins enfumées et un peu plus courtes. Du reste pas de différence appréciable.

♂. L. 3, 2 à 3, 3 mill. Se distingue nettement de la *P. fulva* i. sp. par ses valvules génitales extérieures plus grandes, plus larges à l'extrémité et couvertes d'une touffe épaisse de longs poils très forts. Chez la *P. fulva* i. sp., les valvules génit. ext. ne sont que médiocrement poilues, comme chez les espèces voisines. Les autres valvules génitales sont identiques à celles de la *fulva* i. sp., mais le prolongement interne n'a pas trace de bec.

Le caractère des valvules génitales extérieures du ♂ est si accusé qu'il m'engage à fonder une race.

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(53). Local and rather rare. It appears to be confined to the seashore, or to open land not far from the sea. The communities are large, consisting of several hundred, or even thousand, individuals. The formicarium is generally in rather damp and soft ground, sheltered by a stone or log. There are one or two chambers several inches long immediately under this shelter, with passages leading down four or five inches to one or more chambers below. At the sides of the shelter there may be short passages among the roots of grass, &c. The workers and males are very active, the females less so. The workers are sometimes found on foliage in seashore thickets.

(53*a*). Near Kingstown, Oct. 17th. Damp spot in an open cane-field, about 250 ft. above the sea. Several nests were found, as described above. A male was found in one nest, but no female was observed. Some workers in this bottle were obtained near Wallibou (leeward), Oct. 8th. Seashore thickets, on foliage.

(53*b*). Females, doubtfully referred to this species. The note was lost.

(53*c*). Windward. Seashore near Georgetown, Jan 3rd. Muddy ground at mouth of stream; from two nests under stones. Both were large communities.

(53*d*). Windward. Grand Sable Estate; seashore, under a log. A large community. Jan. 3rd. This nest was almost within reach of the surf, on open sand.

(53*e*). Windward. Open bed of the Dry River, near the sea; sandy and somewhat dry soil, under a stone. The nest was made deeper than usual, about eight inches below the surface, probably to reach soil which contained more moisture. The community consisted of a few hundreds only. Jan. 2nd.

3. *Prenolepis guatemalensis*, Forel, race *antillana*, n. st. (Nos. 54 *a* à 54 *m* et 58 *a*).

J'ai décrit dans mes Etudes Myrmécologiques en 1884 (Bull. soc. vaud. Sc. nat, vol. xx.) sous le nom de *Prenolepis vividula* var. *guatemalensis* une forme que l'étude plus complète faite dès lors du genre *Prenolepis* m'oblige à séparer complètement de la *P. vividula*. Outre sa couleur et sa pubescence plus forte, l'ouvrière se distingue de la *vividula* par sa tête un peu plus large et moins convexe, par sa forme un peu plus robuste et par sa chitine moins lisse. Mais ce sont surtout les valvules génitales du ♂ qui rattachent la *guatemalensis* au groupe *obscura-fulva* et non à la *vividula*.

☿. L. 2, 1 à 2, 5 mill. Elle ne se distingue de la *guatemalensis* i. sp., que par sa couleur plus foncée, d'un brun jaunâtre sale, avec les antennes testacées, sa taille un peu plus grande (la *guatemalensis* n'a que 2, 0 mill.), son épistome un peu moins vôuté et surtout, par son métanotum bien plus bas, plus aplati, plus allongé, formant une voûte très faible, tandis qu'il est assez fortement voûté chez la *guatemalensis* i. sp.; chez les deux formes, la face basale est beaucoup plus courte que la face déclive. La pilosité est aussi un peu plus pointue. Chez l'*antillana*, comme chez la *guatemalensis* i. sp., le bord antérieur de l'épistome est échancré au milieu et le scape dépasse le bord postérieur de la tête des $\frac{2}{3}$ de sa longueur. Chez l'*antillana*, le *mésonotum* est aussi long que le pronotum, chez la *guatemalensis* i. sp., sensiblement plus court.

Elle se distingue de la *P. fulva* par sa taille beaucoup plus petite et par son métanotum plus allongé et bien moins voûté, ainsi que par sa pubescence plus faible.

♀. L. 4, 8 mill. Plus grande que la *guatemalensis* i. sp. qui n'a que 3, 8 à 4 mill. Les ailes sont assez fortement enfumées de brun plus foncé que chez la *guatemalensis* i. sp. et la *fulva*, dont elle est du reste fort difficile à distinguer.

♂. L. 2, 2 à 2, 4 mill. Métanotum allongé et subhorizontal, au moins aussi long que le mésonotum (sans l'écusson). Valvules génitales extérieures pâles (jaunâtres), en triangle isocèle presque équilatéral, plus larges à leur base et plus pointues à l'extrémité que chez la *P. fulva*. Valvules moyennes comme chez la *P. fulva*, mais plus courtes, plus massives; le prolongement externe n'est pas courbé. Du reste semblable au ♂ de toutes les formes voisines.

Il est fort possible que les formes *antillana* et *guate-*

malensis doivent être réunies plus tard à la *P. fulva* comme races.

N.B. Une ♀ du No. 57 *a* est une *Prenolepis antillana.*

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(54). Common locally, especially in the forest. The communities consist of several hundred individuals. The formicarium is generally in rotten wood, sometimes under a stone, and I have found no trace of external galleries; generally there are several small chambers connected irregularly by short passages. All the forms are quite active. N.B.—More than one species may be included here, but I have not attempted to separate very closely allied forms.

(54 *a*). Morne à Garou; forest, 1500 ft. Nov. 1st. Under the bark of a damp rotten log. The formicarium, so far as I traced it, occupied an irregular space about four inches square. The winged ants were numerous.

(54 *b*). Wallilobo Valley (leeward), Nov. 8th. Dry forest, hill-side, 800 ft. Small colony under a stone.

(54 *c*). Morne à Garou; forest, 1500 ft. Oct. 27th. A small nest in rotten wood.

(54 *d*). Wallilobo Valley, Nov. 8th. Damp forest. A nest of several chambers in a rotten stick.

(54 *e*). Bowwood Valley, near Kingstown. Second growth; 800 ft. Oct. 15th. Beaten from foliage.

(54 *f*). Various situations.

(54 *g*). Mountain forest, 3000 ft. March. Found in moss.

(54 *h*). Richmond Valley, 800 ft. Cacao orchard. Sept. Formicarium in rotting leaves.

(54 *i*). Upper Richmond Valley, 1500 ft. Nov. 27th. Forest near stream. Workers found scattered under sod on rocks or beaten from foliage.

(54 *j*). Same locality as No. 54 *i*. Nov. 27th. Forest near the stream. A small nest in and under a log.

(54 *k*). Hermitage Estate, Cumberland Valley, 1000 ft. Damp forest. Formicarium in and under a log on the ground. Some of the galleries were walled in by a substance made of wood-fibre. Several hundred ants, with many winged males and females. Dec 2nd.

(54 *l*). Richmond Valley; thick forest, 1100 ft. Worker found in decaying leaves. Males, doubtfully referred to this species, on freshly-cut wood. Dec. 29th.

(54 *m*). Same locality as No 54 *l*. Jan. 18th. Under stone near stream.

(58). Apparently distinct from Nos. 19 and 54. I have found only a few specimens in thickets near the coast, under stones and rubbish, or on foliage ; and I have not observed the nest.

(58 *a*). Leeward side ; at various points near the coast, thickets, or open land. Under stones and rubbish, or beaten from foliage. Aug.—Nov.

4. *Prenolepis Steinheili*, n. sp. (No. 19).

Dans les Mittheilungen des Münchener entomologischen Vereins 1881 (Die Ameisen der Antille St. Thomas) j'ai nommé *Prenolepis nodifera*, Mayr, une espèce de St. Thomas qui n'est évidemment pas la vraie *nodifera* de Mayr.

☿. L. 2, 1 à 2, 4 mill. Mandibules armées de 6 dents, luisantes, avec quelques stries et quelques points épars. Tête ovale-rectangulaire, aussi large devant que derrière. Les scapes dépassent le bord postérieur de la tête d'$\frac{1}{3}$ environ de leur longueur. Epistome à peine concave au milieu de son bord antérieur. Thorax assez robuste, profondément échancré entre le mésonotum et le métanotum. L'échancrure est presque aussi large au fond qu'un peu plus haut, c'est à dire qu'elle a au fond une courte surface plus ou moins plane, non pas seulement une simple ligne transversale, et que ses bords s'élèvent d'une façon abrupte, subverticale, tant vers le mésonotum que vers le métanotum. Au fond de l'échancrure sont deux stigmates presque aussi gros que l'intervalle qui les sépare l'un de l'autre. La métanotum est en bosse arrondie et presque aussi élevé que le mésonotum ; sa face basale est un peu plus courte que sa face déclive dont on peut à peine la distinguer.

Ecaille, face déclive du métanotum, côtés du thorax, épistome et parfois une partie du pronotum lisses, luisants, et glabres. Le reste ponctué, médiocrement pubescent et subopaque.

Les soies dressées ont la répartition ordinaire sur le corps, les pattes et les antennes. Elles sont plus épaisses et plus obtuses que chez les formes précédentes, d'un brun noirâtre.

D'un noir brun on parfois d'un brun noir. Thorax et pédicule souvent d'un brun plus clair. Antennes, mandibules et pattes brunâtres. Tarses, articulations des pattes, hanches et anneaux fémoraux d'un jaune très pâle, parfois même blanchâtre. La taille varie très peu.

Antille de St. Thomas (moi-même), Guatémala (*Dr. Stoll*).

Var. *minuta*, n. var. (Nos. 19*a* à 19*p*).

☿. L. 1, 8 à 2, 1 mill. Tous les caractères sont moins accentués, la couleur plus mêlée, ce qui le rend parfois difficile à distinguer de la *guatemalensis* v. *antillana*. Du reste comme la forme typique, mais moins pubescente, plus brunâtre, avec les hanches, anneaux, fémoraux, etc., d'un jaunâtre plus foncé.

♀ (v. *minuta*). L. 3, 2 à 4, 4 mill. Comme l'ouvrière. Ailes médiocrement enfumées de brun noirâtre. Mésonotum pubescent ainsi que le pronotum et une partie des côtés du thorax. Plus foncée que l'ouvrière.

♂ (v. *minuta*). L. 1, 6 à 2, 2 mill. Tout le corps court, trapu, surtout le thorax. Le métanotum est bien plus voûté que chez le ♂ des deux formes précédentes. Soies dressées sensiblement plus grossières que chez la *fulva* et la *guatemalensis* (chez le ♂ de ces dernières espèces, les soies sont beaucoup plus fines et plus pointues que chez l'ouvrière), d'un brun foncé. Couleur de l'ouvrière; hanches et anneaux fémoraux très-pâles, thorax seulement un peu plus clair que la tête et l'abdomen (beaucoup plus clair chez la *guatemalensis*). Les valvules génitales sont comme chez la *guatemalensis* r. *antillana*, mais les valvules extérieures sont beaucoup plus obtuses à l'extrémité, plus courtes, en triangle à côtés très inégaux (l'un des côtés a une convexité) et colorées en brun foncé.

St. Vincent.

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(19). A common species in open places below 500 ft. The formicarium is of moderate size, under a stone or log, or in a rotten stump. The passages are irregular, about $\frac{1}{3}$ in. in diameter, and several inches long; they are formed of bits of sand or rubbish loosely cemented together to form an arcade on the lower side of the stone or log. If the nest is in a stump, these galleries are on the inner surface of the bark, and they may communicate with other passages in the rotten wood. Where the wood furnishes a sufficient wall, there is no artificial one. Sometimes the arcade widens to an inch or more, forming a covered chamber. These passages somewhat resemble those made by termites, but are not so strong. The ants are rather active, moving about fussily when disturbed.

(19*a*). Richmond Estate (leeward). Open valley near sea-level. Oct. 31st. The specimens are from two nests under logs. A single female was found in one nest, several males in another.

(19 *b*). Southern end of the island; thicket near the sea. A small nest under a block of coral. Oct. 14th.

(19 *c*). Cumberland Valley (leeward); open hill-side, 500 ft. Small nest among dead leaves under a stone. Oct. 10th.

(19 *d*). Open dry hill-side near Kingstown, 250 ft. above sea. Nest under a log (only workers seen). Oct. 15th.

(19 *e*). Cumberland Valley. Small nest under a stone; open place near the river, not far from the sea. Oct. 10th.

(19 *f*). Golden Grove Estate (leeward). Open place, 300 ft. above sea. Formicarium under a stone (only workers seen).

(19 *g*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 3rd. Second growth, under bark of a rotten log. The colony contained about 200 individuals, with many larvæ, but no female was found. Two chambers were excavated under the bark, each about $1\frac{1}{2} \times \frac{3}{4}$ in.

(19 *h*). Fitz-Hugh Valley, 500 ft.; second growth. Nov. 3rd. A rather small colony at the roots of grass on a rock. No walled passages were observed in this nest, but only tunnels in the sod.

(19 *i*). Wallilobo Valley (leeward), 500 ft.; forest. A rather small colony in rotten wood. Two chambers were uncovered, each about $1\frac{1}{2} \times \frac{3}{4}$ in. Nov. 8th.

(19 *j*). Villa Estate; southern end of the island; thickets near sea-shore. A small nest under a stone.

(19 *k*). Camden Park Estate, leeward side north of Kingstown. Nov. 20th. Seashore under a log. Three females, referred to this species, found without workers.

(19 *l*). Petit Bordelle Valley, 1200 ft. Shady place near stream, in rotten wood. Nov. 13th. The formicarium consisted apparently of a single chamber, about 2 in. long, $\frac{3}{4}$ in. wide, and $\frac{1}{2}$ in. high, with a short entrance passage. The females (winged) are more active than the workers, running quickly to shelter when disturbed; the males are also active.

(19 *m*). Old Botanical Garden, near Kingstown, 500 ft. Oct. 22nd. On foliage, morning. Males doubtfully referred to this species.

(19 *n*). Windward side, near the Dry River; bank by seashore. Nest under a stone, excavated to a depth of

3 in, with two small chambers. Jan. 3rd. Community of about 300.

(19 *o*). Windward; open land near seashore at Robocca. Jan 2nd. From two nests, under stones.

(19 *p*). Windward, seashore thicket, Grand Sable. Jan. 3rd. Community of about 250, under sod on a rock.

3me Tribu PLAGIOLEPISII.

Genre BRACHYMYRMEX, *Mayr.*

1. *Brachymyrmex Heeri*, Forel, var. *obscurior*, n. var. (No. 57 *a* à 57 *l*).

☿ ♀ ♂. Ne diffère de la forme typique que par sa couleur brunâtre et par ses ailes légèrement enfumées de brunâtre. La pubescence est peut être aussi légèrement plus forte.

Cette forme se distingue du *B. patagonicus*, Mayr, par l'absence des ocelles, par sa taille plus petite et par sa pilosité un peu plus abondante. Les scapes sont aussi un peu plus longs.

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(57). Moderately common in communities of a few hundreds at most. The formicarium is formed under a stone, or at the roots of grass and weeds, generally on open ground; but if my hasty identifications are correct, the species ranges to the tops of the highest mountains. So far as I have observed, the formicarium consists only of one or two simple chambers, with a short connecting passage. The ants are moderately active, less so than allied forms. They are sometimes beaten from foliage.

(57 *a*). Wallibou (leeward); thickets near the seashore. Oct. 6th. Community of several hundreds under a stone. Sandy ground.

(57 *b*). Cumberland (leeward); open valley near the sea-level. Male and female found together under a stone (not copulated). Oct. 8th.

(57 *c*). Islet fronting Châteaubelais Bay (leeward), Oct. 31st. Rocky ground, thickets near sea-level. Workers found scattered under stones.

(57 *d*). Workers. Note was lost. Probably obtained by beating.

(57 *e*). Soufrière Volcano, 2500 ft. Sept. Scrubby growth found in moss, &c.

(57 *f*). Wallilobo Valley (leeward), Nov. 8th; open hill-side, 500 ft. A female referred to this species, found alone under sod on a rock.

(57 *g*). Bowwood Valley, near Kingstown, 800 ft. Oct. 15th. Second growth, beaten from branches.

(57 *h*). Not noted. Doubtfully referred to this species.

(57 *i*). Windward side; open sandy valley of the Dry River, near the sea. Jan. 2nd. From two nests under stones. The species is common in this vicinity.

(57 *j*). Same locality and date as (57 *i*). An unusually large community under a stone. The winged females and males (especially the males) were very numerous.

(57 *k*). Bank near seashore, between Georgetown and the Dry River (windward). Jan. 3rd. Nest at the roots of grass.

(57 *l*). Workers, doubtfully referred to this species; near Grand Sable Estate (windward). Jan 3rd. Seashore thicket; side of a rock under loose earth.

2. *Brachymyrmex minutus*, n. sp. (No. 47 *a* à 47 *f*).

☿. L. 1, 0 à 1, 3 mill. Mandibules armées de 5 dents. Tête ovale-rectangulaire, plus longue que large, plus étroite et à côtés plus convexes que chez le *B. Heeri*. Yeux situés au tiers antérieur des côtés de la tête (plus en arrière chez le *B. Heeri*). Ocelles parfois visibles. Les scapes dépassent considérablement le bord postérieur de la tête (bien plus que chez le *Heeri*). Epistome comme chez le *B. Heeri*. Aire frontale très-petite et assez profonde. Tout le corps plus grêle, plus étroit que chez le *B. Heeri*. Le thorax est distinctement, quoique faiblement échancré entre le mésonotum et le métanotum. Il est moins déprimé et plus étroit que chez le *Heeri*. Les stigmates mésothoraciques sont moins apparents et situés non pas, comme chez le *B. Heeri*, sur la face dorsale, mais un peu plus sur la face latérale du thorax, derrière l'échancrure. Ecaille petite, basse, inclinée en avant.

Luisant, très superficiellement et très finement chagriné; épistome lisse. Çà et là quelques poils dressés, surtout sur l'abdomen et le devant de la tête (bien moins que chez le *B. Heeri*). Pubescence adjacente jaunâtre, espacée, ne formant nulle part duvet; elle est un peu plus abondante sur les pattes et sur les scapes qui n'ont pas de pilosité dressée.

D'un jaune pâle; parfois d'un jaune un peu rougeâtre (les exemplaires de St. Thomas). Les funicules, sauf le 1er et le dernier article, le devant de la tête et parfois le milieu des tibias légèrement brunâtres.

♀. L. 2, 3 à 2, 7 mill. Caractères de l'ouvrière. Beaucoup plus étroite que chez le *B. Heeri*. Les ocelles sont placés sur trois taches d'un brun foncé. Pubescence plus forte que chez l'ouvrière, mais bien plus faible que chez le *B. Heeri*. Sur l'abdomen elle forme un léger duvet. Couleur de l'ouvrière, mais le dessus de l'abdomen légèrement bruni. Ailes faiblement teintes de brunâtre.

Antille de St. Vincent et Antille de St. Thomas, où je l'ai récoltée moi-même. Je l'avais alors confondue avec le *B. Heeri* (Mittheil. des Münchener Entom. Ver., 1881).

Cette espèce ressemble tout d'abord aux petites ☿ du *B. Heeri*, mais lorsqu'on l'examine de près, on la distingue facilement à sa taille plus petite et plus grêle, à son éclat plus grand, à sa pubescence plus faible, à la forme de sa tête, à l'échancrure du thorax et à la position des yeux. La ♀ du *B. Heeri* est beaucoup plus grande (plus de 4 mill.), ce qui rend une confusion impossible.

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(47). Rather rare. Communities of fifty to one hundred individuals are found in large tunnels, with very small chambers at intervals, at the roots of sod. The workers are rather sluggish, but the female is pretty active. Only one gravid female is found in a nest.

(47 *a*). Petit Bordelle Valley, 1200 ft. Under sod on a stone, bank of stream; shady place. Nov. 12th.

(47 *b*). Same date and locality as (47 *a*). Another nest; under sod on a rock.

(47 *c*). Same date and locality as (47 *a*). A single female found, without workers, at the roots of grass on a rock.

(47 *d*). Specimens referred to this species. Morne à Garou, forest, 2000 ft. Nov. 1st. Beaten from foliage.

(47 *e*). Upper Richmond Valley, 1500 ft. Nov. 27th. Thick forest by stream. A small nest at the roots of plants, &c., growing on a rock.

(47 *f*). Same locality as (47 *e*). Obtained by beating branches in the forest.

Genre Acropyga, *Roger*.

S. g. Rhizomyrma, n. subg.

☿. Antennes de 7 à 11 articles. Palpes maxillaires de 2 articles, dont le second est fort petit. Palpes labiaux de 3 articles. Epistome large et court, à bord antérieur comme entamé. Mandibules étroites, assez longues, presque droites, laissant entre elles

un large espace vide qui laisse voir le labre et les mâchoires. Leur bord terminal, armé de 3 à 4 dents étroites et pointues, est extrêmement oblique et passe sans limite bien distincte au bord interne; ce dernier est presque parallèle au bord externe. La base du bord externe des mandibules n'atteint pas l'angle antérieur latéral de la tête (l'articulation mandibulaire est un peu éloignée du bord de la tête). Yeux extrêmement petits. Pas d'ocelles. Aire frontale distincte, triangulaire. Antennes clavées. Gésier comme chez les autres *Plagiolepisii*.

♀. Comme l'ouvrière. Ailes manquent.

Du reste comme le genre *Acropyga*. Les différences indiquées suffisent-elles à justifier un sous-genre séparant ces formes américaines des *Acropyga* jusqu'ici connues qui sont toutes asiatiques? L'avenir le montrera, surtout lorsqu'on connaîtra les ♂. La position du *Brachymyrmex decedens*, Mayr, me paraît douteuse. Est-ce une *Rhizomyrma?*

Outre l'espèce de St. Vincent, dont la ♀ seule a été récoltée, une espèce du Brésil dont j'ai reçu les ☿ de M. le Dr. Göldi se rattache à ce nouveau sous-genre. Je fais suivre sa description ici en note *

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* *Acropyga* (*Rhizomyrma*) *göldii*, n. sp.

☿. L. 2 à 2, 3 mill. Mandibules presque droites, armées de 3 à 4 dents, lisses, très luisantes, avec 3 à 4 gros points enfoncés. Tête à peu près rectangulaire, plus large que longue, un peu plus large devant que derrière. Les yeux sont très petits, composés de deux ou trois facettes atrophiées, situés au tiers antérieur des côtés de la tête. Epistome très court, conformé du reste comme chez l'*A. smithii*, ainsi que les arêtes frontales et l'aire frontale. Pas de sillon frontal. Le scape des antennes dépasse légèrement le bord postérieur de la tête. Le funicule a de neuf à dix articles, dont le dernier est renflé et presque aussi long que les 4 précédents réunis.

Thorax comme chez l'*A. acutiventris*. Pronotum légèrement concave longitudinalement. Mésonotum grand et assez élevé. Une échancrure très distincte entre le mésonotum et le métanotum. Ce dernier arrondi; sa face déclive beaucoup plus longue que la face basale. Ecaille assez étroite, ovale-rectangulaire. Pattes assez courtes, un peu embrassantes.

Lisse, luisante, très finement et régulièrement ponctuée. Une pilosité dressée, d'un jaune pâle, très fine, pointue, de longueur irrégulière, assez abondamment répandue sur tout le corps qui est revêtu en outre d'une pubescence jaunâtre adjacente d'abondance médiocre (un peu plus abondante sur l'abdomen). Les tibias et les scapes n'ont qu'une pilosité très courte, oblique sur les premiers, dressée sur les derniers.

1. *Acropyga (Rhizomyrma) smithii*, n. sp. (No. 47 *g*).

♀. L. 2, 0 à 2, 2 mill. Mandibules lisses, luisantes, à peine ponctués, faiblement courbées, avec les caractères du sous-genre. Tête rectangulaire-allongée, beaucoup plus longue que large, à côtés et bord postérieur droits. Les yeux sont plats, assez grands, et sont très rapprochés des angles antérieurs de la tête. Bord antérieur de l'épistome avec une échancrure de chaque côté, largement tronqué et légèrement concave au milieu. Arêtes frontales composées d'une portion antérieure en forme de petit lobe horizontal qui n'est séparé de celui de l'autre côté que par une forte échancrure triangulaire et d'une portion postérieure fortement divergente. Sillon frontal faible, mais visible. Les trois ocelles rapprochés, situés sur une tache brune. Le scape des antennes atteint à peine l'ocelle antérieur. Le funicule n'a que six articles dont le dernier est plus long que les quatre précédents ensemble. Le premier article du funicule est long comme les deux suivants réunis; les articles 4 et 5 du funicule sont plus larges que longs.

Le pronotum n'est pas recouvert par le mésonotum. Scutellum aplati. Métanotum arrondi. Ecaille verticale, petite, rectangulaire, à bord supérieur subrectiligne. Pattes courtes.

Assez luisante, lisse, finement et abondamment ponctuée. L'épistome n'a que des points épars. Une pubescence subadjacente, d'un jaune pâle, un peu laineuse et courte est abondamment répandue sur tout le corps, les pattes et les antennes. En outre quelques poils dressés, assez courts, fins et pointus, épars sur tout le corps, nuls sur les tibias et sur les scapes.

D'un jaune très pâle. Dents des mandibules rougeâtres ; devant de la tête légèrement enfumé de brunâtre. Une tache ocellaire d'un brun foncé sur le vertex. Les ailes manquent.

L'ouvrière inconnue de cette fourmi doit être d'une exiguité remarquable et hypogée.

Une seule ♀ récoltée par Mons. H. H. Smith.

(47 *g*). Forest, Morne à Garou, 1500 ft. Oct. 27th. A single female, found under the bark of a rotten log.

Couleur exactement comme chez l'*A. smithii*, mais un peu plus vive et sans tache sur le vertex.

Rive gauche du Parahyba, Province Rio Janeiro (Brésil), récoltée par le Dr. Göldi sur des racines de Caféier où elle cultivait des Coccides.

♀ et ♂ inconnus.

Genre Myrmelachista, *Roger*.

1. *Myrmelachista ambigua*, n. sp., ☿ (No. 55 *a*).

L. 2, 3 mill. Mandibules fortement ponctuées, finement coriacées ntre les points, subopaques. Tête à peine plus longue que large. Yeux situés au milieu des côtés de la tête. Scapes courts. Antennes de 9 articles. Cependant le 2me article du funicule montre une légère tendance à se partager en deux. Pas d'aire frontale, ni de sillon frontal. Occiput sans sillon. Le mésonotum et le pronotum sont peu convexes; la longueur du premier est plus de la moitié de celle du second. L'échancrure méso-métanotale est faible et n'apparaît que par le fait que la convexité du mésonotum s'élève au dessus du niveau de la face basale du métanotum qui est horizontale (presque rectiligne dans le sens longitudinal). Les stigmates sont placés en arrière de la suture méso-métanotale et distants l'un de l'autre. La face basale du métanotum est subrectangulaire, subdéprimée et sensiblement plus longue que la face déclive. Ecaille inclinée en avant, épaisse à sa base, échancrée et tranchante au sommet. Cuisses assez renflées.

Tête, thorax et écaille lisses, polis et très luisants. Abdomen luisant, faiblement réticulé. Une pilosité jaunâtre très fine et de longueur médiocre est parsemée peu abondamment sur tout le corps. Sur les tibias elle est légèrement oblique. Sur les scapes elle est assez longue et dressée, située d'un seul côté. Pas de pubescence adjacente.

D'un rouge un peu jaunâtre. Abdomen noir avec ses segments étroitment bordés de jaunâtre. Pattes et antennes testacées. Sur l'occiput, sur le pronotum, sur les côtés du thorax, au milieu des cuisses et sur la massue des antennes, de légers nuages brunâtres (celui de l'occiput assez fort).

Cette espèce est évidemment très voisine de la *M. kraatzii*, Roger, mais elle a une pilosité assez longue, l'écaille n'est pas verticale, ni ovale, les tarses antérieurs ne sont pas élargis, l'abdomen a une sculpture distincte (Roger n'a pas pu en voir chez la *kraatzii*) et la couleur est une peu différente. La *M. rogeri*, André, diffère de la *M. ambigua* par sa couleur brune, ses funicules sans poils dressés, sa profonde échancrure méso-métanotale et sa taille plus faible. Les autres espèces ont dix articles aux antennes et sont à d'autres égards moins parentes.

Une seule ☿.

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(55). Rare. Only one specimen found as yet.

(55 *a*). Upper Richmond Valley. Shore of stream in the forest ; on sand, under rubbish, &c.

2me Sous-famille DOLICHODERIDÆ, *Forel.*

Genre DOLICHODERUS, *Lund.*

Dolichoderus lutosus, F. Smith, var. *nigriventris*, n. var. (No. 60 *a*).

☿. Diffère des types brésiliens par son abdomen d'un noir luisant à peine brunâtre, n'ayant que deux petites taches à la base et l'extrémité d'un roux jaunâtre. La ponctuation de l'abdomen est aussi plus forte et plus abondante. La tête et le thorax sont d'un jaune rougeâtre plus vif. L'écaille est distinctement acuminée comme l'indique Smith, ce qui n'était pas le cas des individus de de Mayr (var. *cingulatus*, Mayr).

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(60). Very rare. The only specimens seen were beaten from foliage. Forest near a stream.

(60 *a*). Forest near Châteaubelais (leeward), 250 ft. ; close to open land. Jan. 26th. Four workers, beaten from foliage. I searched vainly in the vicinity for the nest.

Genre IRIDOMYRMEX, *Mayr.*

Iridomyrmex iniquus, Mayr. (No. 56 *a*).

☿. Exemplaires assez grands (2, 3 mill.), se rapprochant un peu du *dispertitus*, Forel. La tête des *I. humilis* et *dispertitus* est fortement élargie derrière, et ces deux espèces ont une pubescence distincte, tandis que chez l'*iniquus* la tête est rétrécie à l'occiput, à peine plus large derrière que devant. L'*iniquus* est plus luisant, à peine pubescent et plus petit. Malgré tout, ces formes sont peu constantes ; la forme du mésonotum et du métanotum varie. Le *dispertitus* n'est guère qu'une race intermédiaire entre l'*iniquus* et l'*humilis*, race qui a plus ou moins la forme du thorax de l'*iniquus*, tandis qu'elle a la taille, la pubescence et la forme de la tête de l'*humilis*.

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(56). A rare species ; found thus far only in the forest.

(56 *a*). Upper Richmond Valley, 1500 ft. Nov. 28th. A good many workers were found near a stream in the thick forest, under rubbish and rotting fruit on the sand by the water, and under sod on rocks. No nest could be found.

Genre Dorymyrmex, *Mayr.*

Dorymyrmex pyramicus, Roger (No. 52 *a* à 52 *c*). ☿ et ♂.

(52). Pretty common on the windward side, and near the southern end of the island; above the seashore, or on slopes near it. Rarely on the leeward side. The formicarium is generally in sandy soil, where the sand is supported by roots of grass, &c. It is without shelter, opening on the surface of the ground by a small perpendicular tunnel; about this there is generally a small mound of loose sand, &c., not over an inch high, and four inches in diameter. The nest proper is about a foot below the surface, and probably goes deeper, as I have not yet obtained the female; it appears to consist of a few passages, not more than half an inch in diameter, horizontal, or nearly so, and without larger chambers. In these passages I have found larvæ and males with the workers. The communities apparently are small, having one or two hundred workers; but several tunnels are generally found near each other, and these may belong to a common, larger, and deeper nest. The workers and males are active; the latter do not fly when the nest is opened, so far as I have observed. Workers are sometimes found on bushes near the seashore.

(52 *a*). Near Brighton Estate (southern end of the island). Nov. 17th. Dry hill-sides, below 300 ft., overlooking flats by the sea; in roads, scrubby growth, rather hard ground; at the mouths of perpendicular tunnels.

(52 *b*). Not noted; apparently an immature specimen of this species.

(52 *c*). Leeward; seashore thickets at Wallibou. Oct. 8th. Beaten from bushes.

(52 *d*). Windward; seashore, at back of the open sands; Grand Sable Estate. Jan. 3rd. From two nests in sandy ground, supported by roots.

(52 *e*). Sandy, open valley of the Dry River; windward, near the sea. Jan. 2nd. From several nests, as described above.

Genre Tapinoma, *Foerst.*

Tapinoma melanocephalum, Fab. (No. 16 *a*). ☿ et ♀.

Espèce cosmopolite des tropiques.

(16). Common about houses at Kingstown, and at Georgetown. Its white abdomen and quick, jerky walk give it a very peculiar appearance. The formicarium is small, consisting apparently of a single chamber, in a cavity of a wall, or under a stone. There may be fifty or more workers in the colony.

(16 *a*). Near Kingstown; shady place on a hill-side near sea-level. Small nest in rubbish lodged between two stones.

(Found also at Georgetown, on the windward coast).

3me Sous-famille PONERIDÆ, *Lep.*

Genre ODONTOMACHUS, *Latr.*

Odontomachus hæmatodes, L. (No. 4 *a* à 4 *f*). ☿ ♀; race typique.

Le No. 15 *a* et 15 *b* est ce que M. le Prof. Emery a décrit sous le nom de *O. hæmatodes* v. *? microcephalus.** M. Emery a déjà émis des doutes à propos de ce singulier insecte, car il en avait reçu un analogue ayant les caractères de l'*O. chelifer*, Ltr. Il a aussi rendu attentif à l'énorme développement de l'abdomen. Or M. Smith a trouvé l'un de ces insectes dans une loge souterraine en compagnie de l'ouvrière du No. 4, c'est à dire de l'*O. hæmatodes*, L. Nous avons donc tout lieu d'admettre avec certitude qu'il ne s'agit pas ici d'une variété à nommer, mais, comme Emery lui-même (Biolog. Centralblatt, 1891) l'admet, d'une sorte de femelle ergatoïde dans le genre de la "femelle aptère" du *Polyergus rufescens* découverte et décrite par Huber. Le dimorphisme de la forme de la tête (rétrécissement postérieur) et la présence d'un ocelle médian est une de ces curiosités que nous rencontrons çà et là dans la famille des Formicides et qui paraît propre au genre *Odontomachus*.

N'est-ce peut être pas, comme le pense Emery, *l. c.*, par cette voie secondaire (dimorphisme de l'ouvrière) que se sont formées peu à peu les femelles aptères des Dorylides (*Dichthadia*) ? Ces individus dimorphes devenus de plus en plus féconds et réguliers, auraient supplanté peu à peu les ♀ ailées de forme ordinaire, et ces

* Bullettino della Soc. entom. italiana, Anno xxii., 1890, p. 45, pl. v., fig. 1. (Formiche della Fauna neotropica; I. Costa-Rica).

dernières auraient fini par disparaître ? Ce n'est qu'une hypothèse ; à l'avenir de venir la confirmer ou la contredire. Le termites présentent des analogies (Fritz Müller).

O. hæmatodes, L. var. *hirsutiusculus*, Smith. (No 5*a* à 5*d*). ☿ ♀.

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(4). Very common, especially in the forest, but also in open land ; 2500 ft. to sea-level. Formicarium generally under a log ; sometimes in rotten wood, or under stones. It may consist of many hundred individuals, but is oftener small. Winged males are rarely found in the colonies, but the winged females may escape observation from their close resemblance to the workers. When disturbed the ants move above lazily, and are not very pugnacious ; a large nest, however, is not to be examined with impunity, as the ants sting rather severely if they get on the skin. In the daytime the ants keep to shady places, and are nearly always found on the ground or on logs. I do not know if they also forage at night. These ants accumulate the mounds of earth and dead flowers sometimes found in the forest, but I have never seen them cutting leaves or flowers ; they may do so at night. The females fly at night. The workers walk about with the jaws wide open, at right angles to the head, but close them quickly when disturbed.

(4*a*). Lot 14 Estate ; shady place, 500 ft. May. Under a log (a large formicarium, probably 2000 individuals).

(4 *b*). Cavolries, S. slope of Mt. St. Andrews, 1400 ft. ; open place. Two only, found under a stone.

(4 *c*). Females ; came to light at light. Golden Grove Estate (leeward), 400 ft. April.

(4 *d*). Camden Park Estate ; leeward, near Kingstown, Nov. 19th. Seashore ; under a stone. About fifty ants were seen.

(4 *e*). Near Barronallie (leeward) ; open places near sea-level ; under a log. Jan. 15th.

(4*f*). Golden Grove Estate (leeward), 300 ft. Jan. 26th. Came to light at night.

This species, so far as I can judge, makes extensive underground works ; probably those found under stones, logs, &c., are merely at the surface ends of tunnels leading to the deeper and perhaps large formicarium. In the woods are often seen mounds of sand and bits of earth,

from which tunnels lead downward; and these ants are always found in the tunnels. The mounds may be two feet in diameter, and a foot high, indicating extensive works, from which the earth is taken. Mingled with the earth there are nearly always quantities of small flowers, probably picked up on the ground when they fell from trees; great quantities of the flowers are also frequently seen under the stones and logs, where the ants are found with their pupæ. I have not seen the ants gathering these flowers, and judge that they collect them at night.

(5). Rather rare; distinct from No 4. All seem more like the specimens sent.

(5 *a*). Thickets by sea-shore at the "Villa" Estate; southern end of the island. Oct. 14th. Under a stone in loamy sand at the root of a tree. About forty individuals in the nest, apparently all workers; they had many larvæ, which, when disturbed, were carried to deep passages under the stone.

(5 *b*). Richmond Estate (leeward); open valley near sea-level. Oct. 31st. Under a log. Apparently a formicarium, but I could find no winged ones.

(5 *c*). Fitz-Hugh Estate (leeward), Nov. 13th. Open place near sea-level; under a stone. Only a few ants seen.

(5 *d*). Windward side; shady bed of Dry River; near the sea. Jan. 2nd. Under a stone. The species is common along the windward coast, under stones and logs. The communities apparently are not large; but, like No. 4, this species seems to make extensive underground works, with outlets under stones and logs.

(6 *a*). These males, as I suppose, belong to No. 4 or 5; they came to light at night. Golden Grove Estate (leeward), 500 ft. The date was lost, but if my memory serves, they were taken in July or August.

(6 *b*). Forest, Morne à Garou, 2000 ft. Nov. 1st. Beaten from foliage. No 4 is common in this forest.

(15 *a*). Richmond Estate; open valley near sea-level. Oct. 31st. A single specimen found under a log. Many workers of No. 4 were under the same log.

(15 *b*). Near the Wallibou River (leeward), 500 ft. Jan. 10th. Open damp hill-side. Found alone under a stone.

Genre Anochetus, *Mayr.*

S. g. Anochetus, sens. strict.

Anochetus Mayri, Emery. (No. 29 *a* à 29 *f*). ☿ ♀.

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(29). Rather rare below 1500 ft., forming small colonies (three or four to twelve) under stones or sod, generally in shady places. The ants are sluggish.

(29 *a*). Lot 14 Estate (windward), 500 ft. April 5th. Shady glen near a stream; under decayiag leaves on a rock.

(29 *b*). Wallilobo Valley (leeward), 500 ft.; shady place, at the roots of sod on a rock. Nov. 8th. From two nests; the larger had about twelve ants.

(29 *c*). Forest above Châteaubelais (leeward), 1000 ft.; under a stone. A single specimen with one egg. Oct. 11th.

(29 *d*). Bowwood Valley, near Kingstown, 800 ft. Oct. 21st. Open hill-side, under a stone.

(29 *e*). Petit Bordelle Valley, 1200 ft. Nov. 13th. Under sod on a rock. Apparently there were several small chambers connected by passages, the whole extending about one foot; fifteen or twenty ants occupied each chamber, and in one were about twenty yellow pupæ.

(29 *f*). Richmond Valley; forest, 1100 ft. Dec. 29th. Under fallen flowers.

S. g. Stenomyrmex, *Mayr.*

Anochetus Stenomyrmex emarginatus, Fab., r. *testaceus*, n. st. (No. 3 *a* à 3 *d*).

☿. Diffère de l'espèce typique du continent américain par les caractères suivants: entièrement d'un jaune roussâtre testacé, avec les hanches et la moitié basale des cuisses d'un jaune plus pâle. Dessus du pronotum et la plus grande partie de l'écaille lisses et luisants. L'impression longitudinale du vertex et la concavité postérieure latérale de la tête (entre l'œil et l'angle postérieur) sont beaucoup plus faibles, plus superficielles que chez l'espèce typique. La dent dirigée en bas qui se trouve sur le bord latéral inférieur du mésonotum est très-petite, bien plus petite que chez l'espèce typique. Les arêtes frontales sont plus courtes, plus écartés, moins élevées et divergent assez fortement en arrière, ce qui n'est pas le cas de la forme typique. Le prolongement lancéolé de l'épistome entre les arêtes frontales est plus court et moins enfoncé, l'épistome

moins tronqué devant. Les dents internes des mandibules sont aussi un peu plus petites et l'échancrure derrière la tête est moins profonde.

♂. L. 7 à 7, 5 mill. Les ailes et la tête sont conformées comme chez l'*Odontomachus hæmatodes*. Mais les antennes sont plus longues, les yeux encore plus énormes et les palpes plus courts. *Le pygidium n'a pas d'épine.* L'hypopygium a un prolongement médian en palette étroite. Les valvules génitales extérieures sont grosses et obtuses, les pénicilli sont distincts. *Le pédicule est en nœud cunéiforme bien plus long que haut, échancré au sommet*, ressemblant assez au premier nœud d'un *Leptothorax* du centre de l'Europe, pourvu dessous et devant d'une forte dent ou d'un appendice vertical. Le métanotum est beaucoup plus allongé et moins convexe que chez l'*Odontomachus hæmatodes*. Le premier segment de l'abdomen est atténué et faiblement convexe devant (ne tombe pas verticalement sur l'articulation du pédicule comme chez l'*O. hæmatodes*). Ces caractères doivent suffire à distinguer génériquement les *Anochetus* des *Odontomachus* ♂.

Les mandibules sont étroites, dirigées en avant, sans dents, pointues et courtes. Les yeux occupent tout le côté de la tête et sont plus larges que l'espace qui les sépare l'un de l'autre. Dirigées en arrière, les antennes atteignent l'extrémité de l'abdomen.

Dos du thorax densément, réticulé et subopaque. Tête, côtés du thorax et pédicule en partie lisses, en partie faiblement rugueux. Abdomen lisse et luisant. Une pubescence jaunâtre, courte, en partie un peu laineuse et oblique recouvre tout le corps, les antennes et les pattes, sans être dense. Sur le derrière de l'abdomen elle est plus longue. Pilosité dressée à peu près nulle.

D'un jaune d'ocre très pâle. Abdomen, tibias et tarses d'un jaune roussâtre. Funicules des antennes (sauf leur 1er article) brunâtres. Ailes faiblement teintées de brunâtre avec les nervures et la tache marginale brunes.

Si l'*Anochetus* (*Stenomyrmex*) *emarginatus* n'était pas très variable, je serais tenté de faire de cette forme une espèce à part, et il est fort possible qu'on doive en venir là. Mais il faudra d'abord étudier les formes des autres Antilles. M. Smith a ouvert plus de cent nids sans découvrir la femelle, ce qui est forte curieux. Serait-elle aptère ?

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(3). Common; forest and second growth below 2500 ft.; shady places. The formicarium is large (several hundred individuals), excavated at the root of a tree or

under a log in dry loamy soil. When the nest is disturbed the ants make little effort to defend it, but wander about helplessly and rather slowly ; if, however, they get on one's skin they sting severely. I have not found larvæ in the nests. Apparently these ants are nocturnal in their habits ; during the day they are seldom seen, except in very sheltered places, or under stones or logs. The males found in one nest took to flight when the passages were disturbed, the workers making no attempt apparently to stop them.

(3 *a*). Near Lot 14 Estate (windward), 500 ft. ; shady place under a log. May. A few are from other situations (workers only).

(3 *b*). Forest, Morne à Garou. Oct. 27th. Formicarium at the root of a tree. The workers did not appear in large numbers, but as the passages extended under the roots, there were probably many more. Most of the males seen were captured.

(3 *c*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Second growth ; under a log, with passages extending several inches down. One male. Numerous cocoon-like pupæ.

(3 *d*). Wallilobo Valley (leeward) ; near sea-level. Nov. 8th. Under a stone ; open places. Passages extending some inches downward. About fifty ants ; one male seen.

(Dec.). It is quite possible that these ants, found under stones, logs, &c., are merely at the outer end of a tunnel which communicates with a deep formicarium ; in that case the females probably keep to inner chambers. Males are frequently found with workers and larvæ under logs, &c., but I have never found any females.

(Jan.). I have searched vainly, in several hundred nests, for the females Is it not possible that the "workers" are really separately developed females ?

Genre Platythyrea, *Roger*.

Platythyrea pruinosa, Mayr. (No. 43 *a* à 43 *e*). ☿ ♂.

☿. La couleur varie du roussâtre au brun noirâtre. L. 6, 5 mill. La ponctuation grossière éparse est parfois plus accentuée, parfois fort superficielle. Aire frontale et sillon frontal visibles.

♂. L. 6, 0 mill. Très semblable à l'ouvrière. Pygidium armé d'une épine Mandibules grosses, trigones, sans dents. Les yeux occupent environ la moitié des côtés de la tête qui a un bord

postérieur net et rectiligne ; occiput tronqué. Arêtes frontales, épistome, aire frontale et sillon frontal comme chez l'ouvrière. Scape court. Premier article du funicule aussi large que long ; second article du funicule le plus long, plus long que le scape ; les autres vont en se raccourcissant. Face déclive du métanotum bordée de deux petites arêtes lamelleuses. Pédicule comme chez l'ouvrière, mais plus fortement bisinué derrière, de sorte qu'il s'y forme trois dents assez nettes. Les ailes n'atteignent pas l'extrémité de l'abdomen. Tache marginale large, assez arrondie ; cellule radiale fermée ; nervures brunes, distinctes. Les ailes sont enfumées de brun. La *P. cineracea*, For., n'est qu'une variété de la *pruinosa*.

La ponctuation grossière espacée est beaucoup plus profonde et plus grossière sur la tête, le thorax, le pédicule et le 1er segment de l'abdomen que chez les ouvrières de la même fourmilière. Du reste sculpture, pubescence et couleur comme chez l'ouvriére.

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(43). Rather rare ; forest or open lands. The communities are small—three or four to twenty—and the formicarium is generally, if not invariably, in rotten wood ; it consists of a single small chamber, or of several connected ones, in which the ants are found with their young. I believe these ants are nocturnal ; they seem averse to daylight. In a neglected building I found some of them moving about in the daytime, but they ran quickly from one shelter to another, avoiding the light as much as possible. They are quite active, but not pugnacious.

(43 *a*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Shady place, in a rotten stick. The chambers and connecting passages had an extent of about three inches, and there were perhaps twenty ants.

(43 *b*). Richmond Valley (leeward), Oct. 31st. Open place not far from sea-level ; in rotten log.

(43 *c*). Not noted.

(43 *d*). Forest above Châteaubelais (leeward), 1000 ft. April. In rotten wood.

(43 *e*). Windward ; sandy bed of Dry River, near sea. Jan. 2nd. Open land ; under a stone. Community of about twenty.

Genre Leptogenys, *Roger.*

1. *Leptogenys arcuata*, Roger. (No. 44 *a* à 44 *d*). ☿ ♂.

♂. 4, 7 à 5 mill. Tête beaucoup plus longue que large, assez

fortement rétrécie à partire des yeux jusqu'à l'occiput. Nœud du pédicule arrondi au sommet, où il est atténué relativement à la base, seulement subtronqué derrière, plus large qu'épais, presque lisse. Métanotum grossièrement et irrégulièrement rugueux. Ailes bien loin d'atteindre l'extrémité de l'abdomen. Elles sont subhyalines, avec les nervures pâles et la tache marginale brune, assez grande. Du reste sculpture, pilosité et couleur de l'ouvrière.

Chez les ♂ de *Leptogenys*, les sillons convergents du mésonotum sont très profonds.

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(44). Rare. The only specimens thus far obtained were found under sod or stones. Moderately active.

(44 *a*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Under sod on a rock; shady place (only one found).

(44 *b*). Bowwood Valley, near Kingstown, 800 ft. Oct. 21st. Open hill-side. A single specimen under a stone.

(44 *c*). Cumberland Valley (leeward), 500 ft.; edge of forest near stream; under sod on a rock. Dec. 1st.

(44 *d*). Cumberland Valley, 500 ft.; edge of forest. Dec. 1st. In rotten wood. I could not well make out the structure of the nest, which apparently consisted of a passage a few inches long, and one or two small chambers. Two or three males, and perhaps thirty workers, were seen.

2. *Leptogenys mucronata*, n. sp. (No. 45 *a*).

☿. L. 7 à 7, 5 mill. Mandibules très écartées à leurs bases, plus longues que la tête, luisantes, finement striées, avec quelques gros points et souvent une petite dent caduque près de l'extrémité. Elles sont distinctement creusées en gouttière sous leur bord interne. Le lobe basal situé en dedans de leur portion articulaire est grand et coupé à angle droit. Une petite dent distincte de chaque côté du bord antérieur de la tête, entre l'articulation des mandibules et la bouche. Epistome fortement caréné; sa carène se termine devant par un petit lobe médian, triangulaire, pointu, avancé, comme chez l'*arcuata*. Tête beaucoup plus large devant que derrière, plus courte que sa largeur antérieure, échancrée à l'occiput. Les scapes dépassent le bord postérieur de la tête de plus du quart de leur longueur. Yeux grands. Thorax comme chez la *L. arcuata*, médiocrement échancré entre le mésonotum et le métanotum. Mésonotum plus large que long. Sutures profondes. Métanotum plus long que le pronotum et le mésonotum réunis, avec une longue face basale faiblement convexe et une courte face

déclive. Nœud du pédicule un peu plus long que sa largeur postérieure, rétréci devant, arrondi en haut où il s'élève d'avant en arrière pour se terminer peu à peu par une forte pointe en forme de dent canine, assez obtuse à l'extrémité, plus longue que sa base n'est large, dirigée en haut et en arrière. Une lobe comprimé et dirigé en avant sous le pédicule, devant. La face postérieure du nœud du pédicule est verticalement tronquée et bordée.

Epistome strié transversalement sur les côtés et longitudinalement au milieu. Dessus de la tête, scapes, tibias et cuisses abondamment et finement ponctués, lisses et luisants entre les points. Pronotum semicirculairement strié devant et sur les cotês. Côtés du mésothorax et du métathorax assez grossièrement, irrégulièrement et obliquement ridés, subopaques et raboteux entre les rides. Face déclive du métanotum grossièrement ridée transversalement. Nœud du pédicule avec de grossières rugosités longitudinales sur les côtés et quelques inégalités en dessus; sa face postérieure est lisse et luisante. Abdomen lisse, luisant, avec des points piligères épars. Une pubescence adjacente jaunâtre, assez longue et assez grossière, assez abondante sur la tête, les antennes et les pattes, très éparse ailleurs. Une pilosité d'un brun jaunâtre, de longueur médiocre, en grande partie oblique, parsemée sur tout le corps, éparse et très oblique sur les scapes et sur les pattes.

D'un brun châtain foncé. Pattes, antennes, mandibules, épistome, face antérieure du 1er segment de l'abdomen et l'extrémité de l'abdomen rougeâtres.

Cette espèce doit être voisine de la *L. punctaticeps*, Emery, mais s'en distingue par sa taille plus grande et par la forte dent de l'écaille. Chez la *L. punctaticeps* l'écaille n'a qu'un angle distinct.

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(45). Very rare. A single colony found. It was under a log on damp shady ground; a smoothly worked, irregular chamber immediately under the log, with a passage about half an inch in diameter, leading downward, probably to a lower chamber. There were about fifteen ants with their pupæ; I could find only one form. Active and rather pugnacious.

(45 *a*). Richmond Valley, 800 ft.; shady damp place near the river. Under log, as above. Nov. 13th.

3. *Leptogenys pubiceps*, Emery. (No. 42 *a* à 42 *b*). ☿ ♀.

Les exemplaires de St. Vincent ont la tête un peu plus ponctuée et le 2me article du funicule un peu plus court que ceux de Venezuela, m'écrit M. Emery.

♂. L. 5 à 5, 5 mill. Se distingue de la *L. arcuata* par son nœud dont le bord postérieur supérieur est distinctement avancé en arrière en angle obtus, et qui est fortement rugueux sur les côtés, par sa taille plus grande et par ses ailes médiocrement teintées de brun.

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(42). A rare species, forming small communities, or found largely under stones or sod, or under bark. Rather sluggish, and not very pugnacious. I have found only one form (workers ?).

(42 *a*). Southern end of the island; Villa Estate. Oct. 14th. Seaside thickets. Formicarium under a block of coral and in its crevices. I could find only workers, and apparently there were about twenty, with as many pupæ, in the community.

(42 *b*). Nov. 19th. Camden Park Estate, north of Kingstown; leeward side; seashore woods, under bark of a palm-log lying on the ground. The community consisted of about forty individuals. I thought I saw one female (winged), which escaped.

Genre Ponera, *Latr.*

1. *Ponera stigma*, Fab. (No. 46 *a* à 46 *g*). ☿ ♀ ♂.

Var. *attrita*, n. v. ☿. (No. 46 *b*).

Diffère de la forme typique par sa taille plus robuste et plus grande (6 à 6, 2 mill. au lieu de 5), par son thorax presque entièrement brun foncé, sa sculpture plus dense qui le rend plus mat, et surtout par ses mandibules plus longues, plus étroites, avec les six dents plus ou moins usées, avec le milieu du bord externe légèrement concave et le bord terminal peu distinct du bord interne. Cependant ces caractères ne sont pas constants; on trouve des formes transitoires parmi les exemplaires récoltés par M. H. H. Smith. Ainsi les Nos. 46 *a* et 46 *g* font passage à la *P. stigma* typique, tandis que 46 *b* correspond à la var. *attrita*.

Le ♂ est long de 5 mill.; il a les ailes enfumées de brun et les valvules génitales longues et étroites.

The species are common in small communities (three or four to twenty-five); under bark of rotten logs, under stones, turf, &c.; generally with a single small chamber and entrance passage. These ants are sluggish, and not at all pugnacious. I have not found the male.

(46). Pretty common. Communities of from five to thirty or forty are met with. The formicarium is made in rather dry and hard rotten wood; it consists of a single chamber, or of several in a row, with short communicating passages; the chambers about 1 in. long in the direction of the wood-fibre, $\frac{1}{8}$ in. wide, and $\frac{1}{4}$ in. high. These chambers may be under the bark, but are generally pretty deep in the log or stump. The ants are moderately active. When the nest is disturbed they are not at all pugnacious, but try to conceal themselves and their pupæ in crevices. The males, generally found in outer chambers, take flight when the nest is opened. Formicarium sometimes under sod.

(46 *a*). Near Palmyra Estate (leeward), 1000 ft. Nov. 3rd. Shady place, in rotten wood.

(46 *b*). Bowwood Valley, near Kingstown, Oct. 15th, 800 ft.; shady place, in rotten wood.

(46 *c*). Richmond Estate (leeward); open valley near sea-level. Oct. 31st. In decaying wood.

(46 *d*). Old Botanical Garden, Kingstown, 500 ft. Oct. 22nd. Shady place, in rotten wood.

(46 *e*). Fitz-Hugh Valley (leeward), 500 ft.; shady place, in rotten wood. Nov. 4th.

(46 *f*). Various situations, in rotten wood.

(46 *g*). Damp forest near stream above Châteaubelais (leeward), 250 ft. Jan. 26th. Scattered, under sod on a rock. The formicarium was destroyed in pulling up the sod.

2. *Ponera opaciceps*, Mayr. (No. 41 *g*, *bis*). ☿.

Dans le No. 41 *g*, deux espèces se trouvaient mêlées: la *P. trigona* et la *P. opaciceps*. M. H. H. Smith ayant trouvé les exemplaires de 41 *g* en diverses localités, le fait n'a rien d'étonnant. Les exemplaires de St. Vincent sont identiques à ceux du Brésil.

3. *Ponera trigona*, Mayr. (No. 41 *f*, 41 *j* et 41 *g*). ☿ ♀.
Var. *opacior*, n. v.

Les exemplaires de St. Vincent diffèrent des types de Mayr, du Brésil, par leur ponctuation plus forte et plus serrée, surtout sur la tête, ce qui les rend moins luisants (subopaques), par leurs antennes et leurs pattes qui sont d'un jaune roussâtre vif, très tranché, et par les côtés de la tête qui sont légèrement moins convexes. L'écaille paraît aussi légèrement moins amincie au sommet et plutôt un

peu moins large. Toutes ces différences sont cependant peu accentuées.

La *P. trigona* n'est pas une variété de la *punctatissima*, mais une espèce américaine. Les yeux rudimentaires de la *P. trigona* (1 à 3 facettes) sont situés plus en arrière que chez les espèces suivantes et que chez les *P. contracta* et *punctatissima*, environ au quart antérieur des côtés de la tête.

(41 *e*). Near Palmyra Estate (leeward), 1000 ft. Nov. 3rd. Under turf on a damp rock; shady place (one female found alone).

(41 *f*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 14th. Shady place; under rotting banana-leaves on a stone.

(41 *g*). Various localities and dates; forest or open places, 2500 ft. to sea-level.

(41 *j*). Hermitage Estate, Cumberland Valley, 1000 ft. Dec. 2nd. Edge of forest under dry sod on a rock.

4. *Ponera fœda*, n. sp. (No. 41 *h* et 41 *i*). ☿ ♀.

☿. L. 1, 9 à 2, 7 mill. Forme d'une très petite *P. punctatissima*. Mais elle se distingue de cette espèce, ainsi que des *P. contracta*, *trigona* et de l'espèce suivante par ses yeux distincts, ayant de 5 à 6 facettes, du reste assez inégales. Les mandibules ont 3 ou 4 dents devant et sont indistinctement denticulées derrière. Les scapes n'atteignent pas tout à fait l'occiput. Forme du métanotum, du pédicule et de l'abdomen exactement comme chez la *P. punctatissima*, mais les côtés de la face déclive du métanotum sont distinctement bordés. L'écaille tient le milieu entre celle de la *P. trigona* et celle de la *P. ergatandria*. Epistome faiblement biéchancré.

Subopaque ou presque mate. Bien plus densément ponctuée que la *punctatissima*, mais moins opaque sur la tête que l'*opaciceps*. Assez abondamment pubescente; la pubescence est d'un jaune grisâtre. Pilosité dressée extrêmement courte, très éparse, en général oblique. Varie du roux jaunâtre au brun foncé.

♀. L. 2, 5 mill. Comme l'ouvrière. Ailes manquent.

J'ai cru devoir nommer cette forme peu accentuée à cause surtout de la différence des yeux qui sont du reste situés comme chez la *P. punctatissima*.

(41 *h*). October; leeward side. Various localities below 1000 ft.; under sod or stones.

(41 *i*). Leeward side. October. Various localities; under bark of rotten logs.

5. *Ponera ergatandria*, n. sp. (Nos. 41 *a*, 41 *b*, 41 *c*, 41 *d*). ☿ ♀ ♂.

☿. L. 2, 3 à 2, 9 mill. Etroite et de forme très allongée. Mandibules relativement courtes, lisses, luisantes, éparsément ponctuées, avec 4 dents devant et distinctement denticulées derrière. Epistome court, assez fortement biéchancré devant. Sillon frontal plus long que la moitié de la distance des arêtes frontales à l'occiput. Yeux rudimentaires, de deux ou trois facettes, situés un peu en avant du 5me antérieur des côtés de la tête. Les scapes n'atteignent pas le sixième postérieur de la tête. Le pronotum est plutôt plus long que large, bien plus long et plus étroit que chez les espèces précédentes, nullement élargi à ses coins antérieurs qui sont absolument effacés. Métanotum comme chez la *P. contracta*, mais la face basale est un peu plus longue que la face déclive, et cette dernière n'est pas même subbordée, mais arrondie de tous les côtés. Ecaille beaucoup plus étroite, plus basse et un peu plus épaisse que chez la *P. contracta*, du reste de même forme. Elle est au moins deux fois aussi large qu'épaisse, de la même hauteur que le 1er segment de l'abdomen. Abdomen très long, très étroit, à peine rétréci après le 1er segment; ce dernier plus étroit, plus bas et moins tronqué devant que chez la *P. fœda* et les *P. contracta* et *punctatissima*. Pattes beaucoup plus courtes que chez toutes ces espèces.

Luisante, finement ponctuée, comme la *P. contracta*, mais la ponctuation de la tête est plus fine. Pilosité et pubescence comme chez la *P. fœda*, mais la pubescence est plus longue et de couleur plus claire, très apparente. D'un brun jaunâtre sale, avec le dessus de la tête, certaines parties du thorax et le milieu des segments abdominaux d'un brun foncé. Pattes, antennes, mandibules et extrémité de l'abdomen d'un jaunâtre sale plus ou moins pâle ou brunâtre.

♀. L. 2, 7 à 2, 9 mill. Plus courte et plus large que l'ouvrière. Du reste les mêmes caractères, mais plus foncée et plus fortement sculptée. Ailes subhyalines; nervures et tache marginale très distinctes. Beaucoup plus petite que la ♀ des espèces d'Europe.

♂. L. 3, 0 mill. Aptère, ergatoïde. Très allongé et très étroit. Du reste extrêmement parent du ♂ dimorphe de la *P. punctatissima* (*P. androgyna*, Roger), mais encore plus semblable à l'ouvrière dont il ne diffère que par les caractères suivants: aveugle, avec une petite tache pigmentée à la place des yeux. Tête

allongée, rectangulaire, d'¼ plus longue que large. Les scapes n'atteignent que le quart postérieur de la tête, à peine, et sont subclavés. Les articles des funicules sont plus larges et plus séparés les uns des autres. Les dents des mandibules sont un peu plus obtuses. L'épistome est un peu plus long et moins voûté. L'abdomen a un segment de plus et des organes génitaux mâles tout à fait normaux: les écailles sont grandes, les valvules génitales extérieures courtes, triangulaires. Le pygidium n'a pas d'épine et l'hypopygium est arrondi. D'un jaune pâle et sale ; devant de la tête et antennes, ainsi que le milieu de l'abdomen d'un jaune un peu plus brunâtre.

Les antennes ont du reste 12 articles, et le thorax étroit ne se distingue en rien de celui de l'ouvrière.

Un seul exemplaire récolté avec les ☿ 41 *b*.

La découverte de ce ♂ aptère et ergatoïde avec sa ♀ et ses ☿ est l'un des plus remarquables resultats des chasses de Mons. H. H. Smith. Est-ce l'unique ♂ de la *P. ergatandria* ou existe-t-il encore un ♂ ailé comme chez la *P. punctatissima* ? On ne saurait le dire. Ce qui est certain, c'est que nous voyons le nombre de ces singuliers mâles ergatoïdes augmenter de plus en plus chez les fourmis, à mesure que nous étudions les faits de plus près. Ce qui est encore certain, c'est que jusqu'ici la *P. punctatissima* est la seule espèce chez laquelle le dimorphisme du sexe mâle soit plus ou moins démontré. Chez les autres on connaît on bien un ♂ ailé seul, on bien un ♂ aptère seul qui est tantôt plus, tantôt moins ergatoïde (semblable à l'ouvrière). Le dimorphisme du ♂ de la *P. punctatissima* me paraît encore sujet à caution. Le ♂ ergatoïde de cette espèce a été trouvé par Roger et par moi seulement, chaque fois en compagnie de ☿ et de ♀ seulement. Je le découvris au moment du départ des ♀ ailées qui étaient très nombreuses, et je ne pus découvrir aucun ♂ ailé parmi les ♀, les ☿ et les ♂ aptères ergatoïdes. M. Emery n'a trouvé par contre à Naples que le ♂ ailé, sans ♂ ergatoïdes. De deux choses l'une : ou bien le ♂ ergatoïde apparaît à une autre époque ou dans d'autres circonstances que le ♂ ailé ; ou bien la *P. punctatissima* que M. Emery a trouvée à Naples est une autre espèce que celle de Roger et que la mienne. Le fait qu'on ne peut pas distinguer deux espèces ne prouve nullement leur identité (qu'on réfléchisse aux Cynipides dont plusieurs

espèces ne peuvent être distinguées que par la galle végétale que produit leur piqûre !).

Quoi qu'il en soit de la question du dimorphisme du ♂, nous voyons un fait absolument certain se produire chez un nombre assez considérable de Formicides appartenant aux genres les plus divers, c'est celui de la transformation aptère et ergatomorphe, soit du ♂, soit de la ♀. Je crois pouvoir proposer le terme d'*ergatomorphisme* pour désigner tous ces phénomènes de transformation régressive secondaire d'un façon générale et sans tenir compte de leur phylogénèse plus ou moins probable. Une loi qui paraît générale jusqu'à preuve du contraire, c'est que, chez le même genre ou chez la même espèce, l'ergatomorphisme n'existe jamais que pour l'un des sexes.

(41 *a*). Bowwood Valley, near Kingstown, 800 ft.; open place near stream. Oct. 15th. Under rotting bark. Small nests with five or six individuals; perhaps different chambers of one formicarium.

(41 *b*). Islet fronting Châteaubelais Bay (leeward), Oct. 31st. Rocky ground; thickets; under bark of rotting stump.

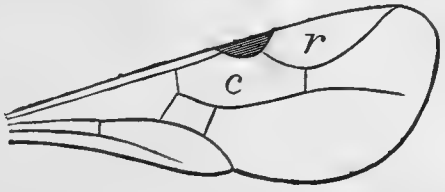
(41 *c*). Richmond Estate (leeward); open valley near sea-level. Oct. 31st. Under bark of rotting log. A very small nest.

(41 *d*). Southern end of the island; Villa Estate. Oct. 14th. Thickets near sea-shore; in rotten wood.

Genre Prionopelta, *Mayr.*

Prionopelta punctulata, Mayr. (No. 40 *a* à 40 *h*). ☿ ♂.

♂ (encore inédit). L. 2, 5 mill. Tout à fait semblable aux ♂ des *Amblyopone*, en particulier à celui de l'*A. gheorghieffii*, Forel. Mais les ailes n'ont qu'une cellule cubitale et la nervure transverse



Aile supérieure de la *Prionopelta punctulata*, Mayr (♂).

s'unit au rameau cubital externe. L'hypopygium se termine par une pointe médiane allongée, poilue et obtuse à l'extrémité. Les valvules génitales extérieures sont très obtuses. Le pygidium est

arrondi, sans pointe. Le pédicule est plus arrondi et descend devant en pente plus douce. Il n'a dessous qu'un petit tubercule à peine apparent. Tête grande, ronde ; yeux situés très en avant ; ocelles petits.

Luisant ; finement réticulé. Pilosité dressée, jaunâtre, très fine, courte, très pointue, oblique sur les tibias et parfois ailleurs (passant à la pubescence), assez abondante. D'un brun foncé, presque noirâtre ; pattes et antennes d'un brun jaunâtre pâle (l'ouvrière est de couleur jaune pâle et presque aveugle).

Les caractères ci-dessus sont en même temps ceux du genre, dont le ♂ était encore inconnu (voir la figure).

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(40). Pretty common, five to fifty together, scattered in small passages, generally under sod in damp places. It would appear that the female does not differ in form from the worker, or else I have found only the latter in the nests, for I have been able to discover only one form, though I have searched carefully. These ants are very sluggish, crawling away slowly when the nest is uncovered, and taking little care to protect the larvæ which are found with them.

N.B.—There is perhaps more than one species included in this number, which I cannot discriminate with my lens.

(40 *a*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Second growth. Under sod on a damp rock.

(40 *b*). Near Palmyra Estate (leeward), 1000 ft. Nov. 7th. Shady place, under sod on rocks (from two nests).

(4 *c*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Under sod on damp rock.

(40 *d*). Richmond Estate (leeward), Oct. 31st. Valley near sea-level; open place, in soft rotten wood, generally half an inch from the surface. Three or four together in very small chambers, with a few eggs or larvæ. I could not discover if the chambers were connected. Ants try to conceal themselves in crevices when disturbed.

(40 *e*). Fitz-Hugh Valley (leeward), 500 ft. Shady place near stream ; under sod on a rock. The nest or passage was several inches long. The community, an unusually large one, contained perhaps fifty individuals.

(40 *f*). From two nests. Valleys on the leeward side below 1000 ft. ; under sod on rocks.

(40 *g*). Petit Bordelle Valley, 1500 ft. Nov. 13th. Under sod on rocks; shady banks of stream. From two small nests.

(40 *h*). Hermitage Estate, Cumberland Valley. Dec. 2nd, 1000 ft. Edge of forest; under dry sod on a rock. Community of perhaps fifty. The male was found with the workers, but there were several other kinds of ants on the same rock.

4me Sous-famille DORYLIDÆ, *Shuck.*

N'a pas été trouvée à St. Vincent par Mons. H. H. Smith, lors même que le genre *Eciton*, Latr., est très répandu dans l'Amérique centrale continentale. L'*Eciton* (*Labidus*) *klugii*, Shuck., est le seul *Eciton* qui ait, à ma connaissance, été trouvé aux Antilles. Or Shuckard l'indique précisément comme pris à *St. Vincent!* Il ne me paraît pas probable qu'un *Eciton* de St. Vincent ait échappé aux investigations si minutieuses de M. H. H. Smith. Je présume donc que le ♂ de l'*Eciton klugii*, Shuck., provenait d'un autre lieu ou qu'il y a eu quelque autre confusion.

5me Sous-famille MYRMICIDÆ, *Lep.*

Genre Atta, *Fabr.*

S. g. Mycocepurus, n. subg.

☿. Taille petite et égale. Mandibules étroites, à bord terminal oblique, muni de 5 à 6 dents. Arêtes frontales très rapprochées devant l'une de l'autre, ne laissant entre elles qu'un sillon frontal assez large. Aire frontale transformée en petite fossette peu distincte. Epistome plus ou moins tronqué verticalement, bordé vers chaque fossette antennaire par une arête vive. Bord latéral inférieur du pronotum sans dent, ni épine. Abdomen tronqué devant; son 1er segment a les côtés fortement bordés et presque parallèles. L'abdomen n'a pas de tubercules. Yeux situés en arrière du milieu des côtés de la tête. Du reste comme les *Acromyrmex*. On ne peut faire rentrer l'espèce pygmée de St. Vincent dans aucun des sous-genres *Atta* proprement dit, ni *Acromyrmex*, Mayr. Ses arêtes frontales et ses mandibules séparent cette espèce de toutes les *Atta* connues et des *Cyphomyrmex*. Son abdomen et l'absence de l'épine inférieure latérale du pronotum la rapprochent des genres *Cyphomyrmex*, Mayr, *Apterostigma*, Mayr, et *Glyptomyrmex*, Forel. Les arêtes frontales et la forme des fossettes antennaires le rapprochent surtout d'*Apterostigma* et de *Glyptomyrmex*.

Mycocepurus smithii, n. sp.* (No. 38 *a* et 38 *b*). ☿.

L. 2, 2 à 2, 5 mill. Caractères du sous-genre. Mandibules armées de 5 dents obtuses, très étroites, à bord terminal très oblique. Elles sont densément striées et subopaques. Tête plus ou moins carrée, un peu plus étroite derrière que devant, largement et faiblement échancrée derrière, dentée aux angles postérieurs. Les yeux sont situés à peine en arrière du milieu des côtés. En arrière, les arêtes frontales divergent comme chez les *Acromyrmex*, laissant entre elles deux arêtes médianes, parallèles, obtuses. Une arête latérale de chaque côté du dessous de la tête, allant rejoindre la dent de l'occiput. Le pronotum et le devant du mésonotum ont chacun quatre épines obtuses, non denticulées, dont les latérales sont les plus longues. Celles du premier sont disposées en demi-cercle concave derrière, celles du second en

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* M. le Dr. Göldi à Rio de Janeiro m'a envoyé une seconde espèce de ce sous-genre :—

Mycocepurus göldii, n. sp.

☿. L. 2, 7 à 2, 9 mill. Mandibules densément striées, mais moins étroites que chez le *M. smithii* et armées de six dents très distinctes, égales et pointues. Les arêtes frontales sont un peu moins rapprochées devant; leur prolongement postérieur forme avec l'arête latérale des joues et de derrière les yeux un emplacement plus distinct pour loger les antennes que chez le *M. smithii*. Les scapes ont tout près de l'articulation une arête transversale, annulaire, lobiforme. Les yeux sont plus grands que chez le *M. smithii* et situés au tiers postérieur de la tête; cette dernière est un peu plus large et plus échancrée derrière. Le pronotum et le mésonotum ont chacun une spinule de plus que le *M. smithii* située immédiatement en dessous de l'épine latérale du demi cercle. Au milieu du cercle se trouvent deux dents pointues au lieu de tubercules. Le thorax est du reste comme chez le *M. smithii*, mais la partie postérieure du mésonotum et le métanotum ont chacun quatre épines, et toutes les épines du corps sont plus élevées et surtout plus pointues. Pas de dents métasternales. Le premier article du pédicule a un pétiole antérieur beaucoup plus court et plus épais que chez le *M. smithii ;* son nœud quadrispineux, le 2me article et l'abdomen sont du reste comme chez cette espèce. Sculpture comme chez le *M. smithii*, mais l'abdomen, les pattes et les scapes sont moins finement et par contre très régulièrement réticulés-ponctués, tandis que le thorax est très irrégulièrement et vaguement (indistinctement) réticulé. Les aspérités de la tête sont plus élevées.

La pubescence est remplacée par une pilosité jaunâtre espacée, courte, çà et là oblique, dressée sur les tibias et les scapes. D'un roux à peine brunâtre. Dessus de l'abdomen plus foncé. Pattes et scapes testacés.

Botucatu, Prov. St. Paulo, Brésil, récolté par M. Göldi.

demi-cercle concave devant ; à elles huit, elles forment un cercle, au milieu duquel sont encore deux tubercules obtus. Derrière ce cercle d'épines, le mésonotum a une forte impression transversale, et derrière celle là une portion élevée et pourvue de deux dents en avant et de deux petites épines en arrière. La face basale du métanotum est bordée latéralement et terminée de chaque côté, devant, par une très petite dent, et derrière par une assez longue épine subverticale. Deux petites dents métasternales obtuses. Premier article du pédicule assez longuement pétiolé et latéralement bordé devant, et surmonté derrière d'un nœud élevé, cubique, à pans verticaux, quadridenté en haut. Second article du pédicule presque 4 fois large comme le premier, presque aussi large que le devant de l'abdomen, avec quatre côtes longitudinales élevées et trois sillons entre elles. Abdomen petit ; son premier segment qui en recouvre plus des $\frac{2}{3}$ est d'$\frac{1}{3}$ plus long que large et a les côtés subparallèles et bordés d'une forte côte.

Entièrement mat. La sculpture est densément, profondément et irrégulièrement réticulée (les mailles sont irrégulières, surtout sur la tête). Le fond des mailles est microscopiquement granuleux. Sur la tête, les réticulations sont moins fines et s'élèvent en partie sous forme de rides ou rugosités très irrégulières qui portent çà et là des aspérités tuberiformes et piligères. Sur le thorax, les réticulations sont très accentuées, plus fines et plus régulières, visibles jusqu'à l'extrémité des épines. Sur l'abdomen, les scapes et les pattes elles sont d'une finesse et d'une densité extrême, assez régulières. Quelques poils dressés, courts sur la tête. Sur le reste du corps, les scapes et les pattes il n'y a qu'une pubescence espacée et recourbée plutôt qu'adjacente, d'un jaune assez brillant.

D'un roux plus ou moins jaunâtre. Dessus de la tête et de l'abdomen plus foncés. Pattes testacées.

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(38). I have found this species only at Belleisle (leeward, 1000 ft.), in open woods, very hard clay soil ; and another locality noted below. They were taken at the mouths of little tunnels, from which they were bringing out grains of earth. Twenty or more of these tunnels were found scattered over a space several yards long and wide ; this was noticed in three localities some distance apart, without, so far as I observed, any intermediate tunnel-mouths. I judge therefore that the tunnels in each locality belong to a common large formicarium, which may be at a considerable distance below the surface. I followed some of the tunnels for several inches perpendicularly down, but the clay was so hard

that a pickaxe would have been required to dig further. The ants are sluggish, and have a kind of staggering gait, that reminds one of the S. American *Œcodomas*.

(N.B.—I am told that a large leaf-carrying ant is found in the forest, but I have not yet seen it (found later; see below). I did not see any indication that this small species carried leaves, but the grains of earth it brings up and piles about the mouth of the tunnel have the same irregularly rounded form as those brought up by the South American leaf-carriers; only they are much smaller).

(38 *a*). Nov. 8th. Belleisle, as noted above.

(38 *b*). Nov. 18th. Near Brighton (south end of island), 300 ft.; hard road in scrubby forest; at the mouths of tunnels like those of 38 *a*. In the same ground were tunnels of No. 51.

S. g. Trachymyrmex, *Forel.*

Trachymyrmex sharpii, n. sp. (No. 51 *a*).

☿. L. 4, 2 à 5 mill. Voisine du *T. saussurei*, Forel, mais la stature est plus robuste et la tête relativement plus grosse. Mandibules lisses, luisantes, avec des points épars, striées vers leurs base. Tête, sans les mandibules, plus large que longue, élargie et fortement échancrée derrière, tronquée à l'occiput qui a deux angles latéraux, l'un postérieur-inférieur, terminé par une épine obtuse, l'autre antérieur-supérieur, terminé par un tubercule denticulé. Les yeux sont fort grands et situés au tiers antérieur. Les scapes, atténués à leur base, épaissis à leur moitié terminale, dépassent l'occiput d'¼ de leur longueur. L'arête latérale et l'arête frontale sont vives; elles s'anastomosent au tubercule antérieur de l'occiput et laissent entre elles un espace qui loge les antennes. Le thorax a quatre paires d'épines qui toutes ont des tubercules secondaires et l'extrémité obtuse. Les épines pronotales inférieures sont épaisses, très obtuses, dirigées en bas. Les épines pronotales antérieures sont assez grêles et longues, les épines pro-mésonotales sont très épaisses et très obtuses, les épines métanotales assez courtes et grêles. Une dent métasternale obtuse. Thorax assez allongée. Le premier article du pédicule est rapidement élargi en arrière jusqu'à deux angles latéraux proéminents qui sont situés vers son tiers ou son quart postérieur. Puis il est rétréci de nouveau et porte derrière, sur son sommet, quatre très petites dents. Le second article a une grande surface supérieure-pos-

térieure aplatie et même un peu concave. Il est un peu plus large que long et aussi large que le métanotum. Abdomen globuleux, avec une forte et large impression longitudinale médiane sur son tiers antérieur, et une côte très obtuse, couverte de tubercules près de chacun de ses côtés, devant.

La sculpture de tout le corps, des pattes et des pattes est microscopiquement granulée et mate, avec deux systèmes de tubercules superposés : de petits tubercules, densément répandus partout et gros comme les mailles d'une ponctuation réticulaire médiocrement fine, de gros tubercules plus espacés qui couvrent le corps et les pattes comme de mouchetures. Ils sont plus obtus et plus bas que chez l'*A. saussurei*, abondent aussi sur les pattes, sur les scapes, sur les épines et les dents, et surtout sur l'abdomen.

Une pilosité dressée noirâtre ou noir brunâtre, courte, épaisse, raide, obtuse, éparse un peu partout, surtout sur les scapes et les pattes, partant de la base des gros tubercules. Pubescence presque nulle.

D'un noir brunâtre ; thorax et parfois la base de l'abdomen variés de roux ferrugineux. Pédicule, mandibules, pattes et antennes d'un roux ferrugineux ; tibias, scapes et base des funicules brunâtres.

Bien distincte de l'*A. saussurei* par sa tête tronquée derrière et bien plus large, ses épines bien plus grandes, ses tubercules bien plus petits, absolument distincts des épines, etc.

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(51). Leaf-carrying ant. It probably makes a large formicarium, with extensive tunnels radiating from it. I have not been able to find the main nest or mound ; the specimens collected were from the mouths of tunnels in hard ground, and descending perpendicularly for five or six inches at least. Careful search did not reveal any mound in the vicinity. Several ants were found walking near the tunnel-mouths, and some of these carried small bits of leaves. The species is said to be found in the forest, at about 2000 ft., but it is certainly rare ; the only specimens I have seen were from below 500 ft., in scrubby growth. These ants, like their S. American congeners, walk slowly, and with a staggering gait.

N.B.—The S. American species work mainly at night, but also in the daytime.

(51 *a*). Near Brighton Estate, 300 ft. ; southern end of the island, in scrubby forest ; at the mouths of perpendicular tunnels in a hard road (clay soil), and in the vicinity, on the ground. Many tunnels were found, scattered over a furlong or more. Nov. 18th.

Genre Cyphomyrmex, *Mayr.*

Cyphomyrmex rimosus, Spinola.

(=*Cyphomyrmex deformis*, Sm., nec. Mayr, F. novogr.).

(No. 50 *a* à 50 *r*). ☿ ♀ ♂.

(= *Cyphomyrmex steinheili*, Forel, Et. myrm., 1884).

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(50). Common, in open or shady ground. Communities of four or five to twenty—rarely larger—to one hundred individuals. The formicarium is a simple cavity under a stone or stick, at the roots of grass, or occasionally in rotten wood. The ants are very sluggish, hardly moving when disturbed. I have not found the workers in beating foliage, and judge that they are nocturnal, and probably terrestrial, in their habits. I have perhaps included more than one species under this number. Those found in a nest are always of the same colour, or nearly so; and, though the colour may be due to age, it is singular that there should be no variation in a community. There seem also to be differences of size and form; but my object in separating the species is simply to get better notes on them, and of course the work is very roughly done. I have found these ants crawling, towards evening, on the floor of a dark outhouse. They move slowly.

(50 *a*). Wallilobo (leeward), Nov. 8th. Open valley near sea-level. Nest under the edge of a stone; an unusually large community. Many grass-seeds were found in the nest.

(50 *b*). Bowwood Valley, near Kingstown, 800 ft. Open place under stone. Oct. 21st.

(50 *c*). Near Palmyra Estate (leeward), 1000 ft. Nov. 4th. Shady place near stream; under turf on a rock. A small community. All I could find are in the bottle.

(50 *d*). Richmond Valley, 1000 ft. Nov. 13th. Shady banks of stream; under turf on a rock.

(50 *e*). Wallilobo Valley (leeward), 500 ft. Nov. 8th. Under sod on a rock.

(50 *f*). Golden Grove (leeward); open place, 300 ft. Oct. 10th. Small nest (ten or twelve ants) under a stone.

(50 *g*). Forest above Châteaubelais (leeward), 1000 ft. Oct. 11th. Under a stick.

(50 *h*). Old Botanical Garden, Kingstown, 500 ft. Oct. 22nd. Under bark of rotten log.

(50 *i*). Wallibou (leeward); seaside thickets. Oct. 8th. From two or three small nests under stones.

(50 *j*). Near Palmyra Estate (leeward), 1000 ft. Nov. 4th. Shady banks of stream. Small nest under sod on a rock.

(50 *k*). Near Cumberland (leeward); open valley, 200 ft. Oct. 10th. Small nest under a stone.

(50 *l*). Various localities. Specimens from different nests.

(50 *m*). Petit Bordelle Valley, 1200 ft. Nov. 12th. Shady banks of stream; under sod on a rock.

(50 *n*). Brighton Estate, southern end of island. Nov. 17th. Open place, 500 ft.; under sod on a rock. A community of about a hundred individuals.

(50 *o*). Hermitage Estate, Cumberland Valley, 1000 ft. Dec. 2nd. Small nest under dry sod on a rock; edge of forest.

(50 *p*). Windward side, Grand Sable Estate. Jan. 3rd. Thicket near seashore; side of a rock under earth. A community of about forty workers, with a good many males and females.

(50 *q*). Windward side; sandy bed of the Dry River; near the sea; open land. Jan. 2nd. Under a stone.

(50 *r*). Richmond Valley; thick forest, 1100 ft. Dec. 29th. Male found under rotting leaves, &c.

Genre Strumigenys, *Smith.*

1. *Strumigenys smithii*, Forel. (No. 24 *a* à 24 *f*). ☿ ♂.

☿. Un peu plus petites que les types de Blumenau.

♂ (encore inédit). L. 2, 7 à 3 mill. Tête arrondie, un peu plus longue que large; mandibules beaucoup plus courtes que chez la *S. baudueri*, Emery, ♂ (au contraire de l'ouvrière !). Mandibules striées, courtes, arquées, épaisses à la base, sans bord terminal, terminées par une longue dent pointue et luisante. Antennes longues, filiformes; scape seulement un peu plus long que large et que le 1er article du funicule. Epistome à peine avancé devant. La tête est beaucoup plus large et plus courte que chez le *S. baudueri*. Face basale du métanotum oblique, en long talus, presque deux fois longue comme la face déclive, dont elle est séparée par une dent presque imperceptible. Face déclive bordée d'une arête très basse. Les deux articles du pédicule comme chez l'ouvrière et entourés de la même façon des mêmes masses chitineuses aréolaires. Valvules génitales extérieures obtusément triangulaires, d'un jaune blanchâtre.

Tête et thorax fortement réticulés-ponctués et mats ; pédicule et abdomen lisses et luisants. La sculpture du pronotum et du mésonotum est forte et irrégulière, celle du métanotum plus faible (subopaque) ; côtés du thorax en partie lisses et luisants. Quelques poils épars. Pattes seulement pubescentes. Tête noire ; abdomen brun foncé ; pattes et antennes brun jaunâtre ; le reste d'un brun rougeâtre. Ailes teintes de brunâtre.

♀ (encore inédite). L. 3 mill. Ailes manquent. Dents du métanotum plus solides, moins membraneuses que chez l'ouvrière. Scutellum non proéminent en arrière. Du reste comme l'ouvrière.

Mons. H. H. Smith écrit du No. 24 (*Strumigenys smithii*) :—"The cavities in which these ants are found are *always* black inside, as if with some fungoid growth." Ce fait est du plus haut intérêt et fait présumer que certaines *Strumigenys* ont comme leurs proches voisines, les *Atta*, *Cyphomyrmex*, etc., l'habitude de cultiver des champignons. Les belles recherches toutes récentes du Dr. Moeller à Blumenau ont démontré dans tous leurs détails les habitudes mycophages des *Attini* présumées par Belt. La systématique m'a prouvé (Bullet. soc. ent. suisse, 1892) que les *Attini* sont intimément liés aux *Dacetonini* (*Strumigenys*, etc.), et m'a fait supposer que les *Attini* sont les dérivés secondaires, ce qui est d'autant plus probable qu'ils sont bornés au continent américain, tandis que les *Dacetonini* sont répandus dans le monde entier, même en Nouvelle Zélande. Or l'instinct mycophage des *Dacetonini*, s'il se confirme généralement, est évidemment *primitif*, c. a. d. primordial, bien moins complexe et moins développé que chez les *Atta* qui vont couper des feuilles pour y faire pousser leurs champignons.

These ants are rather common in shady places. The formicarium is generally under sod or rubbish on a rock; sometimes in rotten wood. It is simply a small chamber (one or two inches long), with an entrance passage ; or, if there are other passages, I have not discovered them. The ants are found crowded in the chamber with their larvæ, and sometimes males and females. They are very sluggish. The colony may contain several hundred.

(24). Pretty common in partly decayed wood, shady or open places. The ants are found crowded thickly in dry cavities, generally an inch long and wide, and half

an inch high; with them are larvæ, and sometimes males, but I have found no females. The workers are very sluggish, hardly moving when the nest is disturbed; so that they may be picked out one by one with the forceps. The males are more active. The cavities in which these ants are found are always black inside as if with some fungoid growth. Occasionally these ants make nests at the roots of grass, &c.

(24 *a*). Near Palmyra Estate (leeward), Nov. 3rd, 1000 ft. Open field near a stream, in a half-rotted log. The ants were found thickly crowded in a small cavity of a knot, well in from the surface; I could not discover the entrance. All that I could find were taken, and I think few were lost. The log was split up without finding others.

(24 *b*). Fitz-Hugh Valley (leeward); shady place, 500 ft., Nov. 4th, in a log. There were two adjoining chambers, apparently of the same colony. The males in one chamber were more mature.

(24 *c*). Forest, Morne à Garou, 1500 ft. Oct. 27th. Found on a leathery fungus growing on log.

(24 *d*). Fitz-Hugh Valley. Near No. 24 *b*. Nov. 4th. Under rotting banana-leaves on a stone.

(24 *e*). Bowwood Valley, near Kingstown, 600 ft. Oct. 15th. Clearing; scattered under the bark of a decaying log.

(24 *f*). Petit Bordelle Valley, 1200 ft. Nov. 13th. Shady banks of stream; under sod on a rock. From some confusion in the notes I cannot describe the formicarium.

I have found workers of these ants foraging in the daytime in a dark outhouse. Golden Grove Estate (leeward), 300 ft. They move about slowly.

2. *Strumigenys imitator*, Mayr. (No. 26 *a*, unicum). ☿.

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(26). Rare; I have found the workers among decaying leaves; forest or shady places.

(26 *a*). Windward side near Lot 14 Estate, 500 ft. May. Shady glen; under decaying leaves on a rock.

3. *Strumigenys rogeri*, Emery. (No. 26 *c*, 26 *d*, et 26 *e*). ☿ ♀.

☿. L. 1, 2 à 2 mill. (avec les mandibules). Emery a décrit par erreur la dent inférieure de l'extrémité des mandibules comme bifide, tandis qu'en réalité elle est simple.

♀. L. 2, 3 mill. D'un jaune un peu roussâtre, à peine plus foncé que chez l'ouvrière. Ailes subhyalines, assez pubescentes. Courte, épaisse. Scutellum très élevé au dessus de la face basale du métanotum et un peu proéminent. Métanotum avec deux larges et courtes épines. Du reste comme l'ouvrière.

(26 *c*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Shady place, under rubbish (variety ?).

(26 *d*). Wallilobo Valley (leeward), 500 ft. Nov. 8th. Shady place, at the roots of plants growing on a damp rock. A single female referred to this species.

(26 *e*). Upper Richmond Valley, 1200 ft.; forest by stream. Jan. 18th. Nest under a stone. About 150 ants in a single small chamber.

4. *Strumigenys eggersi*, Emery, v. *vincentensis*, n. v. (No. 26 *b*).

☿. L. 1, 7 mill. Diffère du type de l'*eggersi* par sa taille un peu plus grande, par ses mandibules qui n'ont aucune denticulation, par ses arêtes frontales un peu plus allongées et plus relevées, par son thorax plus allongé, ses épines métanotales un peu plus courtes, et par son abdomen lisse et luisant. La couleur est aussi d'un rouge un peu plus foncé, et le 2me article du pédicule moins large. A divers égards elle se rapproche donc plus de la *S. denticulata*, Mayr, mais s'en distingue bien par ses mandibules droites, beaucoup plus courtes et sans denticulations. Yeux situés un peu en arrière du milieu des côtés de la tête.

(26 *b*). Leeward side; forest near Châteaubelais, 1000 ft. November. Under rotting leaves.

5. *Strumigenys margaritæ*, n. sp. (No. 25 *a*, 25 *b*, 25 *i*, 25 *d*). ☿ ♀ ♂.

☿ ♀ ♂. L. 1, 8 à 2 mill. Analogue aux *S. baudueri* et *ornata*, mais bien distincte par les scapes et les épines du métanotum. Mandibules droites, environ trois ou quatre fois aussi longues que

larges, pourvues d'un bord terminal assez marqué et armé de 12 à 14 dents microscopiques, mais très distinctes et serrées les unes contre les autres, dont la dernière est apicale et un peu plus longue que les précédentes. La base des mandibules est recouverte par un lobe avancé et arrondi de l'épistome. Labre longuement bifide. Yeux situés aux $\frac{2}{3}$ postérieurs des côtés de la tête qui est étroite, allongée, assez profondément échancrée en arc derrière. Scapes courts, épais, assez dilatés par leur bord antérieur, atténués à leur base, mais sans y former d'angle comme chez la *S. membranifera*. Dos du thorax étroit, faiblement convexe, subbordé et subdéprimé. Sutures pro-mésonotale et méso-métanotale distinctes. Pronotum sans carène. Les faces basale et déclive du métanotum sont de longueur égale, toutes deux bordées d'une arête très distincte, non membraneuse ; face déclive concave. Le métanotum est pourvu de deux épines pointues, médiocrement divergentes, dirigées presque horizontalement en arrière, plus longues que l'intervalle de leurs bases. Leur base est comprimée transversalement et elles ont une structure aréolaire qui correspond à la sculpture réticulée-ponctuée. Deux tubercules métasternaux, arrondis, de même structure. Premier article du pédicule longuement pétiolé et surmonté derrière d'un nœud cubique, verticalement tronqué devant ; il a devant, en dessous, un lobe obtus, dirigé en avant, qui a une structure aréolaire moins spongieuse que chez les autres espèces et qui correspond à la dent inférieure d'autres Myrmicides. Second article aux moins deux fois aussi large que long, entouré d'une faible bordure plutôt aréolaire que spongieuse et surtout visible en dessous. Abdomen tronqué devant où il est large et subdéprimé, fortement convexe sous le premier segment.

Entièrement réticulée ponctuée et mate, y compris l'abdomen. Pas de pilosité dressée, sauf quelques poils au bout de l'abdomen. Tout le corps couvert de poils espacés, brillants, couchés et courbés, élargis en forme de cuiller à l'extrémité. Une rangée de ces poils devant les scapes et devant l'épistome ; sur l'abdomen ils deviennent rares ; sur les pattes ils ne sont plus ou sont à peine élargis. Entièrement d'un jaune ocreux clair, ou (variété No. 25 *i*) d'un jaune roussâtre assez vif.

♀. L. 2, 3 à 2, 4 mill. Comme l'ouvrière, mais les poils ne sont que faiblement ou à peine élargis à l'extrémité, les mandibules sont plus larges et la couleur plus terne, d'un jaune brunâtre. Les épines du métanotum sont fort longues et atténuées à l'extrémité. Ailes hyalines ; presque toutes les nervures atrophiées ; on ne voit plus que la tache marginale et la nervure transverse. Une petite tache brune sur le vertex.

♂. L. 2, 1 à 2, 2 mill. Mandibules avec un bord terminal tranchant, très pointues à l'extrémité, assez longues. Tête étroite, très rétrécie devant, avec un épistome étroit et allongé, échancrée en arc au milieu de son bord postérieur, épaisse derrière. Scapes très courts, élargis, à peine plus longs que le 1er article du funicule. Scutellum arrondi, ne surplombant pas derrière. Face basale du métanotum faiblement inclinée, un peu plus longue que la face déclive, terminée par deux épines longues, grêles et pointues. Face déclive bordée latéralement d'une arête. Second nœud du pédicule avec une petite dent dessous. Valvules génitales extérieures comme chez la *S. smithii*. Ailes comme chez la ♀. Tête et thorax réticulés-ponctués et mats (métanotum en partie subopaque). Pédicule et abdomen réticulés et assez luisants. Pilosité couchée, assez longue, éparse nullement clavée, ni cochleariforme, à peine un peu obtuse. Tibias seulement pubescents. Brunâtre, avec l'extrémité de l'abdomen, les pattes, les scapes, le 1er article des funicules et les mandibules d'un jaune testacé pâle.

(25 *a*). Near Palmyra Estate (leeward), 1000 ft. Nov. 3rd. Shady place near stream. Formicarium under matted turf on a rock. Only workers and larvæ could be found. There were probably 250 in the colony.

(25 *b*). Same date and locality as No. 25 *a*, and the formicarium was in a similar situation; it contained males and females, as well as workers.

(25 *d*). Golden Grove Estate (leeward), 500 ft. Sept. Open place, at the root of a tree.

(25 *i*). Hermitage Estate, Cumberland Valley, 1000 ft. Dec. 2nd. Edge of forest; under sod on rocks. (Two nests, each of perhaps 200 individuals).

5. *Strumigenys alberti*, n. sp. (No. 25 *h*, 25 *e*, 25 *f*). ☿ ♀.

☿. L. 2 à 2, 2 mill. Très voisine de la précédente, dont elle se distingue par les caractères suivants : Mandibules plus longues et plus étroites, avec un bord terminal très distinct, tranchant et translucide à sa partie basale, pourvu de six à dix dents microscopiques sur sa portion périférique. Epistome plus large, avec un lobe arrondi. Le front est rétréci à la hauteur de l'articulation des antennes et les arêtes frontales y forment un angle rentrant ou une concavité anguleuse très forte, ce qui n'est pas le cas chez la *S. margaritæ*. La tête est plus élargie et profondément excavée en arrière. Scapes moins élargis. Le thorax est bien plus convexe que chez la précédente, la suture pro-mésonotale est obsolète ; une

carène longitudinale médiane s'étend du bord antérieur du pronotum au bord postérieur du mésonotum. Angles antérieurs du pronotum subdentés; son bord antérieur relevé en ourlet; un tubercule subdentiforme de chaque côté du mésonotum. Métanotum et épines comme chez la *margaritæ*, mais les épines sont dirigées plus en haut et subparallèles. Premier article du pédicule longuement pétiolé, ayant derrière un nœud plus large, plus arrondi, moins tronqué devant que la *S. margaritæ*, bordé derrière et dessous de masses spongieuses blanchâtres bien plus développées. Second article seulement un peu plus large que long, entouré de fortes masses spongieuses. Abdomen rétréci devant, nullement déprimé.

Assez grossièrement réticulée-ponctuée et mate. Scapes assez fortement ridés. Dessus du second article du pédicule presque lisse. Abdomen lisse, luisant, avec de grossières stries à la base. Pilosité répartie comme chez la *S. margaritæ*, mais les poils sont plus longs, bien moins élargis à l'extrémité, moins brillants, plus jaunâtres. Un peu plus de longs poils dressés et assez pointus. D'un rouge ferrugineux; pattes et antennes d'un jaune roussâtre. Milieu du premier segment abdominal largement brunâtre.

♀. L. 2, 5 mill. Comme l'ouvrière, mais les poils sont encore moins élargis. Scutellum fortement proéminent en arrière. Epines métanotales fortes. Une tache brune sur le vertex. Les ailes manquent.

(25 *c*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Shady place, in a small cavity of rotten wood. Crowded thickly.

(25 *e*). Forest near Châteaubelais (leeward), 1000 ft. Oct. 11th. A single specimen under a stone.

(25 *f*). Petit Bordelle Valley, 1500 ft. Nov. 13th. Clearing in rotten wood. Female found alone.

(25 *g*). Petit Bordelle Valley, 1600 ft. Nov. 13th. Clearing. Very small nest in a cavity of a rotten log.

(25 *h*). Glen; branch of the Richmond River, 1200 ft. Damp forest; under the bark of a log.

Genre Epitritus, *Emery*.

Epitritus emmæ, Emery. (No. 59 *a*). ♀.

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(59). Only one specimen (worker) found; under a stone, near the seashore.

(59 *a*). Sandy bed of Dry River (windward) ; near sea; open land. Jan. 2nd. A single worker, found under a stone.

Genre Cryptocerus, *Smith.*

Cryptocerus discocephalus v. *araneolus*, Smith. (No. 20 *a*). ☿ minor.

(20 *a*). A single specimen, obtained in the dry forest near Wallilobo (leeward). July. It was beaten from foliage at 1000 ft. altitude.

Genre Tetramorium, *Mayr.*

1. *Tetramorium guineense*, Fabr. (No. 21 *a* à 21 *c*). ☿. Espèce cosmopolite des tropiques.

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(21). Not common; found in open places; hill-sides below 1000 ft. The formicarium is made at the roots of grass, generally at the side of and partly under a stone ; it is extensive, and may contain several thousand ants. The galleries are half an inch wide, smooth, and extend for five or six inches below the surface, with small chambers, in which the larvæ may be found. I have only found one form of worker. The ants are rather active, but not very pugnacious, even when the whole nest is dug up.

(21 *a*). Fitz-Hugh Valley (leeward), 500 ft. ; open dry hill-side. Formicarium at roots of grass, and partly under a stone. The colony contained two or three thousand individuals. Several females were found in the lower chambers. Nov. 4th.

(21 *b*). Petit Bordelle Valley (leeward), 1000 ft. The formicarium was a large one, with several thousand individuals. I could find no females, though I dug six inches below the surface. Formicarium like that described above, at roots of grass, and partly under a stone. Nov. 3rd.

(21 *c*). Cumberland Valley (leeward). Oct. 10th. Under a stone, open hill-side. No formicarium observed.

2. *Tetramorium simillimum*, Nyl. (No. 34 *a* et 34 *b*). ☿ ♀. Cosmopolite dans les tropiques.

(34 *a*). Golden Grove House (leeward); open place, 300 ft.; under a stone close to the house. Oct. 30th.

(34 *b*). Another nest (or part of the same formicarium); same locality and date. A few feet distant from 34 *a*, under a stone.

3. *Tetramorium foreli*, Emery, *in litt.* ☿.

A single individual.

Genre Wasmannia, n. gen.

Identique au sous-genre *Xiphomyrmex* du genre *Tetramorium*, Mayr, mais s'en distingue par les antennes du ♂ qui ont 13 articles au lieu de 10, et dont le 2me article du funicule n'est pas, deux fois long comme le suivant. Les ☿ et les ♀ ont 11 articles aux antennes. Les ailes sont destituées de la cellule discoidale qui existe chez tous les *Tetramorium* sens strict et chez tous les *Xiphomyrmex* que je connais. Les antennes de 10 articles avec long second articule du funicle paraissent bien être communes à toutes les espèces du genre *Tetramorium;* elles de retrouvent chez les deux seules espèces de *Tetramorium* ♂ de Madagascar que je connaisse, et dont je ne connais ni la ♀, ni l'ouvrière, mais dont au moins l'un est très probablement un *Xiphomyrmex*. Notre nouveau genre comprend les *Tetramorium auropunctatum*, Roger, et *sigmoideum*, Mayr.

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(34). Rare. The formicarium is subterranean, several inches below a stone or other shelter. It is a neatly worked chamber, ¾ in. or thereabouts in diameter, with short branches, and a passage running to an upper chamber just beneath the stone. It is possible that the two nests found were part of the same formicarium, though they were several feet apart. Two or three hundred ants were found in each chamber and its vicinity. The females were numerous. Rather sluggish.

1. *Wasmannia auropunctata*, Roger. (No. 39 *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *j*, *k*, *l*, *m*, *n*, *o*, *q*, *r*, *s*, *t*, *u*, et 48 *c bis*). ☿ ♀ ♂.

♀ (Inédite). L. 4 à 4, 3 mill.; thorax large de 1, 0 à 1, 1, abdo-

men de 1, 3 mill. Le thorax beaucoup plus large que la tête. Tête beaucoup plus large que longue et beaucoup plus large derrière que devant, largement concave derrière. Occiput subtronqué. Pronotum épaulé devant. Mésonotum subdéprimé. Métanotum pourvu de deux épines extrêmement larges, triangulaires et assez longues qui se prolongent en arêtes un peu translucides jusqu'au lobule métasternal qui est lamelliforme. Premier article du pédicule avec un pétiole beaucoup plus long et plus fort, et un nœud plus court que chez l'ouvrière.

Tête et thorax longitudinalement ridés-striés, mats et très finement réticulés-ponctués entre les rides. Pédicule et 1er segment de l'abdomen très finement et densément réticulés-ponctués et mats (le dernier en partie réticulé et subopaque ainsi que les pattes). Le pédicule a en outre quelques impressions longitudinales. Les autres segments abdominaux très faiblement chagrinés et luisants. Le premier segment de l'abdomen n'a pas les gros points enfoncés de la ☿ et du ♂.

D'un brun roussâtre ou jaunâtre ferrugineux. Dessus de la tête et du thorax ainsi que le milieu des segments abdominaux d'un brun châtain. Ailes teintes de brunâtre, pubescentes ; nervures et tache marginale brunes. Du reste comme l'ouvrière, en particulier la pilosité et la pubescence, les arêtes frontales, etc.

♂ (inédit). L. 4, 2 mill. Yeux grands, rapprochés du bord antérieur de la tête. Mandibules dentées. Epistome sans carène. Scapes longs comme les deux premiers articles du funicule réunis. Premier article du funicule très court, à peine plus long que large ; second article d'$\frac{1}{4}$ plus long que le 3me. Face basale du métanotum bien plus longue que la face déclive ; métanotum portant deux tubercules latéraux allongés. Premier article du pédicule avec un pétiole large et un nœud arrondi, fortement élargi vers sa base. Valvules génitales extérieures terminées par deux immenses appendices longs, étroits, recourbés en bas, faiblement élargis vers leur extrémité, longs comme les $\frac{2}{3}$ de l'abdomen et dépassant d'autant son extrémité. Ces singuliers appendices qui ne sont qu'un prolongement démesuré de l'extrémité des valvules extérieures, donnent à ce mâle un aspect tout particulier. Mésonotum avec un large sillon médian antérieur, deux sillons convergents et deux sillons latéraux postérieurs.

Tête et thorax densément réticulés-ponctués et mats, avec quelques rides (quelques stries sur la tête). Métanotum en outre fortement ridé en long. Pédicule réticulé et subopaque. Abdomen luisant, faiblement réticulé ; sur le premier segment de gros points enfoncés irréguliers. Pilosité et pubescence comme chez la ♀ et l'ouvrière, mais plus pointue et plus fine.

D'un brun foncé ou noirâtre. Côtés du thorax, pattes et funicules d'un brun jaunâtre sale. Mandibules, scapes, tarses, extrémité des segments abdominaux, et appendices génitaux d'un jaunâtre sale. Ailes d'une teinte un peu plus noirâtre que chez la ♀.

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(39). A very common species. The communities are generally rather small, but may be composed of several hundred, or even a thousand, individuals. The formicaria are very simple, advantage being taken of a space among rotting leaves on the ground, or there is a single chamber—sometimes two or three close together—under a stone or stick, at the roots of grass, or under bark, nearly always in a damp place. In this the ants are found closely packed, with a single female, or several, if the community is large, and the eggs and larvæ. The workers are sluggish in their movements, and the females still more so. The workers are frequently found on foliage, forest or open land.

(39 *a*). Oct. 11th (leeward). Forest above Châteaubelais, 1000 ft.; under a stick.

(39 *b*). Near Fort Charlotte, Kingstown, 500 ft. Oct. 25th. Small nest under the side of a stone; thickets. Several males but no female found.

(39 *c*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Open place. Nest under log, and partly under the bark, with several chambers.

(39 *d*). Several nests. Localities and dates not noted.

(39 *e*). Near Golden Grove House (leeward), 500 ft. Oct. 6th. Coco orchards, among rotting leaves, under stones, &c. Several colonies; in one large one (several hundred workers) I could find no female. Some were taken on foliage.

(39 *f*). Same locality and date as No. 39 *e*. A small colony, under a stone.

(39 *g*). Bowwood Valley, near Kingstown, 800 ft. Oct. 21st. Open place under a stone. Small colony.

(39 *h*). Near Palmyra Estate (leeward), 1000 ft. Nov. 3rd. Open place; under a log; between rotting leaves.

(39 *i*). Wallilobo Valley (leeward), Nov. 5th. 5000 ft. Forest. Small nest under sod on a rock.

(39 *j*). Wallibou (leeward); seashore thickets. Oct. 7th. Small nest under a stone.

(39 *k*). Old Botanical Garden, Kingstown; second growth. A small nest, in rotting wood.

(39 *l*). Forest above Châteaubelais, 1000 ft. March. A single female, under rotting leaves.

(39 *m*). Open land and forest, 1500 ft. to sea-level. Beaten from foliage. Various localities and dates.

(39 *n*). Various localities and dates; forest or open land below 2000 ft. Taken from small nests, or found among rotting leaves.

(39 *o*). Southern end of island; Villa Estate. Oct. 14th. Seashore thicket. Small nest under a block of coral (doubtfully referred to this species).

(39 *q*). Petit Bordelle Valley, 1600 ft. Nov. 13th. Clearing. A small nest in rotten wood.

(39 *r*). Camden Park Estate (leeward), north of Kingstown. Nov. 19th. Small nest under the bark of a palm-log; seaside thicket. No female could be found.

(39 *s*). Windward side, Robocca to Grand Sable Estate. Jan. 2nd and 3rd. From several nests in various localities near the seashore; under stones.

(39 *t*). Windward, Grand Sable Estate; open place near the sea. Community of about 500, under a stone. Jan. 3rd.

(32 *u*). Sandy bed of Dry River (windward), near sea. Jan. 2nd. Under a stone. Associated with No. 34 *c*.

(48 *c bis*). Females found without workers; under sod on rocks; different localities near sea-level (leeward), and south end of island. November.

2. *Wasmannia sigmoidea*, Mayr. (No. 34 *c* et *d*, 32 *a* et 39 *p*). ☿ ♀ ♂.

♀ (inédite). L. 2, 2 à 2, 3 mill. Largeur de la tête 0, 7, du thorax 0, 5, de l'abdomen 0, 75 mill. Caractères de l'ouvrière. Tête plus longue que large, à peine élargie et nullement tronquée derrière. Pronotum épaulé. Métanotum armé de deux longues épines grêles et pointues, plus longues que celles de l'ouvrière. Face déclive bordée de deux très petites arêtes. Premier article du pédicule comme chez l'ouvrière. Second article transversal, très court, trois fois aussi large que long.

Finement réticulée-ponctuée et mate, avec des stries ou rides longitudinales sur la tête et le thorax. Premier segment de l'abdomen luisant, très finement et incomplètement réticulé (réticulations

obsolètes chacune à son bord postérieur), avec de gros points pilifères épars colorés en brun.

Pilosité, pubescence et couleur de l'ouvrière. Ailes hyalines, avec les nervures et la tache marginale pâles.

♂ (inédit). L. 2, 5 mill. Scape long comme le 2me article du funicule. Tête, thorax et pédicule conformés tout à fait comme chez la *W. auropunctata*, mais la face basale du métanotum est plus courte, comme la face déclive, et les tubercules du métanotum sont plus courts et plus obtus. Valvules génitales extérieures de forme et de grandeur ordinaire, triangulaires-arrondies, dépassant à peine l'extrémité de l'abdomen.

Tête et thorax finement réticulés et subopaques, avec quelques rides et stries. Métanotum et côtés du pédicule seulement réticulés. Abdomen et dessus des nœuds du pédicule lisses et luisants, sans gros points enfoncés. Pilosité comme chez les autres sexes, mais plus pointue et plus fine ; quelques bouquets de poils sous les derniers segments abdominaux.

D'un brun noirâtre. Pattes, mandibules, antennes, articulations et extrémité des segments abdominaux d'un jaunâtre pâle. Ailes comme chez la ♀.

La comparaison des deux espèces *W. auropunctata* et *sigmoidea* est fort intéressante, la première avec ses enormes ♀ et ♂, si différents de l'ouvrière, la seconde avec ses ♀ et ♂ si petits, la femelle toute semblable à l'ouvrière qui de son côté est un peu plus grande que celle de l'*auropunctata*. Malgré ces différences et malgré la différence des valvules génitales extérieures, ces deux espèces sont proches parentes et appartiennent au même genre qui doit être séparé des *Tetramorium*.

(34 *c*). Windward side; sandy bed of Dry River, near the sea. Jan. 2nd. Under a stone. Nest as described above; the lower chamber supported by roots of grass. There were apparently about 300 workers, with numerous winged females and a few males. There was a nest of No. 39 under the same stone, and in this latter were a good many fragments of dead ants, apparently of No. 34.

(34 *d*). Same locality and date as No. 34 *e*. Females found under various stones. Nearly always associated with No. 39, though not quite in their nests; and in every case remains of dead ants (No. 34) were found under the same stones. I judge that the two species frequent the same places, but fight with each other;

probably No. 39 is generally victorious, because of superior numbers. I did not see them fight, though in exposing the nest of 34 *c* the workers became mingled with those of No. 39. The two kinds of workers are difficult to distinguish in the field, but those of No. 34 are larger and darker.

(32 *a*). Richmond Estate (leeward); open valley near sea-level. Oct. 31st. In rotten wood. A single female.

(39 *p*). Fitz-Hugh Valley (leeward). Nov. 4th. Small nest under sod on a rock (doubtfully referred to this species).

Genre Monomorium, *Mayr*.

1. *Monomorium minutum*, Mayr, r. *ebeninum*, Forel, Fourm. Madagascar, p. 165. (No. 9 *a* et *b*, et Mustique Island). ☿ ♀.

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(9). Observed only about Kingstown and southern end of island; thickets near the seashore, or on hills overlooking the sea. In some places the workers are common on bushes. Apparently the formicarium is made under a stone.

(9 *a*). Villa Estate, southern end of the island; thicket near the seashore; under a block of coral on the sand. I am not sure that this was a formicarium; only workers (no larvæ) were found, and these were not numerous. Oct. 14th.

(9 *b*). Near Fort Charlotte, Kingstown. Oct. 24th. Beaten from bushes, scrubby growth; hill-side overlooking the sea, 400 ft.

2. *Monomorium floricola*, Jerdon. (No. 27 *a* à 27 *f*). ☿ ♀ ♂. Cosmopolite dans les tropiques.

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(27). Common locally about houses, not far from sea-level. Formicarium made in crevices of walls, &c. The workers are diurnal (perhaps nocturnal also). They are attracted by sweet substances, and by dead animal matter; when they find these they remain a long time to feed, but appear to carry nothing away. It would seem that the females came out to forage with the workers, or alone. I have found them on tables, &c.

The workers move about singly, or four or five follow each other in a line; they cannot walk rapidly.

N.B.—Differs from No. 10 not only in colour, but in the proportion of joints of the antennæ.

(27 *a*). About the house at Golden Grove (leeward), 300 ft. October. Many were found on a bird-skin, which was in course of drying.

(27 *b*). Golden Grove, Nov. 9th; evening. Crawling on a table. It was not attended by workers.

(27 *c*). Note lost. Probably from the same formicarium.

(27 *d*). Golden Grove Estate (leeward), 300 ft. Dec. 14th. Formicarium found in a package of glass collection bottles or tubes, which had been packed away on a shelf in a dark corner. The ants had made their way through the cork stoppers of two of the tubes, and in these tubes they kept the larvæ. In one of the bottles were numerous wingless females and a few males; in another there were also winged females. The paper in which the tubes were wrapped was also full of ants, including numerous males and females. The colony must have consisted of at least five thousand ants. The number of wingless females was remarkable, the proportion to workers found in the nest being, I should suppose, one to ten or twelve; but a portion of the workers may have been out foraging. Only a small number comparatively of the different forms were saved. There were few larvæ and pupæ; males very numerous.

(27 *e*). Near Kingstown; open valley, 500 ft. Oct. 27th. A female found alone under a log.

(27 *f*). Windward side; bank near the seashore, north of Georgetown; under a stone. Jan. 3rd. Several nests of this species were found on the windward side.

These ants are often found in water-jars. Whether alive or dead, they always float on the surface of the water, if washed into it.

Genre Cardiocondyla, *Emery.*

1. *Cardiocondyla emeryi*, Forel. ☿.

Genre Pseudomyrma, *Lund.*

1. *Pseudomyrma flavidula*, Sm. (Wallibou et "sandy bed," sans numéro). ☿.

2. *Pseudomyrma elongata*, Mayr (sans numéro). 1 ☿.

Genre Solenopsis, *Westw.*

1. *Solenopsis azteca*, n. sp. (No. 10 *d*, 10 *e*, et 10 *i*). ☿.

☿. L. 1, 2 à 1, 4 mill. Plus robuste que la *S. corticalis*. Mandibules courtes, à bord terminal nullement oblique, large, armé de 4 larges dents peu pointues. Les mandibules sont lisses, luisantes, avec quelques points enfoncés. Tête en rectangle allongé. Yeux relativement développés, plats, composés d'environ 7 facettes et situés un peu en avant du tiers antérieur des côtés de la tête. Epistome fortement bicaréné, à peine avancé, sans dents à son bord antérieur; les carènes assez distantes. Antennes très courtes. Le scape est épais et n'atteint que les $\frac{3}{5}$ de la distance de sa base au bord postérieur de la tête. Les antennes ont 10 articles; les articles 3 à 5 du funicule sont au moins trois fois aussi larges que longs; le dernier article est très grand, aussi long que les 7 précédents réunis. Thorax assez large et assez court, sans trace de suture pro-mésonotale. Une forte incisure entre le mésonotum et le métanotum. Ce dernier médiocrement convexe, sans aucune limite entre la face basale et la face déclive. Cependant, d'après le profil de la courbe, la face déclive serait la plus longue. Premier article du pédicule avec un pétiole plus court que le nœud et une convexité inférieure comprimée et translucide, sans dent dessous. Le nœud est situé à l'extrémité postérieure du 1er article, large et arrondi en haut, bien plus haut que le 2me article, plus large que long. Second article un peu incliné en avant, un peu plus large que long. Abdomen tronqué devant. Pattes courtes.

Très lisse et très luisante. Quelques courtes stries devant les joues. Ponctuation piligère faible et éparse, même sur les joues.

Une pilosité dressée, jaunâtre, fine, de longueur médiocre, également et médiocrement répandue sur le corps, les pattes (y compris les tibias) et les scapes. Pubescence à peu près nulle.

D'un brun jaunâtre sale. Une large bande d'un brun noirâtre au milieu de l'abdomen. Pattes, antennes et mandibules d'un jaune testacé plus ou moins pâle (mandibules plus foncées).

Malheureusement la ♀ n'a pas été trouvée. Si Emery n'écrivait pas *clypeo acute bidentato* je croirais que c'est sa *Solenopsis brevicornis*. Peut-être n'en est-ce qu'une race. La *S. brevicornis* vient du sud du Brésil.

(10 *d*). Various situations. Not noted.

(10 *e*). Petit Bordelle Valley, 1600 ft. Nov. 13th. Open place. A small nest in rotten wood. No female could be found.

(10 *i*). Richmond Valley, thick forest, 1100 ft. Dec. 29th. Under decaying leaves, &c. (workers).

2. *Solenopsis castor*, n. sp. (No. 10 *f* et 10 *g*). ☿ ♀.

☿. L. 1, 3 à 1, 5 mill. Un peu plus svelte que la précédente. Mandibules bien plus longues, moins coudées, plus étroites, à bord terminal oblique, armé de 4 à 5 dents pointues. Les mandibules lisses, luisantes, avec quelques points. Yeux situés comme chez la précédente, mais un peu plus petits, composés de 4 à 5 facettes peu distinctes. Tête en rectangle allongé, à côtés un peu plus convexes que chez la précédente. Epistome fortement avancé au milieu en trapèze, bicaréné, avec deux dents aigües, rapprochées l'une de l'autre devant, au milieu, et en outre deux denticules presque microscopiques de chaque côté de son bord antérieur (deux fortes dents médianes] et quatre denticules latérales en tout). Antennes de longueur ordinaire; le scape atteint les $\frac{4}{5}$ de la distance de sa base au bord postérieur de la tête. Les articles 3 à 5 du funicule moins de deux fois plus larges que longs. Scapes d'épaisseur ordinaire. Thorax plus étroit et plus allongé que chez la précédente. Echancrure méso-métanotale forte et plus large. Face basale du métanotum faiblement convexe, beaucoup plus longue que la face déclive. Pédicule conformé comme chez l'espèce précédente, mais le nœud du 1er article est plus bas (à peine plus élevé que le 2me article), et fortement atténué à son sommet qui est situé bien plus en avant, à peu près au tiers postérieur de la longueur de l'article. Second article aussi long que large, fortement incliné en avant. Abdomen plus étroit devant, Pattes de longueur moyenne.

Sculpture et pilosité comme chez la précédente, mais les points piligères sont un peu plus forts et les poils des tibias et des scapes sont très obliques. Pubescence presque nulle.

D'un jaune rougeâtre ou d'un rouge jaunâtre ; pattes et antennes d'un jaune brunâtre. Tête et une bande transversale sur le 1er segment abdominal d'un brun foncé.

♀. L. 2, 4 mill. Tête plus longue que large. Antennes de 11 articles. Les scapes ne sont pas éloignés d'atteindre le bord postérieur de la tête. L'épistome n'a qu'une denticule latérale distincte à côté des dents médiales. Thorax un peu plus étroit que la tête, beaucoup plus court que chez la *S. corticalis*, long une fois et demie comme la tête (deux fois chez la *S. corticalis* ♀). Face basale du métanotum beaucoup plus longue que la face déclive et

bien séparée d'elle par deux tubercules très faibles. Pédicule comme chez l'ouvrière, mais la convexité inférieure du 1er article n'est pas translucide et le 2me article est bien plus large que long.

Ponctuation de la tête éparse, mais profonde et très distincte, beaucoup plus forte que chez l'ouvrière. Du reste sculpture et pilosité comme chez l'ouvrière, mais pilosité plus abondante. Ailes manquent.

D'un brun noirâtre. Mandibules et devant de la tête d'un rouge brunâtre ou jaunâtre. Pattes, antennes et bord des segments abdominaux d'un jaune brunâtre ou d'un brun jauuâtre.

Cette espèce ressemble à plusieurs autres. Sa petite femelle, les denticules latérales de l'épistome la caractérisént cependant assez. La femelle est tout à fait différente de celle de la *S. corticalis*, et l'ouvrière de cette dernière espèce se distingue par ses yeux plus petits, situés plus en avant, par son épistome seulement subdenté et bien moins avancé.

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(10). Pretty common below 2000 ft.; forest or shady places. The colonies are small; under sod, stones, or logs, or in rotten wood. Apparently the formicarium consists of a single small chamber. The workers and females are sluggish; the former are sometimes found on bushes.

(10 *a*). Near Palmyra Estate (leeward); shady place near a stream; under sod growing on rock. The female and worker were not found together, but are apparently of the same species. Nov. 3rd.

(10 *b*). Forest, Morne à Garou, 1500 ft. Oct. 29th. Under bark of a dry log.

(10 *c*). Bowwood Valley, near Kingstown, Oct. 16th, 800 ft.; second growth. Beaten from foliage.

(10 *f*). Hermitage Estate, Cumberland Valley, 1000 ft. Dec. 2nd. Edge of forest; under sod on a rock. Community of probably fifty ants.

N.B.—The female was found with the workers. It is smaller than that of No. 10 *a*, and it seems likely that I have included two species in this number.

(10 *g*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Open place; under bark of rotten log. A female found alone. Seems to be the same as No. 10 *f*.

(10 *h*). Richmond Valley, 1700 ft.; near the middle of the island; open bed of stream in thick forest. Taken flying at about 3 o'clock p.m. Dec. 30th. A female, apparently like No. 10 *a*.

3. *Solenopsis pollux*, n. sp. (No. 28 *a* à 28 *l*). ☿ ♀ ♂.

☿. 1, 2 à 1, 4 mill. Voisine de la précédente. Tête un peu plus longue que large, mais plus courte que chez la précédente. Mandibules armées de 4 dents, conformées du reste comme chez la précédente, mais avec le bord terminal un peu moins oblique. Epistome avec deux carènes aigües, rapprochées, terminées devant par deux longues et fortes dents encore plus rapprochées que chez l'espèce précédente; à côté de ces dents, il n'y a qu'un feston latéral au bord antérieur qui est un peu moins avancé que chez la précédente. Antennes et yeux comme chez la précédente. Thorax un peu plus court, avec l'échancrure méso-métathoracique plus faible. Le métanotum est faiblement convexe et descend en talus, sans aucune limite entre la face basale et la face déclive. Premier article du pédicule comme chez la *S. azteca*, mais un peu plus atténué au sommet et moins haut. Second article très court, petit, à peine incliné en avant, plus large que long. Abdomen comme chez la précédente.

La sculpture et la pilosité sont analogues à celles de la *S. castor*, mais les poils et les points piligères sont bien plus abondants. La ponctuation est assez abondante sur la tête, la pilosité en partie oblique, plus courte que chez la *S. castor*.

D'un jaune uniforme, à peine le bord des mandibules et un nuage transversal sur le 1er segment de l'abdomen sont-ils un peu roussis.

♀. L. 3, 3 à 3, 5 mill. Caractères de l'ouvrière, mais les dents médianes de l'épistome sont plus courtes et les festons latéraux plus forts; les carènes sont plus écartées. Tête rectangulaire-arrondie, un peu plus longue que large. Antennes de 11 articles; scapes comme chez l'ouvrière.

Thorax aussi large que la tête, plus long que chez la *S. castor*, plus court que chez la *S. corticalis*. Face basale du métanotum plus longue que la face déclive et séparée d'elle par deux faibles élevations allongées et peu distinctes. Premier article du pédicule sans dent dessous, avec un nœud élevé, bien plus large que long, presque squamiforme, mais élargi en bas, situé tout à fait en arrière et contigu sur toute sa hauteur au 2me article. La face antérieure de ce nœud est légèrement concave, sa face postérieure convexe vers le haut. Le premier article du pédicule qui a une convexité translucide en dessous chez l'ouvrière n'est nullement convexe dessous chez la ♀ (convexe chez la *S. castor*). Second article du pédicule atténué en dessous, épais, arrondi et plus large que long en dessus, un peu moins élevé que le nœud du 1er article. Abdomen long et grand. Ailes uniformément teintes de brunâtre, avec les

nervures et la tache marginale d'un brun clair. Cellule discoïdale très petite.

Lisse, luisante, avec de gros points piligères espacés sur la tête et le thorax ; sur l'abdomen ces points sont plus fins.

Pilosité jaunâtre, assez courte, abondante, très oblique sur les tibias et les scapes. Pubescence presque nulle.

D'un noir brunâtre. Abdomen d'un brun foncé. Hanches et milieu des cuisses brunâtres. Mandibules, antennes et le reste des pattes d'un jaune un peu rougeâtre.

♂. L. 2, 7 à 2, 3 mill. Mandibules bidentées, très étroites, avec le bord interne parallèle au bord externe. Tête arrondie, un peu plus large que longue. Scapes un peu plus longs que larges. Premier article du funicule gros et globuleux ; second article un peu plus long que le scape. Antennes de longueur médiocre. Métanotum arrondi. Premier article du pédicule comme celui d'un *Leptothorax nylanderi* ☿, mais bien plus allongé, et à sommet plus tranchant, c'est à dire que le sommet du nœud est tranchant et transversal, et que le nœud descend en long talus en avant et en court talus en arrière, sans former de pétiole distinct. Second nœud plus large que long, anguleux latéralement.

Lisse, luisant, avec des points piligères fort épars. Pilosité comme chez la ♀, mais bien moins abondante. Entièrement d'un noir à peine brunâtre. Pattes et antennes brunes. Ailes comme chez la ♀, mais plus faiblement teintes de brunâtre.

Cette espèce est complètement différente de la précédente, de la *S. corticalis* et de la *S. brevicornis* par sa ♀ qui la rapproche plus de la *S. fugax*.

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(28). Pretty common, forming small colonies at the roots of grass or herbage. I have never seen more than forty or fifty together. Sluggish.

(28 *a*). Near Palmyra Estate (leeward), 1000 ft. Nov. 3rd. Shady place near a stream. A small colony at the roots of grass growing on a rock.

(28 *b*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Small passage in sod on a rock ; shady place.

(28 *c*). Wallilobo Valley ; open place, at the roots of sod on a rock. Nov. 8th. Near sea-level.

(28 *d*). Same locality as last. Another colony.

(28 *e*). Wallilobo Valley, 500 ft. ; under sod on a rock. A small colony.

(28 *f*). Females found under the same sod with No. 28 *e*, and presumably the same species.

(28 *g*). Male, found under sod with Nos 28 *e* and 28 *f*.

(28 *h*). (Doubtfully referred to this species). Near Palmyra (leeward), 100 ft.; under sod on rock.

(28 *i*). Petit Bordelle Valley, 1200 ft. Nov. 13th. Shady banks of stream; under sod on a rock. No female could be found.

(28 *j*). Cumberland Valley, 300 ft. (leeward), Dec. 2nd. Dry place; edge of forest, under sod on a rock. The community contained perhaps 200 ants, with numerous males, many of which flew away.

(28 *k*). Windward, near seashore; at Robocca. Jan. 2nd. Under stone in a door-yard [?]. There were probably 200 workers, with about twenty females, in a small cavity under the stone.

(28 *l*). Windward, near seashore; open, sandy bed of the Dry River. Jan 2nd. Under a stone. About 200 workers in a small cavity. No female could be found.

4. *Solenopsis exigua*, n. sp. (No. 28 *m*). ☿.

L. 1, 0 mill. Presque identique à la *S. latro*, Forel, *i. e.*, mais bien plus petite et différente par son épistome qui n'est que subcaréné et n'a pas de dents appréciables (à peine les carènes proéminent-elles un peu devant). Les yeux sont presque imperceptibles et n'ont qu'une facette. Le dernier article des antennes de 10 articles est presque aussi long que tout le reste du funicule. Les articles 3 à 6 du funicule sont deux ou trois fois plus larges que longs. Une simple suture qui ne forme pas d'échancrure appréciable entre le mésonotum et le métanotum. Premier article du pédicule à peu près comme chez la *S. Pollux*. Très luisante et lisse. Assez abondamment et très finement poilue avec des points piligères très fins. Entièrement d'un jaune extrêmement pâle, beaucoup plus pâle que la *S. latro*. Tête plus étroite et plus allongée, scapes un peu plus courts que chez la *S. latro*. Du reste identique.

(28 *m*). Thicket by stream near sea-level; above Châteaubelais (leeward). Jan. 27th. Under sod on a rock. Several nests of perhaps 150 each.

5. *Solenopsis globularia*, F. Smith. (No. 18 *a* et 18 *b*). ☿ ♀.

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(18). Rare. The only specimens seen were observed near the seashore, windward side; under stones, &c.

(18 *a*). Windward side; sandy bed of the Dry River; open ground, near the sea. Jan. 2nd. A single worker found under a stone. Associated with Nos. 34 *c* and 39.

(18 *c*). A female referred doubtfully to this species; windward side at Georgetown. Jan. 3rd. Muddy land by seashore; at the mouth of a stream; under a stone.

6. *Solenopsis geminata*, Fabr. (No. 48 *a* à 48 *m*). ☿ ♀ ♂.
Espèce cosmopolite des tropiques.

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(48). Common, especially in open places below 1500 ft. The communities are large, often ten or twelve thousand individuals, I should think. The formicary proper is commonly excavated under sod or loose soil, advantage being often taken of the shelter afforded by a large stone, or by vines, a bush, &c; it is never far below the surface. In the centre is a large irregular chamber, or several small ones connected by very short passages; this central portion may occupy a space six inches square. From it a network of tunnels extends in all directions, but always near the surface; connected with these there may be other small chambers for larvæ, food, &c. The longer tunnels may extend for many yards, commonly ending under stones, where other chambers are constructed; and to these distant parts of the formicarium the larvæ are often carried. No matter how large the community is, there appears to be but one gravid female, though several winged females may be found. These ants are very pugnacious, especially when their central nest is disturbed. The sting is unpleasant, but not very painful. The largest-headed workers are few in number, and keep to the inner passages of the formicarium. The other workers are frequently found about houses, on foliage, flowers, &c., and prowling over the ground in open places. They seem to live principally, if not entirely, on vegetable matter; they are especially fond of sweet substances. I have found considerable quantities of grass-seeds stored in small chambers in their nests. In their movements the small-headed workers are moderately active; the large-headed ones move slowly, and in a staggering way. The females are sluggish.

(48 *a*). Near Wallibou (leeward); seashore thickets;

sandy soil. Oct. 8th. The main nest was under a large stone.

(48 *b*). Fitz-Hugh Valley (leeward), 500 ft.; open place near stream. A large nest under sod and vines on a rock.

(48 *d*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Open place. A female found alone in a small cavity of rotten wood.

(48 *e*). Golden Grove (leeward), 300 ft. June. Workers found about the house.

(48 *f*). Workers from various localities on the leeward side and southern end of the island, below 1500 ft.; open places. Some found at the ends of their tunnels, under stones; others on foliage, on the flowers of *Croton*, &c.

(48 *g*). Southern end of the island; Villa Estate, near the seashore; dry hill-side; at the end of a tunnel under a stone. Oct. 14th.

(48 *h*). Near Palmyra Estate (leeward), 1000 ft. Nov. 4th. Open hill-side. A formicary or end of a tunnel, partly under a stone. The ants had formed a small mound at the side of the stone, with the earth brought up. I could find no female; and probably this was not the main nest, though the ants and larvæ were numerous.

(48 *i*). Wallilobo (leeward), near sea-level; open valley. Nov. 8th. From extensive passages under sod and stones.

(48 *j*). Camden Park Estate (leeward, near Kingstown), Nov. 19th; seashore, at the root of a tree. A large colony. The ants had passages on the tree-trunk, following the lines of crevices, and formed roughly of bits of wood-fibre.

The tunnels of these ants are made very near the surface of the ground, and are generally partly open, either because the surface has fallen in, or because the passage is not necessarily a covered one; hence these passages can easily be traced.

(48 *k*). Nov. 23rd. Golden Grove (leeward), 300 ft. Many thousands appeared in the upper room of the house, near sunset, in a corner near a window. They had at least a hundred males, which they let loose near the window. It was curious to see the workers drag the

males to the window, which, however, was closed—a failure of instinct. Very few workers major appeared. I killed thousands of the ants with carbolic acid. Notwithstanding this, and the fact that the window was an effectual barrier to swarming, the ants appeared again in a few days after, in the same place, with other males.

(48 *l*). Hermitage Estate, Cumberland Valley, 1000 ft.; open place. Dec. 2nd. At roots of plants on a rock. A large nest.

(48 *m*). Windward coast of Robocca. Jan. 2nd. Door-yard, under stones. (The species is common on the windward side).

N.B.—Mons. H. H. Smith a encore rapporté plusieurs ♀ et ♂ appartenant au genre *Solenopsis*, mais indéterminables, parce que les ☿ correspondantes manquent. Il se peut qu'ils appartiennent à des ☿ déjà décrites, et c'est un devoir de ne pas encombrer la synonymie de ce genre déjà si difficile. Ces individus sont les numéros (10 *h*) ♀, (11 *a*) ♀ et ♂, quatre espèces de ♂ pris au vol et sans numéros, enfin le No. 10 *a*. La ♀ et l'ouvrière du No. 10 *a* appartiennent à deux espèces différentes, mais l'ouvrière unique, fort rapprochée de la *S. Castor* n'est pas assez caractéristique, ni assez bien conservée pour qu'il soit permis de la décrire.

(11). Perhaps referable to No. 9.

(11 *a*). Open place near sea-level; Cumberland Valley (leeward). Oct. 8th. Flying. Copulated (about 8 a.m.).

7. *Solenopsis succinea*, Emery. (No. 33 *a*). ☿ ♀ ♂.

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(33). Rare. The only formicarium seen was in the mountain forest, in rotten wood. Community large. The workers are rather sluggish.

(33 *a*). Morne à Garou; forest, 2000 ft. Nov. 1st. The formicarium, or part of it, was uncovered by tearing off the bark of a rotten stump. Apparently there were other chambers deep in the half-decayed wood, but, having no axe, I could not get at them. The males and females were numerous, and I judge were about to leave the nest.

Genre Cremastogaster, *Lund.*

Observed at the southern end of the island; thickets along the seashore, or near it. In this region the ants were very numerous on the ground, tree-trunks, and foliage. The females, generally two to four or five together, and attended by many workers, were found in crevices under the outer bark of Manchioneal and Landbox trees; each little nest was two or three inches long, and perhaps an inch broad, but many were on the same tree, and perhaps formed part of the same great colony. The females are very sluggish, and when the nest is uncovered generally cling to the bark of the tree by their jaws; the workers are active and pugnacious. There were many larvæ in the nests, but I could find no males. Apparently the passages of the formicarium are short, and confined to the outer bark of the tree.

1. *Cremastogaster curvispinosa*, Mayr. (No. 7 *b* et 7 *c*). ☿, var. *antillana*, n. var.

Diffère de la forme typique de l'Amérique du sud par l'échancrure méso-métathoracique moins profonde, surtout lorsqu'on la regarde de dessus. Cela provient de ce que le métanotum est moins élargi de côté. Les épines métanotales sont beaucoup plus courtes, et moins divergentes tout en ayant la même conformation et le même poil caractéristique vers la moitié de leur longueur. Les épines sont longues comme la moitié de l'intervalle de leurs bases-environ (presque comme l'intervalle entier chez la forme typique).

(7 *b*). Richmond Estate; open valley near sea-level; in a rotten stump. Ants numerous, in a cavity about 3 in. × ½ × ⅓, with larvæ, but I could find no female by careful search. Perhaps another species.

(7 *c*). Forest, Morne à Garou, 1500—2000 ft. Nov. 1st. Beaten from foliage. Apparently rare in the forest.

2. *Cremastogaster brevispinosa*, Mayr, var. *minutior*, n. var. (No. 7 *a*, 7 *d* et 19 *j bis*). ☿ et ♀.

☿. L. 2, 2 à 2, 6 mill. Epines plus courtes encore que chez le type, un peu courbées en avant. Stries du pronotum et de la face basale du métanotum assez peu apparentes et assez éparses; entre deux ces parties sont réticulées. Mésonotum assez rugueux-strié.

Abdomen luisant et presque lisse. Suture pro-mésonotale obsolète. Poils du corps courts et obtus, comme chez la forme typique.

♀. L. 5, 5 à 6, 1 mill. Métanotum avec deux tubercules. Abdomen tronqué devant, avec deux angles antérieurs latéraux très marqués. Une dent sous le devant du premier article du pédicule. Ce dernier conformé comme chez l'ouvrière. La ponctuation espacée de la tête et du thorax est assez forte et très distincte. Ailes subhyalines (un peu teintées de jaunâtre), avec les nervures et la tache marginale jaunâtres. Le milieu du bord antérieur de l'épistome a une forte échancrure qui fait à peu près défaut à l'ouvrière.

(7 *a*). From nests as above. Oct. 14th.

(7 *d*). Villa Estate (southern end of island), Nov. 20th. By seashore, shady place; under the bark of a log, in small chambers. The winged females are much less sluggish than the wingless ones. This species is also found locally along the windward coast.

Genre Pheidole, *Westw.*

1. *Pheidole fallax*, Mayr, var. *jelskii*, Mayr. ☿ ♀ ♃ ♂. (No. 12 *a*).

♀ (encore inédite). L. 7, 3 mill. Caractères du ♃. Occiput lisse derrière. Mésonotum subopaque, strié en long, avec des points épars. Scutellum assez lisse, avec des points épars. Métanotum grossièrement ridé en travers, aussi sur sa face déclive, armé de deux épines pointues, un peu plus longues que la largeur de leur base. Abdomen subopaque, très finement et vaguement réticulé. Thorax assez élevé, aussi large et plus grand que la tête. Second nœud du pédicule plus de deux fois plus large que long. Ailes manquent.

♂. L. 4, 7 mill. Mandibules tridentées. Derrière de la tête convexe-arrondi, presque semicirculaire. Epistome et face déclive du métanotum ridés en travers. Tête avec des rides éparses. Le reste luisant et assez lisse. Face basale du métanotum plus longue que la face déclive et munie de deux tubercules allongés. Pilosité dressée abondante, aussi sur les tibias et les scapes. D'un jaune brunâtre sale, avec la tête (sauf les mandibules) d'un brun noirâtre. Ailes d'un jaune très pâle, avec les nervures et le pterostigma assez pâles.

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(12). Low, flat land at the southern end of the island, near the sea. The nest is subterranean, with an opening

about $\frac{1}{2}$ in. in diameter to the surface. I do not know how extensive the passages are. Only one formicarium observed.

(12*a*). Lowlands, Great Head, southern end of island; in a subterranean nest. All the forms were obtained within six inches of the surface. Apparently the colony was a very large one.

2. *Pheidole guilelmi mülleri*, Forel, r. *antillana*, n. st. ☿ ♃ ♀ ♂. (No. 23*a* à 23*s*).

Plus petite que l'espèce typique du Brésil méridional, dont le soldat et l'ouvrière sont seuls connus.

♃ (soldat). L. 4, 2 à 5 mill. Diffère de la forme typique par les caractères suivants. Tête plus longue, très sensiblement plus longue que large, à côtés presque droits et parallèles (distinctement convexes chez l'espèce typique). Les scapes n'atteignent que les $\frac{2}{3}$ de la distance de leur articulation à l'angle occipital (presque la moitié chez l'espèce typique). Le bourrelet transversal du mésonotum est plus proéminent et a des angles latéraux très nets. L'incisure méso-métanotale est bien moins profonde; les épines sont plus fortes et un peu plus longues. Le second nœud du pédicule est plus court et plus large; sa longueur n'a guère que les $\frac{2}{3}$ de sa largeur (les $\frac{4}{5}$ ou les $\frac{3}{4}$ chez l'espèce typique). La tête est ridée jusque vers les angles occipitaux qui ont de gros points enfoncés, comme chez la *P. Risii*. Pilosité un peu plus courte et un peu plus fine que chez l'espèce typique, du reste identique, ainsi que la couleur.

☿. L. 2, 0 à 2, 3 mill. (3 à 3, 3 chez l'espèce typique). La tête est moins circulairement arrondie que chez l'espèce typique, sans avoir le bord postérieur distinct de la *P. Risii*. Le thorax a la forme de l'espèce typique et non celle de la *P. Risii*, mais les tubercules du mésonotum sont un peu moins apparents et le métanotum n'a que deux dents triangulaires. Le 2me nœud du pédicule est à peine plus long que large. La tête est luisante et assez lisse; elle n'a que quelques rides transversales derrière et les rides arquées des fossettes antennaires (chez l'espèce typique et chez la *P. Risii* elle est fortement ridée et réticulée). Le thorax est aussi bien plus luisant et plus lisse. Les mandibules sont plus petites et le bord antérieur de l'épistome est crénelé, comme chez l'espèce typique. Pilosité comme chez le ♃. Le reste comme chez l'espèce typique.

♀. L. 5 à 5, 5 mill. Comme le ♃. Tête aussi large que longue, aussi large devant que derrière, plus large et aussi grande que le thorax. Ce dernier court, aplati dessus. Les deux faces du méta-

notum subégales, bordées d'arêtes qui sont la continuation antérieure et postérieure des épines. Ces dernières triangulaires, larges. Premier article du pedicule avec une convexité longitudinale dessous; second article trois fois plus large que long, avec un bourrelet transversal dessous. Abdomen petit, tronqué devant.

Tête entièrement et grossièrement ridée-réticulée et subopaque; seul le derrière de l'occiput est finement coriacé et assez luisant. Dos du mésonotum lisse et luisant au milieu, ridé en long sur les côtés. Métanotum en partie ridé; sa face déclive lisse et luisante. Nœuds du pédicule et devant de l'abdomen subopaques et très finement coriacés. Pilosité comme chez le ♃, mais plus abondante, plus régulière et plus oblique sur le corps.

Roussâtre avec les pattes et les antennes d'un roux jaunâtre. Ailes teintées d'un jaune un peu brunâtre; nervures et pterostigma d'un brun roussâtre.

♂. L. 2, 8 à 3, 2 mill. Mandibules étroites, bidentées, avec le bord interne parallèle au bord externe. Ocelles situés sur une éminence de la tête. Métanotum arrondi, sans tubercules; ses deux faces subégales. Pédicule et abdomen étroits et allongés.

D'un jaune pâle et sale; une tache brune autour des ocelles. Luisant et assez lisse. Pilosité dressée fine, oblique, plus courte et moins abondante que chez les autres sexes; ailes bien plus transparentes que chez la ♀.

La taille de la ♀ et du ♂ est extraordinairement petite relativement à celle du soldat.

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(23). A common species in forest and shady places. The colonies are generally composed of one or two hundred individuals at most, but may have as many as six or seven hundred. The formicarium is generally under bark of very rotten logs, or under a log or stick; rarely under a stone or under turf on a rock. It is an irregular chamber, with short radiating passages, the whole commonly occupying only two or three inches of space. The workers major are few in number, sometimes only one or two in the colony. Both workers major and workers minor are sluggish, especially the former. I have never found these ants except in the nests.

(23*a*). Richmond Estate (leeward); valley near sea-level. Oct. 31st. Shady place. Formicarium under a stone; an irregular chamber, about 2 × 1 in., with branches extending 2 in. deep. Workers major few,

minors numerous. A single male and several winged females found.

(23 *b*). Petit Bordelle Valley (leeward), 1000 ft. Nov. 3rd. Shady place, near a stream. Formicarium under turf on a rock. The colony was pretty large (several hundreds).

(23 *c*). Fitz-Hugh Valley (leeward), Nov. 4th, 500 ft. Shady place. A small colony under bark of very rotten log.

(23 *d*). Leeward side, near sea-level. April. A single male referred to this species. It was taken flying over a cane-field, at nightfall.

(23 *e*). July. Locality not noted. (Female).

(23 *f*). Leeward; forest hill-side, 500 ft.; under rotting leaves. November.

(23 *g*). Forest, Morne à Garou, Oct. 27th and Nov. 1st, 1500 ft. Collected from several colonies, generally under bark or on the lower sides of logs.

(23 *h*). Near Palmyra Estate (leeward), 1000 ft. From a pretty large colony; under a log, shady place.

(23 *i*). Forest, Morne à Garou, 1500 ft. Oct. 27th. A small colony in rotten wood.

(23 *j*). Same locality as No. 23 *i*. Another colony.

(23 *k*). Wallilobo Valley (leeward), 250 ft. Nov. 8th. Open place near a stream. Formicarium in turf and rubbish on a rock. A large colony.

(23 *l*). Wallilobo Valley, 500 ft.; forest. At the roots of *Lycopodia* growing on a rock. A small colony. Nov. 8th.

(23 *m*). Wallilobo Valley, 500 ft.; forest. In rotten wood. The formicarium was in a small cavity near the surface of the log, and there were less than a dozen ants. Many seeds were stored in the cavity, and specimens of these are in the bottle with ants. Nov. 8th.

(23 *n*). Petit Bordelle Valley, 1200 ft. Nov. 13th. Shady bank of stream; under sod on a rock. The formicarium occupied a space six or eight inches long, with a smoothly worked chamber about two inches long, the remainder being passages on two sides, following a depression of the rock. The males were rather numerous; workers major about one-tenth as many as workers minor. Several hundred ants in the nest.

(23 *o*). Petit Bordelle Valley, 1200 ft. Nov. 13th. Another nest similar to No. 23 *n*.

(23 *p*). Petit Bordelle Valley, 1300 ft. Nov. 13th.

Shady bank of stream; under sod on a rock. The nest was a pretty large one, with three chambers each, about three inches long.

(23*q*). Upper Richmond Valley, 1500 ft. Nov. 27th. Under sod on rocks; forest by the river. From two nests. Common in this locality, which is in the midst of the forest region.

(23*r*). Hermitage Estate, Cumberland Valley, 1000 ft.; open hill-side. Nest in a small cavity of a rotten log.

(23*s*). Forest by stream; above Châteaubelais (leeward), 250 ft. Jan. 26th. Nest in rotten wood. A small community.

Var. *nigrescens*, n. var. ☿ ♃ ♀. (No. 13*a*).

Identique à la race *antillana*, mais d'un brun noirâtre de poix avec les pattes et les antennes (sauf le milieu des hanches et des cuisses chez le ♃ et la ♀) d'un roux jaunâtre. En outre l'impression transversale du mésonotum est plus faible chez le soldat et l'ouvrière. Chez la ♀ et le ♃, les scapes sont un peu moins aplatis et un peu moins courbés vers leur base, mais cette différence est peu accentuée. Mayr a aussi décrit un variété noirâtre de la *P. guilelmi mülleri* typique.

Cette race tient à quelques égards de la *P. risii*, Forel, dont j'avais déjà signalé la parenté avec la *P. guilelmi mülleri*. Il s'agit là evidemment d'un groupe répandu dans toute la faune néotropique.

(13*a*). Old Botanical Garden, near Kingstown. A small formicarium in rotten wood; shady place. Oct. 22nd.

3. *Pheidole godmani*, n. sp. ☿ ♀ ♃. (No. 14*a* à 14*c*).

♃. L. 3, 8 mill. Aspect de la *P. megacephala*, mais la tête est carrée, aussi large devant que derrière, avec les angles occipitaux arrondis. Epistome caréné, avec une impression, mais sans échancrure distincte au milieu de son bord antérieur. Mandibules luisantes, lisses, avec des points épars. Une impression transversale distincte au milieu du mésonotum; une impression longitudinale distincte au milieu du métanotum. Premier nœud du pédicule entier à son bord supérieur; second nœud beaucoup plus large que long (aussi long que large chez la *megacephala*).

Les $\frac{3}{4}$ antérieurs de la tête densément striés en long; les stries

sont surtout denses et fines entre l'œil et le vertex ; elles sont beaucoup plus denses et plus fines que chez la *megacephala*. L'occiput, le dessous et les côtés de la tête sont lisses et très luisants. Face basale du métanotum densément striée en travers. Sculpture et pilosité du reste comme chez la *megacephala*. Couleur d'une *megacephala* claire ; tête et thorax d'un jaune roussâtre ; pédicule et abdomen d'un jaune brunâtre ou d'un brun jaunâtre ; pattes et antennes testacées. Pilosité jaune, fort abondante sur la tête. Du reste comme la *megacephala*.

☿. L. 2, 2 à 2, 4 mill. Forme de la tête comme chez la *megacephala*. Thorax plus court que chez cette espèce, et avec la convexité pro-mésothoracique beaucoup plus forte. Le métanotum est par contre plus bas, avec sa face basale bien plus longue que la face déclive. Le second nœud du pédicule est presque aussi large que long (beaucoup plus long que large chez la *megacephala*). L'abdomen est très étroit, plus haut que large.

La tête et le thorax sont entièrement et très nettement striés en travers ; seul l'occiput est parfois lisse. Les stries transversales du front se courbent latéralement en arc en avant et deviennent longitudinales sur les joues. L'épistome est lisse et luisant ainsi que le pédicule et l'abdomen. Pilosité comme chez la *P. megacephala*, mais un peu plus courte et plus fine. Articles 2 à 3 du funicule de l'antenne à peine ou pas plus longs que larges. D'un brun sale. Mandibules jaunâtres. Funicules et pattes d'un jaune brunâtre. Du reste comme la *P. megacephala ;* épines de même longueur.

Cette ☿ est extrêmement curieuse. Elle est striée d'une façon tout à fait analogue à l'*Huberia striata*. Ce sont de vraies stries parfois courbées, n'ayant nullement l'aspect de rides. Je ne connais aucune *Pheidole* analogue.

♀. L. 6, 2 mill. Tête à peine plus large derrière que devant. Les yeux ne sont pas plus grands que l'intervalle qui les sépare du bord antérieur de la tête (beaucoup plus grands chez la *P. megacephala*). Epistome fortement caréné, sans échancrure. Le métanotum n'a que deux fortes dents triangulaires. Premier nœud du pédicule entier au sommet. Second nœud au moins trois fois plus large que long, avec deux cônes latéraux très longs. Abdomen tronqué devant, plus petit que chez la *P. megacephala*.

Devant de la tête et dos du mésonotum fortement et densément striés en long. Sur le vertex les stries divergent fortement. Dessous de la tête et ses côtés derrière les yeux, abdomen et en partie le pédicule et les côtés du thorax luisants, plus ou moins lisses (par-ci par-là quelques stries ou rides) et très éparsément ponctués. Métanotum densément strié en travers. Le scutellum a des stries arquées derrière, transversales devant.

Pilosité comme chez la *P. megacephala*, mais un peu plus abondante. D'un brun rougeâtre ; pattes et funicules d'un jaune brunâtre sale.

(14*a*). Damp forest ; glen near a stream, 1500 ft. March. Formicarium under dead leaves.

(14*b*). Specimens referred to this species. Richmond Valley, 1500 ft. Nov. 27th. By a stream in thick forest. The ants were found in a long passage (at least three feet) under a log on the sand by the stream ; this was evidently not the main formicarium, as I could find no larvæ nor sexually developed ants, and the place is covered during floods. The ants are rather active. I searched carefully in the vicinity for the nest, but could fine none.

(14*c*). Leeward side. January. Note was lost, but the specimens are probably from the Upper Richmond Valley.

4. *Pheidole radoszkowskii*, Mayr, ☿ ♃ ♀ ♂. (No. 22*a* à 22*j*). Var. *luteola*, n. var.

Comme le type, mais le ♃ est entièrement d'un jaune testacé, à peine un peu roussâtre sur la tête, avec la moitié postérieure de l'abdomen d'un jaune brunâtre ou d'un brun jaunâtre. Les épines du métanotum sont un peu plus courtes, un peu courbées et plus pointues. Le 2me nœud du pédicule un peu plus étroit. L'occiput est assez luisant derrière, l'abdomen et le pédicule par contre sont plus mats. L'ouvrière diffère du type par les mêmes caractères, sauf la sculpture ; la différence de couleur est encore plus forte (le type est d'un brun assez foncé, la var. *luteola* d'un jaune assez clair, avec le thorax et la tête d'un jaune un peu roussâtre).

♀ (encore inédite). L. 5, 2 à 6 mill. Tête très élargie et légèrement concave derrière. Scapes légèrement épaissis à leur base et à leur extrémité (ou légèrement, mais distinctement atténués au milieu). Mandibules denticulées à leur bord terminal, entre les deux dents de devant et celle de derrière. Pronotum large devant, un peu plus large que la tête, *avec le bord antérieur et surtout les coins antérieurs bordés et surplombants.* Le métanotum a deux larges épines triangulaires et obtuses qui se prolongent en arêtes bordant latéralement les deux faces du métanotum. Second nœud du pédicule au moins deux fois plus large que long.

Thorax et abdomen assez élevés ; ce dernier tronqué devant, mais nullement déprimé. Dos du mésonotum et abdomen lisses

et luisants. Métanotum ridé en travers. D'un roux jaunâtre, avec les pattes et le bord postérieur des segments abdominaux d'un jaune clair; les $\frac{2}{3}$ postérieurs de l'abdomen du reste brunâtres. Ailes teintées de jaune brunâtre, avec les nervures et la tache marginale d'un brun pâle. Du reste comme le soldat, en particulier la pilosité et la sculpture.

♂ (inédit). L. 4 à 4, 4 mill. Mandibules triangulaires, tridentées. Métanotum arrondi, avec deux tubercules faiblement marqués et ses deux faces subégales. Tête réticulée-ponctuée et mate. Mésonotum assez lisse en dessus. Métanotum ridé en long. Abdomen étroit et allongé. Pilosité dressée médiocrement abondante sur la tête, le métanotum et le pédicule. Antennes et pattes sans poils dressés. Pubescence comme chez le soldat. D'un jaune pâle, testacé; une tache brune autour des ocelles; deux raies brunes longitudinales sur le mésonotum. Ailes comme chez la ♀.

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(22). A common species in open places, from 3000 ft. to sea-level. The formicarium is often quite large, with two or three thousand ants. Commonly it is under a stone or log on dry and more or less open ground; immediately beneath the stone is a branching chamber. From this passages, $\frac{1}{3}$—$\frac{1}{2}$ in. broad, extend down irregularly several inches, with small chambers (1—$1\frac{1}{2}$ in. long and an inch wide), in which larvæ and sometimes females are found. The passages and chambers are smoothly worked. The workers major are sluggish, and keep to the inner chambers; the workers minor are quite active, and may often be found in the daytime prowling about bushes. These ants are not pugnacious, even when the nest is disturbed. The workers major are much less numerous than the workers minor, perhaps one-fifth of the whole colony. Occasionally the nest is made in rotten wood, or under rubbish.

(22 *a*). Near Barronallie (leeward), September, 500 ft. Open place, under chips, &c. Formicarium not noted.

(22 *b*). Scrubby growth near the top of the Soufrière Volcano, 2500 ft. September. Beaten from bushes. Others along the edge of the crater to 3000 ft. January. Under moss and stones. I could find no nests.

((22 *c*). Near Palmyra Estate (leeward), 1000 ft.; open field under a stone. A large colony. Nov. 3rd.

(22 *d*). Fitz-Hugh Valley (leeward), 500 ft.; open hillside. Nov. 4th. The formicarium was partly under a stone, with passages among the roots of grass. Colony

quite large. Only one female found after careful search. (N.B.—I believe the colonies of this species have only one fertile female, though several winged ones may be found).

(22*e*). Near Fort Charlotte, Kingstown; scrubby growth, 500 ft. Oct. 25th. Pretty large colony, under a stone. I could find no female.

(22*f*). Richmond Estate; open valley (leeward), near sea-level. A large colony in rotten wood. I could find no female. Oct. 31st.

(22*g*). Seashore thickets, Wallibou (leeward). Small colony under a stone. Some of the workers minor brushed from bushes. Oct. 8th.

(22*h*). Seashore, Villa Estate, southern end of the island. A small nest under a block of coral. Oct. 14th.

(22*i*). Hermitage Estate, Cumberland Valley, 1000 ft.; damp open hill-sides; under logs or sod. From several nests. Males were not found in the same nests with winged females. Some nests had forty or fifty males, and others as many winged females. As these ants make pretty extensive passages, it is possible that such nests were parts of the same formicarium; but I do not think so. All the nests were as described above. Dec. 2nd.

(22*j*). Western slope of Morne à Garou, 800 ft. Dec. 9th. Open place near stream; under sod on a rock. A female. The only workers near were of No. 35.

5. *Pheidole subarmata*, Mayr, v. *elongatula*, n.v. ☿ ♀ ♃ ♂. (No. 30*a*, *b*, *c*, *e*, *g*, *h*, *i*).

Diffère du type par la tête plus allongée du ♃, large de 0, 9, longue de 1, 3 à 1, 4 mill., sans les mandibules (large de 1, 0, longue de 1, 2 chez le type). En outre la pilosité des tibias est moins dressée, plus oblique et plus courte, surtout chez l'ouvrière.

Les arêtes frontales sont assez élevées et anguleuses antérieurement.

♀. L. 5 à 5, 2 mill. Tête plus longue que large, aussi large devant que derrière. Métanotum tout à fait comme chez le ♃, Second nœud du pédicule un peu plus large que long. Occiput, côtés et dessous de la tête lisses et luisants. Les poils du corps assez obliques, même en partie subadjacents sur l'abdomen. Rougeâtre, avec l'abdomen, le dessus du mésonotum et du pédicule ainsi qu'une tache sur le vertex brunâtres. Pattes testacées. Ailes

teintées de jaune sale, avec les nervures brunâtres. Du reste comme le ♃.

♂. L. 3, 6 à 3, 9 mill. Mandibules triangulaires, tridentées. Tête striée devant. Métanotum bas, avec la face basale bien plus longue que la face déclive, inerme, arrondi. Penicilli assez gros et poilus. Pilosité comme chez le soldat. Ailes comme chez la ♀. D'un jaune sale un peu brunâtre, avec trois larges bandes longitudinales brunes sur le dos du mésonotum. Abdomen assez étroit.

Les numéros (30 *d*) et (30 *f*) appartiennent à une autre variété plus petite, dont le soldat n'a que 2, 7 à 3 mill., mais a du reste la forme de la tête et la pilosité de la forme typique, et non pas de la var. *elongatula*.

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(30). Common in forest or open places. The communities are generally rather small (100 individuals), but occasionally larger, with several hundred ants. The formicarium is generally under a stone or under sod, sometimes in rotten wood; it is simply made, with one or two small chambers and few passages. The workers minor are rather active in their movements; the workers major and females sluggish. The workers minor are often found prowling about foliage or on the ground. Workers major pretty numerous.

(30 *a*). Southern end of the island, Villa Estate; near seashore, under a block of coral. Oct. 14th. A small nest. One male found.

(30 *b*). Morne Ronde (leeward, near the northern end of the island); October. Not far from sea-level. Formicarium not noted.

(30 *c*). Fitz-Hugh Valley (leeward), 500 ft.; open place near a stream. Formicarium under sod on the side of a rock. This was a large colony, with a passage a foot long, and smoothly worked at the roots of the sod. Nov. 4th.

(30 *d*). Locality, situation, and date as in (30 *c*). The colony was apparently a small one, but the formicarium was concealed in a crack of the rock. (Worker major smaller than usual.)

(30 *e*). Workers, from various nests, and some of the workers minor brushed from foliage, or found on the ground; leeward side. Various localities below 1500 ft.

(30 *f*). Fitz-Hugh Valley (leeward); shady place. A small colony in rotten wood, Nov. 4th, 500 ft.

(30 *g*). Females, found without workers in various localities; leeward side, below 800 ft. All were found under sod on shady rocks. Four of them were on the same rock, but no workers were found. November.

(30 *h*). Golden Grove (leeward), October, 300 ft. Formicaria near the house. The male, presumably of this species, was found while I was digging near one of the nests.

(30 *i*). Petit Bordelle Valley, 1300 ft. Nov. 13th. Open place near stream. Found under sod on a rock.

(30 *j*). Male referred to this species. Not noted.

6. *Pheidole susannæ*, Forel, r. *obscurior*, Forel. ☿ ♃ ♀ ♂. (No. 31 *a* à 31 *d* et "plantations de cocos").

♀ (inédite). L. 6, 2 mill. Tête plus réticulée que chez le ♃, un peu échancrée derrière; les rides de la tête se prolongent sur l'occiput. Mésonotum et côtés du métanotum ridés en long; ces derniers en outre finement réticulés-ponctués ainsi que les nœuds du pédicule qui ont des rides transversales. Base de l'abdomen striée et mate (finement réticulée-ponctuée). Reste de l'abdomen presque lisse et luisant, avec des points piligères. Epines du métanotum médiocres; entre elles quelques rides transversales; face basale et face déclive du reste lisses et luisantes. Thorax et abdomen, plutôt élevés, non déprimés; thorax plus large que la tête; abdomen grand. D'un brun noirâtre; mandibules, articulations et funicules roussâtres; tarses jaunâtres. Ailes subhyalines; nervures et tache marginale d'un brun jaunâtre. Du reste comme le ♃.

♂ (inédit). L. 3, 6 à 3, 7 mill. Mandibules triangulaires, bidentées. Un peu moins étroit que les précédents. Métanotum avec deux faibles bourrelets longitudinaux; face basale un peu plus longue que la face déclive. Lisse et luisant. N'a pas la longue pubescence du ♃ et de la ♀. Pilosité dressée comme chez l'ouvrière.

D'un jaune brunâtre sale. Tête d'un brun noirâtre; dos du thorax presque entièrement brunâtre. Pattes, antennes et mandibules pâles. Ailes comme chez la ♀.

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(31). A rare species, forming large colonies. Formicarium generally in rotten wood. When disturbed these ants are rather pugnacious. The workers minor are active; the workers major move about heavily. The latter are not numerous.

(31 *a*). Wallilobo Valley (leeward), 500 ft.; forest near a stream. Formicarium in very rotten wood; the passages extended through six or eight inches of the log, with several chambers, each about 1 × ½ in. The colony probably contained over 1000 individuals. Immature males were numerous. Only a few females could be found. Nov. 8th.

(31 *b*). Hermitage Estate, Cumberland Valley, 1000 ft. Dec. 1st. Open hill-side near forest. Formicarium in a rotten stick on the ground. It extended irregularly through about 15 in. of the stick, with several chambers, each about ¾ in. long, and half as wide and high. The colony may have contained 500 individuals, the workers major being about one-tenth as numerous as the workers minor. There were many immature males in this nest, but I could find no female.

(31 *c*). Same locality and situation as the last, in another log. The nest did not differ from No. 31 *b*, except that the chambers were rather larger; the community probably contained over 1000 individuals. About twenty winged females were seen, but no males.

(31 *d*). Upper Richmond Valley, 1500 ft.; forest by a stream; under rubbish near the water. No nest could be found.

7. *Pheidole flavens*, Roger, v. *vincentensis*, n. v. ☿ ♃ ♀ ♂. (No. 36 *a* à 36 *t*).

♃. Le quart postérieur de la tête lisse et luisant. Couleur variant du rouge jaunâtre au roux brunâtre, avec l'abdomen et les pattes plus clairs, d'un jaune plus ou moins brunâtre. Pilosité de la tête et du thorax plus abondante, et, surtout celle du thorax, plus longue que chez le type. Epines du métanotum parfois presque aussi longues que la face basale, ou comme ses ⅔. Le pronotum et le mésonotum forment une convexité très courte et très forte; ce dernier est presque verticalement tronqué derrière. L. 2 à 2, 2 mill.

☿. Mêmes différences que le ♃. Couleur souvent d'un brun à peine roussâtre; tête et thorax très mats, densément réticulés, ponctués, sauf l'épistome (à part les rides). L. 1, 5 mill. Ne connaissant pas le type, je ne puis juger exactement des différences. D'après Roger, le ♃ et l'ouvrière n'ont que des dents au métanotum d'après Mayr ce sont des épines. A cet égard, nos exemplaires correspondraient à ceux de Mayr.

♀. Correspond à la description de Roger, mais le métanotum a des épines bien plus longues que larges. Thorax petit, abdomen grand. Tête faiblement élargie derrière. Second nœud du pédicule sans conules latéraux. Métanotum ridé en travers. L. 3, 5 à 3, 7 mill.

♂ (inédit). L. 3 à 3, 2 mill. Mandibules triangulaires, bidentées et avec un angle postérieur. Face déclive du métanotum assez nettement distincte de la face basale, aussi longue qu'elle et assez abrupte. Tête densément striée-ridée, mate, très finement réticulée-ponctuée entre les stries. Métanotum densément réticulé et mat; le reste lisse et luisant. Pilosité des pattes assez dressée et assez longue. Entièrement jaune, sauf le vertex et l'occiput qui sont bruns. Tache marginale d'un brun foncé; nervures assez pâles; ailes assez faiblement teintées d'un jaune brunâtre.

Espèce évidemment très répandue à St. Vincent.

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(36). A common species, generally second growth; open places or forest. Forms large communities (of several thousand sometimes), the workers major constituting from one-fourth to one-third of the whole. The formicarium is found in rotten wood, under sod, or sometimes under stones or sticks. It consists generally of several smoothly-worked passages, which may be eight to twelve inches long, and forming an irregular network; at the junctions of the passages are small chambers, and of these there may be twenty in a single nest. The ants also make arched galleries on the outside of the log containing the formicarium, or, if it is under sod, in cavities that are too large for their purposes; these galleries resemble those made by termites, and it is possible that the ants simply utilise the old termite-galleries. Each community, however large, seems to have but one gravid female, and, as she keeps to an inner chamber, it is often difficult to find her. The workers major also keep to the inner passages and chambers. They, as well as the female, are very sluggish; the workers minor much less so. I have not found the workers on foliage. Apparently the species is nocturnal; it ranges to 3000 ft.

N.B.—Closely allied to No. 35, and I cannot discriminate the workers minor with my lens; but great care has been taken to keep specimens from the same nest together.

(36 *a*). Islet fronting Châteaubelais Bay (leeward), Oct. 31st. Rocky ground overlooking sea; in thickets. Formicarium in a rotten stump.

(36 *b*). Southern end of the island; thickets near sea at the Villa Estate. Oct. 14th. A large colony (several thousand) in rubbish under stones and blocks of coral.

(36 *c*). Near Palmyra Estate (leeward), 1000 ft. Nov. 3rd. The workers are from two formicaria in neighbouring logs; open field near a stream. The communities were both large. I copy from my field-note:— "Under the log are passages and considerable chambers ($1\frac{1}{2} \times 2$ in.), walled in with a rather tough material formed of wood-fibre. Small holes ($\frac{1}{16}$ in.) lead perpendicularly into the log, sometimes two or three inches, to many chambers, each about one inch long; in these are the larvæ and workers major. Only one female was found after long search. Perhaps the ants utilise the borings of beetles for their passages into the wood. The logs were only partly decayed, and rather hard."

(36 *d*). Fitz-Hugh Valley (leeward), 500 ft.; near a stream; shady place. A large formicarium under sod on a rock.

(36 *e*). Soufrière Volcano, 2500 ft.; open land near the crater. June. Formicarium under moss. Not noted.

(36 *f*). Wallilobo Valley (leeward), 500 ft. Nov. 8th. Second growth, under sod on a rock. A large community, with passages extending for nearly two feet among the roots of the sod.

(36 *g*). Near Fort Charlotte, Kingstown, 500 ft. Oct. 24th. Shady place, loamy soil. Formicarium under a stone (imperfectly observed).

(36 *h*). Wallilobo Valley (leeward), 500 ft. Nov. 8th. Second growth. A large formicarium under sod on a rock.

(36 *i*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. A large community, at roots of sod on a rock near stream; open place.

(36 *j*). Wallilobo Valley (leeward), 500 ft. Nov. 8th. Forest near stream. A small colony (apparently) under sod on a rock.

(36 *k*). Fitz-Hugh Valley, 500 ft. Nov. 4th. Shady place. Formicarium in rotten wood. It was large, with many passages and chambers; outside of the log these communicated with galleries formed of wood-fibre,

possibly old termite-galleries. The female was found, after long search, in an inner chamber, unattended by workers. Males (immature) were abundant in the outer passages.

(36 *l*). Fitz-Hugh Valley (leeward), 500 ft. Nov. 4th. Under vines and weeds on a rock. Long passages and artificial galleries. A large community. Numerous males.

(36 *m*). Leeward, near Châteaubelais, 500 ft. April. Flying at twilight. A female referred to this species.

(36 *n*). Female referred to this species. Not noted.

(36 *o*). Mountain forest, 3000 ft. March. Under decaying leaves.

(36 *p*). Petit Bordelle Valley, 1500 ft. Nov. 13th. Open place near stream; under sod on a rock. A large colony.

(36 *q*). Petit Bordelle Valley, 1600 ft. Nov. 13th. Clearing. A small colony (apparently) in rotten wood.

(36 *r*). Near Brighton Estate; southern end of island. Nov. 17th. Open place, 500 ft.; under sod on a rock.

(36 *s*). Leeward; Cumberland and Wallibou Valleys; edge of forest, 700—1000 ft. Dec. 1st—10th. From several nests under sod on rocks.

(36 *t*). Windward, near Grand Sable; thicket adjoining the seashore. Nest under sod on a rock. Few males and one female were seen.

r. *Pheidole sculptior*, n. st. ☿ ♃ ♀. (No. 35 *a* à 35 *h*).

♃. Diffère de la *P. flavens* v. *vincentensis* par sa tête entièrement sculptée, jusqu'au bord postérieur; les angles occipitaux sont densément réticulés-ponctués et mats. Le thorax est aussi plus mat et réticulé-ponctué entre les rides. L'occiput n'est lisse et luisant qu'autour du bord articulaire. La couleur est aussi d'un jaune roussâtre plus clair. Du reste identique à la variété précédente. Cette race ressemble beaucoup à la *P. lignicola*, Mayr, mais les scapes sont beaucoup plus courts et n'atteignent que la moitié de la distance de l'articulation de l'antennæ à l'angle occipital (les $\frac{2}{3}$ chez la *lignicola*); les pattes sont aussi plus courtes et les scapes moins renflés.

☿. Identique à celle de la variété précédente.

♀. Tête striée-ridée et mate jusqu'à l'articulation occipitale (lisse et luisante autour de l'articulation occipitale, entre elle et le bord postérieur, chez la *P. flavens* v. *vincentensis*).

(35). Not common. Small communities found in forest or open land, under sticks or stones, loamy soil; occasionally in rotten wood. The workers major and females are very sluggish; workers minor less so, but not active. The workers major are not numerous. The formicarium appears to consist of a single small chamber, with passage for exit.

(35 *a*). Near Fort Charlotte, Kingstown; in scrubby growth, 500 ft. above sea. Oct. 24th. Under a stone. Colony of perhaps 200.

(35 *b*). Bowwood Valley, near Kingstown, 800 ft. Oct. 20th. Open hill-side, under a stone. A single female.

(35 *c*). Southern end of the island; Villa Estate. Oct. 14th. Nest under rotten wood, near the seashore.

(35 *d*). Wallibou (leeward), seashore thickets. Oct. 10th. Small colony under a stone.

(35 *e*). Forest above Châteaubelais, 1000 ft. Oct. 11th. Small nest under a stick. (Workers only referred to this species).

(35 *f*). Petit Bordelle Valley, 1200 ft. Nov. 13th. Shady banks of stream; under sod on a rock. Small colony.

(35 *g*). Petit Bordelle Valley, 1600 ft. Nov. 13th. Clearing in rotten wood.

(35 *h*). Windward side; sandy, open valley of the Dry River, near the sea. Jan. 2nd. A single female, found under a stone.

8. *Pheidole orbica*, n. sp. ☿ ♃ ♀ ♂. (No. 37 *a* à 37 *g*).

♃. L. 2, 2 à 2, 5 mill. Extrêmement semblable à la précédente dont elle diffère par les caractères suivants: vertex encore plus distinctement imprimé transversalement. Epistome sans apparence de dents, à peine largement échancré au milieu de son bord antérieur. Le pronotum et le mésonotum forment une convexité encore bien plus courte et plus forte que chez la *P. flavens*, à peu près hémisphérique; le mésonotum n'est nullement tronqué derrière et n'a ni dents, ni bourrelet, tout au plus une apparence d'impression transversale chez quelques individus. Le premier nœud du pédicule est faiblement échancré au sommet; le 2me nœud a deux conules latéraux distincts, situées un peu en avant de son milieu. L'abdomen est un peu plus grand.

Les rides du devant de la tête divergent en arrière et atteignent l'occiput en s'y affaiblissant et en se terminant dans quelques

fossettes allongées ; les angles postérieurs ne sont qu'en partie lisses et luisants. Thorax, pédicule et abdomen lisses et luisants, sauf quelques vagues rides transversales sur le métanotum.

Pilosité dressée plus courte et plus clair-semée que chez la précédente, très courte sur la tête ; les tibias n'ont qu'une pubescence adjacente.

Couleur variable ; tantôt d'un brun châtain avec l'abdomen et le pédicule d'un brun jaunâtre, les pattes jaunâtres, les antennes et le devant de la tête rougeâtre ; tantôt la tête entièrement ou en partie rougeâtre ou même d'un jaune rougeâtre et les autres parties plus claires ou l'abdomen plus foncé. Du reste comme la *P. flavens* v. *vincentensis*.

☿. L. 1, 2 à 1, 4 mill. Entièrement lisse et luisante. Forme de la *P. flavens* v. *vincentensis*, mais les épines du métanotum sont plus courtes, le pronotum et le mésonotum forment une voûte plus forte, tout l'insecte est plus court et plus petit. Pilosité comme chez le ♃. D'un brun légèrement roussâtre ou jaunâtre. Pattes, antennes et mandibules jaunâtres.

♀. L. 3, 5 à 3, 8 mill. Tête carrée, à peine plus large que le thorax. Le métanotum n'a que deux larges dents triangulaires. Le second nœud du pédicule est 2½ fois plus large que long et a deux conules latéraux très développés à ses angles antérieurs. Abdomen grand.

Tête ridée-striée en long ; les rides divergent en arrière. Métanotum ridé sur les côtés, faiblement réticulé sur sa face basale ; le reste lisse et luisant. Pilosité comme chez la *P. flavens* v. *vincentensis*, mais les tibias n'ont que des poils adjacents.

Brunâtre ; tête rougeâtre, avec le milieu de sa face supérieure brun. Pattes et antennes jaunâtres. Ailes à peine teintées de brunâtre ; tache marginale et nervures pâles.

♂. L. 3 mill. Mandibules étroites, tridentées. Métanotum bas ; sa face basale beaucoup plus longue que la face déclive ; deux bourrelets longitudinaux distincts. Abdomen et pédicule étroits et allongés. Tête mate, densément réticulée-ridée. Métanotum réticulé ; le reste lisse et luisant. Poils des tibias plus obliques ; du reste pilosité comme chez les autres sexes. D'un jaune brunâtre sale ; tête brune ; épistome et ses alentours d'un jaune brunâtre. Pattes, antennes et mandibules d'un jaune pâle.

Cette espèce démontre une fois de plus le manque de concordance entre les caractères du ♃ et ceux de l'ouvrière chez les *Pheidole*. La tête du ♃ est plus fortement sculptée chez l'*orbica* que chez la *flavens*, tandis que celle de l'ouvrière est entièrement lisse chez l'*orbica*, par contre mate et densément sculptée chez la *flavens*.

Elle est certainement fort voisine de la *P. minutula*, Mayr, mais cette dernière est jaune, plus grande, a une pilosité plus forte, des poils dressés aux tibias, et n'a pas de conule au 2me nœud du pédicule.

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(37). Apparently rather rare ; forest (or open land ?). Communities much smaller than those of No. 36. Formicaria in rotten wood, under sod, &c. Workers major rather numerous ; sluggish.

(37 *a*). Forest, Morne à Garou, 1500 ft. Oct. 27th. Community of perhaps 200, in and under a very rotten log.

(37 *b*). Damp forest, Wallilobo Valley, 500 ft. Nov. 8th. Formicarium under sod on a rock.

(37 *c*). Forest, 2000 ft. ; September. Not noted.

(37 *d*). Deep forest glen ; south branch of the Cumberland River, 1200 ft. Dec. 19th. A community of about 500 ants. Formicarium under roots of plants growing on a rock. The males were numerous. No female could be found.

(37 *e*). Same locality as No. 37 *c*. From two small nests under sod on rocks.

(37 *f*). Richmond Valley, near the centre of the island, 1700 ft. Dec. 30th. Shore of stream in thick forest. Community of about 500 under a stone ; sandy, damp ground. There were several small irregular chambers, either immediately below the stone, or in the sand an inch below the surface. This species is pretty common in damp forest.

(37 *g*). Richmond Valley, 1100 ft. Jan. 18th. Female. Under a stone ; damp ground near a stream, forest.

9. *Pheidole megacephala*, Fabr. ☿ ♃ et ♀. (No. 49 *a* à 49 *d*). Cosmopolite dans les tropiques.

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(49). Apparently a rare species.

(49 *a*). Wallilobo (leeward), Nov. 8th ; seashore. From passages at the root of a tree. Formicary could not be found. The ants are moderately active, and not very pugnacious.

(49 *b*). Fitz-Hugh Estate (leeward), near sea-level. Dec. 12th. A large community, with extensive passages about an old arrowroot-machine ; the passages partly under stones, or by the sides of posts which supported

the machine; partly in the ground near the surface. In places there were galleries, covered with a substance apparently formed of wood-fibre and earth. I could find no larvæ, and no males nor females, though I dug deep. Probably this was a branch of the main nest, which may have been some distance away. The workers major were numerous, probably one-fourth of the whole. The place was quite near the seashore.

(49 *c*). Petit Bordelle Estate; open land near the sea. Dec. 15th. A very large community (eight or ten thousand, I should think), under turf on a rock; shore of a stream. The chambers were large, some of them four inches long and wide, but not high; and they were partly built up with walls of wood-fibre or some similar substance. The passages were numerous, and the whole formicarium occupied a space of about two square feet. The workers major are not numerous; about as one to twenty compared with the workers minor. Only one female could be found. The larvæ were numerous. This ant walls in a large proportion of its works, both passages and chambers, with the wood-fibre substance mentioned above. It does not tunnel more than an inch or two below the surface of the ground, so far as I can discover.

(44 *d*). Same locality and date as No. 49 *c*, but another nest; under a stone. Most of the space under the stone was occupied by a large chamber, about 6 × 4 in., but not high, around the outside of the stone; next the ground were other chambers, formed of the wood-fibre substance. Apparently this was only a part of the nest, with branches under other stones. Only one female found.

The species is common at Petit Bordelle, but I have not been able to find males.

XXI. *The cost and value of Insect Collections.*

By David Sharp, M.A., M.B., F.R.S., &c.

[Read October 4th, 1893.]

The discussions that have from time to time taken place as to the number of species of insects have had the result of making it pretty clear that if all the extant collections of insects were put together it would be probably found that they did not contain one-tenth part of the existing species. Moreover, this great general collection—if we can imagine it brought together—would be found dreadfully deficient in other respects; for instance, a large part of the species would be represented by only one, two, or three specimens; many of the individuals would be found to be in a very inferior state of preservation, and not a series would be found to illustrate either variation, geographical distribution, or metamorphosis, although these are essential points for a good collection. We should also discover that there were dreadful discrepancies as to the primary requisite, nomenclature. We should find in some cases several species standing under one name, and in others we should see individuals of the same species standing under different names. In other words, the world has made very little progress with the formation of a collection of insects. The enormous amount of enthusiasm, labour, devotion, and study bestowed on Entomology have as yet effected but little towards what is required.

There can be no doubt that the insect-fauna of the world is becoming greatly depauperated; one hears it from all sources. In our own country, in North America, in New Zealand, in Australia; insects that were formerly found in places are not there now. And I often ask myself whether the insects will not succeed in becoming extinct before mankind has become acquainted with them.

There are but few data accessible for the purpose of

calculating the cost of insect collections. The chief item is the cost of collecting; and by far the larger part of the collecting that has been, and is being, carried on, is done as a labour of love. The number of those who have persistently collected insects for the remuneration they could obtain for it has always been extremely small, though a good many have tried it and abandoned it, owing partly to their own want of skill, and partly to the uncertainty and inequality of the demand. In order to calculate the cost of a collection, one must in the first place put a value on the labour of the collector, and in doing this we must treat the matter from a purely business point of view. It is quite true that men whose time is worth £1000 or more per annum devote some of it to forming a collection of insects, and it is equally true that men who only realise £100 per annum are frequently quite as successful entomologically as their more expensive—if I may be pardoned the expression—colleagues. I believe, however, that if any one wished to secure an entomologist of good natural ability to collect for him permanently in Britain, he could find such a man for about £150 per annum; and I take that therefore as the standard value of entomological labour. If we do this, and calculate what this labour should be expected to accomplish per annum over a number of years, we have then the data for approximating to the cost of a collection of insects.

Let us suppose the collector to be limited to making a collection of British insects, collecting them, mounting them, naming, and preserving them. I have no doubt he could progress at the rate of 6000 specimens, representing about 300 species, per annum. A very energetic and devoted man could do much more, but according to the conditions of our problem,—I am dealing with the case of ordinary men,—worth £150 per annum. And I am also taking into consideration the fact—and a very important one it is, as entomologists well know—that he is to secure the rare as well as the common species. If we take the number of species of British insects at 12,000, then, according to the above calculation, a fairly good collection of British insects, averaging twenty well-selected specimens of a species, would be formed in forty years at an expense of about £6000; and that, I think, is a very fair estimate. A collection of 12,000 species

of British insects, averaging twenty to a species, and thus consisting of 240,000 specimens, could, I think, be made for £6000, the average cost per specimen being 6d. It will be perhaps objected that I have allowed nothing for the cost of travelling, which must, of course, be incurred; but a little reflection will show that this would be very small under the conditions I am supposing, and would be more than recouped by the sale of duplicates.

The next point for consideration is the extent to which the preceding calculations must be modified in considering the cost of an ultra-British,—that is to say, a general,—collection.

At first sight it would appear that to make, in England, a collection of extra-British insects must be more expensive than making one limited to the indigenous creatures. And doubtless it would be, if all the departments of the work were undertaken by one man, as I have supposed to be the case in the formation of a British collection.

The efforts of one man in forming a general collection of the insects of the world would, however, be thrown away, and for this larger purpose the combination of a number of employés would be essential; and in that case the advantages derived from division and organisation of labour would more than compensate for the fact that some of the operations have to be carried on in distant parts of the world. We will, however, suppose that only similar progress should be expected for like expenditure, and then multiplying our factors by twenty we arrive at the result that for an annual expenditure of £3000 a general collection of insects progressing over a long series of years at the rate of 6000 species and 120,000 specimens of selected insects could be collected, mounted, arranged, and preserved.

This estimate of the rate of progress that might be made is a very moderate one, as can readily be ascertained by checking it in the converse manner of arranging a staff, calculating the cost and the results that it could attain. It is then seen that the above sum is sufficient for attaining the result mentioned.

Cost and value are very different things, so that when we come to consider the value of collections we have to take a wider view than we have done when considering

their cost. We may, however, dismiss the question of the value of entomological collections to individuals with a very few words, because each individual is the best judge of the value he himself puts on a collection. We know that collections of insects never pay in money those who have formed them for the labour and time they have bestowed on the work; and I do not suppose any private person ever undertakes the formation of a collection for himself with the expectation of recouping a sum of money as an equivalent for his time and labour. Any one who did so would probably be disappointed.

But there are reasons why a public collection has, or rather should have, a much greater value relative to its cost than is the case with private collections. These are —1. The fact that a public collection continues to exist for a great number of years, and, if intelligently formed and properly arranged, would acquire a constantly increasing value from its historical associations, and from the extinction in nature of the species contained in it. 2. The fact that a public collection receives great increments from private individuals, without anything like a corresponding expenditure on its part. 3. That the educational and hedonic results of a collection are, or should be, in the case of a public one, extended over a greater number of individuals without any corresponding increase in its cost.

These considerations not only amply justify the formation of public collections, but also render it certain that it is worth while the work should be well done; indeed, the considerations render it very evident that the value of the collections depends almost entirely on their being undertaken and carried on in an efficient manner.

It may not be superfluous to deal with these reasons at somewhat greater length. When we recollect that a large copper butterfly was worth a few years ago about a shilling, and at the present time about six pounds, and that the chain of causes that have led to this increase of value are at work in the case of a large number of other insects, we recognise that the increment of value from this source is far from unimportant. If the spread of the white races over the globe continue to go on as rapidly as it has done, it is certain that there will be a great increase in the value of very many specimens that can now be procured for a very small expenditure.

The historical value that should attach to public collections, I cannot enlarge on, because it has hitherto been nearly entirely sacrificed by the unintelligent manner in which public collections of insects are formed and arranged. Certain specimens and certain labels will be found in a drawer, but what the connection between the two is or was cannot after a few years be ascertained. We could almost suppose, from the way in which they carry out their task, that the reflection that man is mortal has never occurred to those engaged in the formation of public collections of insects.

But the greatest of the advantages that a public collection has over a private one, so far as the relation between cost and value is concerned, doubtless exists in the fact that the former might expect to receive, and doubtless with wise arrangements would receive, very extensive assistance from private individuals. Such assistance is already to some extent given, and if arrangements were made with the object of leaving to private individuals the work they prefer doing, and of fostering the interest such persons feel in the public collections, there would beyond doubt be a still greater advantage accruing from such assistance. Hence we may expect a very much more rapid increase than that we have mentioned as the minimum that can be accepted as satisfactory progress. So that, instead of the position we find at present, *viz.*, that each public collection of insects is getting more and more hopelessly in arrear of the general progress, it might be fairly anticipated that a good public collection would keep fully abreast of the advance of knowledge. And this for the expenditure of such a sum as I have mentioned would be very good value indeed.

In the considerations we have entered into the chief point kept in view has been the extension of general collections intended for the advancement of knowledge. The questions connected with the exhibition of specimens with a view to the diffusion of knowledge amongst the people have not been in any way alluded to, as they form a quite distinct subject. To enter here on a consideration of the number of persons in the community that would directly benefit by the existence of a good public collection would not be profitable, because it must be complicated by considerations as to the relations

between the two great objects of collections, the advancement of knowledge and its diffusion. But it will be clear to all entomologists that the number of persons who would derive direct pleasure and satisfaction from the existence of an adequate public collection of insects for the advancement of knowledge is by no means inconsiderable.

It thus appears that though it is not worth while for a private individual to make a collection of insects, yet a public collection, if efficient, would offer a good value in return for its cost.

XXII. *The* Scolyto-platypini, *a new subfamily of* Scolytidæ.

By Walter F. H. Blandford, M.A., F.Z.S.

[Read October 4th, 1893.]

Plate XIV.

One of the most interesting questions connected with the *Rhynchophora* is that of the determination of the systematic position, or rather of the systematic importance and affinities of the *Platypini*. This isolated and compact group of insects presents abnormalities in structure which separate it widely from the remainder of the *Scolytidæ* and from other *Rhynchophora*. Indeed, it may be said that the structural differences between a Platypid and other Scolytids, in the formation of the trophi, legs, prothorax and metasternum, and indeed all the chitinous parts, are far greater than those which separate the genera at the other end of the Scolytid series, for example, *Hylastes*, from *Curculionidæ*, such as the Cossonids. This difference has been generally recognised by the division of the family into two groups or subfamilies, to contain respectively the *Platypini* and the other Scolytids; and is perhaps more as a matter of convenience, than for any other reason, that the *Platypini* have been retained in the same family at all. They have indeed been rejected by Eichhoff, who, after close study of the *Tomicini*, the group usually supposed to have most affinity with the *Platypini*, has expressed the opinion that they form an absolutely distinct family, and are not to be brought, "gleichsam unter einen Hut," with the other *Scolytidæ*. Latterly, Bedel, in his *Coléopteres du Bassin de la Seine: Rhynchophora*, has separated the *Platypidæ* as a distinct family in the table of families at the beginning of the work (p. 3), but has reunited them with the other *Scolytidæ* (p. 385) when dealing with the family in detail. This decision is wise, as systematic works on the fauna of a very restricted

region are hardly the place for introducing classificatory novelties, which can only be appreciated by a study of forms from all parts of the world, without respect to country.

At present our knowledge of extra-European Scolytids, other than *Tomicini* and *Platypini*, is of the most fragmentary kind. Those of North America are known, but present no anomalous forms. Central and South America possess some curious groups, but, with the exception of the *Camptoceri*, which are closely allied to the true *Scolyti*, they are at present undescribed, or at most briefly diagnosed in Chapuis' *Synopsis des Scolytides*, a mere preliminary sketch of a work never carried out, and quite useless for classificatory purposes. Nothing much is known of these groups in Africa nor in Australasia, which, nevertheless, contains some interesting forms; and little can be said of the Asiatic genera, with the exception of the *Dactylipalpi*, which are in all respects allied to the South American *Phlœotrupi* and *Phlœobori*, and not remote from the *Hylesinini*. A very moderate study of undescribed forms has convinced me that the *Scolytidæ*, other than the two above-mentioned groups, are more variable and extensive than has been supposed, and that a satisfactory knowledge and classification of this section of the family will be a work of considerable time.

With the small knowledge that we possess of part of the family, it is not surprising that the *Platypini* have remained isolated, and that other forms bearing an obvious relationship to them have been somewhat wanting. In 1858, Motschulsky* described a rather mysterious genus *Genyocerus* from India, to which he added a subsequent species from Japan,† with a strong resemblance to a Platypid. This genus has not been rediscovered, and has been properly rejected by Chapuis from the *Platypidæ* on account of the antennal structure.

Among the remarkable and suspicious features of the Indian *G. albipennis*, Motsch., are the mandibles, which are very long, falcate and recurved. It is not unlikely that Motschulsky has either mistaken for the true mandibles appendages such as are found on the mandibles of the males (Chap.) of *Diapus*, or even a

* Etudes Ent., vii. p. 68, figs. 18-18^{iv}. † Id., ix. p. 19.

matted condition of the long curled hairs which sometimes occur on the front of the head in Scolytids. I have seen them in a condition curiously like the mandibles figured by Motschulsky, whom I believe, from examination of other work of his, to have been capable of such an error. In 1885, Dugès described an aberrant genus, *Chapuisia*,* from Mexico, which he believes to have affinities with the *Platypini*. At present I content myself with saying that its affinities are probably more remote than Dugès supposed, and that, so far from being aberrant, it may be related to *Coptonotus*, Chap.

In the very fine collection of *Scolytidæ* made in Japan by Mr. Geo. Lewis, which he has entrusted to me for examination, are three or four species of a remarkable kind, forming a closely-allied and compact group, which cannot be associated with any of the existing divisions of the family. In certain points they show a remarkable resemblance to *Platypini;* and though the dissimilarity of other structural features may indicate that the resemblance is not so great as it appears to be, I have thought it desirable to treat them in a separate paper as forming the nearest allies to *Platypi* which we as yet know.

Besides the Japanese species there is another from India, of which a male exists in the British Museum collection, and a female in Chapuis' collection in the Brussels Museum. The latter was received after the publication of his *Monographie*, and was labelled by him, "Platypide, gen. nov." I have, therefore, his authority as to the probable relationship of these forms with the *Platypini;* but the definition of the latter subfamily cannot possibly be extended so as to include them. They must, therefore, form a distinct subfamily of the *Scolytidæ*. In 1891, C. Schaufuss described a form from Madagascar under the name *Scolyto-platypus permirus*, which he considered as a true Platypid. In this paper, when first written, I accepted his view, as borne out by the generic characters, and compared the species with my Japanese forms, as their nearest ally among *Platypini*. Since then Herr Schaufuss has very generously entrusted to me for examination one of his two examples of this insect. I find it most closely allied

* Ann. Ent. Belg., xxiv. 2, p. 58, pl. v.

to the Japanese species, and examining it in the light of those insects, I note that in two essential points—the number of joints in the antennal funiculus, and the length of the first tarsal joint—his description is erroneous. In these points his insect does not correspond with the *Platypi*, and it must be grouped with the Japanese forms as distinct. But the sight of this insect has increased my difficulties with regard to generic classification. The several species, though most distinct in male characters, show little signs of difference among the females; and *S. permirus* appears to be intermediate between the two genera I had constructed. As I cannot dissect the type, which is somewhat mutilated, and have not seen the male, I think it better to unite the species under the general name of *Scolyto-platypus*, while indicating the genera I had founded on the Japanese species, as being possibly distinct from *S. permirus*, when it shall have been further examined. This makes it, unfortunately, necessary to adopt Schaufuss' name for the subfamily, a name which begs the whole question of their affinities. If my genera remain good, it would be better to change the family name to *Tæniocerini*.

The insects do not present any one striking feature, such as the upturned abdomen in *Scolytus*, or the elongate first tarsal joint of *Platypi*, and must be recognised by a combination of characters.

Subfamilia SCOLYTO-PLATYPINI.

Caput exsertum. Oculi oblongi, antice integerrimi. Antennæ inter basim mandibularum et angulum oculorum inferiorem insertæ, longitudine variantes, funiculo sex-articulato, clava magna, solida, compressa, imbricata, absque suturis, spongiosa. Prothorax subquadratus, haud asperatus, lateraliter sinuatus vel emarginatus, angulis posticis distinctis, lateribus pro receptione pedum anteriorum excavatis, margine elevato a pronoto separatis. Elytra thoracis basi latiora, cylindrica, apice convexo, declivi, pygidium obtegente. Pedes antici validi, coxis magnis, quadratis, a processu prosterni quadrato late discretis, femoribus robustis, compressis, tibiis curvatis, versus apicem dilatatis, apice excavatis, et spinula valida instructis, extus scabrosis-tuberculatis. Pedes intermedii et postici compressi, femoribus oblongis, tibiis curvatis, post basin leviter dilatatis, extus subtiliter serratis, pro tarsorum receptione excavatis. Tarsi tibiis haud longiores, simplices, articulo primo singulis sequentibus vix longiore vel breviore. Metasternum

abdomine brevius, utrinque ante coxas pro receptione femorum posticorum excavatum. Abdomen segmentis longitudine subæqualibus.

Mas. Capite transverso, fronte valde deplanata et excavata; femoribus anticis tibiisque subtilioribus, his obsolete tuberculatis; elytris ad apicem spinulis vel tuberculis armatis.

Fem. Capite globoso; in pronoto medio poro magno; femoribus anticis et tibiis fortiter dilatatis, his valde scabrose porcatis.

Of robust cylindrical form, not elongate, and of moderate size. Head visible from above, large and globose in the females; in the males the whole front is depressed and excavate, and the gular region is flattened to afford a hollow for the reception of the antennæ, so that the head viewed from the side appears rostrate. Eyes oblong or oblong-oval, not very convex, narrower and flatter in the females, without a trace of anterior emargination. Antennæ with six-jointed funiculus, variable in length and shape in the males, in the females with very short straight scape and funiculus, the latter not geniculate, with the basal joint strongly capitate, mushroom-shaped and not cupulate, the rest very transverse. Club large, flat and solid, impressed with close circular or irregular foveæ, the narrow interstices between which give it a reticulate or honeycombed appearance; these large foveæ show no trace whatever of hair-follicles, but two irregular vittæ crossing the club, which perhaps take the place of the obliterated sutures, are covered with minute crowded pits, which, under high magnification (1-12th oil-imm. obj.), show papillæ projecting from them; the rest of the club is hairy, the hair-pits being situated on the borders between the foveæ, and it may be ciliated. Labrum* connate, only distinct on buccal surface. Epistoma slightly produced in the males in front of antennæ, covering the greater part of the mandibles. These are larger and prominent in the females, but present no special characters. Maxilla with a strongly chitinised cardo, its mala quadrate, with the outer apical angle shortly produced in the males, and hairy; inner edge straight in that sex, dilated at base and sinuate in females, its apex short, rounded, and closely set with fine falcate setiform spines, the rest of edge with a row of similar nearly straight spines. Maxillary palpi short, triarticulate, with a well-marked palpiger simulating a fourth joint, joints cylindrical, decreasing in width, first oblique, slightly transverse, second very short, third longer than broad, with obscure longitudinal striation.

* My description of the mouth-parts is based on those of the Japanese species alone.

Basilar piece of head coriaceous, fused with submentum, the limits of which are not discernible. Mentum attached to the base of a short triangular or transverse peduncle,* trapezoidal in the male, and twice as long as broad; narrow in the female, dilated at base, then constricted, and becoming wider up to the truncate apex, which bears the three-jointed labial palpi, their joints cylindrical, decreasing in width, first longer than broad, hairy on outer half, second transverse, hairy, third as long as broad. Ligula tongue-shaped, as wide as mentum at base, inserted behind its middle, and just reaching its apex, quite devoid of the usual hairs. Prothorax subquadrate or transverse, not declivous anteriorly, and smooth, in the female, with a conspicuous circular or oval pore (at the junction of the anterior and middle third), the opening of which is usually blocked; its lateral borders emarginate for the posterior half, so that the basal angles are prominent, the emargination sharply bordered, corresponding to a lateral depression to receive the anterior legs. The anterior border of the prothorax presents in the males a fine trace of a median notch, as seen more clearly in *Scolytus*, and is oblique, so that the prosternum is short; before the anterior coxæ in the males is an excavation varying from a deep well-defined pit to a faint impression, probably for receiving part of the antenna, and a ridge which limits its lower border separates the flanks in front from the ventral surface. Anterior cotyloid cavities widely separated by a quadrate prosternum, the hind margin of which is prominent; posteriorly they appear to reach the prosternal border, but the true cavity is situated away from the posterior border, and has behind it an excavation to receive part of the dilated coxæ. Mesothorax short, transverse, narrower than upper part of episterna, which separate the lower part of the elytra from the prothorax, and extend back to meet the metasternum and form the outer border of the middle cotyloid cavities, cutting off the transverse epimera, which also meet the metasternum, being wider than the episterna of the latter. Mesonotum short, not carinate. Metathorax not elongate, grooved for anterior femora, its episterna rather narrow, subparallel. Abdomen with first two segments equal, sometimes slightly longer than third and fourth; fifth shorter than the two preceding ones, its hind margin

* By the term *mental peduncle*, I denote a short triangular piece usually visible at the base of the Scolytid mentum, and serving for its attachment; sometimes, as in this group, it appears to be segmented off; sometimes, as in *Tomicus sexdentatus*, it is distinct, but continuous with the rest of the mentum. It is not homologous with the submentum, as defined by Lacordaire, for both often coexist in one species. It appears, hitherto, to have escaped description, even by Eichhoff.

angulately flexed, so that the anal opening is dorsal and not terminal. Anterior coxæ remote, large, quadrate and flattened, in the females produced externally into a short lobe over base of femora; trochanters applied to whole base of femora, which are short, stout and compressed, with the lower internal border lobed at apex; the lobe small in the male, very large in the female, and covering the base of the tibia, so that the femora appear as broad as long when seen on their inner aspect. Anterior tibiæ curved, dilated gradually in male, strongly in female, their outer border spined to near apex, then strongly excavate, the excavation limited below by an outwardly directed spine; in the female scabrous externally with transverse rows of coarse tuberculation, which are nearly obsolete in the male. Middle coxæ rounded, remote, posterior, transverse, pointed, nearly contiguous; middle and posterior femora oblong, tibiæ curved, slightly dilated, flattened and grooved for tarsi, with the outer edge crenate with fine teeth. Tarsi not longer than tibiæ; first joint at most less than twice as long as second, which is equal to or slightly shorter than third, fourth very small, hardly discernible, fifth elongate; all joints simple, the first three with slight vertical flattening.

Scolyto-platypus, *Schauf. ii.*

Schauf., Tidjs. Ent. xxxiv., p. 31.

The species may be distinguished thus:—

1. Thorax with base sinuate, but not produced in middle (*Spongocerus*) 2
   Thorax with base evidently produced in middle 4
2. Elytra with feeble striæ before apex .. .. *S. tycon.*
   Elytra not striate before apex 3
3. Elytra piceous .. .. *S. daimio.*
   Elytra testaceous .. .. *S. siomio.*
4. Elytra not striate before apex. (*Scolyto-platypus, s. str.*) *S. permirus.*
   Elytra strongly striate before apex (*Tæniocerus*) *S. mikado & S. raja.*

(*Spongocerus*, sub-gen. nov.).

Pars basilaris capitis margine antico in maribus subrecto, concavo in feminis; mentum pedunculo in maribus brevissimo, transverso, in feminis triangulari insertum. Prothorax quadratus, angulis posticis distinctis, haud productis, basi fere transversa, in medio non producta. Tarsi tibiis breviores, articulis tribus basalibus compressis, subtriangularibus.

Mas. Antennis dimidio corporis brevioribus, clava acuminata, in margine interno pilis longis ciliata.

Fem. Antennis funiculo per-brevi, clava ovali, nonnunquam acuminata.

Antennæ short in both sexes, scape strongly clubbed in the males, funiculus short but variable in structure, in one form being in direct line with the scape, with the first joint clubbed as in the females, in the other being flexible, with the first joint produced internally so as to be transversely subcylindrical; club oval, acuminate, ciliated on its inner border and apex with a fringe of long hairs. In the females the antenna is of the type already described, with the first joint of the funiculus clubbed; the club is oval, and acuminate in the form where the male funiculus is flexible. Anterior border of the basilar piece of the head straight in the males, the mental peduncle narrow, transverse, with a median process for its attachment to the head; in the females the mentum is about $2\frac{1}{4}$ times longer than broad, narrow at base, and dilated towards apex, with the sides slightly concave. Prothorax subquadrate, base slightly bisinuate, not produced in middle, the posterior angles sharp, but not produced, lateral emarginations shallow, their anterior angles indistinct, so that the sides appear sinuate. Elytra cylindrical, scarcely visibly striate or non-striate, except at apical declivity, where the striæ are distinct; interstices of declivity finely tuberculate in the male, or carinate at base. The anterior legs are somewhat slender in the males, and the inferior junction of trochanter and femur is not angulate; very robust in the females, with the inferior junction forming a distinct angle. Tarsi distinctly shorter than tibiæ, with 2nd and 3rd joints vertically flattened and triangular, 1st less distinctly so; 1st joint of middle and posterior pairs shorter than 2nd.

Scolyto-platypus tycon, n. sp.

Oblongus, cylindricus, sat nitidus, parcissime pubescens, colore variabili, capite fusco-nigro, prothorace ferrugineo, nonnunquam antice fusco-nigro vel omnino infuscato, elytris ferrugineis, striga media plus minusve infuscata, vel nigris, antennis pedibusque ferrugineis; prothorace transverso, lateribus sinuatis, antice rotundatis, subtilissime reticulato, punctato; elytris subtiliter striatis, interstitiis multi-punctatis; declivitate striis nonnihil profundioribus, interstitiis rugosis, 1mo et 3io tuberculatis. Long. 3·5—4 mm.

Mas. Fronte excavata, pilis longis fulvis circumdata; elytrorum striis magis distinctis, stria suturali impressa.

Hab. Japan, Nikko and Kiga.

Oblong, cylindrical, somewhat flattened above. Head black, in males excavate up to eyes, fundus finely reticulate, and distinctly punctured behind, margin of reticulation ciliate with long inwardly curved yellowish hairs, vertex strongly punctured; in females

convex, impressed over mouth, front slightly flattened, with a fine median impressed line, and somewhat close punctuation, mouth fringed with hair, and front with short dense pubescence. Antennæ with scape and funiculus nearly similar in both sexes, the former more strongly clubbed at apex in male; club in male acuminate, with a fringe of about 14 long serrate cilia on inner side and apex, in female exactly oval, shortly hairy. Prothorax rather broader than long, more distinctly so in the male which has the anterior border emarginate, its base feebly bisinuate, basal angles nearly rectangular, sides subsinuate to near apex, with anterior angle of emargination inconspicuous, thence strongly rounded; its surface variable in colour, entirely ferruginous, or with an anterior black patch, which may invade the whole dorsum, finely reticulate with short sparse pubescence and a fine median raised line, limited in front in the females by dorsal pore, distinctly punctured in male, the punctures close on anterior third at sides of median line, in female with finer sparse punctuation. Elytra wider than thorax at base, and twice as long, basal angles rectangular, rounded, sides feebly convex to near apex, then strongly rounded at apical flexure, apex obtusely rounded; surface convex, slightly flattened in middle, somewhat shining, ferruginous, or with sides and suture blackish, or entirely black, irregularly punctured with fine striate impressions, the punctures of which are barely distinguishable from those of the interstices; in the male the striæ are deeper, especially the sutural stria, and the interstices are feebly convex; apical declivity rounded, shortly pubescent, striate, its interstices subconvex, with close rugose punctures, 1st with seven or eight, 3rd with five or six small tubercles, the other segments with traces of tuberculation at the base of the declivity. Tarsal joints 2—3 strongly dilated. Under side punctured and hairy; abdominal segments 1 and 2 longer than 3 and 4. Lateral fovea of thorax indistinct in male.

The male prosternum does not show the remarkable modification of its anterior edge seen in the next two species, and in *S. mikado*.

Scolyto-platypus daimio, n. sp.

Convexus, cylindricus, nitidus, fere glaber, nigro-piceus, elytris plaga basali obscure dilutiore; prothorace parum latiore quam longiore, angulis posticis acutis, lateribus sinuatis, subtilissime reticulato et punctato; elytris ad apicem fortiter declivibus, ante declivitatem irregulariter punctatis, striis omnino nullis, declivitate striata, interstitiis 1mo et 3io tuberculatis. Long. 3·5 mm.

Mas. Fronte impressa pilis longis crispatis circumdata, antennarum funiculo flexuoso, articulo primo transverso, subcylindrico, extus producto, ceteris transversis, clava subtriangulari acuminata, ciliata; prothorace antice in medio distincte impresso, interstitiis elytrorum in declivitatis versura carinatis.

Fem. Antennarum clava ovali, subacuminata; interstitiis in versura non carinatis.

Hab. Japan, Nikko.

Cylindrical, convex, much smaller and narrower than *S. tycon*, shining, piceous black; elytra obscurely marked at base with two testaceous streaks. Head in male excised deeply, fundus finely reticulate, set over eyes with two dense fasciculi of long piceous hairs, which are curled into fundus, vertex punctured; in female, convex, punctured, finely pubescent. Antennæ of male short, scape curved, clubbed, funiculus shorter than scape, flexible, its 1st joint produced externally so as to be subcylindrical, but pointed at apex, and transverse, 2nd joint situated on distal side of 1st before apex, transverse, conical, succeeding joints transverse, little increasing in size, 4th and 6th slightly produced internally to bear a long seta; club subtriangular, acuminate, its outer edge feebly convex, its inner edge convex at base, forming a prominent rounded angle inside attachment of funiculus, and thence subconcave to apex; extremity of the scape, the funiculus and club, hairy, the hairs of the latter of various lengths, and there is a fringe of about 16 long hairs on the inner edge and apex, as in *S. tycon*. Scape in the female less strongly clubbed; the 1st joint of the funiculus of the usual mushroom shape, and the rest as in the male; club oval, feebly acuminate and hairy, but without the long cilia and processes. Prothorax rather broader than long, its base slightly bisinuate, its basal angles acute; sides bisinuate, the anterior angles of the emargination being feebly marked, and broadly rounded at the apex in the female, more narrowly in the male, where there is a well-marked emargination. Surface finely reticulate, punctured and feebly pubescent; in the male there is a distinct longitudinal impression towards the anterior end of the median line, and two less marked ones on either side behind it. Elytra cylindrical, convex, double as long as thorax, and much wider at base, basal angles rectangular, sides parallel to near apex, then angled, the angulation being marked with a small tooth, and proceeding nearly straight to apex, which is obtuse; surface piceous brown, obscurely testaceous at shoulders, without trace of striæ, with rather fine irregular punctures, some of which belong to the obliterated striæ, but are not

distinguishable from the rest, except with a strong light; apex rather abruptly declivous, subconvex, striate, the striæ after the first two being obliterated below the flexure, the interstices in the male shortly carinate at the flexure, the alternate ones more strongly, 7th toothed, forming lateral tooth of elytron; declivity with six or seven tubercles on 1st, three or four on 2nd interstice in both sexes. Under side piceous, with mesosternum lighter, pubescent and punctured, strongly on prosternum and abdominal segments, these nearly equal in length. Legs and antennæ testaceous brown, club of latter darker. Middle and posterior tibiæ with outer border angulate in middle; tarsal joints not strongly compressed.

The antennal hairs of the male are all either serrate for their whole length or thickened at their tips, particularly those of the inner angle and base of the club, which end in variously formed flattened processes, reminding one of golf-clubs or antennæ of butterflies; these processes are covered with fine aciculations, and the long cilia display the same thickening, but less conspicuously. Serration is visible on the hairs of *S. tycon* ♂, but there is no clubbing. The antenna, when extended, either assumes a position with the club vertical, and its inner edge below, or is turned completely round so that the lower surface of the club becomes uppermost. I do not know which position is assumed in life, or whether the torsion takes place at the junction of the scape with the head, or of the funiculus with the scape, as I have not been able to separate the antenna from the head of a unique specimen; but I think the latter is correct. I have described the external and internal borders in accordance with their morphological position, not that assumed by the inverted antenna.

At the anterior angles of the prosternal process in the male two small colourless chitinous processes project forwards and outwards; they are below the level of the prosternum, but are attached to the true anterior ventral border of the prothorax, which is here split, or really infolded so as to form a small flat recess lying internally to the prosternal process. This recess is probably separated from the inside of the thorax by a thin membrane, but it is impossible to see it. This peculiar structure will be made more intelligible by a reference to the description of the male prothorax in *S. mikado*. The lateral foveæ are larger and more distinct than in *S. tycon*.

Scolyto-platypus siomio, n. sp.

Antecedenti simillimus et forsan varietas. Differt elytris ferrugineo-testaceis, pro portione brevioribus, tuberculis in declivitate fere obsoletis. Long. 3 mm.

Mas. Prothorace antice in medio obsolete impresso; interstitiis elytrorum in versura elevatis, spinosis, vix carinatis.

Hab. Japan, Nikko, Sendai.

Differing from *S. daimio* in very slight characters, which in the series collected appear to be constant. Somewhat shorter, and comparatively broad. Prothorax in the male with anterior depression feeble and nearly obsolete. Elytra ferrugino-testaceous, darker along suture, relatively shorter than in *S. daimio*, with sides less parallel, and apex more vertically declivous, their basal border hardly visibly raised, less distinct than in *S. daimio;* declivity with striæ finer, and tubercles, except last tubercle of sutural interstice, nearly obsolete; carinæ in the male less prominent. Under side similar, but lighter.

As examples of the two species were caught at the same time and place, it is possible that this is merely a depauperized form of *S. daimio;* but the evident difference in shape is against that supposition, and they cannot be geographical varieties. The question of its distinctness must be settled by further specimens.

There is no non-comparative character, except colour, by which to separate the two species. The females of either can be separated from those of *S. tycon* by the complete absence of all striæ on the disc of the elytra. In *S. siomio* a sutural row of punctures is evident, chiefly owing to their darker colour, and it cannot be made out on the infuscate elytra of *S. daimio*.

(*Scolyto-platypus, s. str.*).

Scolyto-platypus permirus, Schauf. ii.

Schauf. ii., Tijds. Ent. xxxiv., p. 31.

Hab. Madagascar.

The female is most like that of *S. daimio* among the Japanese species, but is much shorter and broader; its colour is deep black, and it is duller; the prothorax is nearly glabrous, and is evidently produced in the middle as in the following species. Its lateral angles terminate with a small sharp tooth, but are not produced as a whole. The scutellum is much larger than in any Japanese species. The legs are piceous, and the hinder tibiæ strongly ciliate

along the tarsal groove; the posterior tarsi (the only ones I have been able to examine) are less slender than in the following species, with the 1st joint a little longer than the 2nd, which is about equal to the 3rd, and not shorter, as in the subgenus *Tæniocerus*. Schaufuss is in error in stating that the 1st joint is twice as long as the 2nd, and that the antennal funiculus is 4-jointed. It is exceedingly short, and the joints are almost impossible to count unless it is mounted in balsam. I have made out certainly five, and I believe six, the number in all the other species. The club is not acuminate; and Herr Schaufuss informs me that there is no marked difference in the male antennæ.

(*Tæniocerus*, subgen. nov.).

Pars basilaris capitis in utroque sexu margine concavo; mentum pedunculo triangulari insertum, in feminis ter longius quam latius. Prothorax angulis posticis productis, basi valde bisinuata, in medio producta. Tarsi longi, tibiis fere adæquantes, articulis angustis; articulo 3io 2do duplo fere longiore.

Mas. Antennis dimidio corporis longioribus, scapo elongato, recto, clavato, funiculo flexili, articulis duobus primis elongatis, ceteris transversis, clava longissima, valde acuminata, apice piloso.

Fem. Antennis brevibus, funiculo recto, articulo 1mo capitato, 2—6 transversis, latitudine vix crescentibus, clava longitudine scapo funiculoque conjunctim æquali, ovali, subacuminata.

Antennæ in the male very long, reaching nearly to the middle of the elytra; scape straight, except for articular hook, strongly clubbed at apex; funiculus as long as scape, flexed outwardly on it, 1st joint long, nearly cylindrical, being strongly produced externally, its inner border hairy, 2nd joint inserted within external point of 1st on its anterior side, elongate, cylindrical, joints 3—6 short, transverse, their outer margins closely applied, their inner separated to allow of flexion; club more than three times as long as wide, narrow and pointed, attached at its outer basal angle, outer edge concave, inner convex at base, thence straight to apex, hairy. Antenna of female with scape short, curved, little clubbed; funiculus very short, scarcely thickened; club oval, acuminate, hairy. Elytra strongly striate.

Scolyto-platypus mikado, n. sp.

Oblongus, cylindricus, obscurus, glaber, niger vel piceus, elytris nonnunquam apice dilutioribus, pedibus antennisque rufescentibus; prothorace vix latiore quam longiore, angulis posticis productis, acutis, lateribus ad medium emarginatis, inde subrectis, et gradatim versus apicem rotundatis; disco subtiliter reticulato, punctis

magnis, haud profundis, frequentis notato, linea media impressa obsoleta; elytris prothorace sesqui longioribus, versus apicem declivibus, striis subsulcatis, irregulariter punctatis, interstitiis subconvexis, reticulatis, multipunctatis; declivitate subconvexa, interstitiis dense ac rugulose punctatis, 1mo cum 3io et 7mo, 4to cum 6to conjunctis. Long. 3·3—4 mm.

Mas. Vertice capitis subtilissime pubescente, elytrorum interstitiis 1, 3, 5, 7 non declivibus, carinatis, nitidis, in spinulas liberas circum declivitatem productis; spinulis et declivitate glabris.

Fem. Vertice glabro, interstitiis elytrorum similibus, 2do in declivitate parum depresso. Long. 3·3—4 mm.

Hab. Japan, Nikko, Oyama, Sapporo, and Oyayama.

Head in both sexes dull, with close reticulation; front in male impressed to eyes, concave, vertex, which forms an angle with front, and is hidden when head is extended, more strongly punctured, feebly pubescent; front in female convex, glabrous, except for a fringe over mouth, impressed above mouth, and with a fine central suture. Antennal hairs of male not very long, except at tip of club, simple; pores of club small, not close. Thorax with base strongly bisinuate, produced in middle, its basal angles produced, and pointing slightly forwards; anterior angles of emargination less prominent than in next species, and lateral border gradually rounded anteriorly and not angulate, apical emargination in male inconspicuous, surface quite dull, with a fine median impressed line, not extending in front of pore in female, closely covered with shallow, somewhat variolose punctures, which are smaller in the female. Elytra with base slightly bisinuate, its margin raised and acute, humeral prominence small, obtuse; striæ impressed, with irregular coalesced punctures, the first two obsolete at base, interstices finely reticulate, somewhat shining at base, with fine irregular punctures, which become stronger and more rugose towards apex; alternate interstices carinate in male from before middle of elytra the carinæ smooth on the summit throughout, ending in short free spines with but the barest trace of any hairs, towards the apex the 2nd interstice is faintly impressed and narrowed; interstices in female similar throughout.

Under side black, with apex of elytra lighter, sparsely pubescent, punctured, coarsely on base of prosternum and abdomen; metasternum flattened in front with a fine longitudinal carina. Male with a long wisp of hair on anterior coxæ; abdomen with apical segments flatter than in female, last segment hairy. Anterior legs of male somewhat stout, junction of trochanter and femur angulated below, femoral lamella distinct. Prothoracic foveæ of male

arge, deep, reniform. Prothoracic pore in female conspicuously filled with a tuft of yellow material.

This species, one of the most remarkable among the *Scolytidæ*, presents notable features in the development of the male antennæ and prothorax. The former have been described; the first joint of the funiculus is apparently elongated in its long axis, but comparison of it with the antennæ of *S. daimio* and *tycon* shows that it is prolonged outwardly, carrying the rest of the funiculus with it. When the antennæ are fully extended, the scape points directly forwards, and the funiculus is curved outwards; when they are flexed, the funiculus is flexed outwards on the scape, inwards on the club, curving round its convex base so that, if the scape remains fixed, it and the club will point forwards, the funiculus backwards; a movement of the scape will then bring the antenna under the head, in the hollow of which it lies. The prothoracic foveæ in the males of these insects are correlated in size with the antennæ, but I have not been able to discover how they are used.

In addition to the ridge which forms the lower boundary of these foveæ, and separates the ventral surface of the prothorax from the flanks, the anterior edge of the prothorax is flexed upwards in the male of this species, forming a narrow border, which is bounded by a well-marked ridge passing in front of the anterior coxæ and prosternal process; this flexion is probably to increase the cavity for the antennæ formed by the recessed outer surface. The ridge bears two prominent tubercles at the front of the prosternum, which is narrowed, and before them on the flexed margin are two minute inwardly curved chitinous hooks, conspicuous because nearly colourless. These hooks are close together, and not apart, like the processes in *S. daimio*. Between these structures the recess is deep, and contains a circular hole, visible from in front, and only separated by a thin transparent membrane from the cavity of the prothorax. I can form no reasonable conjecture as to the use of this extraordinary arrangement, which is not present in the females, but exists in a modified form in the males of *S. daimio* and *siomio;* the dorsal pore of the females is equally unintelligible.

Scolyto-platypus raja, n. sp.

Antecedenti paullo minor, prothorace breviore, punctis minoribus notato, interstitiis elytrorum postice subtilissime asperatis, et his notis utriusque sexus distinctus. Long. 3 mm.

Mas. Rufo-brunneus (? immaturus); capitis vertice pilis longis flavis prorsus directis ciliato; elytris brevioribus, interstitiis omnibus in medio elytrorum ante declivitatem rugosis, alternis minus carinatis, spinulis pilis flavis circumdatis; declivitate minus obliqua, subtilissime asperata, et pube brevissima flava vestita.

Fem. Nigra, elytrorum apice dilutiore; prothoracis lateribus inter emarginationem et apicem obtuse angulatis; elytrorum striis subtilioribus, vix sulcatis, interstitiis fere planis, punctis minoribus notatis, in declivitate scabrosis, impunctatis, interstitio 3io distincte elevato, 2do impresso.

Hab. India (Himalaya).

Male in the British Museum. Female in the Brussels Museum (Chapuis' collection).

Male readily distinguishable from *S. mikado* by the pubescence. The vertex has a dense fringe of hairs in the middle, which project forwards; the elytral spines are each set in and nearly hidden by a small brush of yellow hairs; and the declivity has a very fine pile, which is evident when viewed sideways. The interstices of the elytra are smooth for the basal third, after which they become rough and dull, whereas the carinate interstices of *S. mikado*, ♂, are shining as far as the apical spines. The female is harder to distinguish; the anterior angles of the thoracic emargination are prominent, before them the sides are straight and slightly narrowed towards the apex, thence very obtusely angulated to form the apical curve. The elytral striæ are narrow, and present less sign of coalesced punctures; the interstices are hardly convex, and their punctures are fine, and not distinct variolose depressions; the interstices on the apical declivity are covered with fine transverse rugosities, and are quite impunctate, the 3rd, besides being elevated, is curved towards the suture as in the male, but this character cannot be used for separation, except comparatively, as it occurs less distinctly in *S. mikado*.

I have not thought it desirable to examine the under sides of these unique specimens, the male of which is in bad condition; as far as can be seen, they present no structural differences from the last species. I believe I am justified in referring them to the same species.

It is now necessary to discuss the relationship of these insects, which, in antennal development, the structure of the fore legs, the presence of the thoracic foveæ and prosternal modification in the male, and the dorsal pore in the female, present such remarkable structural features. They appear to me to stand midway between the wood-boring *Tomicini*, such as *Trypodendron* and *Xyleborus*, and the *Platypini*. They agree with the latter in possessing an exposed head, eyes without emargination (they are not so elongate in any Platypid, and are usually more convex), the quadrate and laterally emarginate prothorax, and the strongly-developed anterior tibiæ. The elytral armature of the males is like that of the *Platypini* (females, Chap.), and the dorsal pore may find its homologues in the paired pores of the *Platypi discopori* (males, Chap.). But though they are apparently on the road to *Platypus* development, they have not reached the goal. The antennal funiculus is 6-jointed, whereas it is always 4-jointed in the *Platypini*, the flattened scape of which is not like the curved clubbed scape of these insects. The tarsi are shorter than in any *Platypi;* the 1st joint, if a little longer than the 2nd in *S. permirus*, is certainly not elongate; the hinder legs resemble those of a *Trypodendron*, the mesonotum is not carinate, and the metathorax short. Moreover, the mouth-parts are not modified to the *Platypus* type, and in the females are not readily distinguishable from those of *Xyleborus dispar*, ♀, differing only in the hairless ligula and the absence of a distinct submentum; the malar armature, if Eichhoff's generalisation is right, shows that they are wood-borers. The prothorax differs strongly from the cowled and asperate prothorax of the *Tomicini*, without attaining the elongation of that of *Platypi;* the lateral emargination and border are of little importance, and indicate merely an arrangement for the reception of the large fore legs. This feature occurs to some extent in many *Scolytidæ*, *Coptonotus*, *Camptocerus*, *Hexacolus*, *Xyloctonus*, &c. An excavation for the fore legs which is not bordered is quite common in *Tomicini*, with which the body of these insects agrees behind the prothorax. The development of the fore legs is anticipated to some extent in *Tomicini*. The femoral lamella is feebly developed in some wood-borers (*Amphicranus*, *Trypodendron*); the scabrous tibiæ find their

counterpart in *Pterocyclon*, and even the triangular tarsal joints of *S. tycon* are repeated in *Platydactylus*.

The 6-jointed funiculus is not found in any known wood-boring Tomicid, though it occurs in others; but this part is very variable, and always a reduction from a 7-jointed structure. The solid *Platypus*-like club is not rare in *Tomici*, e. g., *Trypodendron;* its reticulation may serve as a guide to their relationship, but at present I know nothing quite like it. In *S. mikado*, ♂, it is less evident, owing to the smaller size of the pits, a further reduction in which would bring the antennal surface to a condition resembling that of *Crossotarsus wallacei*, the largest Platypid.

I cannot indicate more than a general relationship with the *Tomicini*. The smallest species, *S. siomio*, ♀, has, if we disregard the thorax, a certain likeness to *Trypodendron*.

Mr. Lewis informs me that *S. mikado*, which appears to be the commonest and most widely distributed of the Japanese species, as well as the most striking, was usually taken in May on the twigs of plum-bushes in blossom, from which it was beaten.

Explanation of Plate XIV.

Fig. 1. *Scolyto-platypus tycon*, ♂.
- *a*. Antenna.

2. *S. tycon*, ♀.
- *a*. Antenna; the dark bands indicate the situation of the smaller pores.
- *b*. Part of antennal surface, × 400.

3. *S. daimio*, ♂.
- *a*. Antenna.
- *b*. Antennal hairs.

4. *S. mikado*, ♂.
- *a*. Side view.
- *b*. Under side of prothorax.
- *c*. Antenna.
- *d*. Anterior leg, from behind.

5. *S. mikado*, ♀.
- *a*. Anterior leg, from behind.

XXIII. *On the Homopterous genus* Pyrops, *with descriptions of two new species.* By William L. Distant, F.E.S.

[Read November 8th, 1893.]

The genus *Pyrops* was founded by Spinola in 1839 (Ann. Soc. Ent. Fr., viii., p. 231), but the type must be sought in the description of his 2nd Division (p. 235), and in the *P. tenebrosus*, Fabr. To those who maintain that the first described or enumerated species of a genus is to be taken as the type of that genus, it would appear that a new generic name is required, for the first species cited is the *Fulgora candelaria*, Linn., which is undoubtedly not a *Pyrops* in the sense universally used. However, all homopterists have followed Spinola's second division as typical, and no useful end would be served in disturbing the arrangement. From this division, however, must be eliminated the *Fulgora obscurata*, Fabr., from Australia, which Stål has placed in his genus *Eurystheus* (Hem. Fabr., ii., p. 115), and the *Fulgora annularis*, Oliv., from Central America, which belongs to the genus *Diareusa*, Walk.

Pyrops is allied to *Fulgora*, and, like that genus, has many points in common. Thus in both, though the specific characters are to be sought in the length and structure of the cephalic process, secondary characters to group the species are found in the colour of the wings, and in *Pyrops* in the colour of the abdomen.

Fulgora is confined to the Oriental region, but *Pyrops* belongs not only to that, but also to the Ethiopian region, in the last of which are alone found the black-winged species; whilst those with white wings are distributed throughout the whole area of the genus.

Having two undescribed species of this somewhat scarce genus in my collection, and possessing most of the other species, I have thought that a generic revision and enumeration might with advantage be given, and such I now present to the Society.

A. *Species with black wings.*

P. tenebrosus, Fabr.
P. flammeus, Linn.
P. natalensis, n. sp.
P. madagascariensis, Sign.

B. *Species with fuscous wings, hyaline towards base.*

P. clavaticeps, Karsch.

C. *Species with greyish wings, fuscous towards base.*

P. pustulosus, Gerst.

D. *Species with white wings.*

a. *Abdomen alone fulvous.*

P. nobilis, Westw.
P. perpusilla, Walk.
P. mustellinus, Dist.
P. dohrni, Stål.

aa. *Abdomen alone fuscous or black.*

P. servillei, Spin.
P. javanensis, Dist.
P. affinis, Westw.
P. chinensis, n. sp.
P. marginatus, Westw.
P. intricatus, Walk.
P. albipennis, Spin.

Species little known or imperfectly described.

P. punctatus, Oliv.
P. cognatus, Westw.

1. *Pyrops tenebrosus.*

Fulgora tenebrosa, Fabr., Syst. Ent., p. 674, 8 (1775); Sp. Ins., ii., p. 314, 9 (1781); Mant. Ins., ii., p. 260, 9 (1787); Ent. Syst., iv., p. 3, 9 (1794); Syst. Rhyng., p. 3, 9 (1803); Oliv., Enc. Méth., vi., p. 568, 7 (1791); Burm., Gen. Ins., subg. *Pyrops*, f. 1 (1846); Westw., Trans. Linn. Soc., xviii., p. 142, 14 (1851).

Fulgora africana, Pal. Beauv., Ins., p. 168, Hém., t. 19, f. 3 (1805).

Flata tenebrosa, Germ., Mag. Ent., iii., p. 189, 2 (1818); Thon., Ent. Arch., ii., 2, p. 47, 5 (1830).
Pyrops tenebrosa, Spin., Ann. Ent., viii., p. 235, 3 (1839); A. & S. Hist. des Hém., p. 492, 1 (1843); Walk. (part), List. Hom., ii., p. 268, 2 (1851).
Pyrops tenebrosus, Stål, Hem. Afr., iv., p. 140, 1 (1866); Gerst (part), in Decken, Reise, 3, 2, p. 426, 63 (1873).

Hab. West Africa: Senegal, Sierra Leone (Stål). East Africa: Zanzibar (coll. Dist.), Delagoa Bay (S. Afr. Mus. and coll. Dist.).

2. *Pyrops flammeus.*

Cicada flammea, Linn., Cent. Ins., var., p. 16, 39 (1763).
Fulgora flammea, Linn., Syst. Nat., ed. xii., 1, 2, p. 704, 7 (1767); Fabr., Syst. Ent., p. 674, 7 (1775); Spec. Ins., ii., p. 314, 8 (1781); Mant. Ins., ii., p. 260, 8 (1787); Ent. Syst., iv., p. 3, 8 (1794); Syst. Rhyng., p. 3, 8 (1803); Westw., Trans. Linn. Soc., xviii., p. 143, 15 (1851).
Cicada laternaria fusca, deGeer, Mém., iii., p. 200, 3, t. 32, f. 1 (1773).
Pyrops flammeus, Stål, Hem. Afr., iv., p. 141, 3 (1866).

Hab. West Africa: Isubu, Angola (coll. Dist.).

This species is differentiated from *P. tenebrosus* by its much shorter cephalic process. Its precise habitat was unknown to Stål, who redescribed the unlocalised specimen in deGeer's collection.

3. *Pyrops madagascariensis.*

Pyrops madagascariensis, Sign., Ann. Soc. Ent. Fr., ser. 3, vol. viii., p. 183, 15 (1860); Stål, Hem. Afr., iv., p. 140, 2 (1866).

Hab. Madagascar (coll. Sign.); Ins. Anjoana (Stål).

Of this species Stål remarks: "*P. tenebroso* maxime affinis, processu capitis apice quam prope apicem haud magis compresso, sed lateribus ante medium parallelis instructo divergit; au distinctus?" Subsequently Signoret (Ann. Soc. Ent. Fr., ser. 6, vol. vi., p. 27 (1886)), in

recording his *P. madagascariensis*, remarks: "Nous voyons si peu de différence avec le *Pyrops tenebrosus*, F., que nous croyons que ce n'est qu'une variété; nous en dirons autant du *flammea*, Lin."

I have not been able to examine a specimen of *P. madagascariensis*, but should presume it to be a distinct species from the differential structural characters of the cephalic process, as given by Stål (supra), while Signoret as certainly did not possess the typical Linnean species.

4. *Pyrops natalensis*, n. sp.

Head, thorax, tegmina, and legs luteous, slightly tinged with testaceous; cephalic process irregularly spotted with black, and with a central elongate ochraceous spot at base; thorax thickly and finely spotted with black, the lateral angles and apex of the mesonotum impunctate; tegmina obscurely and finely spotted with black, the spots most distinct and prominent on costal and apical areas, which are also paler in hue; wings pitchy black; abdomen black, above with the posterior segmental margins brownish, beneath with oblique marginal ochraceous spots; legs irregularly spotted with black. Cephalic process long and robust, coarsely rugose, with three prominent longitudinal narrow waved carinæ above, and two beneath, the others merged and tessellate, the apex obliquely and concavely truncate. Long. from eyes to apex of abdomen, 28 millim.; cephalic process from eyes to apex, 18 millim.; exp. tegm. 85 milim.

Hab. Natal; Durban (coll. Dist.).

A species to be differentiated from the other black-winged Ethiopian species by the length and rugosity of the cephalic process.

5. *Pyrops clavaticeps.*

Pyrops clavaticeps, Karsch, Berl. Ent. Zeit., xxxv., p. 62, t. 11, f. 4 (1890).

Hab. West Africa: Loango. East Africa: Zanzibar (Karsch).

6. *Pyrops pustulosus.*

Pyrops pustulosus, Gerst, in Decken Reise, 3, 2, p. 427, 64, t. xvii., f. 9 (1873).

Hab. East Africa: Zanzibar (Gerst.).

7. *Pyrops nobilis.*

Fulgora nobilis, Westw., Trans. Linn. Soc., xviii., p. 146, t. 12, f. 10 (1841).

Pyrops nobilis, Walk. (excl. syn.), List. Hom., ii., p. 268, 1 (1851); Journ. Linn. Soc., Zool., 1867; Atkins, J. A. S. Beng., vol. lv., pt. ii., No. 1, p. 200, 116 (1886).

Hab. Malay Peninsula: Malacca (Westw.), Perak (coll. Dist.). Malay Archipelago: Sumatra (Brit. Mus. and coll. Dist.), Borneo, Kina Balu Mt. (coll. Dist.).

8. *Pyrops perpusilla.*

Pyrops perpusilla, Walk., List. Hom., ii., p. 269, 7 (1851); Atkins, J. A. S. Beng., vol. liv., pt. ii., n. 3, p. 140, 23 (1885).

Hab. Continental India: North Bengal (Brit. Mus.), Naga Hills (coll. Dist.).

9. *Pyrops mustellinus.*

Pyrops mustellinus, Dist., Ann. & Mag. Nat. Hist., ser. 5, vol. xii., p. 243 (1883).

Hab. Java (coll. Dist.).

10. *Pyrops dohrni.*

Pyrops dohrni, Stål, Ofv. Vet.-Ak. Förh., 1858, p. 449.

Hab. Ceylon (Stål).

Mr. Kirby, in his much controverted paper on Ceylonese Rhynchota (Journ. Linn. Soc., Zool., vol. xxiv., p. 133 (1891)), records this species as a synonym of the *P. affinis*, Westw. This is the more singular, as Stål, besides other differences, distinctly describes the different colour of the abdomen, "Abdomine sordide flavo-testaceo, haud nigro."

11. *Pyrops servillei.*

Pyrops servillei, Spin., Ann. Soc. Ent. Fr., viii., p. 237, 6, t. 2, f. 1 (1839).

Hab. Java (Spin.).

Walker (List. Hom., ii., p. 268 (1851)) records this species as a synonym of *P. nobilis*, Westw. It is to be noted that Walker, who so frequently described the same

species several times over, is equally to be dreaded when he writes synthetically.

12. *Pyrops javanensis.*

Pyrops javanensis, Dist., Ann. & Mag. Nat. Hist., ser. 5, vol. xii., p. 242 (1883).

Hab. Java (coll. Dist.).

13. *Pyrops affinis.*

Fulgora affinis, Westw., Trans. Linn. Soc., xviii, p. 144, t. 12, f. 6 (1841).

Pyrops punctata, Walk. (part), List. Hom., ii., p. 268, 3 (1851); Atkins (part), J. A. S. Beng., vol. liv., pt. ii., n. 3, p. 140, 22 (1885).

Pyrops affinis, Kirby (part), Journ. Linn. Soc., Zool., vol. xxiv., p. 133 (1891).

Hab. Continental India: Nepaul, Silhet (Brit. Mus.), Sikkim (Calc. Mus.), Naga Hills (coll. Dist.), Ceylon (Brit. Mus.). Malay Archipelago: Java (Brit. Mus.). China: Hong Kong (Brit. Mus.).

Mr. Atkinson followed Walker in placing this species as a synonym of *P. punctata*, Oliv., which was founded on a figure given by Stoll of an insect he recorded from Guinea. Though Stoll's habitats are not always without doubt, neither is his figure in this instance capable of being applied to the Indian species of Westwood.

14. *Pyrops chinensis*, n. sp.

Head, thorax, tegmina, and legs sordidly greyish, slightly tinged with ochraceous; cephalic process with a few black spots, more numerous at base, its apical margin ochraceous; thorax somewhat thickly spotted with black; tegmina thickly spotted with black, the spots slightly larger and more prominent at anterior and apical areas, the venation ochraceous; wings lacteous; abdomen black, more or less tinged with cretaceous, the posterior segmental margins obscurely brownish; legs prominently and irregularly spotted with black. Cephalic process about as long as the abdomen, its apex obliquely truncate and moderately excavated; its surface marked with eight narrow longitudinal carinæ, some of which are much waved, and become obscure towards base. Long. from eyes to apex of abdomen, 19 millim.; cephalic process from eyes to apex, 14 millim.; exp. tegm. 60 to 65 millim.

Hab. China: Chia-Hou-Ho, 1700 ft.

For the possession of this species I am indebted to J. H. Leech, Esq., and it was obtained during Mr. Pratt's expedition.

15. *Pyrops marginatus.*

Fulgora marginata, Westw., Trans. Linn. Soc., vol. xviii., p. 144, 17 (1841).

Hab. S. Africa: Cape of Good Hope (Oxford and Brit. Mus.), Cape Colony (coll Dist.).

16. *Pyrops intricatus.*

Pyrops intricatus, Walk., List. Hom., Suppl., p. 43 (1858).

Hab. S. Africa: Natal, Durban (Brit. Mus. and coll. Dist.).

17. *Pyrops albipennis.*

Pyrops albipennis, Spin., Ann. Soc. Ent. Fr., viii., p. 238, 7 (1839); Stål, Hem. Afr., iv., p. 141, 4 (1866).

Hab. West Africa: Senegal (Stål), Guinea (Spin.).

Species little known and of doubtful habitat.

Pyrops punctatus.

Fulgora punctata, Oliv., Enc. Meth., vi., p. 569, 8 (1791); Gray, Griffith An. King, t. 138, f. 2, a, c (1832); Westw., Trans. Linn. Soc., xviii., p. 143, 16 (1841).

Flata punctata, Germ., Thon's Archiv., ii. (2), p. 47 (1830).

Pyrops punctata, Walk. (part), List. Hom., ii., p. 268 (1851); Schaum, Peters, Reise Ins., p. 51 (1862); Atkins. (part), J. A. S. Beng., vol. liv., pt. ii., n. 3, p. 140, 22 (1885); Stoll, Cig., f. 28.

Hab. Guinea ?.

Pyrops cognatus.

Fulgora cognata, Westw., Trans. Linn. Soc., vol. xviii., p. 145, 19 (1841).

Hab.——?.

XXIV. *On the sexes of larvæ emerging from the successively laid eggs of* Smerinthus populi. By Edward B. Poulton, M.A., F.R.S., F.L.S., &c., Hope Professor of Zoology in the University of Oxford.

[Read November 8th, 1893.]

My friend and former pupil, Mr. R. C. L. Perkins, once told me that he had sometimes noticed that a pair of *Sphinx* larvæ found in the same stage of growth, in close proximity upon the same tree, and presumably hatched from a pair of eggs laid by the same parent, produce moths of different sexes. He inferred that this arrangement facilitated pairing, and he was led to wonder whether there is a regular alternation of sex in the successive offspring.

On the other hand, it appeared quite possible that the cases which he had observed were exceptional, and that the succession is irregular, or that it is such as to facilitate intercrossing rather than frequent pairing between closely related individuals. This latter view is suggested as a probable one by the numerous adaptations by which wide intercrossing is favoured in other departments of organic nature, and by the following direct evidence. Mr. W. Hatchett Jackson and Mr. O. H. Latter have observed that the pupæ obtained from different batches of larvæ of *Vanessa io* "were principally, but not entirely, of one or of the other sex."* It is generally admitted that the separate colonies of *Vanessa* larvæ are, at any rate as a rule, hatched from different batches of eggs. Such an observation, if confirmed, is to be interpreted by one of two suppositions. We must either suppose that the whole mass of eggs of each female *Vanessa* produces a great preponderance of one and the same sex (males in some individuals and females in others), or that different batches of eggs laid

* Trans. Linn. Soc. Lond., vol. v., 1890, p. 156.

by the same individual produce now a preponderance of one sex, and now of another. Either of these alternatives would appear strongly to favour intercrossing. The following observations, so far as they go, tend to support the latter alternative.

A pair of *Smerinthus populi* were found *in coitu* in an Oxford garden, between 10 and 11 a.m., on May 25th, 1893. They were carefully removed, and remained together until 8.40 p.m. The attempt was made to observe the order in which the eggs were laid, and to rear the larvæ separately, the sexes being determined in the pupal state. The results are most concisely shown in a tabular statement.

Date.	Number and order of eggs laid.	Sexes produced. M = male; F = female.	Observations.
May 25.	44 eggs laid, order unnoted.	15 M 28 F	1 missing (unknown whether the egg hatched). 1 male and 1 female moth emerged in the hot summer of 1893. 1 male pupa was deformed and dead.
May 26.	47 eggs laid.	——	All these eggs, the order of which had been carefully noted, hatched during my absence from home, and the larvæ were lost.
May 27.	34 eggs laid. The order of the first 22 unnoted.	9 M 8 F	4 missing; 1 larva died. 1 female moth emerged 1893. 1 male pupa was deformed and dead, and another rather deformed.
	23	——	Larva died small (probably 3rd stage).
	24	.. .. M	Pupa rather deformed.
	25	.. .. F	
	26	.. .. M	
	27	.. .. M	
	28	.. .. M	
	29	.. .. M	
	30	.. .. M	
	31	.. .. F	
	32	.. .. F	
	33	.. .. M	
	34	.. .. M	Moth emerged 1893.
		Total 17 M, 11 F	

Date.	Number and order of eggs laid.	Sexes produced. M = male; F = female.	Observations.
May 28.	28 eggs laid, order shown below.		
	1	F	Moth emerged 1893.
	2	F	
	3	F	
	4		Larva died in 3rd or 4th stage, owing to accident to branch of food-plant.
	5	M	
	6	F	
	7	F	
	8		Larva died in 3rd or 4th stage.
	9	M	
	10	F	
	11	M	
	12	M	
	13	M	
	14	M	
	15	F	
	16	M	
	17	M	
	18	F	
	19	M	
	20	M	
	21	F	
	22	M	
	23	F	
	24	F	
	25	F	
	26	F	
	27	M	
	28	M	
		Total 13 M, 13 F	
May 29.	8 eggs laid, order unnoted.	4 M 2 F	1 missing; 1 larva died. 1 male moth emerged 1893. 1 male pupa dead and deformed, and 1 very small and rather deformed.
May 30.	14 eggs laid. order unnoted.	7 M 4 F	3 larvæ died.
May 31.	7 eggs laid, order unnoted.	1 M 6 F	
June 1.	3 eggs laid, order unnoted.	1 M 1 F	1 egg did not hatch.

Date.	Number and order of eggs laid.	Sexes produced. M = male; F = female.	Observations.
June 2.	7 eggs laid, order shown below.		
	1	.. .. F	
	2	.. .. M	
	3	.. .. F	
	4	.. .. F	
	5	.. ..	Larva hatched, but died very small.
	6	.. ..	Did not hatch. Probably no development took place; egg blackened.
	7	.. ..	Ditto. ditto.
		Total 1 M, 3 F	
June 3.	1 egg laid.	——	Larva did not hatch, but was apparently fully formed in the egg.

The total number of eggs laid on each successive day forms an interesting curve rising to a maximum on the second day and declining very rapidly on the fifth.

The most striking result shown in these tables is the remarkable change in the proportion of the sexes on different days. Thus on May 25th there were nearly twice as many females as males, on May 27th over 50 per cent. more males, while on May 28th the numbers were equal. It is possible that this change in proportion may follow some biological law, especially when considered in connection with Mr. Jackson's and Mr. Latter's above-mentioned observations. It is at any rate enough to suggest further observation. At present, however, as I learn from Mr. Francis Galton, to whom I have submitted the figures, the numbers are not large enough to warrant any such conclusion.

With regard to the succession of the sexes in a series of individuals (May 27th, 28th, and June 2nd), the arrangement does not appear to differ from that of black and white balls drawn successively out of a bag containing equal numbers of each. But here, too, wider observations are required. The arrangement in little groups of the same sex *may* possibly be adapted to favour cross-fertilisation. But even in drawing pairs of

black and white balls, two of the same colour will be drawn together twice as frequently as those of different colours. In future observations of a sluggish species like *Smerinthus populi*, it would be desirable to track the moth as it lays little groups of eggs on different leaves, and to rear such groups separately. We must not altogether put aside the remote possibility that the parent may possess some power of controlling the sex of her offspring.

Six moths emerged in the hot summer of 1893 ; three of these were males and three females. The eggs from which these individuals were hatched were scattered through the successional series, and were not peculiar to any part of it, and the same appears to be true of the deaths of larvæ and deformity of pupæ.

Failures to hatch, however, are confined to the end of the series, unless some of the "missing" larvæ are to be explained in this way. This tendency is especially clearly seen on the last two days, and yet the very last egg laid contained a well-formed larva which was unable to hatch.

Even the small number of larval deaths which took place are chiefly to be accounted for by the conditions of the experiment. Thus, considering only the eggs laid during May (and omitting the later eggs because of the frequent failure to hatch), we find out of 40 larvæ reared in separate sleeves (23 to 34 on May 27th, and the 28 on May 28th) only two deaths occurred, not including the manifestly accidental death of the fourth larva on May 28th. On the other hand, out of 95 larvæ reared in groups of from 3 to 8 (usually 7) in number, 11 larvæ died or were missing. From this it may be inferred that larvæ are in some way injured by being reared in groups with a much greater relative proximity than in nature. I have also found this to be true of *S. ocellatus ;* for, when groups of more than 10 or 12 small larvæ were enclosed in sleeves of moderate size, it was always found that the numbers became reduced to a maximum of about a dozen, and often much lower ; whereas groups of smaller numbers were frequently maintained without any deaths.

The list as a whole strongly impresses upon us the comparative rarity of death from internal causes (including disease), and the overwhelming importance of

the struggle with highly organised enemies in determining the vast amount of destruction which occurs among these animals in the natural state.

The unfortunate loss of the 47 larvæ of May 26th served to show that the period of development within the egg is extremely uniform. The eggs laid on May 25th had been properly enclosed, and I thought I was safe in leaving the others for a day. On my return every one of the eggs laid on the 26th had hatched, and the larvæ had escaped; while not a single larva had emerged from any egg laid at a later date.

Six of the male pupæ were deformed, but not one of the females.

The total number of eggs laid was 193, and subsequent dissection revealed a single egg in the body of the parent moth. From these eggs 68 female and 59 male pupæ were obtained.

The results afford no support to the opinion that the sex of insects can be determined by external conditions during larval life. With conditions of very complete uniformity, the proportions of the sexes—68 females to 59 males—appear to be normal. It may be admitted that the larger female larvæ require more food, chiefly to prepare for the amount of material to be stored up in the ova. It would not therefore be at all surprising if the female larvæ were starved before the males when a minimum of food was supplied. The consequent emergence of a number of males would in no way support the view that a scanty diet "determines" this sex. It is probable that some writers on this subject have mistaken *favouring* for *determining* conditions.

There was no tendency towards the predominance of males in the last-laid eggs, and therefore no indication that this sex may be determined by exhaustion (in itself most improbable) of the spermatozoa.

XXV. *A revision of the genus* Œneis. By Henry John Elwes, F.L.S., F.Z.S., President of the Entomological Society of London, and James Edwards, F.E.S.*

[Read November 8th, 1893.]

Plate XV.

In accordance with the practice of the majority of European lepidopterists, we apply the name of *Œneis*, Hübner, to the group of insects here treated of, instead of *Chionobas*, Bdv., although it is quite clear that the former is a mere catalogue name. As W. H. Edwards says, in the 'Canadian Entomologist,' vol. xxi., p. 63, note:—"Perhaps the definition of the genus *Œneis* (and a definition is indispensable to recognition) was given by Mr. Scudder in 'Systematic Revision of the American Butterflies,' 1872; but *Chionobas*, Boisduval, 1832, has the priority."

The genus, by whichever name it is called, may well be regarded as an Arctic development of *Satyrus*, from which, however, all its members differ in the following particulars:—The costal vein only is inflated at the base; the antennæ are gradually widened to the apex, and do not form a more or less abrupt club; the intermediate tibiæ are considerably more than half as long as their tarsi; and the fore wing, especially in the males of the more typical species, has a characteristic pointed appearance, owing to the comparatively short inner margin, and the cell is comparatively long and narrow. The species are yellow-brown or grey-brown above, with a more or less distinct pale submarginal band, which bears from one to five roundish black spots or ocelli; brown, with a more or less distinct submarginal row of fulvous spots; or unicolorous smoke-brown, and in the latter case the wings have a very abraded appearance.

In characterising this genus a point has been made of the hairiness of the under side, *i. e.*, of the legs and hind

* For statements appearing in the first person singular I am alone responsible.—H. J. Elwes.

wings; but they are equalled in this respect by some species of *Satyrus*, *S. hermione*, for example.

The following types of clasp-form are found in this genus; in *norna* and *jutta* there is an unusual amount of individual variation, but the differences are merely those of degree, and are not, in the most extreme cases, sufficient to obscure the relationship of the species :—

1. Clasp oblong, more or less pointed at the apex, its upper edge bearing a single tooth or projection somewhere between the middle and the base.
   ex. *chryxus*, *bore*, *taygete* (figs. 3, 10).
2. Clasp rather broadly triangular, and wanting the projection on the upper edge . . . . ex. *urda*, *uhleri* (fig. 1).
3. Clasp oblong, gradually narrowed; apex bluntly rounded or subtruncate; serrulation of the upper edge inconspicuous or absent . . . . . ex. *hora*, *walkyria* (fig. 7).
4. Clasp not curving inwardly at the apex, which is bluntly rounded, and, together with the upper edge nearly or quite to the middle, bears unequal and comparatively large teeth.
   semidea, *jutta*, *fulla* (figs. 5, 9).
5. Clasp rather suddenly narrowed about the middle, strongly curved inwards at the apex; the teeth decumbent and almost confined to the upper apical angle, which is somewhat produced.
   ex. *subhyalina*, *brucei*, *norna* (figs. 6, 13).

Œneis appears to be the most cold-enduring of all known genera of butterflies. With the exception of the aberrant *nevadensis* group there is not one species inhabiting a region in which the winters are not very long and severe, and usually of an Arctic character. About half the species are confined to high mountain regions, where they frequent stony and rocky ground above timber-line; another section, like *uhleri* and *alberta*, inhabit grassy steppes and prairies; a third, like *bore* and *subhyalina*, occur on the coasts of Arctic seas; and a few, such as *chryxus* and *nevadensis*, are inhabitants of mountain forests. Their larvæ, so far as known, are all grass-feeders, but most of them are unknown. Their geographical distribution is, if we except the almost unknown *Œ. antarcticus* from Patagonia, strictly confined to the Palæarctic region, in which I include, so far as Rhopalocera are concerned, the Nearctic region of Sclater.

As will be seen from the references below, the literature of the group is somewhat extensive; but it is for the

most part too scattered and fragmentary to be readily utilised by the student of to-day.

We have excluded the following species from our arrangement of the genus :—

Chionobas stretchii, W. H. Edw. (Trans. Am. Ent. Soc., iii., p. 192, 1870), which is the same as the *Hipparchia ridingsii* of the same author (Proc. Ent. Soc. Phil., iv., p. 201, 1865), and is figured by Strecker (Lep., pl. iv., fig. 6, ♀, 1873), is perhaps best treated as an aberrant *Œneis*, since the balance of its characters seem to be rather with that genus than with *Satyrus*. It has the antennæ and something of the facies of an *Œneis*, but the cell of the fore wing is comparatively wider, the lower surface of the hind wing wants the long upright hair, the intermediate tibiæ in the male are about half as long as the tarsi, and there seems to be a very feeble thickening of the basal portion of the median vein ; but it has not the facies, the strongly clubbed antennæ, or the swollen base of the median vein found in typical *Satyrus*. It is true that its divergence both from *Œneis* and *Satyrus* is as great as that of some other genera of *Satyridæ* from each other ; but if a separate generic name is required for it, that of *Neominois* has been provided by Scudder (Bulletin Buffalo Soc. Nat. Sci., ii., p. 241, 1875).

Chionobas pumilus, Feld., Reise Novara, Lep., iii., p. 490, pl. lxix., figs. 6, 7, 1866, ♂ ; *ib.*, Elwes, P. Z. S., 1882, p. 404, pl. xxv., fig. 3 ; *Œneis pumilus*, Marsh. and de Nicé., Butt. Ind., i., p. 238, pl. xv., fig. 37, ♂ ; *Œneis?* (*Satyrus?*) *palearcticus*, Stgr., Stett. Ent. Zeit., 1889, p. 20 ; *Œneis pumilus* var. *lama*, Alphéraky, Rom. Mem. sur Lép., v., p. 80, 1889 ; *Œneis pumilus* var. *iole*, Leech, Butt. China, &c., p. 76, pl. xi., fig. 2, is unquestionably an *Aulocera*, Butl. (Ent. Mo. Mag., iv., p. 121). It possesses the peculiar wing-pattern and other characters proper to that genus, and, moreover, has the same type of clasp-form which is found in at least one species of *Aulocera*, and which is perhaps correlated to the wing-pattern found in that genus. Its superficial resemblance to *Aulocera brahminus* had already been remarked upon by Marshall and de Nicéville and Leech (*l. c.*). The type of this species was described from Ladak, where it is common on the dry plateaus at from 14,000 to 16,000 ft. I afterwards got specimens from the alpine valley of

Chumbi, on the frontiers of Sikkim (*c.f.* P. Z. S., 1882, *l. c.*). Though these specimens were on the average considerably darker than those from Ladak, I did not think it necessary to give them another name. Later, however, Dr. Staudinger described a form from Issyk-kul, which is hardly separable from the Sikkim form under the name of *palearcticus*, and gave mine the varietal name of *sikkimensis*. About the same time Alphéraky described the same or a similar form from Lob-Nor, in Northern Thibet, where it is found at as low an elevation as 3000 ft. Still more recently, Grum-Grshimailo collected, in the Koko-Nor district, specimens which differ in colour amongst themselves as much or more than the Ladak and Sikkim forms previously described, one in particular being as dark as the form named *iole* by Leech from Western China and East Thibet, and having the band on the upper side of both wings almost entirely absent. Considering the wide range of this species in Central Asia, and the small number of localities which have hitherto been explored, I do not think we are yet in a position to say how far any of these variations are locally constant, for, although *iole* is at first sight abundantly distinct from typical *pumilus*, the clasp-form is identical.

The *Chionobas argenteus* of Blanchard, in Gay's Fauna Chilena, pl. ii., figs. 9—11, and the *Arge williamsianus* of Butler (Cat. Sat. B. M., p. 159, pl. 4, fig. 1), have been improperly placed in this genus.

With the exceptions dealt with above, the following list includes all the species of *Œneis* at present described:—

Œneis, *Hübner*, Verz. bek. Schmett. p. 50 (1816); Scudd. Butt. N. Am. i. p. 123 (1889).

Chionobas, *Boisduval*, Icon. Hist. Lép. Eur. p. 182 (1832); Westw. Gen. Di. Lep. p. 381 (1851).

jutta, *Hübn.*, Samml. Eur. Schmett. i. 25, figs. 614, 615, 1806—19 (*Papilio*).
Œneis jutta, Hübn., Verz. Schmett. 58 (1816); Holmgr. Ent. tidskr. vii. 151—154, figs. (1886); Scudder, Butt. N. Eng. i. 149—156, figs. (1889).
Chionobas jutta, Möschler, Wien. Ent. Monats. iv. 342 (1860); vii. 201 (1863); Stett. Ent. Zeit. xxi. 116—117 (1870);
Eur. bor. from about 55° (*in Livonia*) *to about* 68° *N.; Asia from about* 50° *N. to* 68° *N.* (*fide Trybom*); *Am. from* 45° *N.* (*Maine*) *to about* 55° *N.* (*Labrador*).

Scudd. Proc. Ent. Soc. Phil. v. 3—5, fig. (1865); Pack. Guide Ins. 263, fig. 192 (1869); Mayn. Butt. N. E. 2—3, pl. 3, figs. 2, 2*a* (1886); Fyles, Can. Ent. xx. 131—133 (1888); Edw. Butt. N. A. ser. iii. pl. xiii. *Chionobas* v. fig. larvæ.

Chionobas balder, H.-S., Schmett. Eur. i. figs. 384—386 (1847—1850).

Eumenis balderi, Hübn., Zutr. Ex. Schmett. figs. 981, 982 (1837).

var. *magna*, Graeser, Berl. Ent. Zeit. 1888, p. 97.

MULLA, *Stgr.*, Stett. Ent. Zeit. 1881, p. 270. — *Tarbagatai mts., C. Asia.*

NEVADENSIS, *Feld.*, Reise Nov. Lep. iii. p. 489, pl. lxix. figs. 4, 5 (1867), (*Chionobas*). — *California.*

Œneis gigas, Butl., Cat. Sat. B. M. p. 161, pl. ii. fig. 2 (1868); Edw. Butt. N. A. ser. ii. *Chionobas*, i. figs. 5, 6, ♀; id. ii. figs. 1, 2 ♂. — *Ins. Vancouver.*

Chionobas californica, Bdv., Lep. Cal. p. 62 (1869); Edw. Butt. N. A. ser. ii. *Chionobas*, ii. figs. 3—6. — *California.*

Chionobas iduna, Edw., Butt. N. A. ser. ii. *Chionobas*, i. figs. 1—4 (1874). — *California* (*Mendocino County*).

MACOUNII, *Edw.*, Can. Ent. xvii. p. 74 (1885); Scudd. Butt. N. E. iii. p. 1775 (1889); Fletcher, Rep. Ent. Soc. Ont. 1888, p. 76 (1889). — *Nepigon, Lake Superior.*

BUDDHA, *Grum-Grshimailo*, Hor. Ent. Ross. xxv. p. 458 (1891); Leech, Butt. China, &c., p. 76 (1892). — *Mts. of Koko Nor.; N. E. Tibet.*

TARPEIA, *Pallas*, Reise, &c., i. (1771); Esp. Schmett. i. 2, pl. lxxxiii. figs. 1, 2 (1783); Hübn. Eur. Schmett. i. figs. 779—782 (1824—1826); H.-S. Schmett. Eur. i. figs. 61—64 (1843, 1844). — *S. E. Russia to N. Asia, lat.* 50° *N. to* 57° (*Trybom*).

celimene, Cram., Pap. Exot. iv. pl. cccl xxv. figs. E, F (1782), (*Papilio*).

AELLO, *Esp.*, Schmett. i. 2, pl. cxv. fig. 1 (1800?); Hübn. Eur. Schmett. i. figs. 519—521 (1800—1823). — *Alps of Central Europe.*

norna, Hübn., *l. c.*, figs. 141, 142.

ALBERTA, *mihi*, sp. nov. — *Calgary, Alberta Province, Brit. N. America.*

CHRYXUS, *Doubl. & Hew.*, Gen. Diur. Lep. ii. p. 383, pl. lxiv. fig. 1 (1851), (*Chionobas*); W. H. Edw. Proc. Ent. Soc. Phil. ii. p. 82 (1863); Scudd. id. v. p. 5 (1865); Edw. Butt. N. A. ser. ii. *Chionobas*, iii. figs. 1, 2, 5, 6 (1892).	*Rocky Mountains, N. America, from Colorado to Alberta.*
Chionobas calais, Scud., Proc. Ent. Soc. Phil. v. p. 7 (1865); Butt. N. E. p. 1777 (1889); Edw. Butt. N. A. ser. iii. *Chionobas*, ii. figs. 3, 4, *type* (1892).	*Rupert House, Hudson's Bay (fide Scudder).*
IVALLDA, *Mead*, Can. Ent. x. p. 196 (1878); Edw. Butt. N. A. ser. ii. *Chionobas*, iii. figs. 1—5 (1879), (? var. prec.).	*Sierra Nevada, California.*
NORNA, *Thunb.*, Diss. Ins. Suec. ii. p. 36, pl. v. fig. 11 (1791), (*Papilio*); Esp. Schmett. i. 2, pl. cviii. fig. 4 (1800); Hübn. Eur. Schmett. i. figs. 763—766 (1824—1826).	*Eur. bor. from about 63° N. (prov. Jemtland) to 70° N.; Asia bor. Altai; Alaska bor. (fide W. H. Edw.).*
Papilio hilda, Quens., Act. Holm. 1791, p. 272, pl. ix. figs. 7, 8; Stgr. Stett. Ent. Zeit. 1861, p. 355.	
Papilio celæno, Hübn., Eur. Schmett. i. figs. 152, 153 (1793—1794).	
NANNA, *Mén.*, Schrenk's Reisen, ii. p. 38, pl. iii. fig. 5 (1859); Stgr. Rom. Mem. sur Lép. vi. p. 200.	*Amurland.*
Œneis hulda, Stgr., Rom. Mem. sur Lép. iii. p. 149, pl. xvi. fig. 8, ♀ (1887); Graeser, Berl. Ent. Zeit. 1888, p. 98.	
URDA, *Evers.*, Bull. Mosc. 1847, p. 69, pl. ii. figs. 1—4 *c* (*Hipparchia*); H.-S., Schmett. Eur. i. figs. 461—463 (1850); Stgr. Rom. Mem. sur Lép. vi. p. 200 (1892); Graeser, Berl. Ent. Zeit. 1888, p. 98.	*Sib. or.; Amur.*
WALKYRIA, *Fixsen*, Rom. Mem. sur Lép. iii. p. 310, pl. xiv. fig. 4 (1887); Leech, Butt. China, &c., p. 77.	*Korea.*
MONGOLICA, *Oberthür*, Etud. d'Ent. ii. p. 31, pl. iv. fig. 6 (1876), (*Chionobas*).	*E. Mongolia.*
SCULDA, *Eversm.*, *l. c.*, p. 612 (1851), (*Hipparchia* (*Chionobas*)); H.-S., *l. c.* figs. 613, 614 (1851—1856); Graeser, Berl. Ent. Zeit. 1888, p. 98.	
var. *pumila*, Stgr., Rom. Mem. sur Lép. vi. p. 201.	*Upper Amur.*

FULLA, *Eversm.*, Bull. Mosc. xxiv. p. 614*a* (1851), (*Hipparchia* (*Chionobas*)); H.-S. Schmett. Eur. i. figs. 615, 616 (1851—1856).	*Lake Baikal? Tarbagatai.*
HORA, *Gr.-Gr.*, Hor. Ent. Ross. xxii. p. 307; Rom. Mem sur Lép. iv. p. 454, pl. xx. fig. 1.	*Alai Pamir, Central Asia*, 11,000 *ft.*
UHLERI, *Reak*, Proc. Ent. Soc. Phil. vi. p. 143 (1866); Strecker, Lep. p. 28, pl. iv. (1873), (*Chionobas*); Edw. Butt. N. A. ser. iii. *Chionobas*, iii. (1891).	*Am. bor. Colorado, Montana, Alberta.*
Chionobas varuna, W. H. Edw., Can. Ent. xiv. p. 2 (1882); id. Butt. N. A. ser. iii. *Chionobas*, iv. (1891).	*Dakota.*
BORE, *Esp.*, Schmett. i. 2, pl. c, fig. 1, pl. cviii. (1790); Hübn., Eur. Schmett. i. figs. 134—136 (1793—1794); Sandberg, Berl. Ent. Zeit. 1885, p. 247 (translation, Holland, Can. Ent. 1891, p. 16).	*Lapland.*
Papilio norna, Quens., Act. Holm. 1791, pl. x. figs. 1, 2.	
TAYGETE, Hübn., Samm. Ex. Schmett. iii. Nymph. ix. Oread. D. Nubilæ, 4, figs. 1—4 (1816—1824); id. Eur. Schmett. i. figs. 1025—1028, ? 1841 (*Eumenis? Bootes*).	*Labrador.*
Chionobas Bootes, Bdv., Icon. Hist. p. 191, pl. xxxvii. figs. 4—6 (1832); id. H.-S. Schmett. Eur. i. p. 69, pl. lxxx. figs. 391, 392 (1843—1850).	
SUBHYALINA, *Curt.*, App. Ross, 2nd Voy. p. 68 (1835), (*Hipparchia*).	*Newfoundland, Labrador; Am. arct. or. to about 67° N.; Alaska (fide W. H. Edw.); Asia arct. to St. Lawrence Bay (fide Aurivillius).*
Chionobas taygete, H.-S., Schmett. Eur. i. p. 70, pl. xxiv. figs. 112—115 (1843).	
Papilio crambis, Frey., Neu. Beit. v. pl. ccccxl. figs. 3, 4 (1845).	
Chionobas also, Möschl. (nec Bdv.), Wien. Ent. Mon. vii. 205 (1863).	
Chionobas œno, Scudd., Proc. Ent. Soc. Phil. v. p. 13 (1865).	
Œneis assimilis, Butl., Cat. Sat. B. M. p. 163, pl. ii. fig. 10 (1868).	
Œneis crambis, Aurivillius, Lep. Vega Exp. p. 76, pl. i. figs. 1, 5, 6.	
Chionobas crambis, Edw., Butt. N. A. ser. iii. *Chionobas*, vi. figs. 1—4 (1892).	
SEMIDEA, *Say*, Am. Ent. iii. pl. i. (1828), (*Hipparchia*).	*Am. bor. White Mts. North Hampshire; Labrador; Colorado*, 12—14,000 *ft.*
Chionobas semidea, Scud., Bost. Jul. Nat. Hist. vii. p. 621, pl. xiv. figs. 2—8	

	(1863); id. Proc. Ent. Soc. Phil. v. p. 20 (1865); id. Butt. N. E. i. p. 134, pl. i. fig. 9, pl. xi. fig. 3, pl. xxxiii. fig. 4, &c.	
BRUCEI,	*W. H. Edw.*, Can. Ent. xxiii. p. 154 (1891), (*Chionobas*); id. Butt. N. A. ser. iii. *Chionobas*, vi. figs. 5—8 (1892).	*Am. bor. Colorado*, 12 — 14,000 *feet*; *Alberta*, 8 — 9000 *feet*.
BEANII,	*mihi*, sp. nov. *Chionobas subhyalina*, Bean, MSS.	*Am. bor. Alberta*, 8—9000 *ft*.
ANTARCTICUS,	*Mabille*, Nouv. Arch. Mus. (3), i. p. 142, pl. x. figs. 5, 6.	*Patagonia*.
VACUNA,	*Grum-Grshimailo*, Hor. Ent. Ross. xxv. p. 458 (1891).	*Central Asia*.

Œ. jutta.—After examining a series of ten males and seven females from Norway, Sweden, Finland, Esthonia, and Russia, five males and four females from Pokrofka, on the Upper Amur, among which are several sent me by Dieckmann as var. *magna*, Graeser, and a pair from Labrador, six pairs from Laggan, three males and a female from Quebec, I find a great amount of variation both in the expanse, number and size of the ocelli, and in the distinctness and shape of the band on the under side. The Asiatic specimens on the whole are distinctly largest, though not more so than some from Southern Norway. The American specimens average considerably smaller than either European or Asiatic ones, though I have two from Esthonia as small as any of them. I should be able to pick out nine out of ten American specimens by the following characters:—Ground colour of the under side more distinctly freckled on both fore and hind wings, band less distinctly defined, ocelli smaller:—but I do not think that there is any ground for treating the American form as a distinct variety. The sex-mark is very conspicuous in all my fresh males, but least so in the Asiatic ones; the number of ocelli varies from five in the fore wing, of which the one in cell 4 is always the smallest, and usually obsolete; and the largest in cell 2 (very rarely absent) to one; in cell 5; and from 4 in the hind wing, of which only those in cells 2 and 3 are usually present, and always the largest, to none; in those cases where the ocelli are nearly or

wholly obsolete, the fawn-coloured blotches surrounding them are also faint or almost obsolete.

With regard to the habits of this species, I cannot add much to the excellent account given in W. H. Edwards' 'Butterflies of North America' (*l. c.*). I have taken it myself only in Norway, where it is one of the earliest butterflies, and flies in peat-bogs in June. At Laggan it is very abundant in small boggy openings in pine-woods, and is much easier to catch than it appears to be in Canada, as it is not shy, and frequently settles on dwarf willows and flowers; it is in perfection here from about the end of June to the middle of July, from 4000 to 6000 ft.

The variety or aberration *balderi* has the ocelli fewer and less conspicuous than the typical form, and, according to Dr. Staudinger, most specimens from Labrador and Livonia are of this form; but as its transition forms to true *jutta* are numerous, I cannot see any greater ground for retaining this varietal name than I can for var. *magna*.

The clasp-form of this species is of the same general type as that of *Œ. fulla* (fig. 4), as may be seen from Scudder's figure, *l. c.*, pl. xxxiii., fig. 5.

Œ. mulla.—With regard to this insect, I have not sufficient material to judge from, but Dr. Staudinger writes me that it is doubtless distinct from *jutta*, and far more distinct than *bore* from *taygete* or *semidea;* it has been taken, so far as I know, only in the Tarbagatai Mountains, at about 6000—8000 ft. by Haberhauer.

Œ. nevadensis.—After comparing very numerous specimens in my own and other collections from California, Oregon, Washington, and Vancouver's Island, of which the last was sent me by Mr. Fletcher as *gigas*, I cannot allow that the differences relied on by Mr. W. H. Edwards between these *californica* and *iduna* are of any weight, and have no hesitation in uniting these four supposed forms. The habitat of this species is peculiar; I have taken it in Oregon, at about 2000 ft., flying in stony or rocky pine-woods, where there was not much undergrowth. It occurs as high as 7000 ft. on Mount Hood, in the same State, according to Morrison, and is common in the pine-forests of Mendocino County, California.

Œ. macounii.—This remarkable species is so like the

last in size, markings, and general appearance, that I could not have separated it but for the total absence of the sex-mark in the male, which is so conspicuous in all forms of *nevadensis*. Nepigon, a railway station on the Canada Pacific Railway, at the point where the Nepigon River runs into Lake Superior, is the only spot where it has hitherto been taken by Prof. Macoun, and Messrs. Fletcher, Scudder, and Lyman. Its habits are well described by Mr. Fletcher in the Annual Report of the Entomological Society of Ontario for 1888. It flies most abundantly from about June 28th to July 15th, in open grassy glades surrounded by swampy forest near the river-bank, a mile west of the station, and also less commonly on a rocky ridge north-east of the railway bridge.

I visited Nepigon in the hope of finding it at the end of July this year, on my return from the west; but, though the season was said to be a late one, and I searched both the localities carefully, I did not find a trace of it; so its season must be a short one.

Mr. Fletcher states (*l. c.*, p. 79), that a single female was taken by Prof. Macoun at Morley Alberta, on the foot-hills of the Rocky Mountains; but, in the absence of any confirmation of this statement, I am inclined to think this specimen must have been *C. nevadensis*, to which, indeed, he says it had a great resemblance. Judging from the few females of *Œ. macounii* I have seen, I cannot distinguish between them, and though I am not aware that *C. nevadensis* has been recorded from the Rocky Mountains, or north of the American boundary, I see no reason why it should not occur there. The isolated existence of *Œ. macounii*, which is certainly more nearly allied to *nevadensis* so very far to the east of any recorded habitat, is certainly very extraordinary; but our entomological knowledge of the vast tract of prairie and forest north and west of Lake Superior is so trifling that I have little doubt but that it will be discovered elsewhere.

Œ. buddha is a species recently described by Grum-Grshimailo, from the mountains south-east of Koko-nor, on the borders of Kan-su and North-east Thibet, and, judging from the specimens kindly sent me by M. Alphéraky, is perfectly distinct from any other of the white-veined group, on account of the grey marginal

border of both wings. Nothing is recorded of it beyond the bare description.

Œ. tarpeia.—This species does not appear to vary to the same extent as many; it has an extremely wide range, from the steppes of South-east Russia, through Southern and Central Siberia to Kiackta, and, according to Trybom, occurs on the Yenesei River, as far north as lat. 57°.

Œ. aello.—Very little need be said about this well-known species. The great variation which prevails in its size, ground colour, and the number and size of its ocelli, shows that we must be careful not to make too much of specific distinctions based on these characters. According to Frey, our latest good authority on Swiss butterflies, *aello* occurs only in alternate years, in the canton of Berne, in West Switzerland, in the years with even numbers, in East Switzerland in the years with uneven numbers. This is borne out by my own experience, so far as it goes; I took it in the Engadine in 1879 and 1885, in the Valais and Engelberg in 1884. Very probably, however, this rule is not invariable, and that some specimens may be found in the intermediate years. Meyer-dur, however, whose knowledge of the Swiss butterflies is very accurate, seems to have no doubt on the subject.

Œ. alberta, n. s.

♂. Upper side pale grey-brown, generally with a strong fulvous tinge on the hind wings. Fore wing with the costa from the base pale grey, more or less strongly mottled with black; a rather inconspicuous pale submarginal band, bearing from one to three round black spots or ocelli in cells 2, 3, and 5, of which that in cell 3 is the first, and that in cell 5 the last, to disappear; sex-mark wanting. Hind wing with a more conspicuous pale submarginal band, bearing a round black spot or ocellus in cell 2 (the latter is sometimes wanting, and sometimes attended by a punctiform black spot in cells 3 and 4); fringes chequered. Under side: fore wing pale grey-brown, inclining to whitish round the tip, the costa and the cell mottled with black, the dark mottling in the cell coalescing in various degrees, and sometimes forming a dark transverse bar about the apical third of the cell; a pale submarginal band corresponding with that on the upper side, but having the ocelli more conspicuous, and its inner edge bounded throughout by a well-defined blackish line, which is angularly produced towards the

hind margin on vein 4, about as far as the ocellus in cell 5. Hind wing pale grey-brown, inclining to whitish (sometimes absolutely whitish) on the disc; a broad irregular dark brown median band, sharply defined on both edges, where its colour is intensified, but without any sharply projecting angles; a distinct ocellus (sometimes absent) in cell 2, coinciding with that on the upper side; veins conspicuously whitish. Upper fringe of palpi whitish. Clasp of the *chryxus* type. Exp. 42—44 mm.

Amongst the described species this insect bears the greatest superficial resemblance to *Œ. taygete*, from Labrador, but the latter is larger, non-ocellate, and normally has a conspicuous sex-mark in the ♂.

I found three males of this species in a small collection made by Mr. F. H. Wolley-Dod, near Calgary, in 1893. In the same collection were specimens of *varuna*, of which at first I thought it might possibly be a variety, but as Mr. Wolley-Dod assured me that it appears three weeks earlier than the latter in the same localities, and being in perfection on May 16th, whilst *varuna* was not out till about June 11th.

Mr. J. Edwards finds that the clasp-form is very different, and as the band of the under side in the three specimens also constantly differs from that of *varuna*, I think there can be no doubt that it is a good species. I cannot believe that this insect is confined to this locality, which is of a thoroughly prairie character, forty miles from the true base of the mountains, and has an extremely cold winter and warm summer; but the very early appearance of the insect probably accounts for its not having been found before by one or other of the few entomologists who have crossed the continent in this latitude.*

Œ. chryxus.—A very abundant species both in Colorado, from about 9000—12,000 ft., and in the Rocky Mountains, from 4000—7000 ft., coming out at the end of June and in July. It was just appearing at 6000 ft. when I left the Yellowstone on June 15th. It is a woodland rather than an alpine species, frequenting rocky hill-sides among conifers, and settling, usually, on a

* Since this was written I have found, in the British Museum, a male, taken at Moosejaw, a station on the Canada Pacific Railway, 400 miles east of Calgary, by the Rev. J. H. Keen, on May 12th, 1890, which is much smaller, but otherwise agrees with *alberta*.

fallen log or tree-trunk, with the wings closed, when disturbed; but it also occurs above timber line, as high as 13,000 ft., in Colorado, later in the season, and these high-level specimens seem smaller and darker than the others. It is very variable in size, tint, and ocellation. I was inclined to think that *Œ. ivallda* was a pale form of this, as I could not see any distinction but that of colour. Prof. Owen, of Madison, Wisconsin, however, who has taken both, assures me that the habitat and flight of the two differ; and, as the geographical range of *Œ. ivallda*, which, as far as we know, is confined to the Sierra Nevada, in Placer County, California, and about Lake Tahoe, is quite distinct from that of *chryxus*, which is not known to occur west of the Rockies, in the United States; it may probably be looked on as a constantly distinct species, though there is nothing in the form of the clasp to distinguish between the two forms.

Œ. norna.—This is one of the most variable of all the genus, both in size, colour, and ocelli. It is found all over Scandinavia, as far south as Jemtland, where I have taken it in open marshy forests; it has in all cases a distinct sex-mark, which is usually very conspicuous; the ocelli vary from four in the fore wing to more, and the variety called *hilda*, which has but one ocellus on each wing, is hardly worth a name. Some of the specimens taken by Schoyen, on the Porsanger fiord, are very small and pale, almost without ocelli, and might be mistaken for transition forms from this species to *fulla*; others from the Altai Mountains, taken by Ruckelberg, do not differ much from large Swedish specimens, though variable in colour.

In 'Canadian Entomologist,' 1886, p. 16, Mr. W. H. Edwards records three females from Northern Alaska, one of which, being sent to Dr. Staudinger, was considered, "as far as I can judge from this one bad specimen, to be a dark variety of *norna*." There would be nothing improbable in this, but the identification is as yet hardly satisfactory.

Œ. nanna.—This species, described by Ménétries from the Amur, had long been confused with *urda*, but the numerous specimens collected by Graeser at Pokrofka, on the Upper Amur, have enabled Dr. Staudinger to recognise it; and, though I had two specimens for some time mixed with *urda*, I now see that it is distinct by

reason of the well-defined sex-mark, which is never found in *urda*, and the want of the black line on vein 4 of the fore wing, which is found in the latter species. Graeser says that *nanna* only flies in very boggy meadows, and never settles on plants, but only on the ground in the muddy spots between the clumps of grass; whilst *urda* is found on stony slopes thinly covered with vegetation, and prefers to sit on the flowers and leaves of low plants.

Œ. urda is a very variable species, and apparently by far the most generally distributed species in Amurland; in colour it ranges from dark rufous brown to pale yellowish brown, and though the ocelli are usually well marked, in some cases they are faint or wanting.

Œ. walkyria.—I can add nothing to what has been said about this very distinct species by Fixsen; it has hitherto only been found in Korea by Herz, at about 3000 ft.

Œ. mongolica.—This species has remained unknown, except from the excellent figure and description given by M. Oberthür. Owing to the kindness of this gentleman I have been able to inspect one of the original specimens taken by the Abbé David in the mountains of Mongolia. It is strikingly different from every other species known to me, except *walkyria*, on account of the fringe, which, like that of *walkyria*, is absolutely unchequered; and I notice that it differs from the latter, of which I have one male and two females, kindly lent to me by the Grand Duke Nicolas Mikhailovitch for comparison, in the following particulars:—The general coloration is paler and more yellow; vein 4 of the fore wing is not heavily marked with brown; and, if I can judge from the description of the female given by M. Oberthür, the ocellus in cell 2 is not so conspicuously larger than the other as it is in the female of *walkyria*. Though I should not venture to form a decided opinion as to the distinctness of these two species on such scanty material, yet I think that the two are certainly nearly allied, and though, as far as at present known, distinct in their habitat, yet they may one day be connected by intermediate varieties. So far as the clasp-form of *mongolica* can be examined without dissection, it appears to agree with that of *walkyria*.

Œ. sculda.—The true *sculda* is a species which I have

only recently identified from specimens sent me by Dr. Staudinger, and which agrees exactly with one of the cotypes which I had previously received from the St. Petersburg Museum, and had treated as an abnormal form of *urda*. The type came from near Kiackta, and it has more recently been found by Graeser in marshy larch-woods at Pokrofka.

Œ. fulla.—This species, which was described by Eversmann from the mountains round Lake Baikal, has more recently been taken by Haberhauer on the southern slopes of the Tarbagatai (see Staudinger, Stett. Ent. Zeits., 1881, p. 271). The latter considers it as a form of *norna*, from which, however, it may always be distinguished by the clasp-form It is very distinct in appearance from typical *norna*, but it might easily be confounded with small pale specimens of the latter, of which I have one from South Lapland, and have seen others taken by Schoyen on the Porsanger fiord, particularly when these have the sex-mark almost obsolete; but the two species may be readily separated on a comparison of the clasp-form, which in some cases may be effected without dissection, if some of the long scales at the apex of the abdomen be removed, either by scraping with a pin, or rubbed off with a moistened camel's-hair pencil, when it may be seen that the clasp in *norna* is suddenly narrowed about the middle, the apical part being about one-third as wide as the basal part; the apex (viewed from the side) is narrowly rounded, and the teeth on the upper edge extend backward but a little way from the apex; in *fulla*, however, the clasp is gradually, not suddenly, narrowed, the apex (viewed from the side) appears obliquely subtruncate, and the teeth on the upper edge extend almost to the base of the clasp, as visible *in situ* (see fig. 4).

Œ. hora. — This species, described from the Alai Valley of Eastern Turkestan, where it was taken at 11,000 ft. elevation by Grum-Grshimailo, and afterwards more numerously by the same gentleman in the southern part of the Thian-shan Mountains, is very like *fulla;* but may be separated not only by the differences given in the conspectus (*vide infra*), but by the different shape of the clasp (see fig. 7).

Compared with my specimens, which were taken by M. Grum-Grshimailo at Thian-shan, the figure of this

species (*l. c.*) is not characteristic, so far as regards the shape of the outer edge of the dark band on the hind wing below; in my specimens the two points at which the outer edge of this band is farthest from the base of the wing occur on vein 4 and in cell 6, the space between them being concave; in the figure, however, the outer edge of the band bulges outward in an almost even curve from vein 2 to vein 7. That this is a mere error of the artist seems clear from the representation of the hind wing above, because there the outer edge of the band (which in these insects always coincides with that on the lower surface) shows the projection on vein 4, and, in a less degree, that in cell 6. It is possible that the specimen figured may have been an aberrant one, in which the outer edge of the band on both hind wings below was not symmetrical, but in any case there seems no reason to think that the figure is intended to represent a species different from that to which my specimens belong.

Œ. uhleri. — I cannot add much to the excellent account of this species given by W. H. Edwards (*l. c.*). I took it in Colorado, in the first week in July, in the drier valleys, at about 9—10,000 ft. elevation; it was flying at the same time on the foot-hills near Denver. I have also taken it in the Yellowstone Park, at 7000 ft., in June. The form *varuna* was originally described from Dakota and Montana, where it was taken by Morrison in 1881, and appears to be essentially an insect of the northern plains and prairies, and though it enters the foot-hills of the isolated mountain ranges of Montana and Dakota, neither Messrs. Wright, Morrison, or Bean have taken it in the mountains. In Alberta and Saskatchawan, Mr. Bean has taken it abundantly between the 1st and 8th June, as well as at McLean and Swift Current in Assiniboine; and Mr. Wolley-Dod finds it at Calgary in the early summer. In the Rocky Mountains of Alberta it goes up to about 4000 ft. at Kananaskis, where the valley of the Bow River runs into the mountains; it has also been taken by Mr. Fletcher at Fort McLeod.

In examining a large series it is impossible to separate the two forms, although, as a rule, the Colorado specimens are larger and paler than those from the north, and the prairie form *varuna* is smaller. The ocelli on the

hind wing are frequently absent in both sexes, and in these there is only one ocellus on the fore wing.

Œ. bore.—With regard to the specific distinction of the European *bore* and Labrador *taygete*, I can only say that extreme examples of both might be separated on account of the generally darker colour, and more distinct band on the under side of the hind wing in *taygete;* yet, according to Dr. Staudinger, it is absolutely impossible to separate the latter as a species, and Mr. J. Edwards finds the clasp-form of both identical. For a full account of the habitat and larva of *bore*, see Sandberg (*l. c.*).

Taygete seems to be the commonest species in Labrador (*cf.* Möschl.), and, like *bore*, is found on the sandy coast of an Arctic sea. It is quite probable that one or other form exists on the coast of Siberia and America, but so far I have seen no specimens from other localities.

Œ. semidea.—This species has been so completely described by Scudder (Butt. New Eng., i., p. 134) in its White Mountain habitat that I need say nothing more of it here; but I am still in great doubt as to its distribution in other localities, because, though stated by Möschler to occur in Labrador, where he says it is much rarer than *taygete* and *crambis*, I have no specimens from that locality which I can identify certainly with *semidea*, and what he called *semidea* from Labrador may have been what I call *subhyalina*.

As, however, I have examined a specimen in Mr. Lyman's collection, from Hudson Strait, which is certainly *semidea*, I have no doubt of its existence in Labrador, though I am unable to give any certain characters other than those taken from the clasp, by which it may be distinguished.

All authors who have as yet examined specimens of the form occurring in Colorado seem to agree in identifying them with the typical White Mountain *semidea;* but, on carefully comparing a series of five pairs from each locality, carefully selected from all I have on account of their perfection, I can certainly pick out the Colorado specimens by the following characters:—On the under side more or less distinct white dots ringed with brown, hardly worthy of the name of ocelli, are present on the fore and hind wings in every specimen, and are quite well marked on the fore wing of the female; whilst in the White Mountain specimens the ocelli are so faint as to be hardly

perceptible, and in most cases entirely absent. In the female the general tint of the under side is much more ochreous, and in both sexes the freckling of the fore wing, instead of being principally confined to the apical and costal areas, is more spread over the whole of the wing.

Though I am not prepared to say that these characters are sufficient to distinguish the form specifically, yet, considering the widely separated habitat of the Colorado form from that of the White Mountain one, and the marked difference in its climate and vegetation, I certainly think there is good ground for looking on it as an incipient species. I have taken this form on the mountains round the head of Hall's Valley, in Clear Creek County, Colorado, at the same time and elevation as the following species; it is by no means so abundant, however, and seems to fly somewhat earlier, as most of the fresh specimens I got were females. In its habits and flight it is like *brucei*. Scudder records its presence on many other peaks and passes of Colorado, at 12—14,000 ft., as far south as Sierra Blanca, the southern extension of the Sangre de Christo range in 37° 30′ N. It is quite likely that it exists on the high peaks of Montana, but has not yet been discovered there.

In the British Museum are several specimens from various parts of Arctic America, which are very puzzling, and which I am not able to identify with certainty without closer examination of the clasps than is possible: four specimens from Winter Cove and Cambridge Bay, collected in 1885 by the Arctic Expedition under Captain Collinson, all of which are distinctly banded, and, in my opinion, are *subhyalina;* one from the same locality, which has no band, and may be *semidea;* two females from Repulse Bay, of which the one marked type has the band faint, the other has it more distinct, whilst the third is intermediate; and a male and female from Sir J. Richardson, taken in 67½° N. lat., which agree better with *taygete*.

Œ. brucei.—I cannot add much to the account given by Mr. Bruce of the habits of this insect, quoted by W. H. Edwards. During my visit to Colorado this year I was able, under his guidance, to catch a great number of this species during the first week in July. The weather, being extremely fine and hot, and the ground over which

the insects fly easy to run upon, there was no difficulty in taking a large quantity. The amount of variation is not great, though the general appearance and band of the under side of the hind wing bring this species uncommonly close to some specimens of *taygete* from Labrador; yet I agree with W. H. Edwards in considering it distinct by reason of the absence of the rufous tinge, which that species shows on both surfaces. A few specimens of *brucei* have been taken by Mr. Bean on a mountain close to the Kicking Horse Pass, at about 8000 ft., but it seems to be comparatively rare there. It will no doubt turn up in other parts of the Rocky Mountains.

Œ. subhyalina.—I have had more difficulty in dealing with the synonymy of this species than any other, but after having compared the unique type of *subhyalina*, Curt., in Guénée's collection, kindly lent me by M. Charles Oberthür, the figure of *crambis* given by Freyer, the type of *assimilis* in the British Museum, from Repulse Bay, and several other specimens in the British Museum from various parts of Arctic America, as well as one from Hudson's Straits, lent to me by Mr. Lyman, of Montreal, I have come to the conclusion that it is impossible to distinguish more than one species. It is true that the variation in size, colour, and distinctness of the band on the hind wing below is great, but not greater, or even so great, as that found in some other species I have already dealt with; and, considering that all these supposed species occur in comparatively limited areas of Arctic America, which are very similar in point of climate, it would be more surprising if several species were found than only one, because there is hardly a case in which an essentially Arctic species like this has not a very wide range; this opinion is confirmed by Mr. J. Edwards' examination of the clasps of some of the specimens differing most remarkably in appearance, including the type of *subhyalina*, in which, fortunately, a critical examination is possible without dissection. Several authors, including such good authorities as Möschler and Staudinger, have treated a species occurring in Labrador as *semidea* of Say, the typical habitat of which is in the White Mountains of New Hampshire. The latter species can be certainly distinguished from *subhyalina*, as Mr. J. Edwards has shown, by the form of the clasp (figs. 5, 9), and usually by the less distinctly

defined band of the hind wing below; but I have no Labrador specimens in my collection of true *semidea*, though one lent me by Mr. Lyman, from Hudson Strait, is proved by the clasp-form to be that species, and it therefore doubtless occurs in Labrador as well. *Subhyalina* appears to be commonest in Labrador and Newfoundland, whence I have seen very large specimens in Mr. Godman's collection. It may also be distinguished from *semidea* by the more rufous tinge of the fore wing below, and by the almost invariable presence of some white spots, rarely amounting to ocelli, on the under side. The clasps and tegumen of this species are figured by Aurivillius in the plate to his paper on the Lepidoptera of the Vega Expedition; his fig. 6, that of the parts seen from above, is recognisable, but fig. 5, that of the parts seen from the side, is not satisfactory, because the drawing is too small to allow a proper expression of the character of the clasp; the contour of the latter is well enough, but its apex is represented as simply acuminate.

Œ. beanii, n. s.

♂. Wings subdiaphanous, very sparsely scaled. Upper side uniform rather pale smoky brown; costa, from the base, very narrowly pale grey, mottled with black; sex-mark present but indistinct. Under side: fore wing as above, but with costa narrowly, and the tip broadly, pale grey, mottled with blackish brown. Hind wing pale grey, closely mottled with blackish brown, the general direction of the dark markings being from the costa to the inner margin; fringes chequered. Entire clothing of the palpi blackish. Clasp of the *semidea* type.

♀. Similar but slightly larger. The hind tibiæ thickened and curved inwards at the apex; the basal joint of hind tarsi dilated and laterally compressed. Exp. ♂ 46 mm., ♀ 52 mm.

This very distinct species is most nearly allied to *Œ. semidea*, from which it is easily distinguished by the blackish (instead of white) upper fringe of the palpi, the smoky colour of the upper side, and the absence of any tendency to the formation of a dark band on the under side of the hind wing. The modification of the hind tibia is a structural character, which will also distinguish this species from any of its allies, though we have hitherto critically examined a single female only.

This species was discovered by Mr. Bean at Laggan three or four years ago, and has been sent out by him under the name of *subhyalina*. It is, however, perfectly distinct from that species, as we have shown above. This species appears, as far as I know at present, to be confined to the bare rocky summits of the mountains at 8—9000 ft. elevation. Under Mr. Bean's guidance I spent three days hunting for it, but, though it had then been flying for at least a week, and was tolerably numerous, I was, owing to the extreme difficulty of the ground, only able to take five or six males. The insect frequents the piles of broken rock which surround and frequently cover the summits of these mountains; its flight, like that of most of the genus, is not particularly strong, but, owing to its shyness and the difficulty of approaching it within reach, it is very hard to secure. It rarely comes out on to level ground, or far from its strongholds, and only flies in the sun when the wind is not too strong. The males come out from the 15th to the 20th July, and the females a week or ten days later. Mr. Bean has not yet discovered the food-plant of the larva, and though old pupa-cases, which look like those of a Satyrid butterfly, are not rare under the stones where it occurs, he has never found a living pupa. Amongst a large series collected by Mr. Bean, I noticed a certain amount of variation on the under side, but the dark smoky appearance of the insect will separate it at once from any other known to me.

I transcribe below the original diagnoses of the two species which I have not been able to examine :—

Œ. antarcticus. — "Statura parva: alæ fusco-rufæ: antice puncto apicali nigro, et radiis obscure fulvis inter ramos nervorum; posticæ radios habent lineola nigra distinctos. Subtus alæ posticæ fuscæ, fascia media in virgulas nigras fracta.

"Une femelle prise à Santa Cruz." (A river and port on the east coast of Patagonia in lat. 58° S.).

Mr. J. Edwards made the following note on the figure of the above, which appears to be a true *Œneis* :—

Expanse, 35 mm. Upper side: fore wing with a black spot in cell 5; hind wing with black spots in cells 2, 3, 4, and 5. Under side of hind wing dark brown from the base to the outer edge of the dark band; the latter starts about the middle of the costa, and

proceeds outwardly to a point on vein 4, about one-third from the hind margin, whence it passes obliquely to near the anal angle.

Œ. vacuna.—"Supra alis fulvis, late nigro fusco marginatus, serie punctorum; anticarum quatuor, posticarum quinque coracino-nigrorum ornatis et lutescenti ciliatis. Subtus alis anticis fulvescentibus, in cellula media, ad costam et apicem fusco strigulatis, nervis albidis; posticis albido-rosaceis, dense fusco-strigulatis, limbo medio obscuriore et ad marginem externum distincte dentato, nervis albis; punctis alarum omnium nigris, distinctissimis. ♂, 19 mm.

"Specimen unicum imperfectum in montibus ad Dongar-tschen detectum."

This species evidently belongs to the ocellate, white-veined group, in which it is distinguished by its small size.

The following "Conspectus" has been prepared by Mr. J. Edwards for his own use in working at my specimens of this genus; the characters employed will *not* be found absolutely diagnostic in the case of every individual specimen, but the table will serve to show what points have proved most useful in separating the members of this admittedly difficult genus.

CONSPECTUS SPECIERUM.

1	(36).	Ocellate species, *i.e.*, having at least one distinct roundish black spot or ocellus (or indication of such) on fore wing below.*	
2	(9).	Hind wing below with the veins conspicuously whitish.†	
3	(4).	Fore wing below with a broad dark grey marginal band, bounded inwardly by a blackish line. No sex-mark in ♂	*buddha*, Gr.-Gr.
4	(3).	Fore wing below with the marginal band (if any) not bounded inwardly by a blackish line.	
5	(6).	Fore wing below normally with 4 subequal ocelli. No sex-mark in ♂	*tarpeia*, Pall.

* In some specimens of *bore* a weak ocellus is present on the fore wing below in cell 5, and, very rarely, in cell 2.

† Certain specimens of *hora* have the veins paler than others, but in that species the dark band on the hind wing below is produced into a blunt point on vein 4 and in cell 6. *Œ. sculda* also is more or less white-veined, but the characteristic shape of the dark band on the hind wing below, with its projecting tooth on vein 4, as in *urda*, and the yellowish rust-red colour of the fore wing, prevent its confusion with any species in this section.

6 (5). Fore wing below with ocelli normally absent from cells 3 and 4; never present in cell 4, and but rarely in cell 3.

7 (8). ♂ with a sex-mark. Hind wing below generally evenly mottled, the dark band scarcely defined .. .. *aello*, Hübn.

8 (7). Sex-mark wanting. Hind wing below with a sharply defined dark band .. .. .. *alberta*, n. s.

9 (2). Hind wing below with the veins sometimes in part, but not conspicuously, pale.

10 (33). Hind margin of hind wing practically even,

11 (14). Hind wing below with the dark band not bordered outwardly with white or whitish grey.

12 (13). Fore wing above with the pale submarginal band suffused, reduced to a series of spots, or absent; an ocellus (rarely wanting) in cell 2 of fore wing below .. .. *jutta*, Hübn.

13 (12). Fore wing above with the pale band sharply defined on its outer edge, the marginal grey-brown band of even width throughout; an ocellus in cell 2 of fore wing above, but not below .. .. *mulla*, Stgr.

14 (11). Hind wing below with the dark band bordered outwardly with white or whitish grey.

15 (22). ♂ with a distinct sex-mark.

16 (21). Hind wing below with at most one black spot or ocellus in cell 2.

17 (20). Fore wing very pointed. Clasp with a large projection before the middle of its upper edge. Species inhabiting America.

18 (19). Ground colour of upper side bright fulvo-testaceous .. .. *chryxus*, Doubl.

19 (18). Ground colour of upper side grey-brown .. *ivallda*, Mead.

20 (17). Fore wing less pointed. Clasp without any projection near the middle of its upper edge. Species inhabits Europe .. .. .. *norna*, Thunb.

21 (16). Hind wing below with 3 or 4 distinct black spots or ocelli .. .. *nanna*, Mén.

22 (15). Sex-mark wanting, or very indistinct.

23 (26). Fore wing above with vein 4 broadly black.

24 (25). Fringes distinctly chequered. Ocellus rarely absent from cell 5 of fore wing .. .. *urda*, Eversm.

25 (24). Fringes dirty whitish grey, not chequered. The ocellus in cell 5 of fore wing very feeble or absent, that in cell 2 very strongly developed, especially in the female .. .. *walkyria*, Fixs.

26 (26). Fore wing above with vein 4 not broadly black.

27 (28). Fringes not chequered, dirty whitish grey. Upper side bright tawny yellow. Fore wing with two ocelli, 1 each in cells 2 and 5 (the former the larger) both above and below; hind wing above with 4 subequal ocelli in cells 2—5, below with a black point in cell 2 .. .. .. *mongolica*, Ob.

28 (27). Fringes distinctly chequered.

29 (32). Hind wing below with the dark band sharply defined, its outer edge angularly produced on vein 4 and in cell 6.

30 (31). Fore wing above with a well-defined broad pale ochreous submarginal band, which is distinct towards the costa beyond cell 5. Fore wing below with the dark band from the costa cut short by vein 4. Clasp (fig. 4) subtruncate at the apex, its upper edge strongly serrate for more than half its length .. .. *fulla*, Eversm.

31 (30). Fore wing above with the pale region suffused, most distinct towards the inner margin. Fore wing below with the dark band from the costa always continued beyond vein 4, generally reaching the inner margin. Clasp (fig. 7) broadly rounded at the apex, its upper edge not evidently serrate .. .. *hora*, Gr.-Gr.

32 (29). Hind wing below with the dark band not often distinctly traceable, and never produced into two teeth on its outer edge.. *uhleri*,* W. H. Edw.

33 (10). Hind margin of hind wing rather strongly scalloped. Large bright fulvous species.

34 (35). ♂ with a sex-mark .. .. .. *nevadensis*, Feld.

35 (34). Sex-mark wanting .. .. *macounii*, W.H.Edw.

36 (1). Non-ocellate species.†

37 (42). Texture and scaling of wings normal.

38 (41). ♂ with a sex-mark.

39 (40). Hind wing below with the veins not conspicuously whitish; inner edge of the dark band generally ill-defined .. .. *bore*, Esp.

40 (39). Hind wing below with the veins conspicuously whitish; both edges of the dark band well-defined .. .. .. *taygete*, Hübn.

41 (38). Sex-mark wanting. Fore wing, especially below, inclining to reddish brown. Clasp (fig. 6) strongly curved inwards at the apex, the teeth on its upper edge almost confined to the upper apical angle, which is somewhat produced .. .. .. *subhyalina*, Curt.

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* Specimens with a more or less evident dark band on hind wing below and fewer ocelli are *varuna*, W. H. Edw.; those with the band disintegrated and more numerous ocelli are *uhleri* proper.

† *Vide* note to par. 1, p. 478, *supra*.

42 (37). Wings subdiaphanous, grey-brown or smoke-brown; scaling very sparse.

43 (46). Upper fringe of palpi white or whitish. Hind tibiæ of female simple.

44 (45). Hind wing below with the inner edge of the dark band undefined. Clasp (fig. 5) not curved inwardly at the apex, which is bluntly rounded, and, together with the upper edge nearly or quite to the middle, bears unequal and comparatively large teeth .. .. *semidea*, Say.*

45 (44). Hind wing below with the inner edge of the dark band sharply defined. Clasp of the *subhyalina* type .. .. .. *brucei*, W. H. Edw.

46 (43). Upper fringe of palpi black or blackish. Female with the hind tibiæ thickened and curved inwards at the apex, and the basal joint of the hind tarsi dilated and laterally compressed .. .. .. *beanii*, n. s.

Explanation of Plate XV.

Fig. 1. Clasp of *Œ. uhleri.*
2. ,, ,, *alberta.*
3. ,, ,, *chryxus.*
4. ,, ,, *fulla.*
5. ,, ,, *semidea.*
6. ,, ,, *subhyalina.*
7. ,, ,, *hora.*
8. ,, ,, *beanii.*
9. ,, ,, *semidea* (Colorado form).
10. ,, ,, *bore.*
11. Hind tibia and tarsus of *Œ. beanii*, ♀.
12. ,, ,, ,, ,, *semidea*, ♀.
13. Clasp of *Œ. norna.*

* Specimens of *semidea* from Colorado differ from the typical form in the decidedly reddish ochreous tinge of the under side, the presence of a small feeble ocellus in cell 5 or cells 2 and 5; and in the two specimens examined the teeth of the clasp (fig. 9) are larger and fewer.

THE

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR 1893.

February 8, 1893.

HENRY JOHN ELWES, Esq., F.L.S., F.Z.S., President, in the chair.

Donations to the Library were announced and thanks voted to the respective donors.

Nomination of Vice-Presidents.

The President announced that he had nominated Mr. Frederick DuCane Godman, F.R.S., Mr. Frederic Merrifield, and Mr. George Henry Verrall, as Vice-Presidents during the Session 1893–1894.

Election of Fellows.

Mr. Charles R. C. Hibbert, of Holfield Grange, Coggeshall, Essex; Mr. Oswald B. Lower, of Bleak House, Parkside, Adelaide, South Australia; and Mr. John Baxter Oliver, of 12, Avenue Road, St. John's Wood, N.W., were elected Fellows of the Society.

Exhibitions.

Mr. S. Stevens exhibited a specimen of *Chœrocampa celerio*, in very fine condition, captured at light, in Hastings, on the 26th September last, by Mr. Johnson.

Mr. A. J. Chitty exhibited specimens of *Gibbium scotias* and *Pentarthrum huttoni*, taken by Mr. Rye in a cellar in Shoe Lane. He stated that the *Gibbium scotias* lived in a mixture of beer and sawdust in the cellar, and that when this was cleaned out the beetles disappeared. The *Pentarthrum huttoni* lived in wood in the cellar. He also exhibited *Mezium affine*, taken by himself in a granary in Holborn.

Mr. McLachlan exhibited a large Noctuid moth* (*Erebus odora*, L.), which had been placed in his hands by Mr. R. H. Scott, F.R.S., of the Meteorological Office. It was stated to have been taken at sea in the South Atlantic, in about lat. 28° S., long. 26° W. Colonel Swinhoe and the President made some remarks on the species, and on the migration of many species of Lepidoptera.

Mr. W. F. H. Blandford exhibited larvæ and pupæ of *Rhynchophorus palmarum*, L., the Gru-gru Worm of the West Indian Islands, which is eaten as a delicacy by the Negroes and by the French Creoles of Martinique. He stated that the existence of post-thoracic stigmata in the larva of *R. cruentatus* had been mentioned by Candèze, but denied by Leconte and Horn. They were certainly present in the larva of *R. palmarum*, but were very minute. He also exhibited a piece of a drawing-board, showing extensive injury by longicorn larvæ during a period extending over seven years.

Mr. G. T. Porritt exhibited two varieties of *Arctia lubricipeda* from York; an olive-banded specimen of *Bombyx quercus* from Huddersfield; and a small melanic specimen of *Melanippe hastata* from Wharncliffe Wood, Yorkshire.

Mr. H. Goss exhibited a few species of Lepidoptera, Coleoptera, Hemiptera, and Neuroptera, sent to him by Major G. H. Leathem, of the 31st Regiment, who had collected them, last June and July, whilst on a shooting expedition in Kashmere territory. Some of the specimens were

* I am indebted to Mr. Hamilton Druce for the name of the species.—H. G.

taken by Major Leathem at an elevation of from 10,000 to 11,000 feet, but the majority were stated to have been collected in the Krishnye Valley, which drains the glaciers on the western slopes of the Nun Kun range. Mr. Elwes remarked that some of the butterflies were of great interest.

Mr. G. F. Hampson exhibited a curious form of *Parnassius*, taken by Sir Henry Jenkyns, K.C.B., on the 29th of June last, in the Gasternthal, Kandersteg.

Mr. J. M. Adye exhibited a long series of remarkable varieties of *Boarmia repandata*, taken last July in the New Forest.

Mr. C. O. Waterhouse exhibited a photograph of the middle of the eye of a male *Tabanus*, showing square and other forms of facets, multiplied 25 times.

Papers read.

Mr. Roland Trimen communicated a paper entitled "On some new, or imperfectly known, species of South African Butterflies," and the species described in this paper were exhibited.

Mr. T. D. A. Cockerell communicated a paper entitled "Two new species of *Pulvinaria* from Jamaica."

Mr. Martin Jacoby communicated a paper entitled "Descriptions of some new genera and new species of Halticidæ."

February 22, 1893.

Henry John Elwes, Esq., F.L.S., F.Z.S., President, in the chair.

Donations to the Library were announced and thanks voted to the respective donors.

Election of Fellows.

Mr. Kenneth J. Morton, of Glenview Cottage, Carluke, N.B.; Herr A. F. Nonfried, of Rakovnik, Bohemia; and Mr. Charles B. Taylor, of Rae Town, Kingston, Jamaica, were elected Fellows of the Society.

Exhibitions.

Mr. F. J. Hanbury exhibited, on behalf of Mr. Percy H. Russ, of Sligo, several long and very variable series of *Agrotis tritici*, *A. valligera*, and *A. cursoria*, together with Irish forms of many other species, some of which were believed to be new to Ireland. Mr. W. H. B. Fletcher and Mr. J. W. Tutt made some remarks on the specimens.

Mr. R. W. Lloyd exhibited specimens of a species of *Acarus* found in New Zealand wheat. He stated that Mr. A. D. Michael had examined the specimens, and pronounced them to belong to *Tyroglyphus farinæ*, a species which had been known for over a hundred years as a destroyer of corn, and was only too abundant all over Europe, and probably over the temperate regions of the world.

Dr. T. A. Chapman exhibited, by means of the oxy-hydrogen lantern, photographs of the larva of *Nemeobius lucina* in its first stage, showing the conjoined dorsal tubercles, each carrying two hairs, which are remarkable in being divided into two branches. For comparison he also showed, by means of the lantern, drawings of the young larva of *Papilio ajax*, after Scudder, and of a portion of a segment of *Smerinthus populi*, as the only instances known to him of similar dichotomous hairs in lepidopterous larvæ.

Mr. E. B. Poulton pointed out that he had described the forked hairs of *Smerinthus* in the Entomological Society's 'Transactions' for 1885, and that such hairs were even better developed in the genus *Hemaris* originally described, as he believed, by Curtis. Mr. Poulton also said that he had noticed similar forked hairs covering the newly hatched larvæ of *Geometra papilionaria*.

Mr. Poulton exhibited, and made remarks on, a number of cocoons of *Halias prasinana*, in order to show the changes of colour produced in them by their surroundings; he also exhibited the coloured backgrounds employed by him in his recent experiments on the colours of larvæ and pupæ, and illustrated his remarks by numerous drawings on the black-board.

Papers read, &c.

Dr. Chapman read a paper—which was illustrated by the oxy-hydrogen lantern—entitled "On some neglected Points

in the Structure of the Pupa of Heterocerous Lepidoptera and their Probable Value in Classification." He stated that the paper was in the main a preliminary one, and he should not give any detailed descriptions of pupæ of individual species, nor indeed descriptions of pupæ at all, except as to the general features characteristic of some more important families and genera. Dr. Chapman pointed out that the pupæ of Lepidoptera-Heterocera belonged, with some exceptions, to one or other of two great groups, with very definite and very distinct characters. One group was characterised by a rounded, smooth, hard pupa, with the appendages firmly soldered together, and not separating on "dehiscence" so as to demonstrate their nature more than in the living pupa, the inner casings of parts being very slight and flimsy, the head and antennæ coverings never together in one piece, unless held so by continuity with other parts, and the only "free" segments in all species and both sexes being the 5th and 6th abdominal segments. One great division of them was the Macros, distinguishable by their adult larvæ having hooks on the inner margins only of the ventral prolegs, and fitted for existence as external feeders. In the other division or divisions (Pyraloids) the larvæ though rarely if ever miners, were fitted for a concealed existence and always possessed sixteen legs, and the ventral prolegs were always armed with a complete circle of hooklets. The other great group had a pupa which was semi-incomplete; the appendages were less firmly soldered to the rest of the pupa, were often partially separate, their covered casings were firmer and persisted in their place on dehiscence, and the head and antenna coverings were almost always separated from the rest of the pupa, but remained attached together; the pupa was active and mobile, and emerged from its case or cocoon for the escape of the moth. Not only the 5th and 6th abdominal segments were free, but often also the 3rd and 4th, and the 7th was always free in the male, and fixed in the female. Sundry families of this latter group were at present mixed up with the Macros, and the view he entertained was that their pupal peculiarities were isolated variations from allied obtected forms; but Dr. Chapman

considered there could be no doubt that the families possessing incomplete pupæ were allied together, and were probably a more ancient form; the probability of such a special and peculiar set of characters being separately reached by different families being very small. The larval characters, moreover, of these same families separated them in almost every instance decidedly from the true Macros, and associated them with other families of the incomplete group. Dr. Chapman further remarked that three families of the Incompletæ were suited as larvæ for exposed existence; all the rest were concealed feeders, living either between leaves, in the tissues of plants, or were leaf-miners, &c. These three families were *Zygæna*, *Limacodes*, and *Micropteryx* (*calthella*), of all which the larvæ are slug-like in form and movement, and possess very retractile heads. *Tortrix* formed a large and very uniform section of the Incompletæ, and *Cossus* was held to possess in all its stages characters that did not admit of any describable difference between it and the Tortrices. *Sesia* occupied a position rather nearer *Tinea*; whilst *Hepialus* and *Zeuzera* presented characters showing no very distant relationship to lower forms, such as the *Adelidæ*. Certain families of *Tineina* appeared to belong to the first group; *Obtectæ* and *Gelechidæ* were held to be true Pyralidina. It was shown that many Incompletæ that had no maxillary palpi (6-jointed) in the imago, had them well developed in the pupa. A definition of Incompletæ as possessing at least some trace of 6-jointed maxillary palpi in the pupa, and of Obtectæ as without them, was suggested as in the main correct. It was also shown that the Incompletæ possessed a dorsal plate in the pupa, very distinct on dehiscence, described as prothoracic, but possibly cephalic, and wanting in Obtectæ, which carried with it the glazed eye (true eye?) covers on dehiscence. The prolegs of Incompletæ were also referred to. *Pterophorus*, though exceptional in having a fixed pupa, was shown to belong to Incompletæ, whilst *Alucita* belonged to Obtectæ. Several other similar removals of genera were noted, and others would no doubt appear as the subject was worked out, several such removals having of late years been made on other grounds, and confirmed by the larval and pupal

characters noted in this paper. A discussion ensued, in which Mr. Elwes, Mr. Poulton, Mr. Champion, and Mr. Merrifield took part.

Dr. F. A. Dixey communicated a paper entitled "On the Phylogenetic Significance of the Variations produced by Differences of Temperature on *Vanessa atalanta*." In this paper he pointed out that Mr. Merrifield's specimens, which had been exposed as pupæ to unusual temperature-conditions, showed marks of reversion to older forms. This was the case with both the "warmed" and the "cooled" specimens, but the ancestral marks differed under the two conditions, the latter showing a further degree of reversion than the former. A possibility was thus suggested that while more than one kind of disturbance is capable of inducing reversion, the extent to which reversion takes place may vary with the nature of the disturbance. Other unusual features visible in the same specimens did not seem to have any ancestral significance, and were perhaps direct results of the altered conditions of temperature.

Dr. Dixey further remarked that he considered the peculiar interest of Mr. Merrifield's experiments with V. *atalanta* lay in the fact that this species is monomorphic and not very variable, the forms produced under altered conditions of temperature being older than any now extant (except as occasional aberrations). The results obtained by Weismann with *A. levana* and *P. napi*, and by Edwards with *P. ajax*, differed from Mr. Merrifield's in the fact that they were confined to the artificial production of the oldest of two or more normally existent forms of a polymorphic species.

In conclusion Dr. Dixey stated that Weismann had already advanced reasons for concluding that unusual heat as well as cold was capable of inducing reversion, but that the ancestral characters thus revived should be different under the two different antecedent conditions appeared to be a new and unexpected phenomenon.

The President, Mr. Merrifield, Mr. Poulton, Dr. Chapman, and Mr. Tutt took part in the discussion which ensued.

March 8, 1893.

Henry John Elwes, Esq., F.L.S., F.Z.S., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Fellows.

Mr. Frank E. Beddard, M.A., F.R.S., of the Zoological Gardens, Regent's Park, N.W.; Monsieur Edouard Brabant, of Château de Morenchies, Par Cambrai (Nord), France; Mr. Frank Bromilow, of Avalon, St. Maurice, Nice, France; Mr. Henry Powys Greenwood, F.L.S., of Harnham Cliff, near Salisbury; Mr. Frederick Michael Halford, of 6, Pembridge Place, W.; Lieut.-Colonel Leonard Howard L. Irby, F.L.S., of 41, Cornwall Terrace, Regent's Park, N.W.; Mr. Bertram S. Ogle, of Steeple Aston, Oxfordshire; Herr Wilhelm Paulcke, of 33, Langstrasse, Baden-Baden, Germany; Mr. Louis B. Prout, of 12, Greenwood Road, Dalston, N.E.; and Captain Savile G. Reid, late R.E., of Foyle House, Alton, Hants, were elected Fellows of the Society.

Election of Honorary Fellows.

Herr Pastor H. D. Wallengren, of Farhult, bei Mjöhurt, Sweden, and Herr Hofrath Dr. Carl Brunner von Wattenwyl, F.L.S., of Trantsohngasse 6, Vienna, were elected Honorary Fellows of the Society to fill the vacancies in the list of Honorary Fellows caused by the deaths of Professor Hermann C. C. Burmeister and Dr. Carl August Dohrn.

Exhibitions, &c.

Dr. D. Sharp exhibited a species of *Enoplotrupes* from Siam, which was believed to be new, and which he thought Mr. Lewis intended to describe under the name of *E. principalis*. He said that this insect had great stridulating powers, and the female seems in this respect to surpass the male.

Mr. W. F. H. Blandford said he wished to supplement the remarks which he had made at the meeting of the Society on the 8th of February last on the larva of *Rhynchophorus*

palmarum. He stated that on making a more minute examination he had since found that only the first seven pairs of rudimentary abdominal stigmata were visible. No trace of the eighth pair could be detected in the normal situation, but they were eventually discovered to be fully developed and displaced on to the dorsum of their segment, which was thickly chitinised, and bore a deep median depression, with projecting lateral margins, on the inner faces of which the spiracles were situated. Dissection showed that the posterior spiracles were the principal agents of respiration, and were connected with the larger ends of the longitudinal tracheal trunks, the communications of which with the aborted stigmata were very small, and, indeed, could not be detected in the somewhat decomposed specimens examined. This displacement was exceptional in terrestrial coleopterous larvæ, and was similar to that found in aquatic larvæ. He suggested that the rudimentary condition of the lateral abdominal spiracles was perhaps correlated with the wet and slimy condition of the larval burrows, and that the persistence as functional organs of the prothoracic pair, which was inexplicable on this hypothesis, might be due to the fact that the larva is stated to return to the outside of the tree along its old burrow, which it enlarges, and that the anterior pair might be the more important during the later stages of larval life. Neither Candèze nor Horn had described the presence of these large posterior stigmata in the larva of *Rhynchophorus cruentatus* (= *zimmermanni*). Dr. Sharp, Mr. McLachlan, and Mr. Champion made some remarks on the subject.

Mr. W. H. B. Fletcher exhibited a long series of bred *Zygæna loniceræ* and *Z. trifolii*, hybrids of the first generation with the following parentage:—*Z. loniceræ*, male—*Z. trifolii*, female; *Z. trifolii*, male—*Z. loniceræ*, female; also hybrids of the second generation between *Z. trifolii*—hybrid, and *Z. loniceræ*—hybrid.

The President enquired whether the hybrids were robust and healthy or the reverse.

Mr. Fletcher stated that many of the hybrids were larger than the parent species, and that some hybrids between *Z. loniceræ* and *Z. filipendulæ* were the largest *Zygænidæ* he had

ever seen. He added that he had made many attempts to cross *Zygæna meliloti* with *filipendulæ*, *loniceræ*, and *trifolii*, and the hybrids between the last two, with the result of obtaining two pairings between *Z. meliloti* and *filipendulæ*, and one between the former and a hybrid male. In all cases the eggs failed to hatch.

Mr. Barrett said that this seemed to suggest that *Zygæna loniceræ*, *Z. trifolii*, and *Z. filipendulæ* were one species.

Mr. Tutt remarked that in a certain field in Kent, some ten years ago, what is known as the small form of *Zygæna trifolii* was taken very abundantly during the first week in June. These specimens were very characteristic, many of them being strikingly blotched; but occasionally an odd specimen was taken with six instead of five spots on the fore wings. The species afterwards got very rare, and of the specimens captured, at least 50 per cent. had six spots, although still retaining the small size and general characters of the old five-spotted form. Two of the five-spotted specimens captured in 1892 had their fore wings taken off and their bodies forwarded to Mr. Pierce, of Liverpool, who examined the genital organs and returned them as undoubted *filipendulæ*. Knowing their history completely, Mr. Tutt felt satisfied that these represented the development of a race of six-spotted *trifolii*. There were, he said, two suggestions open: first, that we have a separate species occurring in late May and early June, distinct from both *filipendulæ* and *trifolii*, which (like some of the continental species) may be either five- or six-spotted; secondly, that *Zygæna filipendulæ* and *Z. trifolii*, although distinct enough in most localities, are in others in such a transition state that they have the inherent ability to change from one form to the other under certain conditions. The ease with which Mr. Fletcher has hybridised the species seemed to point to the latter as a more probable conclusion. He added that both typical *loniceræ* and *filipendulæ* occur in the immediate neighbourhood, but that the former rarely appears until the form described above is well over, whilst the latter is always a week or two behind *loniceræ*.

Mr. F. W. Frohawk exhibited a bred series of *Vanessa atalanta*, showing the amount of variation in the red band on

the fore wings of the female. In seven specimens there was a white spot on this band, and in ten specimens it was absent.

Mr. Elwes exhibited a large number of specimens of *Chrysophanus phlæas* from various localities in Europe, Asia, and North America, with the object of showing that the species is scarcely affected by variations of temperature, which was contrary to the opinion expressed by Mr. Merrifield in his recent paper "On the effects of temperature in the pupal stage on colouring."

Mr. Tutt remarked that on the whole the specimens exhibited by Mr. Elwes tended to prove the point brought forward, *viz.*, that the males of *C. phlæas* were, as a rule, brighter in more northern latitudes and at greater altitudes, whilst those from more southern localities were more suffused; and that no doubt the reasons why a few specimens did not exhibit this general tendency could be explained, if the local conditions were more perfectly known.

Mr. McLachlan, Mr. A. J. Chitty, Mr. Bethune-Baker, Mr. Barrett, and Mr. Frohawk continued the discussion.

Papers read, &c.

Dr. Sharp read a paper entitled "On Stridulating Ants." He said that examination revealed the existence in ants of the most perfect stridulating or sound-producing organs yet discovered in insects; they are situated on the 2nd and 3rd segments of the abdomen, and the perfection of the articulations of these segments gives them admirable delicacy of movement. These organs exist only in certain ants, and, so far as he knew, are not found at all in the Formicides proper. In the Ponerides they exist in a stage of development varying according to the species, and in the lower conditions of the organ they seem to be formed merely of the sculpture of the surface, which becomes more perfect and regular. Our little English ant, *Ponera castanea*, possesses a band about the 150th part of an inch long, which has about 60 perfectly parallel slightly curved lines on it, being at the rate of about 9000 lines to the inch. The stridulating apparatus is as a rule more perfect in the Myrmicides than it is in the Ponerides, and seems to surpass, in the number of lines and their fineness,

anything he has yet found in the latter group; and the method of producing sound seems to be somewhat different in the two groups. The structures that Sir John Lubbock thought might be stridulating organs in *Lasius flavus* are not really such, being merely a portion of the general sculpture of the surface; this may possibly be capable of producing sound by the rubbing together of two sculptured surfaces, but any sounds thus produced must be of excessive delicacy, and beyond the range of human ears. Dr. Sharp said that Mr. H. Goss had been in communication with Mr. W. H. Preece, F.R.S., with the view of ascertaining whether the microphone would assist the human ear in the detection of sounds produced by ants, and read the following letter on the subject from Mr. Preece :—

"General Post Office, March 4, 1893.

Dear Goss,

I made a great many experiments with microphones to try and detect sounds emitted by ants and other insects. The sounds I got were invariably due to the mechanical disturbance produced by the motion of the insect over the microphone. The microphone does not *magnify* sound, as its name implies. It simply reproduces sounds, and its range in this respect is limited. I tried to produce sonorous vibrations of a very high frequency in the hopes of exciting the auditory organs of ants, but without any success, and I made a little instrument for Sir John Lubbock which I believe he found equally unsuccessful. If ants communicate by sound, the view is that it must be by sounds that are far beyond the range of our ears. Nevertheless, Dr. Sharp mentions sound-making ants that may upset this dogma. Science is always breaking down such dogmas.

Sincerely yours,

W. H. Preece."

Mr. Goss read the following note which he had that day received from Mr. G. A. James Rothney on the subject of stridulating insects :—

"65, Old Bailey, London, E.C., March 8th, 1893.

Dear Mr. Goss,

Perhaps the following may be of use to you this evening. I have never found Indian ants stridulating. The

males of many Indian species of the genus *Mutilla* (closely allied to the ants), particularly the common *Mutilla sex-maculata*, stridulate freely; they always stridulate when in the net. The females will also occasionally utter sounds, but in a very mild and modified degree. *Œcophylla smaragdina*, when you disturb a nest, make a loud noise, but I believe this to be the pattering of thousands of feet on the hollow leafy nest. Wroughton, in his excellent work, "Our Ants," records an observation of Aitken's of the noise made by *Lobopelta* when disturbed on the march; but I have never heard this noise, although I have met with many marching columns of this ant.

Yours very truly,
G. A. James Rothney."

Dr. Sharp remarked that *Œcophylla* belonged to the sub-family Formicides, in which no instruments of stridulation have been detected, and also that he had quoted in his paper the opinions of Messrs. Aitken and Wroughton on the subject.

A long discussion ensued, in which the President, Canon Fowler, and Messrs. Champion, McLachlan, Goss, Hampson, Barrett, Jacoby, and Burns took part.

Mr. C. J. Gahan read a paper entitled "Notes on the Longicornia of Australia and Tasmania, Part I.; including a list of the species collected by Mr. J. J. Walker, R.N., and descriptions of new forms."

March 29, 1893.

Henry John Elwes, Esq., F.L.S., F.Z.S., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of a Fellow.

Mr. Ernest Swinhoe, of Avenue House, Oxford, was elected a Fellow of the Society.

Exhibitions, &c.

Mr. G. C. Champion exhibited a living specimen of a luminous species of *Pyrophorus*, sent to him by Mr. Arthur E. Stearns, which had been found in an orchid-house in Dorking. It was supposed to have emerged from the roots of a species of *Cattleya* from Colombia. The following notes on the subject are extracted from Mr. Stearns' diary:—

"On Monday, 20th March, 1893, Mr. S. Welbore Ellis, of Dorking, brought me a living specimen of *Pyrophorus*, which he kindly permitted me to exhibit to Sir William H. Flower, Mr. Waterhouse, and others, his colleagues of the Natural History Department of the South Kensington Museum. I also showed it to Mr. Champion, of the Entomological Society, who asked permission to exhibit it at the next meeting of the Society on the 29th, which was kindly granted by Mr. Ellis. It appears that this insect was discovered in Mr. Ellis's orchid-house, and would doubtless have been destroyed as a 'cockroach,' as is usual with gardeners, had not Mr. Ellis noticed its luminous tubercles. It had been imported into this country probably as a larva last year among the roots of some *Cattleya* from the U. S. of Colombia, and hatched out under heat. I am feeding it with treacle, which it eats freely. Friday, 24th March. This insect has unfortunately died. . . . . Some hours after its apparent death I took the creature in my hand, laying it upon its back in order to examine the under side of the abdomen, and I fancied that the warmth of my hand induced spasmodic movement of the limbs; to test this, I breathed hard upon it for perhaps fifteen seconds, and gradually the body arched itself in such a way as to poise upon the thorax and the tail end, the elytra assisting to the support of this position, and at the same time a portion of the body became brilliantly luminous, the light slowly dying away as the rigidity of the body relaxed."

Mr. A. H. Jones exhibited living full-grown larvæ of *Charaxes jasius*, found by Mr. Frederic Raine, at Hyères, feeding on *Arbutus unedo*.

Surgeon-Captain Manders exhibited a series of *Lycæna theophrastus* from Rawal Pindi, showing climatal variations,

the rainy-season form being of darker coloration, and larger than that occurring in the dry season. The ground colour of the former on the under surface was markedly white, with deep black striæ; in the latter form the ground colour was distinctly reddish, and the marking reduced to reddish lines. He said that the latter form had been described as *L. alteratus*. Mr. F. Merrifield mentioned that Dr. Weismann, as appeared by his work on 'The Germ Plasm,' just published, had been engaged in temperature experiments upon *Chrysophanus phlæas*, the general results of which, so far as stated, corresponded with those obtained by him. Dr. Weismann's experiments, however, had established that the difference in the colouring of *phlæas* in different climates or seasons, though in part attributable to the temperature to which the individual had been exposed, was in part constitutional.

Mr. S. G. C. Russell exhibited a beautiful variety of *Argynnis selene*, taken near Fleet, Hants; two varieties of *A. selene* from Abbot's Wood, Sussex; typical specimens of *A. Selene* and *A. euphrosyne* for comparison; and a remarkable variety of *Pieris napi* from Woking.

Mr. C. J. Gahan exhibited a microscopic preparation of the antenna of the larva of a beetle (*Pterostichus*), for the purpose of demonstrating the sensory nature of the so-called "appendix" of the antenna. Since he wrote a note describing this structure, a short time ago, he found that Professor Beauregard had already suggested its sensory character, and was inclined to believe that it was an auditory organ.

Mr. H. Goss exhibited a specimen of *Trogus lapidator*, Grav., believed to have been bred from a larva of *Papilio machaon* taken in Norfolk by Major-General Carden. Mr. Goss stated that he sent the specimen to the Rev. T. A. Marshall, who said it was a well-known parasite of *P. machaon* on the Continent, but not proved to exist in the United Kingdom. Mr. Merrifield said he knew this parasite, and had bred several specimens of it from pupæ of *P. machaon* received from Spain.

Papers read.

Colonel Swinhoe read a paper entitled "The Lepidoptera of the Khasia Hills. Part I." A long and interesting dis-

cussion ensued, in which Mr. Elwes, Mr. Hampson, Colonel Swinhoe and others took part.

Mr. W. Bartlett Calvert communicated a paper entitled "New Chilian Lepidoptera."

Mr. J. W. Shipp communicated a paper entitled "On a New Species of the Genus *Phalacrognathus*."

April 12, 1893.

Frederic Merrifield, Esq., Vice-President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Exhibitions, &c.

Sir John Talbot Dillwyn Llewelyn, Bart., exhibited a number of specimens of Lepidoptera, Coleoptera, and Hymenoptera, all caught in Glamorganshire. The Lepidoptera included two remarkable varieties of *Vanessa io*, both obtained from the same brood of larvæ, from which the usual eye-like spots in the hind wings were absent; varieties of *Arctia menthastri;* a long series of melanic and other forms of *Boarmia repandata* and *Tephrosia crepuscularia;* and bleached forms of *Geometra papilionaria*. The Coleoptera included specimens of *Prionus coriarius*, *Pyrochroa coccinea*, *Otiorhynchus sulcatus*, and *Astynomus ædilis*, which latter Sir John Llewelyn stated had been handed to him by colliers, who obtained them from the wooden props used in the coal mines, made out of timber imported from the Baltic. Mr. Merrifield, Dr. Sharp, Mr. Bower, and Mr. Stevens made some remarks on the specimens.

Sir John T. D. Llewelyn enquired whether the name of the moth which had a sufficiently long proboscis to fertilize the large Madagascan species of Orchis, *Angræcum sesquipedale*, was known. Mr. C. O. Waterhouse stated that the collections received at the British Museum from Madagascar had been examined with the view to the discovery of the species, but up to the present it had not been identified.

Mr. H. Goss exhibited, for Mr. Frank W. P. Dennis, of Bahia, Brazil, several nests of Trap-door Spiders containing living specimens of the spider, and read a communication from Mr. Dennis on the subject. Several photographs of the nests and the spiders were also exhibited. It was stated that Mr. Dennis had found these nests at Bahia in one spot only in a cocoa-nut grove close by the sea.

Paper read.

Mr. McLachlan read a paper entitled "On species of Chrysopa observed in the Eastern Pyrenees; together with descriptions of, and notes on, new or little-known Palæarctic forms of the genus." The author stated that the species referred to in this paper had been observed by him in the Eastern Pyrenees, in July, 1886, when staying with Mons. René Oberthür. After alluding to the nature of the district, and its capabilities from an entomological point of view, the paper concluded with descriptions of certain new palæarctic species of the genus. Dr. Sharp, who said that he was acquainted with the district, and Mr. Merrifield made some remarks on the paper.

May 10, 1893.

Henry John Elwes, Esq., F.L.S., F.Z.S., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of a Fellow.

Mr. A. Cowper Field, of 81, Wiltshire Road, Brixton, S.W., was elected a Fellow of the Society.

Exhibitions.

Mr. McLachlan exhibited, for Dr. Fritz Müller, the larvæ and pupæ of a dipterous insect, *Paltostoma torrentium*, and read the following letter from Dr. Fritz Müller on the subject:—

"Blumenau, Santa Catharina, Brazil,
8th March, 1893.

Dear Sir,

Only a few days ago did I become aware that at the meeting of the Entomological Society, held on October 1st, 1890, Mr. C. J. Gahan exhibited a remarkable small larva-like creature, concerning which the Society expressed no definite opinion, and which you and Lord Walsingham thought might be allied to the Myriapods.

I have found here for many years an entirely similar animal, and have discovered that it is the larva of a dipterous insect, viz., *Paltostoma torrentium*.

I have described the larva, pupa, and imago, together with the anatomy of the larva, in the 'Archivos do Museo Nacional do Rio de Janeiro,' 1881, vol. iv., pp. 57–85, and four plates accompany the description.

The imago is especially remarkable, inasmuch as the female occurs in two forms, one of which is honey-sucking and the other blood-sucking (*cf.* 'Kosmos,' 1880, vol. viii., p. 37).

I take the opportunity of sending, with this letter, some larvæ and pupæ found yesterday, which may be useful to you, and which I ask you to exhibit at a meeting of the Society.

Yours faithfully,

Fritz Müller."

R. McLachlan, Esq., F.R.S.

Mr. Gahan, Mr. Jenner Weir, Colonel Swinhoe, Mr. Blandford, Mr. Verrall, Mr. Slater, and Mr. Jacoby, took part in the discussion which ensued (*cf.* Proc. Ent. Soc., 1891, p. ii.).

Mr. S. G. C. Russell exhibited *Hesperia alveolus*, variety *Taras*, taken by him at Woking in April last.

Mr. J. M. Adye exhibited a long series of *Moma orion*, *Eurymene dolobraria*, *Amphidasis betularia*, and *Chloephora prasinana*, and a few specimens of *Notodonta dodonea*, *N. chaonia*, and *N. trepida*, *Acronycta alni*, and *Selenia illustraria*, all bred by him in March and April last, from larvæ obtained in the autumn of 1892 in the New Forest.

Mr. H. Goss read a copy of the following letter from the Governor of the Gold Coast to the Marquess of Ripon at the

Colonial Office, reporting the occurrence of vast swarms of locusts at Aburi and Accra, West Africa, in February last:—

"Government House, Christiansborg Castle,
Accra, 27th February, 1893.

My Lord,

It may be interesting to your Lordship to be informed that on Thursday, the 23rd instant, I received a telegram from the Curator at Aburi stating that the entire station was covered over by vast swarms of locusts, and that he feared they would be very destructive to the plants in the garden. On the following morning, at 10.15, the Colonial Secretary called my attention by telephone to a vast swarm of locusts that was approaching Accra in the form of a semicircle from the north, the middle appearing to be in the vicinity of the Governor's lodge, two miles north-east from Accra; they extended east and west as far as the eye could see. The sky in one direction could only be seen through the dark cloud of these insects. Their numbers were simply beyond all calculation. They appeared to occupy a space about two miles wide, and from a quarter of a mile to a mile in height. They gradually came round in a semicircular direction curving from Accra towards the Governor's lodge, going on to Labadi, and keeping as close to the sea as the grass extended on the sand. On a long plain between the lagoon by Christiansborg Castle, extending towards Labadi, about a mile long and quarter of a mile wide, they descended like a vast covering, and consumed the grass on the plain, leaving the harder portions brown and dried up. I am sorry to say that they took a fancy to the cocoa-nut trees which I planted some years ago in the land attached to the Castle, and literally stripped the leaves that hung above the bunches of fruit, the midribs only remaining. During this time there was not a breath of wind; the sun was shining brightly, the heat was intense, and the locusts for a while had their own way. At one time the roofs of the Secretariat and of the huts at Victoriaborg, which can always be seen distinctly from the Castle, which is a mile and a quarter distant, were completely hid from view by the vastness of the number of

locusts. On their first approach to Government House I had the windows and doors closed to prevent their ingress into the apartments. When they got so close to the verandah that I could nearly touch them, I shouted and struck a stick against some of the iron pillars, upon which I noticed that the locusts, appearing to dislike the noise, wheeled away. I then had some blank cartridges fired at them, and the bell, which is used on Sunday for Church purposes, rung. The noise apparently alarmed the locusts, for they left the Castle and contented themselves with ravaging the cocoa-nut trees to the north of it.

2. I have heard by telegraph that no damage was done at Aburi.

3. The swarms of locusts were reported by the District Commissioner to have visited Labadi on the Friday, and some were also reported to have been seen at Elmina.

4. The market women at Accra were much alarmed at the fearful sight of these insects, and went about in large numbers shouting and crying out that war or famine would follow, and urging the Fetish priests to propitiate their gods, owing to whose displeasure the locusts were sent. The last visit of locusts to the Coast is reported to have occurred about thirty years ago, when the people suffered greatly for want of food in consequence of their ravages.

5. The rate of flight has been roughly estimated at six miles per hour. The first arrivals reached the sea-shore at about 11 a.m., and the last at about 2 p.m.; in this estimation the depth of the swarm would be about eighteen miles. The extreme density of the cloud in the vicinity of Accra and Christiansborg was owing to the front of the column being stopped by the sea: this was very marked. This was also the cause of the damage done to vegetation, as no inclination to settle was evinced in their flight. This variety was brown in colour, and about $1\frac{3}{4}$ in. in length.

6. About 1.30 the following day a cloud of locusts was observed to the north of Accra; they did not approach the sea within three miles, but soon afterwards disappeared, going northwards into the interior.

7. The occurrence of the visit of these insects is so extra-

ordinary, and they came in such incalculable numbers, that I thought it would be interesting to your Lordship to be informed of the circumstances I have mentioned.

I have the honour to be, &c.,

(Signed) W. Brandford Griffith,
Governor.

The Most Honourable
The Marquess of Ripon, K.G., F.R.S., &c."

Colonel Swinhoe stated that some years ago he had been requested by the Indian Government to report on plagues of locusts. He said he had witnessed swarms of these insects far larger than the one just reported from the Gold Coast, and mentioned that many years ago, when going up the Red Sea in one of the old P. and O. paddle-boats, the boat had frequently to stop to clear her paddle-wheels from locusts, which had settled in such swarms as to choke the wheels and stop their action.

Mr. C. G. Barrett called attention to a field excursion to the Cotswolds, which it was proposed to have in June. Fellows of the Society were requested by the President to communicate to Mr. Barrett, as early as possible, their views as to the date which would be most generally convenient for such excursion, and to offer any other suggestions on the subject which might occur to them.

Papers read, &c.

Mr. Edwin C. Reed communicated the following "Notes on the Migratory Locust of the Argentine Republic":—

"During the months of October and November, 1891, the migratory locust of the Argentine Republic, generally spoken of as *Acridium paranense*, but by many considered to be identical with the Old World species, *A. peregrinum*, emerged in immense numbers from its constant habitat, near the River Plate, and invaded the western and south-western regions of the Argentine Republic.

Day by day telegrams were received here of its advance towards the Andes, but no one imagined that it would pass them; yet about Dec. 10th telegrams from Southern Chile announced that it had entered this country. A few days after

the Chilian Government commissioned me to investigate into the cause of alarm, and to report upon it.

In Central and Northern Chile there is a locust, the *A. cancellatum*, very similar in size and structure to the Argentine species, but differing much in colour, especially in having a dull reddish orange longitudinal stripe on the dorsal part of its thorax. It also differs widely in not being at all social or gregarious. I have known this species for nearly a quarter of a century, and for some years it has been moderately common in my garden, and I have often wondered that it never appeared in numbers, nor did any perceptible harm.

The Argentine species I also know very well, having seen great numbers on the Argentine pampas; and I have always seen it with a dull yellowish-green coloured thorax, never with any sign of a reddish stripe.

I also knew that in the south of Chile the *A. cancellatum* was never found, though there were some smaller species of *Acridium* very destructive to crops in regions where woods have been cut down and farming carried on, and fully expected to find these to be the species complained of.

Arriving at the south, in the famous Araucania, I found that the Argentine locusts had really invaded this country in millions. They had passed near Villa Rica, about lat. 39° S., at 4000 ft. above the level of the sea. Immense numbers had died in the snowy pass, but the survivors devoured the poor Indians' crops of beans, potatoes, tobacco, &c. Having rested and fed, they formed two columns, one flying N.W., and the other S.W.; a few days afterwards some forty tons of eggs, according to a rough calculation, were laid. I had reason to believe that there were two or three other invasions by passes rather more to the north. I saw many thousands of live specimens, and all were coloured just as the Argentine species should be.

Having given in my report to the Government, in which, of course, urgent measures were recommended, 200,000 dols. was voted by the Congress to defray expenses of destroying them; and there the matter rested till the end of April, when the clamour in the south became great on account of the immense numbers of larvæ that had hatched out, and were

seeking what they could devour; and then I was appointed to exterminate them.

A careful study of the state of affairs showed me that they were in a place where they could do no harm; on poor scrubby land near the margins of forests; an uninhabited region, where it would be very difficult to attack them from want of men. Troops might perhaps have been taken there, but the civil war was just over, and there were difficulties.

At that time the young locusts were rather over an inch long, and more than sixty days old; food was very scarce, and winter rapidly approaching. From this I considered that few, if any, would attain the winged state and lay eggs; so I advised a policy of 'masterly inactivity,' which was accepted, and they were left alone. The result proved the wisdom of this policy, and they all died out.

Meanwhile news poured in of another invasion near the origin of the River Bio-bio, more to the north, therefore more to be feared; and on May 26th, at twilight, I reached a wood where every tree was coated with such a layer of winged locusts that the bark was not visible. Taking a handful from the nearest tree, I found to my surprise that every specimen had a reddish stripe on the thorax, like *A. cancellatum*, though in other respects they resembled the Argentine specimens more than the Chilian ones. Next morning showed that for miles round the country was carpeted with locusts innumerable, all with the reddish stripe; there was no transition, no variation.

The inhabitants of these parts assured me that they found a difference between the specimens bred there and those that had crossed the Andes and laid the eggs that produced them.

I can offer no explanation of the matter, neither do I know of any similar case. There is no postal parcel communication between Chile and London, or I would gladly send specimens.

Few entomologists would fail to consider the specimens that crossed the Andes, those produced by the eggs they laid, and the Chilian *A. cancellatum*, as three good and distinct species; yet they are but one.

From information obtained there has been no other invasion in the memory of man; so *A. cancellatum* has been in Chile,

say, more than fifty years. It can exist only in the north, and is most common on the borders of the desert of Atacama.

All the specimens I saw near the Bio-bio died during the winter, or were eaten by birds. A very few eggs hatched out in a warm corner of a hill, which were destroyed when small.

A swarm did fly northward from a place on the plains, and I have just found a winged specimen and news that they bred, though not in numbers. This specimen agrees with the Bio-bio ones.

The Bio-bio specimens were struggling against the cold and scanty food. On opening some fifty females the ovaries were found in a rudimentary state."

Colonel Swinhoe, Mr. Champion, Mr. Elwes, Mr. McLachlan, and Mr. Merrifield took part in the discussion which ensued.

Prof. L. C. Miall communicated a paper entitled "Dicranota: a Carnivorous Tipulid Larva."

Dr. T. A. Chapman communicated a paper entitled "On a Lepidopterous pupa (*Micropteryx purpurella*) with functionally active mandibles." The author stated that though the pupa has been known for thirty years, its remarkably large jaws have never been referred to, still less the fact that they are employed to tunnel the way for the pupa out of its cocoon and through the superincumbent soil. They are active for some minutes immediately before the exclusion of the moth; their attachments to the moth are such that they are not moved by direct muscular action, nor by the movement of any enclosed imaginal parts; yet they manifest great power in their movements and much intelligence.

Mr. McLachlan said Dr. Chapman's observations were of great value, and tended to show that the position of *Micropteryx* was still nearer the Trichoptera than had been supposed.

New Library Catalogue.

The President announced that the new Library Catalogue, which had been edited by Mr. Champion, with the assistance of Mr. McLachlan and Dr. Sharp, was now ready for sale to the public at 9s., and to the Fellows of the Society at 6s. a copy.

June 7, 1893.

Henry John Elwes, Esq., F.L.S., F.Z.S., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of a Fellow.

Mr. George Willis Kirkaldy, of St. Abbs, Worple Road, Wimbledon, S.W., was elected a Fellow of the Society.

Exhibitions, &c.

Mr. W. C. Boyd exhibited varieties of *Fidonia piniaria* and *Thecla rubi*, taken at Bournemouth on May 20th, 1893.

Mr. C. O. Waterhouse exhibited certain large galls on oak-leaves from Mexico, one of which was apparently produced by a species of *Cynipidæ*.

Mr. A. Cowper Field exhibited varieties of *Smerinthus tiliæ*, bred between 1890 and 1893, under varying conditions of temperature, those which had been exposed to a lower temperature being much darker than those which had been exposed to a higher. Mr. Merrifield made some observations on the subject, and remarked that, as far as his experience went, no hard and fast rule could be laid down with regard to the production of the lighter or darker colourings, as a high temperature sometimes produced dark forms.

Mr. W. M. Christy exhibited a series of *Zygæna trifolii*, including very many yellow forms, all, with one exception, taken at one spot during the latter half of May, 1893, and belonging to one colony. Some of the specimens were more or less incomplete, both in structure and colour. Lord Walsingham, Mr. Merrifield, and others took part in the discussion which followed.

Canon Fowler exhibited cocoons and specimens of *Coniatus suavis* var. *chrysochlora*, Luc., taken by Lord Walsingham in great abundance on the flower-shoots of tamarisk in the West of Italy.

Mr. A. J. Chitty exhibited black varieties of the following Coleoptera from the slopes of Ben Cruachan, N. B.:—*Cara-*

bus violaceus and *arvensis*, *Pterostichus versicolor*, *Phyllopertha horticola*, and *Telephorus figuratus*, and stated that the latter seemed a permanent race, as it occurred both in 1892 and 1893.

The President remarked on the great abundance of *Coleophora laricella* in Gloucestershire, and stated that they were committing great ravages among young larches. Lord Walsingham stated that he had seen young larches at Carlsbad completely bleached by this moth.

It was suggested by several Fellows of the Society that care should be taken to observe the occurrence of second broods of insects during the year.

Mons. Wailly exhibited a collection of Lepidoptera, Coleoptera, and Orthoptera, which he had just received from New Zealand. There were 109 specimens of Lepidoptera, and about 80 specimens of Coleoptera. The latter included a number of specimens of *Lasiorhynchus barbicornis* (rare), and *Ectopsis ferrugalis* (very rare). The Lepidoptera included the following:— *Argyrophenga antipodum*, *Erebia pluto* (alpine), *Chrysophanus salustius*, *Chrysophanus boldenarum*, *Chalastra pelurgata*, *Agelina gallaria*, *Notoreas peromata*, *Sestra humeraria*, *Rhapsa oestosialis*, *Drapanodes muriferata*, *Diptychophora metallifera*, *Musotima nitidalis*, *Hydriomena semifissata*, *Notoreas paradelpha* (alpine), *Orthosia comma*, *Hydriomena deltoidata*, *H. purpurifera* (rare), *Selidosema productata*, *S. lupinata*, *Hepialus virescens* (very rare), *Declana atronivea* (bred, very rare), *Mamestra ustistriga*, *Notoreas brephos*, *Xanthorhoe clarata*, *Leucania atristriga*, *Selidosema dejectaria*, *Gonophylla nelsonaria* (rare), *Ipana leptomera*. Mons. Wailly said that his correspondent stated in his letter that insects were rare in New Zealand, and that the specimens sent were the accumulations of several years of active collecting. Many of the species, such as *Erebia pluto*, *Argyrophenga antipodum*, &c., frequent remote places, which he could visit but once in a season, and *Erebia pluto* was only to be found on mountain tops at an elevation of 5000 ft. A discussion followed, in which Lord Walsingham, Dr. Sharp, Mr. McLachlan, Mr. Durrant, and others took part.

Mons. Wailly further exhibited cocoons of various silk-

producing Lepidoptera, and read the following notes on the subject:—

"On the 1st of February, 1893, I sent to my correspondent in San Fernando, Trinidad, live cocoons of silk-producing Lepidoptera, for the purpose of trying their rearing in that tropical island. Quantities of *A. cynthia* cocoons besides were sent to four of the West India islands through the medium of the Sub-Director of Kew Gardens. The worms were to be bred on the castor-oil plant, *Ricinus communis*.

"The result of the various rearings in Trinidad has so far been most satisfactory, the *Cynthia* worms having reached their last stage in the middle of May. By next mail I expect a statement of the final result respecting the rearing of *cynthia* and *promethea*. But the most extraordinary success has been that of the rearing of the oak silkworm, *A. pernyi*. There was no difficulty about the food-plant for *A. cynthia* (the *Ailanthus* silkworm), as it was known that it could feed on the *Ricinus;* but what substitute could be found for oak? I had sent to my correspondent only nine cocoons of *A. pernyi*, thinking that this species could not be reared in Trinidad for want of its natural food; but great was my surprise, great was my joy, to hear, from most interesting letters received from my correspondent, of the wonderful progress of this most valuable silkworm.

"The *pernyi* moths emerged from the 26th of February (when two pairs were found) to the 28th. In two days all the nine moths had emerged, and five pairings were obtained. On the 8th of March larvæ hatched from eggs laid on the 27th February. Various kinds of foliage were offered to the larvæ without success, but on the 2nd of April my correspondent wrote as follows:—'In my last letter to you I expressed my regret that I was unable to find any substitute for the oak to feed my *pernyi* larvæ on; however, I am happy to inform you that the next day, after posting my letter to you, on looking into one of my cages in which I had put about fifty larvæ, I found, much to my delight, that on a branch of *Terminalia latifolia* there were a lot of them feeding with great voracity. Every day since then they have made rapid progress, the food-plant being

very abundant and of quick growth here; so that I have every hope of success, as they are now about three weeks old, and have grown to a very large size.'

"On the 16th of April larvæ began to spin, 39 days after hatching, and on the 15th of May my correspondent was preparing for the second generation. Two live cocoons of a beautiful white silk and a skein of silk reeled from one cocoon were sent to me as samples of the produce obtained; and here they are. I hope that the same success will attend the rearing of the following generations."

October 4, 1893.

Henry John Elwes, Esq., F.L.S., F.Z.S., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of a Fellow.

Mr. Arthur Ernest Gibbs, F.L.S., of the Hollies, St. Albans, was elected a Fellow of the Society.

Exhibitions, &c.

Mr. F. Merrifield exhibited specimens showing the effects of temperature in the pupal stage on several species of Lepidoptera. *Vanessa polychloros* was much darkened, especially towards the hinder margin, by a low temperature. *Vanessa c-album* showed effects on both sides, especially in the female; they were striking on the under side. Several examples of the striking effect produced by temperature on the summer emergence (*prorsa*) of *Araschnia levana* were exhibited. Some *Vanessa io* showed the gradual disintegration, by exposure to a low temperature, of the ocellus on the fore wing, which in the extreme specimens ceased to be an ocellus, and was a remarkable confirmation of Dr. Dixey's views of the origin of that ocellus, as exemplified in the Plate attached to his paper in the Entomological Society's Transactions for 1890.

Mr. Goss stated that in his experience of *V. c-album* in Northamptonshire, Gloucestershire, Herefordshire, and Monmouthshire, the form with the pale under side was the first brood, occurring in June and July; and that the second brood, occurring from the end of July to October, was invariably dark on the under side. Mr. Jacoby, Mr. Merrifield, and the President continued the discussion.

Mr. A. H. Jones exhibited Lepidoptera collected in Corsica in June last, including dark forms of *Polyommatus phlæas* (Vizzavona); *Lycæna astrarche*, in which the orange marginal band is very brilliant on upper and under sides of both wings (Vizzavona); *Lycæna argus*, the females of which are much suffused with blue, probably var. *calliopis* (Tattone); a series of *Vanessa urticæ* var. *ichnusa*, bred from larvæ found at Vizzavona (4000 feet); *Argynnis elisa*, *Satyrus semele* var. *aristæus*, *Satyrus neomiris*, *Cœnonympha corinna*, both spring and summer brood (Vizzavona); *Syrichthus sao* var. *therapne*, and many others.

Mr. G. C. Champion exhibited, for Mr. G. A. J. Rothney, a number of *Methoca ichneumonides*, Latr. (female), taken at Bexhill, Sussex, showing great variation from the usual large black and red form to a small and nearly black one.

Dr. D. Sharp exhibited a pupa of *Galleria melonella*, on which the eggs of a parasitic Hymenopteron, as he believed, had been deposited while the insect was in the cocoon. He also exhibited, from the collection of Alexander Fry, Esq., the hitherto unique *Aprostoma planifrons*, Westw. The genus was correctly assigned by Westwood to the *Colydiidæ*, though described as a Brenthid.

Mr. J. J. Walker exhibited specimens of the following species of *Halobates*, viz.:—*H. sericeus*, Esch., from the Pacific; *H. sobrinus*, B. White, from Marquesas Islands; *H. wüllerstorffi*, Esch., from Marquesas Islands; *H. princeps*, White, from the China Sea; and a female of *H. wüllerstorffi*, with ova attached.

Mr. W. H. B. Fletcher showed a variable series of 75 *Cymatophora or*, bred in 1893 from larvæ from Sutherland, a series of about 40 *C. ocularis* bred-in from stock from Oundle. Also a series of 33 moths, all females, supposed to be hybrids

between *C. ocularis* male and *C. or* female, from the above stock in each case, bred as a second brood in August and September, 1893. He stated that he placed the reputed parents in a muslin sleeve on a branch of *Populus nigra*, and did not open the sleeve until the resulting larvæ required fresh food. To the best of his belief the female parent had no chance of pairing with a male of her own species. The supposed hybrids resembled the female parent, except that both orbicular and reniform stigmata were very conspicuous, being pure white filled up slightly with black, whereas in *C. or* they are usually inconspicuous, and the orbicular are sometimes wanting. None of the *C. or* bred had the stigmata developed so fully as had the hybrids, which were most uniform in this respect. The tone, too, of the *or* shown was decidedly brown, while the others were grey. It was suggested that as fully half the pupæ came out unexpectedly as a second brood, and knocked themselves to pieces, the males of the batch might have been among them.

Mr. F. J. Hanbury exhibited a specimen of *Leucania vitellina*, taken at Brockenhurst on August 24th, 1893, by Mrs. Hanbury, and another taken by himself at Freshwater, I. of Wight, on Sept. 7th; also an extraordinary *Gonepteryx rhamni*, showing red blotches at the tips of the fore wings, taken by a gardener at Walthamstow, Essex.

Mr. C. G. Barrett exhibited a gynandrous *Argynnis paphia* recently taken in the New Forest by Mr. Cardew.

Mr. J. M. Adye exhibited a specimen of *Deilephila livornica* recently caught at Christchurch, Hants.

Mr. Elwes exhibited two species of the genus *Œneis* (*Chionobas*, Bdv.), *Œ. beani* and *Œ. alberta*, from North America, which had not been previously described, and stated that he had prepared, with Mr. Edwards's assistance, a revision of this very difficult genus, which would be read at the November meeting.

Papers read.

Mr. Osbert Salvin communicated a paper entitled "Description of a new genus and species (*Baronia brevicornis*) of *Papilionidæ* from Mexico," and exhibited both sexes.

Dr. Sharp read a paper entitled "On the Cost and Value of Insect Collections." Mr. W. F. H. Blandford, Mr. McLachlan, Mr. Jacoby, Mr. Waterhouse, and the President took part in the discussion which ensued.

Professor Auguste Forel communicated a paper entitled "Formicides de l'Antille St. Vincent, récoltées par Mons. H. H. Smith."

Mr. Blandford read a paper entitled "Description of a New Subfamily of the *Scolytidæ*." The author said that the new subfamily consists at present of six species, four from Japan, one from India, and one from Madagascar described under the name *Scolytoplatypus permirus* by C. Schaufuss, who considered it as a true Platypid. He had recently received the type of *S. permirus* for examination, and found it to be closely allied to his species, and to differ in some important particulars from Schaufuss' description. It would necessitate a reconsideration of the generic divisions. The insects are characterised by an exposed head, deeply recessed in the males above and below, a thorax which is emarginate and bordered at the sides, stout fore legs with scabrous tibiæ, greatly dilated in the females, short oblong elytra with apical tubercles or carinæ in the males. The under-skeleton resembles that of certain *Tomicini*, as do the mouth parts, and hinder legs. They differ essentially from *Platypi* in possessing a six-jointed antennal funiculus, a non-carinate mesonotum, and a short metasternum and first tarsal joint. Among the remarkable features are a large dorsal pore on the thorax of the females; great elongation of the antennæ in the males of some species, which have a deep fovea on the sides of the prothorax, and a modification of the prosternum, which is recessed in front, furnished with a fenestra covered with a transparent membrane, and armed with two minute hooks, like the nippers of an earwig. The antennal club is oval or pointed, solid, and honeycombed, with two bands of very minute papillæ. For the present they may be placed between *Tomicini* and *Platypini*, but are distinct from either. The President, Dr. Sharp, and Mr. Waterhouse took part in the discussion which ensued.

October 18, 1893.

Henry John Elwes, Esq., F.L.S., F.Z.S., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of a Fellow.

Professor C. H. Tyler Townsend, of the Institute of Jamaica, Kingston, Jamaica, was elected a Fellow of the Society.

Exhibitions, &c.

Mr. R. Adkin exhibited two *Leucania vitellina* and one *L. extranea*, taken by Mr. B. W. Adkin in the Scilly Islands, in August, 1893.

Mr. R. South exhibited a specimen of *Polyommatus bœticus*, and a number of varieties of *Chrysophanus phlœas*, captured in Kent, in September last, by Mr. Sabine; also a curious variety of *Argynnis cuphrosyne*, taken in Lancashire in May, 1893, by Mr. T. Baynes; a pallid variety of *Vanessa urticæ*, taken by Mr. W. E. Cox in Monmouthshire, in July, 1893; and a *Triphæna pronuba*, the right wings of which were typical, and the left wings resembled the variety *innuba*, caught at sugar, in Dovedale, Derbyshire, by Mr. Blagg, in July, 1893.

Mr. G. H. Verrall exhibited a specimen of the Tsetse (*Glossina morsitans*), and also one of the common European allied species (*Stomoxys calcitrans*). He also exhibited a specimen of *Hæmatobia serrata*, Dsv., which he stated was not uncommon on cattle in England, but believed to be harmless; while in North America the dreaded "horn-fly" is said to be the same species.

Mr. Elwes exhibited a larva which he had found three days previously under stones on a moraine, apparently quite destitute of vegetation, in the Austrian Tyrol, at an elevation of about 7000 feet. He remarked on the number of Alpine butterflies, some of them in fresh condition, which he had seen whilst chamois-hunting in the Tyrol during the last

week, and he suggested that in such a fine autumn as the present one collectors might find more novelties among the larvæ of Alpine species than in the summer.

Papers, &c., read.

Colonel Swinhoe read a paper entitled "A List of the Lepidoptera of the Khasia Hills" (Pt. 2). Mr. Elwes said he thought all entomologists would be grateful to Colonel Swinhoe, Mr. Hampson, Mr. Meyrick, and others, for the work they had recently been doing in describing the moths of India; but as the district of the Khasia Hills was probably richer in species than any other part of India, except Sikkim, and new species were being received almost daily, it was impossible to make any list complete. He regretted that Colonel Swinhoe had not given fuller details as to the physical conditions of the localities in which the species he described were taken. These, however, had been well described by Sir Joseph Hooker in his "Himalayan Journals," which Mr. Elwes considered one of the most interesting books of travel ever written.

Mr. Jacoby, Mr. McLachlan, Mr. Jenner Weir, and Colonel Swinhoe continued the discussion.

Mr. E. Meyrick communicated a paper entitled "On a Collection of Lepidoptera from Upper Burma." The author stated that the species enumerated in the paper were collected by Surgeon-Captain Manders whilst on active service in the Shan States and their neighbourhood, shortly after the British annexation of the territory, and that most of the country visited was previously unknown to Europeans, and highly interesting. The unhealthy climate, however, kept Dr. Manders's hands full of other work, and the constant presence of hostile natives made collecting always dangerous, and often impossible; whilst a wound from an enemy in ambush eventually led to his being invalided home when just about to visit some of the most promising regions.

A discussion followed, in which the President, Surgeon-Captain Manders, and Colonel Swinhoe took part.

November 8, 1893.

Henry John Elwes, Esq., F.L.S., F.Z.S., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Election of Fellows.

Mr. Henry Jerome Turner, of 13, Drakefell Road, Hatcham, S.E.; Mr. F. W. Urich, of Trinidad, West Indies; and Mr. John Cooper Webb, of 32, Henslowe Road, Dulwich, S.E., were elected Fellows of the Society.

Exhibitions, &c.

Mr. F. Merrifield exhibited some low-temperature forms of *Vanessa atalanta*, artificially produced, which showed a great reduction in the area of the scarlet bands on the wings, and a great increase in the area of the white and bluish markings.

Professor E. B. Poulton described and illustrated, by means of a map, a simple method for showing the geographical distribution of insects in collections. Below the name-label of the genus, and of each species, are placed coloured slips of such a size as to be distinctly visible at a distance; and the colours, with one exception, correspond with those made use of in the map at the beginning of vol. i. of Dr. A. R. Wallace's 'Geographical Distribution of Animals.' The exception referred to is the Palæarctic Region, which is coloured blue, instead of pale brown, as in the original. Framed maps of the same kind, and coloured in the same way as the one he exhibited, are placed in the museum, so as to be readily seen from various groups of cabinets. In these maps the names of the Regions, and numbers of the Sub-Regions, are distinctly printed, so that they can be read at a considerable distance; while the sea is left uncoloured. Thus the regional distribution of genus and species can be comprehended at a glance. The Sub-Regions are also indicated; for upon each coloured slip a rectangular area divided into four squares is printed. In these squares the numbers of the Sub-Regions over which the genus or

species ranges are written in ink, the numbering proceeding from left to right. Hence the Sub-Regional distribution can be learnt with the expenditure of only a little more time than that necessary for learning the Regions. In this way many of the advantages of a classification based primarily on geographical distribution appear to be gained by a collection classified in the ordinary way so as to represent zoological affinities. Prof. Poulton added that the method he had described was being gradually introduced into the Hope Collections at Oxford.

Mr. McLachlan stated that a somewhat similar plan to that described by Prof. Poulton, for showing the geographical distribution of insects, had been adopted in the Brussels Museum by Mons. Preudhomme de Borre.

Mr. W. F. H. Blandford said he had visited the Brussels Museum, and could confirm Mr. McLachlan's statement.

Dr. Sharp expressed the opinion that it would be desirable for some museums to keep their collections, or a portion of them, geographically or faunistically arranged.

Mr. C. O. Waterhouse also remarked that it would be useful if a geographical collection could be kept in museums.

Mr. Stevens stated that in Haworth's collections insects of different counties were arranged with various coloured labels, indicating the region or district from which they had come.

Mr. C. J. Gahan, Mr. Osbert Salvin, and the President continued the discussion.

Prof. Poulton in reply stated that many of the advantages of a geographical classification could be gained by labelling the outside of the drawers with the names of the contained genus or genera, together with the coloured slips which denote the distribution. If, then, the insects of any one Region were under consideration, only the drawers bearing the appropriate strips would be opened.

Dr. Sharp read the following extract from Dr. Livingstone's 'Narrative of an Expedition to the Zambesi,' and stated that he was indebted to Mr. Gahan for calling his attention to it:—"We tried to sleep one rainy night in a native hut, but could not because of attacks by the fighting battalions of a

very small species of *Formica*, not more than one-sixteenth of an inch in length. It soon became obvious that they were under regular discipline, and even attempting to carry out the skilful plans and stratagem of some eminent leader. Our hands and necks were the first objects of attack. Large bodies of these little pests were massed in silence round the point to be assaulted. We could hear the sharp, shrill word of command two or three times repeated, though, until then, we had not believed in the vocal power of an ant; the instant after we felt the storming hosts over head and neck, &c."

Papers, &c., read.

Prof. Poulton read a paper entitled "On the sexes of larvæ emerging from the successively laid eggs of *Smerinthus populi*."

This paper contained an account of a somewhat laborious experiment, in which many of the larvæ hatched from the eggs laid by one moth were reared separately until the pupal stage was reached, when the sexes were determined.

It was found that the relative proportion of the sexes was subject to immense fluctuation on the separate dates on which eggs were laid. As regards eggs laid on any one day, the sexes generally succeeded each other in little groups of irregular size. No law of succession of the sexes could be established.

The results were of sufficient interest to suggest the collection of further evidence of the same kind.

Prof. Poulton said that the most difficult and most important point is to number the eggs as they are laid by the female moth. To this end the moth is placed under a tumbler on a sheet of paper, and as soon as an egg is laid the tumbler is slightly raised, and gently pushed until the egg is outside its rim. The egg can then be numbered, while the moth is prevented from laying several eggs in a heap or crowded group, the numbering of which would present great difficulty, and would be liable to introduce errors.

Mr. Merrifield, Dr. Sharp, and the President took part in the discussion which ensued.

Mr. W. L. Distant communicated a paper entitled "On

the Homopterous genus *Pyrops*, with descriptions of two new species."

The President read a paper, written by himself and Mr. J. Edwards, entitled "A revision of the genus *Œneis*," which he characterized as the most cold-enduring genus of butterflies. Mr. Elwes also exhibited his complete collection of species of this genus, which was said to be the finest in the world. A long discussion ensued, in which Prof. Poulton, Mr. McLachlan, Mr. Salvin, Mr. Bethune-Baker, the Rev. Dr. Walker, Mr. Kirby, Mr. Merrifield, Mr. Barrett, Mr. Blandford, Dr. Sharp, and Mr. Jacoby took part.

December 6, 1893.

Henry John Elwes, Esq., F.L.S., President, in the chair.

Donations to the Library were announced, and thanks voted to the respective donors.

Exhibitions, &c.

Mr. W. F. Kirby exhibited, for Dr. Livett, a series of specimens of a moth taken at Wells, which Dr. Livett considered to be varieties of *Dasycampa rubiginea*, but which many entomologists present thought were varieties of *Cerastis vaccinii*. Mr. Kirby added that specimens similar in appearance to those exhibited had been taken rather freely during the past autumn in Berkshire, and it was suggested that they might be hybrids between *D. rubiginea* and *C. vaccinii*.

Mr. Lovell Keays exhibited, for Mr. Arthur Lovell Keays, a series of *Lycæna alexis*, with confluent spots on the under sides of the front wings. He drew attention to the fact that the insects were all taken within a short radius, and probably were in the ratio of about one in forty with reference to the ordinary form. All the examples, with one exception, were females. Mr. Lovell Keays remarked that he had some years ago met with a similar brood near Weymouth, in which the confluent spots were, as far as the specimens collected by him extended, entirely confined to females, and in that instance the proportion was much higher. Mr. Lovell Keays

expressed his willingness to indicate the exact spot to any Fellow of the Society visiting Weymouth during the coming summer, but he preferred not to publish it for obvious reasons. From the same town a specimen of *L. adonis*, ♀, with similar variation, was also exhibited. Professor S. H. Scudder, of Cambridge, Mass., U.S.A., stated that he had observed the occurrence of broods with suffused spots in America, but they were not confined to any special locality.

Mr. C. O. Waterhouse exhibited the type-specimen of *Coptomia opalina* of Gory, from the Hopeian Collection at Oxford, and pointed out that it was quite distinct from *C. mutabilis*, W. The distinct punctuation of the whole insect, and the striolate pygidium in *C. opalina*, were sufficient to distinguish it at once. Mr. Waterhouse called attention to this, as some French entomologists maintain that these insects are the same species. He also called attention to *Silpha atomaria*, of Linnæus (Syst. Nat., ed. xii., i., p. 574), a Swedish species which appeared to have escaped notice, and was not included in any catalogue. The type is still extant in the Linnean cabinet, and Mr. Waterhouse said he was of opinion that it is *Olibrus geminus* of our collections, but he had not had an opportunity of making a critical examination. He also exhibited male and female specimens of a *Helopeltis* (the Tea-Bug), which he considered a distinct species, and stated that it had occurred only in Assam.

Mr. M. Jacoby exhibited certain species and varieties of the genus *Ceroglossus* from Chili, and Dr. D. Sharp, Mr. J. J. Walker, R.N., and Mr. Champion made remarks on their geographical distribution.

Prof. Scudder exhibited the type-specimen of a fossil butterfly—*Prodryas persephone*—found in beds of Tertiary Age (Oligocene) at Florissant, Colorado. He said the species belonged to the *Nymphalidæ*, and the specimen was remarkable as being in more perfect condition than any fossil butterfly from the European Tertiaries. He also stated that he had found a bed near the White River on the borders of Utah, in which insects were even more abundant than in the Florissant beds. Dr. Sharp, Mr. Kirby, Mr. H. Goss, and the President took part in the discussion which ensued.

Mr. Goss exhibited hybernating larvæ of *Spilothyrus alceæ*, which had been sent to him by Mr. F. Bromilow from St. Maurice, Nice.

Papers, &c., read.

Mr. W. F. H. Blandford read a paper entitled "The Rhynchophorous Coleoptera of Japan. Part III. Scolytidæ." The author said that in this paper he gave the results of his examination of the collection of *Scolytidæ* formed by Mr. George Lewis in Japan, in 1880 and 1881. The *Scolytidæ* of his earlier collection were worked out by Chapuis and Eichhoff, who described 18 species, of which one was European. The latter writer, in his monograph on the *Tomicina*, added six species, and the number (together with one of Motschulsky's, not since recognised) amounted to 25 species. In the present paper it was raised to 98. Few were recognisable as existing out of Japan. Six were also found in Europe; and one or two others hardly differed from European forms. Only one Oriental species was recognised, but several genera were of an Oriental type, which on the whole predominated. The small number of previously described species was due to the meagre accounts which have been given of Oriental and North Asiatic forms. The best represented genera in Japan were *Hylesinus*, *Scolytus*, *Dryocætes*, *Xyleborus* (26 species, excluding male forms), and the *Platypini*. *Cryphalus* and *Tomicus* were at present poor in species. In conclusion Mr. Blandford said he desired to warmly acknowledge the admirable way in which Mons. G. Severin had facilitated his study of the types in the Brussels Museum. The President, Dr. Sharp, Mr. Champion, Mr. MacLachlan, and Mr. J. J. Walker took part in the discussion which ensued concerning the distribution of the group, and the admixture of Palæarctic and Oriental forms in Japan.

Mr. G. T. Bethune-Baker read a paper entitled "Notes on some Lepidoptera received from the neighbourhood of Alexandria," and exhibited the specimens. In this paper the list of captures was detailed, and about twenty new species or varieties were described. Several of Klug's species from Aden found their way up the Red Sea, as might have been expected,

otherwise the collection was quite typical of the Mediterranean basin, with the admixture of certain species from the Punjaub and Scindh; Algerian and Syrian types were most predominant. Mr. McLachlan suggested that the scarcity of insects in Lower Egypt was possibly to be accounted for by the fact that much of the country was under water for a portion of the year; and Dr. Sharp said that another cause of the scarcity was the cultivation of every available piece of land for centuries past. The President and Mr. J. J. Walker continued the discussion.

Mr. C. O. Waterhouse read a paper entitled "Further Observations on the Tea-Bugs (*Helopeltis*) of India."

Dr. F. A. Dixey communicated a paper entitled "On the Phylogeny of the *Pierinæ*, as illustrated by their Wing-markings and Geographical Distribution." The paper contained an analysis of the principal wing-markings, which were shown to be homologous, wherever they occurred, throughout the entire subfamily. Treating of them under the following main divisions—(1) the marginal, (2) the submarginal dark series; (3) the light areas between 1 and 2; (4) the discoidal spots; (5) the precostal yellow, and (6) the basal red of the hind wing under side—the author traced each series through the various Pierine genera, and stated that the first four seemed to take their origin from the gradual invasion of a primitive dark ground colour by patches of a paler tint, which at first bore a definite relation to the nervures and their branches, but soon tended to become confluent in all directions. An early stage of Pierine development was visible in *Eucheira*, *Catasticta*, *Delias*, and *Metaporia*, in many species of which genera much of the original dark ground colour persisted; while *Catasticta* and *Delias* both exhibited, in addition, the basal patches of brilliant colour on the under side of the hind wings, out of which were developed the last two of the characteristic kinds of markings. Putting together all the evidence afforded by these features in their successive modifications, the author endeavoured to sketch out the phylogenetic history of the whole group, incidentally discussing the various cases in which mimicry had acted as a disturbing influence, and showing that the affinities disclosed

by other structural points, and by the character of the pupa, when known, corresponded generally with those inferred from a comparison of the markings. The bearing of the geographical distribution of existing Pierine forms upon the preceding phylogenetic conclusions was then considered, and it was shown that the facts of distribution, taken in connection with what was known of the means of transit possible for insects, and especially of the migratory habits of certain Pierines, were in general accordance with the same conclusions. Looking at the whole assemblage of the *Pierinæ* as at present existing, Dr. Dixey said he was of opinion that the great bulk of them belonged to the stock headed by *Catasticta* in the New World, and *Delias* and *Metaporia* in the Old. There were, however, still existing relics of a perhaps more ancient Pierine fauna, among which might be reckoned *Elodina*, *Nychitona*, and the African species of *Mylothris*.

ANNUAL MEETING.

January 17, 1894.

Frederic Merrifield, Esq., Vice-President, in the chair.

Mr. J. Jenner Weir, one of the Auditors, read the Treasurer's Balance Sheet, showing a balance in the Society's favour of £10. 6s. 1d.

Mr. H. Goss, one of the Secretaries, read the following :—

Report of the Council.

During the Session 1893–1894 five Fellows have died, *viz.*, Professor Hermann August Hagen, M.D., one of the ten Hon. Fellows; the Rev. Leonard Blomefield, M.A., F.L.S., one of the last three original Fellows; Herr E. G. Honrath; Mr. A. C. Horner, M.R.C.S.; and Mr. Francis P. Pascoe, F.L.S.; three Fellows have resigned, and twenty-three new Fellows have been elected.

The number of Fellows elected during the year is not above

the average, and the Society is in need of a considerable increase in this respect to enable it to publish more papers, and allow more plates, and in other ways to advance its interests and promote its objects. The Council therefore earnestly hope that the Fellows will do their utmost to induce their friends to join the Society, and thus increase its usefulness.

At the present time the Society consists of 9 Honorary Fellows, 49 Life Fellows, and 308 paying the Annual Subscription, making the total number of Fellows now on the Society's List 366, which, after allowing for the losses by deaths and resignations, is an increase of 15 since the Annual Meeting last year.

The Transactions for the year 1893 form a volume of 481 pages, containing 25 memoirs contributed by the following authors, *viz.*, Mr. Henry J. Elwes and Mr. J. Edwards (2 papers), Mr. F. Merrifield, Dr. F. A. Dixey, M.A., M.D., Mr. K. J. Morton, Mr. W. L. Distant (2 papers), Dr. T. A. Chapman, M.D. (2 papers), Mr. J. Cosmo Melvill, M.A., Mr. Roland Trimen, F.R.S., Mr. M. Jacoby, Mr. T. D. A. Cockerell, Mr. C. J. Gahan, M.A., Dr. D. Sharp, M.A., F.R.S. (2 papers), Mr. W. Bartlett Calvert, Mr. J. W. Shipp, Mr. R. McLachlan, F.R.S., Professor L. C. Miall, F.R.S., Colonel C. Swinhoe, M.A., Mr. Osbert Salvin, M.A., F.R.S., Dr. Auguste Forel, Mr. W. F. H. Blandford, M.A., and Prof. E. B. Poulton, M.A., F.R.S. Of these 25 papers, 12 relate to Lepidoptera (or to enquiries in which Lepidoptera were the subjects of experiment), 4 to Coleoptera, 3 to Hemiptera, 2 to Neuroptera, 2 to Hymenoptera, 1 to Diptera, and 1 is on the subject of the Cost and Value of Insect Collections.

The memoirs above referred to are illustrated by 15 plates, of which 3 are coloured. The Society is indebted to the President for the cost of Plates I., II., and III.; to Mr. F. Merrifield for the cost of Plate IV.; to Mr. J. Cosmo Melvill and Mr. C. Hastings Dent for part of the cost of Plate VII.; and to Prof. Miall. F.R.S., for part of the cost of Plates X., XI., XII., and XIII.

The Proceedings, containing an account of the exhibitions and discussions at the Meetings, in addition to abstracts of

several of the papers published in the Transactions, extend to over 45 pages.

A printed Catalogue of the books and pamphlets in the Society's Library had long been under consideration, and its publication during the past year is a matter for congratulation.

During the past year about 200 books, pamphlets, journals, and papers have been added to the Library, and the Meetings have been better attended than in any previous year.

The Subscriptions received (notwithstanding those in arrear) amount to a larger sum than in any previous year, but only three Life-Compositions have been received.

The sales of publications show a considerable diminution as compared with some previous years.

The Balance Sheet, which you have just heard read, and which is appended to this Report, includes under the head of "payments" the cost of Part IV. of the Transactions for 1892, which was unascertained at the date of the last Annual Meeting. The cost of that Part was £136 6s. 5d., against which is to be placed a liberal donation by Professor Poulton towards the expenses of his lengthy paper contained therein.

As has been already remarked, the amount received from the sale of our Transactions again shows a diminution, and this is almost entirely due to a want of demand for the back stock; the sale of the current parts remaining practically stationary. The sale of back stock has always proved fluctuating and capricious, and it may be that when the great financial depression now existing has passed away a fresh demand will arise.

The only other item in the Balance Sheet that appears to call for special notice is the cost of the printed Catalogue of the Library. The total cost, including compiling, printing, binding, and distributing, has been £142 6s. 3d., the whole of which sum has been paid; so that there will be no further liability on this head until a Supplement is needed. This sum includes the item of £26 19s., which was actually paid in 1892, but which was transferred to 1893 by order of the Council. This happy result has been arrived at partly by a donation of £25 from Mr. Dunning, to whose generosity the

Society has been so often indebted ; partly by the transfer of the three Life-Compositions received during the year ; partly by the sum of £52 16s. received from Fellows for copies (a further small sum is still due by Fellows) ; and partly by a small amount taken out of the ordinary income of the Society. It is worthy of remark that only about half of the Fellows have subscribed to the Catalogue. Now that it has been published it is to be hoped that a considerable further sale will take place. This expensive matter being now out of hand, the Council hopes to place future Life-Compositions to their more legitimate purpose, that of adding to the invested funds.

The Subscriptions in arrear are slightly more than is usual; nevertheless, the Society commenced another financial year with £10 6s. 1d. in hand, and no ascertained liabilities.

11, Chandos Street, Cavendish Square, W.
January 17*th*, 1894.

The Secretaries not having received any notices of objection, the following Fellows of the Society were declared duly elected members of the Council for the Session 1894–1895 :— Mr. Walter F. H. Blandford, M.A., F.Z.S. ; Mr. George C. Champion, F.Z.S. ; Mr. Henry John Elwes, F.L.S. ; Canon Fowler, M.A., F.L.S. ; Mr. Charles J. Gahan, M.A. ; Mr. Herbert Goss, F.L.S. ; Mr Robert McLachlan, F.R.S. ; Mr. Frederic Merrifield ; Professor Edward B. Poulton, M.A., F.R.S. ; Colonel Charles Swinhoe, M.A., F.L.S. ; Mr. George Henry Verrall ; Mr. James J. Walker, R.N., F.L.S. ; and the Rt. Hon. Lord Walsingham, M.A., LL.D., F.R.S.

The following were the Officers elected :— *President*, Mr. Henry John Elwes ; *Treasurer*, Mr. Robert McLachlan ; *Secretaries*, Mr. Herbert Goss and the Rev. Canon Fowler ; *Librarian*, Mr. George C. Champion.

Mr. F. Merrifield (in the absence of the President through illness) then read the President's Address, at the conclusion of which Colonel Swinhoe moved a vote of thanks to Mr. Elwes for his Address, and for his services as President during the past year. This was seconded by Mr. J. Jenner Weir, and carried unanimously. Mr. Merrifield replied for the President.

Lord Walsingham then moved a vote of thanks to the Treasurer, Secretaries, and Librarian for their services during the past year. This was seconded by Mr. Waterhouse, and carried unanimously. Mr. McLachlan and Mr. Goss made some remarks in acknowledgment.

ENTOMOLOGICAL SOCIETY OF LONDON.

Balance Sheet for the Year 1893.

Receipts.	£	s.	d.
Balance in hand, Jan. 1st, 1893	138	5	1
Subscriptions for 1893	303	9	0
Ditto, in advance	14	14	0
Arrears	6	6	0
Admission Fees	37	16	0
Life-Compositions	47	5	0
Donations	43	18	0
Ditto, special towards Catalogue of Library	25	0	0
Sale of Transactions, &c.	61	4	3
Ditto, of Catalogue of Library	52	16	0
Interest on Investments	11	9	2
	£742	2	6

Payments.	£	s.	d.
Printing Transactions, &c.	291	8	8
Plates, &c.	90	7	6
Rent and Office Expenses	166	7	9
Books and Binding	26	12	3
Catalogue of Library, total cost	142	6	3
Subscriptions in advance carried to 1894	14	14	0
Balance	10	6	1
	£742	2	6

ASSETS.

Subscriptions in arrear (considered good), £10 10*s.* 0*d.*

Investments:—

Cost of £427 10*s.* 3*d.* Consols = £408 13*s.* 0*d.*

LIABILITIES.

(Nil.)

Robert McLachlan,
Treasurer.

Audited and found correct,

J. Jenner Weir.
F. Merrifield.
Osbert Salvin.

10th January, 1894.

THE PRESIDENT'S ADDRESS.

Gentlemen,

In assuming the Presidency of this Society last January, I felt grave doubts as to whether my doing so would be conducive to the welfare of the Society, because in the first place I felt that the amount of knowledge I have been able to acquire, covered but a small part of the great order of insects, and therefore would not enable me to offer the remarks and criticisms which are expected from the President on many of the varied objects which are exhibited at our meetings in a manner that would satisfy all; and secondly, because, like many others of your members, I find that the time which I am able to snatch from the numerous duties, interests, and pleasures which crowd upon one is too little to enable me to attend to the affairs of the Society as I should wish to do.

I also felt that there was a desire among some of our Fellows that the chair should be filled by one who has devoted himself more to what is now called the biological side of the subject, rather than to the collection and systematic arrangement of Lepidoptera, which has been, and will probably remain, the principal object of my entomological studies. I feel, however, for myself, and I think that others must also feel, that however great and important is the knowledge which we may ultimately attain by endeavouring to discover the laws which govern the development, variation, and distribution of insects, the knowledge we have of the actual facts is in many cases quite insufficient to bring such speculations to a definite end. I also feel that the number of persons whose talents are sufficiently great to enable them to steer a

straight course through the numerous difficulties, contradictions, and doubts, which constantly surround such enquiries is very limited; and that if it was conceded that by such work alone the highest ranks of science could be reached, a great check would be placed on the humble endeavours of persons like myself, who find their greatest pleasure in collecting and arranging the material which must form the only solid foundation for such work as has been done by Darwin, Wallace, Bates, Weismann, and others.

Once or twice in a generation perhaps some surpassing and far-seeing intellect will arise, who can explain the phenomena of nature in a way that all can follow him, but such work is not possible to most of us; and personally I shall be content if I am able, by careful and orderly collection and exact observation, to provide the raw material for such deeper speculations. When, however, we see that nearly all the greatest naturalists have begun by being travellers, collectors, and to some extent systematists, and that no one can speculate with advantage until he has a very intimate knowledge acquired by personal study of some one order or family; and also how impossible it is for any man to work at all families of insects; I believe we must all acknowledge that even a humble collector of Lepidoptera has it in his power to observe and place on record facts which must be of greater eventual importance than they now seem, provided that accuracy of observation and record are strictly attended to.

I am very glad to see that our Society continues to increase in a satisfactory manner; that its meetings are better attended than ever, and that though we still are, as we always have been, hindered by lack of funds from publishing and sufficiently illustrating the work of our Fellows, yet our 'Transactions' are increasing in size and in interest, and that the library, which forms an indispensable foundation for all our work, is larger, better arranged, and more accurately catalogued than ever before.

We have received a bequest from our late lamented Life-President, Prof. Westwood, which will enable additional plates to be given in our 'Transactions' in future years, and this

example will, I hope, be followed by others, as an increase in our invested property, which is still very small, is one of the most pressing wants of the Society.

The vacancy on the staff of the Royal Agricultural Society, caused by the retirement of Miss Ormerod from the honorary position of consulting entomologist, which she had so well occupied, has been filled by the appointment of Mr. Cecil Warburton, M.A., to the salaried office of zoologist, though it may well be doubted whether the Council can reasonably expect any one man, in addition to a knowledge of general Zoology, to be qualified to make the very difficult investigations on the habits of all kinds of insects injurious to farm crops which are required of an economic entomologist. And I must add that, as a practical farmer, as a gardener, and as a planter, my experience leads me to doubt whether, even when the life-histories of noxious insects have been thoroughly worked out, we shall be able in nine cases out of ten to apply that knowledge economically to their destruction. In the case of valuable crops occupying small areas of ground it may sometimes be done, but rarely, if ever, in the case of generally cultivated and less valuable plants. And, as long as farmers and planters are not fully convinced of the efficacy of scientific preventive measures, which I personally may say, as a general rule, I am not, it would be impossible to expect such a general adoption of any measures which might be recommended for the destruction of insect-pests as could alone render them successful.

The comparative activity in this branch of our science shown in the United States is very marked, and it is not too much to say that there is more done by some individual States of North America than by Great Britain. The use of insecticides in America has been adopted by farmers and gardeners much more largely in the United States than in England, on account of the much greater severity and more general attacks of insects, and the measures which have been adopted by Professor Riley and his numerous assistants and followers have often been highly successful.

We cannot sufficiently thank the Department of Agriculture at Washington for the support that they give to this branch of our science, and the liberality with which their publications are distributed both at home and abroad.

The Hope Professorship at Oxford has been filled by one of our most active Fellows, Prof. Poulton, F.R.S., who has already shown that he intends to rescue the collections under his charge from the state of neglect into which they had of late years been drifting. I am sure we shall all wish him success in the task.

A great deal of activity prevails among entomologists at the present time, several of the most important works on Lepidoptera having made rapid progress during the last year.

Among them, Leech's 'Butterflies of China and Japan, one of the most beautifully got up and important faunistic works that have ever appeared, is nearly approaching completion, and reflects great credit both on Mr. Leech and Mr. South, who has lately taken a considerable share in it.

Hampson's 'Moths of India' is another work which deserves the very highest commendation, and will not only be of invaluable assistance to all entomologists in India, but creates a new and complete classification for Oriental Heterocera, which was very much needed.

Edwards's 'Butterflies of North America' has appeared at more frequent intervals, and has been more generally interesting than in any recent year, and though it is hardly possible to hope that it can ever be completed by the author, yet it stands almost alone, as far as it goes, as a work of art, and for its descriptions of the early stages of many little-known species.

Moore's 'Lepidoptera Indica' makes steady but slow progress in the hands of its veteran author, whilst de Nicéville's 'Butterflies of India' is believed to be nearly completed, though no volume has been published in the last year.

Our late President and Mr. Salvin continue the Herculean task which they have undertaken of figuring and describing the wonderfully rich fauna of Central America in a manner

worthy of their scientific renown; so that, even if it can be said that the Society is too much controlled by lepidopterists, it must at the same time be allowed that the activity of workers in this most attractive branch of Entomology is not confined to our 'Transactions.'

On the Continent a similar activity prevails. The Grand Duke Nicolas Mikhailovitch, aided by several energetic workers, continues to publish and liberally distribute his splendid Memoires.

M. Charles Oberthür has now reached the 18th Livraison of 'Etudes Entomologiques,' and though he has introduced in the last part of it some of the least euphonious and most barbarous sounding specific names I have ever heard of, has beautiful illustrations in the best style of French art.

The veteran Dr. Staudinger devotes every moment which his health will allow him to give to the completion of the third and anxiously-awaited edition of his Catalogue of the Lepidoptera of the European Fauna, and the additions to this fauna have been so numerous in the twenty-three years which have elapsed since the last Catalogue was published that we may expect it to be of the highest interest when published, as it is based, like the last one, on perhaps the most complete and carefully studied collection which has ever been formed in any branch of natural history.

Our new honorary member's revision of the System of Orthoptera in the Annals of the Genoa Museum is a most valuable aud excellent piece of work, and the first volume of the new catalogue of Hemiptera by Lethierry and Severin is also very valuable. I am not aware that anything of first-rate importance has been published on the anatomy, physiology, or embryology of insects, but Müller's pamphlet on the fungi cultivated by ants is said to be an interesting work.

And now I wish to call your attention to a subject of great and rapidly increasing difficulty, which applies perhaps more strongly to entomological than to ornithological or botanical work. It is the rapid increase of the number of short notes, descriptions, and papers on Entomology, and the great number of periodicals in which they are published.

The first thing that any man must do before putting on record his own observations is to see what has been written by others on the same subject, and unless he is so rich that he can afford to purchase very largely, or has easy access to such a public library as can hardly be found out of the great European capitals, he finds a great many papers which he is unable to consult. If, after a great expenditure of time, labour, and money, he does succeed in getting access to most of them, he too often finds that a great deal of his time is lost, because so many of the papers and descriptions are fragmentary, incomplete, and inaccurate. These faults largely arise from the very difficulties I have mentioned, for, though some men are so careless that they will not take the trouble to consult the sources of information which are at hand, many more with the best possible intentions are quite unable to do so; and thus the state of things becomes constantly worse. Men who would rather not write than write incompletely or inaccurately are deterred from writing at all, and others, perhaps too many others, are tempted to follow bad examples, and thus the standard of work is set low, instead of high.

This state of things may to some slight extent be kept in check by societies like our own refusing to publish papers which do not come up to a proper standard; but there are always smaller and newer societies to be found who will publish almost anything written by their members, and as long as the rules of science oblige us to recognise all descriptions, however and wherever published, this difficulty will continue to increase.

The time for reformation has come, and though I fear there will at first be grave difficulties in getting such an international agreement on the question as shall have power to make its laws binding, yet I think that if the Royal Society would appoint a committee to enquire into and report on the subject a great deal would be gained.

Dr. Sharp, who, as editor of the 'Zoological Record,' is probably more able than any other of us to realise the extent of the evil, knows better than I do how many of the 1026 separate papers on Entomology which he has catalogued in the

last year's Record are generally accessible, and how many of them would be worth consulting if they were. I should not like, by giving instances of what I consider unnecessarily published papers or periodicals, to raise opposition to a reform, but no one who knows the facts can deny that there are many of them.

We do not desire to check the publication of papers by beginners, or to throw cold water on the efforts of small local societies to create and develop local interest in science, or to obstruct the descriptions even of mere priority seekers. But we do want to have such rules as will prevent the honest and conscientious naturalist of small means or isolated residence from being entirely at their mercy, and unable to work in a manner that will satisfy the modern requirements of science.

My own idea is that if each country, or each group of countries, using the same language, would select some existing entomological journal, or if no suitable one exists, found one, in which the description of every new species should be published before it could be recognised, we should attain two great points without interfering with any existing interests.

First, we should have no more questions about dates of publication, which are often considerably antedated in private works published in parts, like Moore's 'Butterflies of India,' or by some of the smaller and less regular serials; and secondly, we should run no risk of overlooking descriptions of new species published in little-known local periodicals.

We should not take away the power that every writer has of publishing his descriptions and papers where he likes, but we should oblige him, if he wishes to have his writings recognised by scientific men, to conform to the laws established by scientific men for their mutual protection and advantage, by sending a *précis* of his paper, and a copy of his descriptions, to the recognised medium for their publication. Personally, I would be inclined to restrict his choice of language to four or five—Latin, English, French, and German; Spanish might possibly be added, as spoken over a larger area of the world's surface than even French,

though the speakers of Spanish have hitherto not shown sufficient ardour in scientific pursuits to have much claim to international consideration.

In countries like England, Germany, and the United States of America, which have a large number of working entomologists, it would probably be convenient to divide the record into subjects, so as not to oblige lepidopterists, coleopterists, or dipterists pure and simple to purchase a very much larger quantity of matter that they could not use. But countries which have but few workers, or which only have them from time to time, might be obliged to group themselves for the purpose of a record in such manner as was decided by an international congress, and colonists might be required to make use of the record of their parent country.

All these and many other details would no doubt require time and consideration to determine, but I venture to think that if the Royal Society took the matter up, and, after it report had been circulated, an international congress was convened, we should find that minor difficulties could be settled; and, as a last resort, countries or persons refusing to conform to the decision of such an international congress, could be scientifically ignored until they did.

Another point to which I should like to call the attention of collectors, and especially dealers, is the importance of making and keeping an accurate record of the locality of specimens, and the name of the person by whom they were taken.

Though we are constantly seeing instances of the laxity of our predecessors in this respect, I fear that even now the importance of good locality labels is not recognised by some owners of large and growing collections. Very many specimens are constantly received from remote and little-known places, and sold, given away, or exchanged without such labels. In setting or resetting the tickets get changed or mislaid, and the value of the specimen is to a great extent entirely lost. Coloured tickets, or labels, with merely the name of some obscure village or camp, which cannot be found on an ordinary map, may serve the purpose of the collector

himself, but are of little use to others; and loss of memory, or the death of the owner, may thus render valueless specimens which if fully labelled at first might have been of the greatest scientific value.

The reverence which has usually been shown to so-called type-specimens is, however, in my opinion, often entirely misplaced, for unless a type is really typical, which in variable species it often is not, and unless it is in sufficiently good condition to show its characters perfectly, it may only, and often does only, tend to obscure and confuse. There are many types in public and private collections which, from a scientific point of view, would be far better destroyed, and the names founded on them ignored; but the love of describing is so great in some minds that we cannot hope to abolish the practice of naming imperfect or insufficient specimens. All we can do is to refuse to recognise those guilty of such practices as deserving of anything but reprobation.

I have been led to make these remarks from personal experience of the difficulty, and even impossibility, of following the descriptions or recognising the characters of many so-called species from North America, where a great deal still remains to be done in working at the distribution, variation, and classification of many common species. In the United States entomologists seem to be even more behind botanists and ornithologists than in other countries, for, though two of the best, if not the two very best, collectors now living are Americans, there are not enough entomologists of leisure, means, and ability to have made much impression on the task; and even in the most popular branch of the subject, namely, Lepidoptera, there does not as yet exist a single handbook which will help a student to identify his captures in the south or west. Having spent parts of two summers most delightfully in collecting in the United States, I hope to return to this subject at a later period, and will not now enlarge upon it.

Among the names of those Fellows of the Society and others who have died during the past year, there are, I am glad to say, none who will be as much missed at our meetings

as those whom we lost in 1892, and the obituary notices on some of them, so ably written by our valued Treasurer in the 'Entomologist's Monthly Magazine,' absolve me from the necessity of saying very much about them. Among our Fellows we have lost :—

Dr. Hermann August Hagen, M.D., Professor of Entomology in Harvard University, U.S.A., died at Cambridge, Mass., on Nov. 9th, in the seventy-seventh year of his age. He had been a Honorary Fellow of our Society since 1863, and for nearly twenty years had had charge of the entomological collection at Harvard. He was a good general entomologist, best known to the scientific world as the author of the 'Bibliotheca Entomologica.' He was a native of Germany, but had become naturalised in America. His papers on *Parnassius* and *Colias*, published in 'Papilio' a few years ago, showed that his views on classification were broader than those of many American lepidopterologists, and it is a subject for regret that he had not been able to continue them.

The Rev. Leonard Blomefield, M.A. (better known under his former name of Jenyns), died at Bath on Sept. 1st, in his ninety-fourth year. He was called the "father" of the Linnean Society, which he joined in 1822, and was an original member both of the Zoological and Entomological Societies. He was essentially a field naturalist, and was best known as the author of 'British Vertebrate Animals,' published in 1836. He had also written some papers on insects, but hardly enough to be reckoned as an entomologist, though one of the best all-round naturalists of a bygone time.

Mr. Francis P. Pascoe, F.L.S., died at Brighton on June 20th, at the age of eighty years. He joined our Society in 1854, and was President in 1864–65, and for many years was one of the most regular attendants of our meetings. He was at one time a surgeon in the navy, and had travelled much in many countries, including a journey to the Amazons for the special purpose of collecting Coleoptera, in which order he was mostly interested. He had written largely on *Longicornia*, *Colydidæ*, *Curculionidæ*, and other families, and had accumu-

lated a large collection, which was sold to the British Museum not long before his death. Though I had not the pleasure of knowing him personally, I believe that he was an extremely amiable and sociable man, and though not perhaps in the highest rank as regards his scientific attainments, was a true naturalist, and a most industrious worker.

Professor Wood-Mason, who was formerly a Fellow of our Society, died at sea on his return from India, on May 6th, at the age of forty-seven. He had for the last fifteen years or more been employed at the Calcutta Museum, first as assistant, and latterly as director, in which capacity he succeeded Dr. Anderson. He was one of the late Professor Westwood's most distinguished pupils, and always spoke of him as the greatest entomologist of his time. Prof. Wood-Mason at one time was an active worker, and paid special attention to the *Mantidæ* and *Phasmidæ*, on which he published several important papers in the Journal of the Asiatic Society of Bengal. He also, in conjunction with Mr. de Nicéville, worked out and wrote papers on several collections of Rhopalocera made by himself and others in Assam, the Andaman and Nicobar Islands. Of late years, owing no doubt to failing health and the heavy duties of his position in charge of the Calcutta Museum, and as one of the secretaries of the Asiatic Society of Bengal, he had not published much.

Arthur Horner, M.R.C.S., died suddenly at Tonbridge, where he was in practice as a surgeon, on Aug. 3rd. He had long been known as a British coleopterist, and was surgeon to the 'Pandora' during a voyage to the Arctic Regions in 1875–76. He had been a Fellow of our Society since 1886.

The Rev. Henry Burney, M.A., died on July 16th, in his eightieth year, at Wavendon, Bucks. He was well known as a student of British Lepidoptera, of which he had a fine collection, which was recently disposed of by auction, and realised a very high price, showing that the mania for authentic British specimens is as strong as ever.

Mr. John Charles Bowring, F.L.S., died on June 20th, aged seventy-two years. He was an ardent entomologist,

and formed a large collection of Coleoptera; but, from his retiring disposition, was little known in the scientific world.

The Rev. F. O. Morris, B.A., Vicar of Nunburnholme, Yorkshire, who died on Feb. 10th, at the age of eighty-three, was well known for his popular works on British butterflies and British moths, which, though they have had a large circulation, are rather compilations than the works of an original observer. He was an extreme opponent of all modern ideas on Evolution, and in consequence held somewhat aloof from the scientific society of the present day.

Mr. James Batty, who died recently at Sheffield, was an excellent type of the artisan entomologist, who is, I am afraid, becoming rarer than formerly, notwithstanding the great increase of facilities for study and locomotion. He studied Lepidoptera in the field for many years, and discovered the larvæ of *Tapinostola elymi* and other species.

Herr Eduard G. Honrath died at Berlin on April 19th. He had for many years been one of the principal dealers in modern pictures and works of art in Berlin, and for some time President of the Entomological Society of Berlin. As a lepidopterist he was active in forming a collection of European and exotic butterflies, which rivalled that of the late Mr. Hewitson in the larger and more showy genera, and was especially rich in species of the genus *Parnassius*. He described and published many new species in the Journal of the Entomological Society of Berlin, and was a Fellow of our Society.

Dr. Adolf Speyer died at Rhoden, Waldeck, on Nov. 14th, 1892, at the age of eighty, and a long account of his life was published in the 'Iris,' vol. vi., pt. i., pp. 37–68, by his relative, Prof. Otto Speyer. For fifty years he had been an enthusiastic lepidopterologist, and published as many as seventy separate papers in the 'Iris,' 'Stettiner Entomologische Zeitung,' and other periodicals. His principal work, and the one by which he was best known in England, was 'Die Geographische Verbreitung der Schmetterlinge Deutschlands und der Schweiz,' published in 1858 and 1862. This is the best work on the geographical distribution of European

butterflies I know of, and though now, in view of the great increase of our knowledge in the last thirty years, somewhat out of date, may still be usefully consulted in many cases.

In conclusion, I may say that the change in our hour of meeting, which has been made in deference to the expressed wishes of a very large majority of our Fellows, will be generally approved, and that our meetings will thereby be rendered more sociable and not less scientific than they have been.

INDEX.

Where the name only of the Genus or Species is mentioned, the description will be found on the page referred to.

The Arabic Figures refer to the pages of the 'Transactions'; the Roman Numerals to the pages of the 'Proceedings.'

The new genera and species will be found in the detailed index, but certain of the longer papers are arranged under their separate headings.

GENERAL SUBJECTS.

ARACHNIDA.

Trap-door spiders from Bahia, Brazil, exhibited, xvii.

COLEOPTERA.

DIPTERA,

HEMIPTERA.

HYMENOPTERA.

LEPIDOPTERA.

NEUROPTERA.

ORTHOPTERA.

WEST, NEWMAN AND CO., PRINTERS, HATTON GARDEN, LONDON, E.C.

F. del.

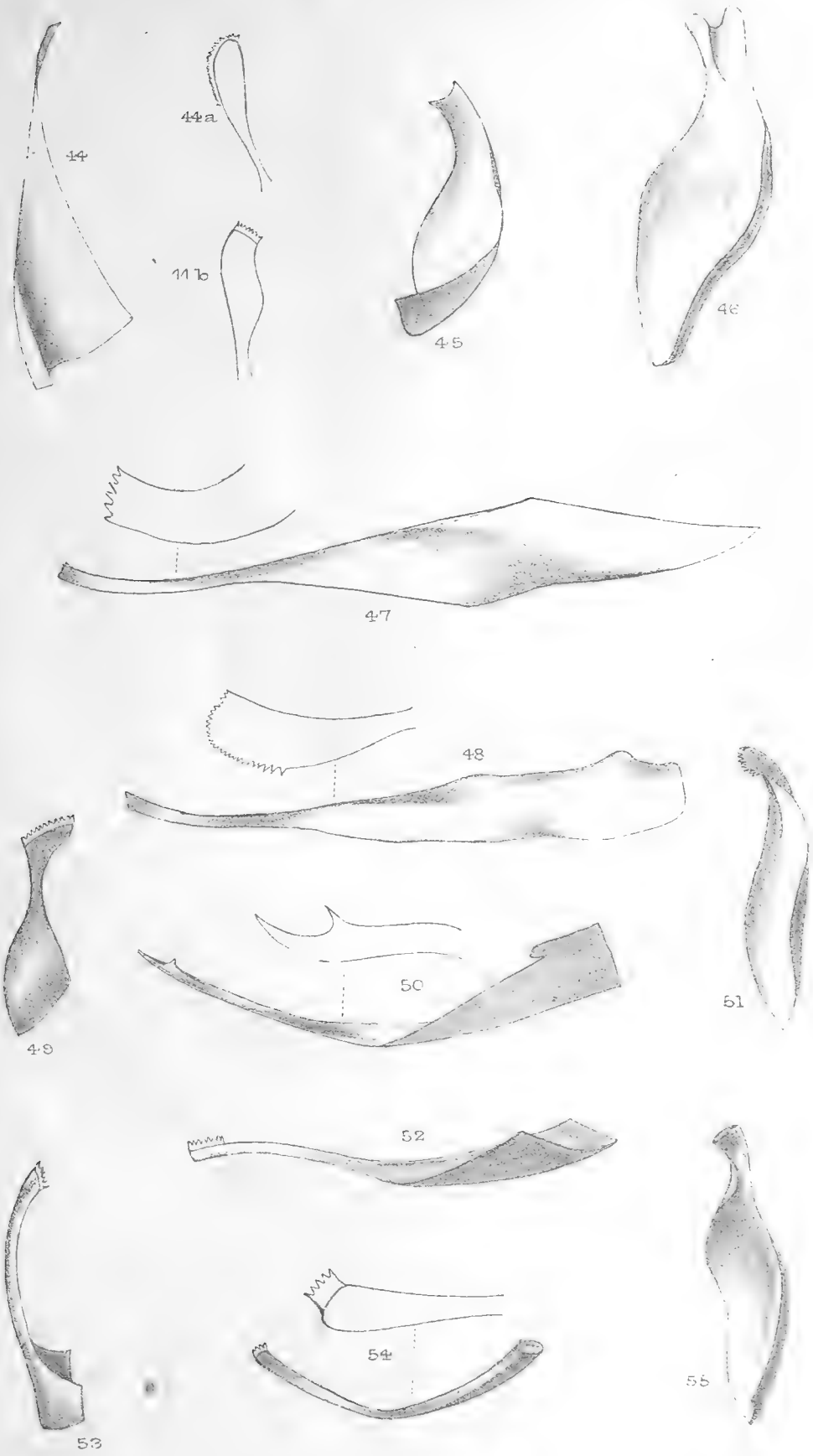
West, Newman, lith.

♂ GENITALIA OF SPECIES OF YPTHIMA.

F del

West, Newman lith.

♂ GENITALIA OF SPECIES OF YPTHIMA.



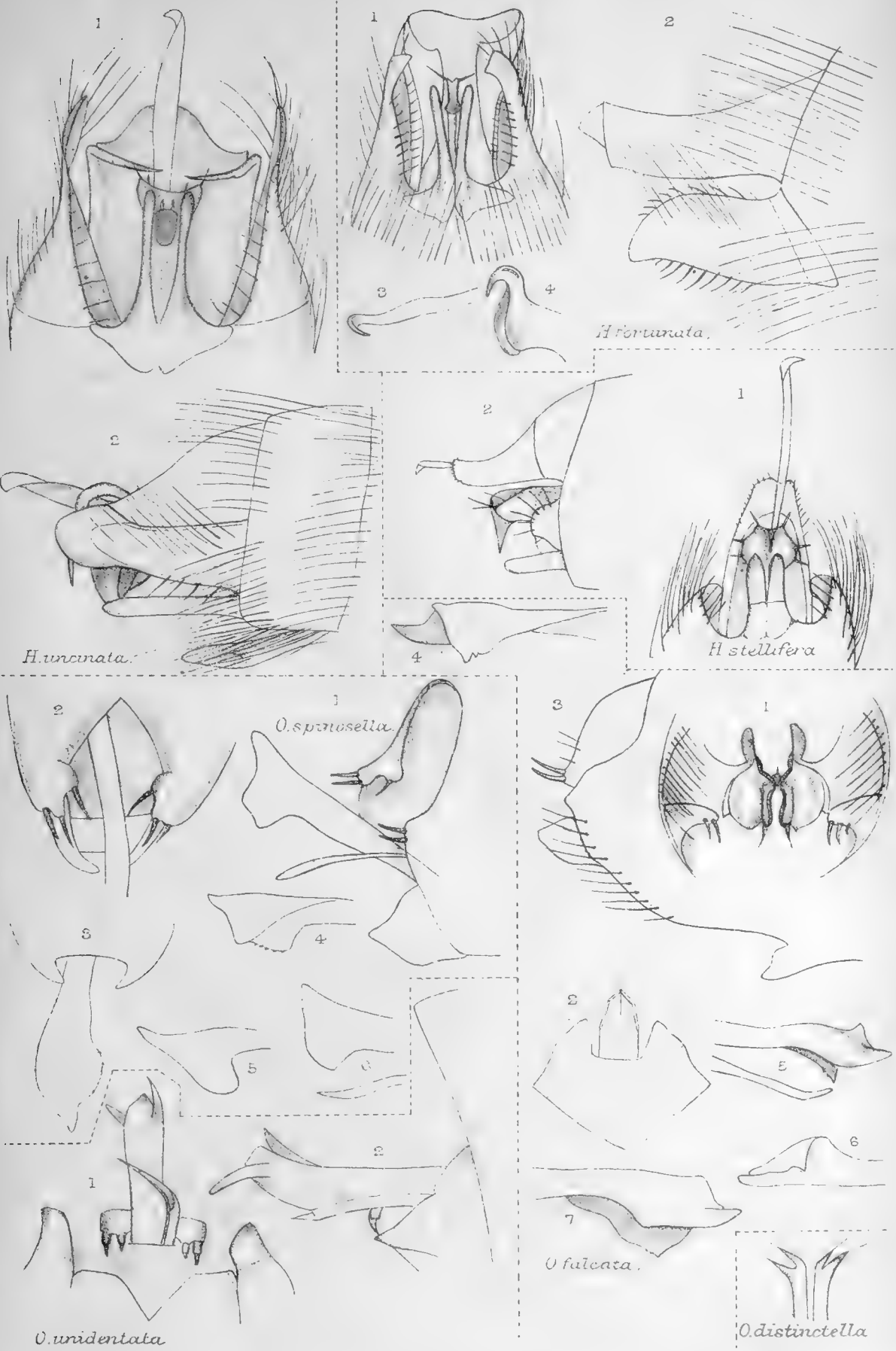
F. del.

West, Newman lith

♂ GENITALIA OF SPECIES OF YPTHIMA.

F.W.Frohawk del. et lith. West, Newman, chromo

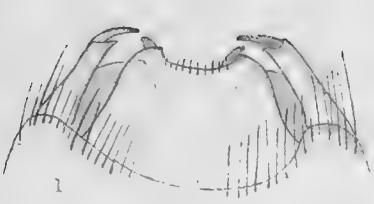
Variation caused by temperature during the pupal stage,
1, 1a, 3, heat. 4, temperate, 2, 2a, 5, 5a, cold.

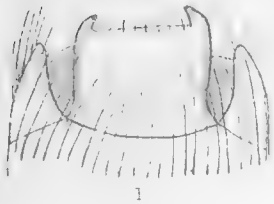


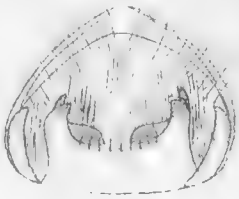
K.J.M. del.

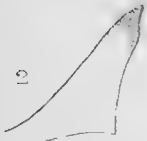
West, Newman lith.

HYDROPTILIDÆ





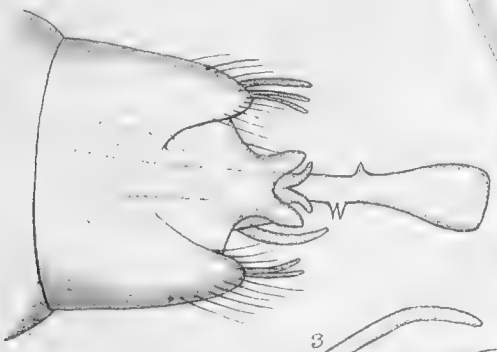




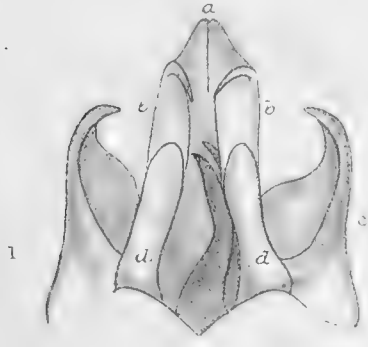
O costulis

H Maclachlani

O. ecornuta.



O. Frica.



S atra

K.J.M. del.

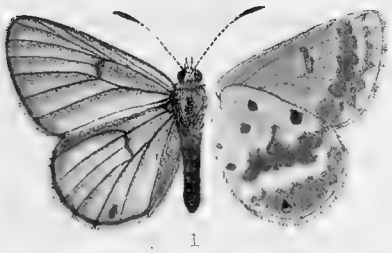
West, Newman lith.

1

2

West, Newman ad nat. chromo

Calinaca Sudassana.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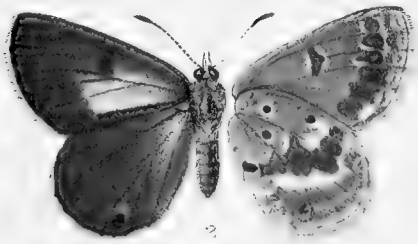
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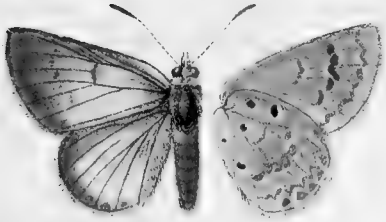
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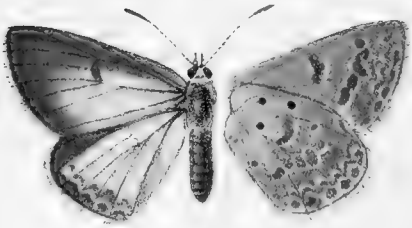
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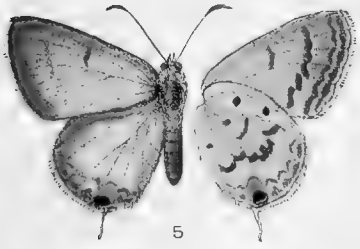
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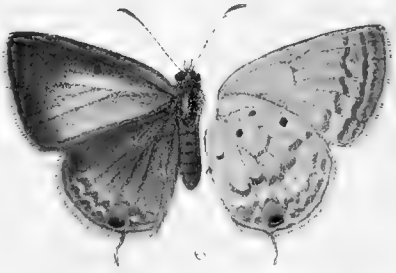
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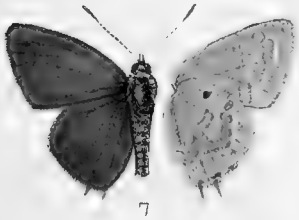
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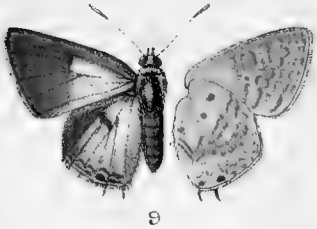
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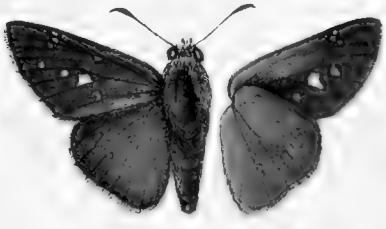
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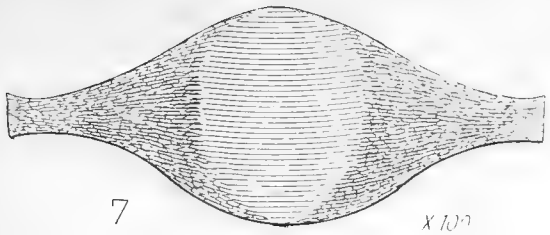
West, Newman ad nat. chromo.

South African Lycænidæ & Hesperidæ.



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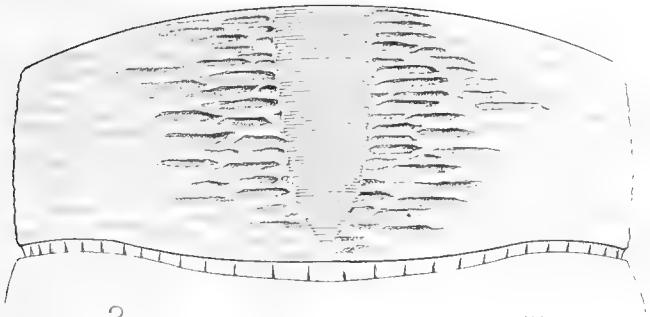

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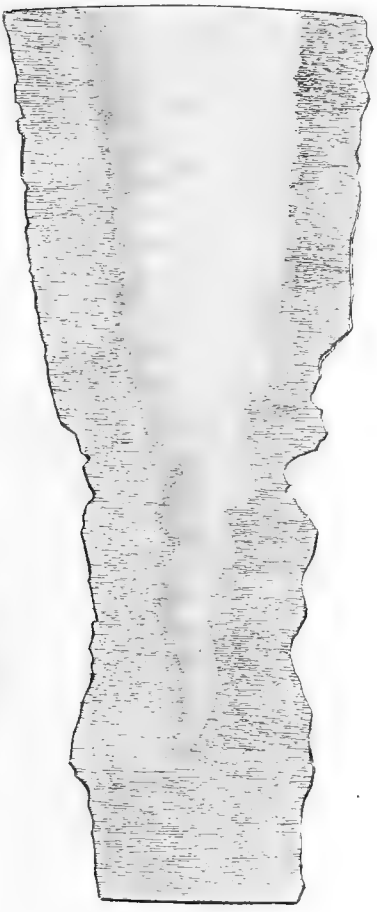

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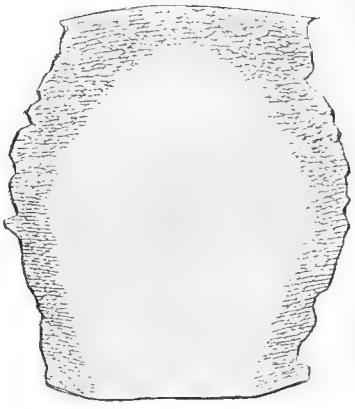

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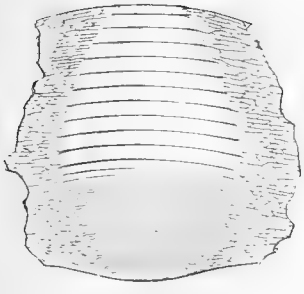

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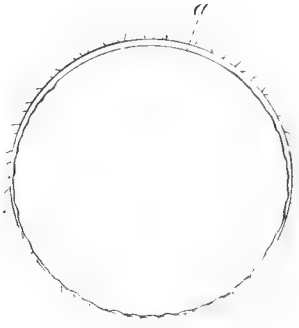

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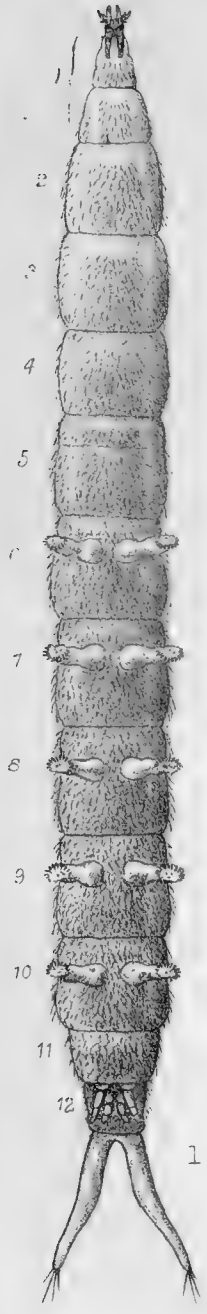
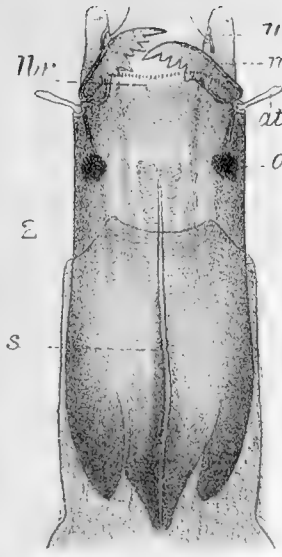
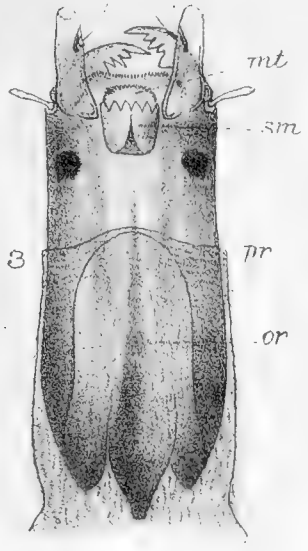
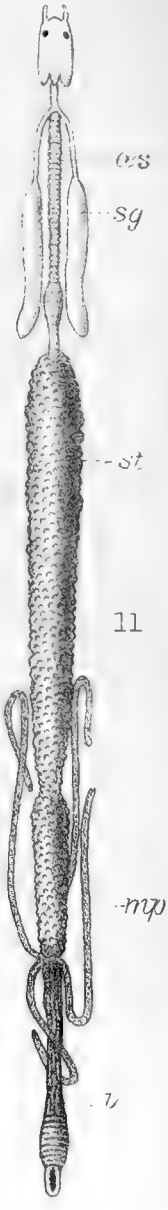
Organs of Stridulation of Ants.

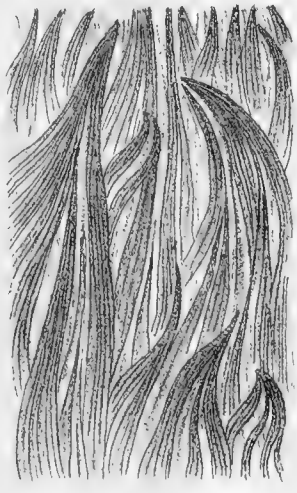
Edwin Wilson del et lith. Cambridge

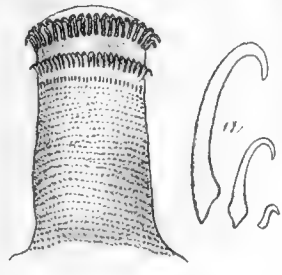


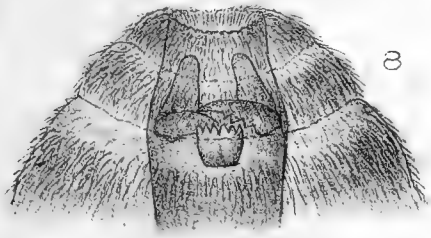








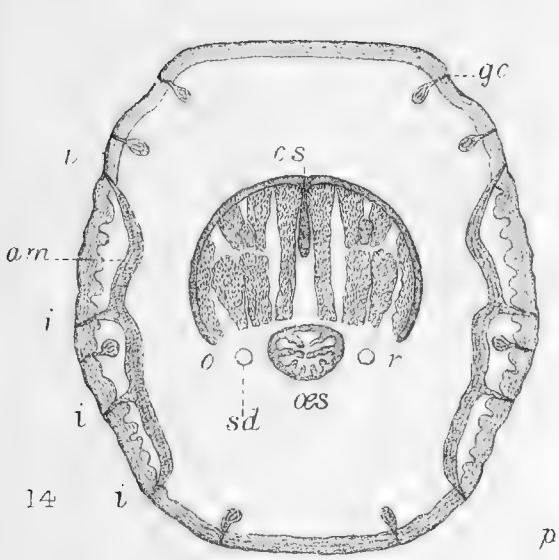




A.R. Hammond lith.

West, Newman imp

Dicranota.



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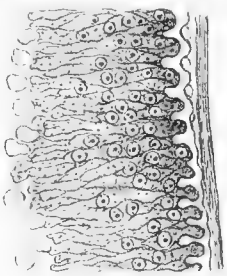

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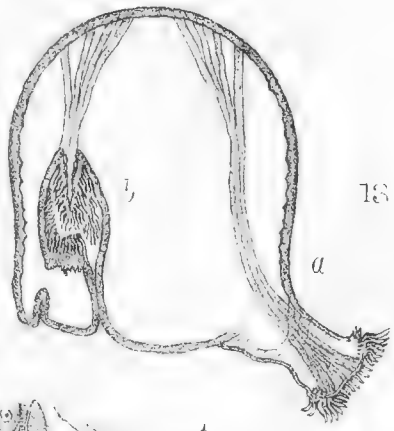

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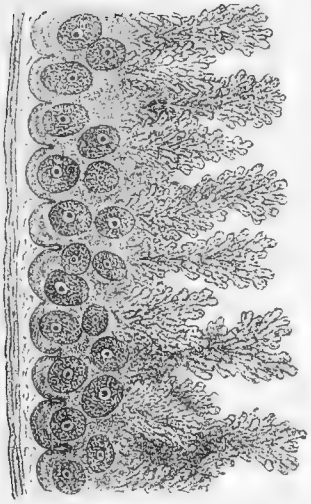

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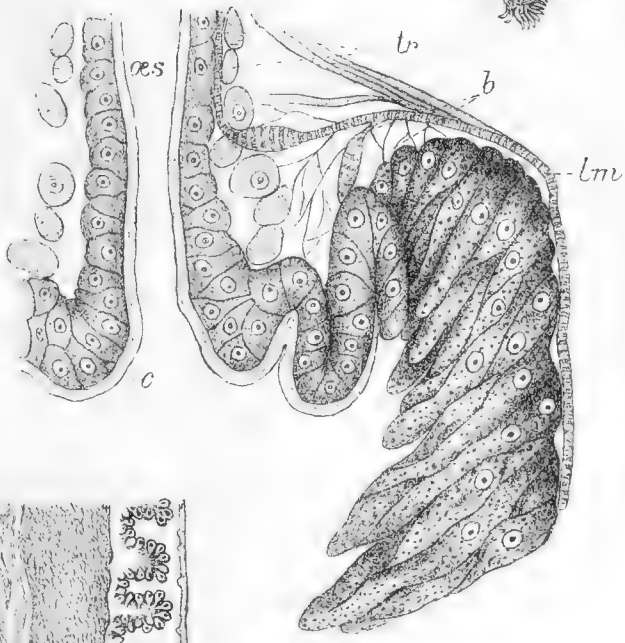

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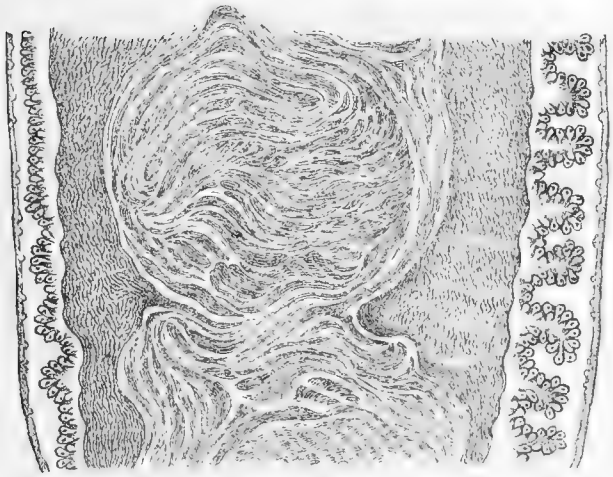

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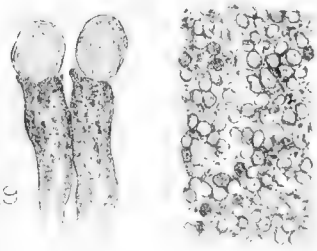
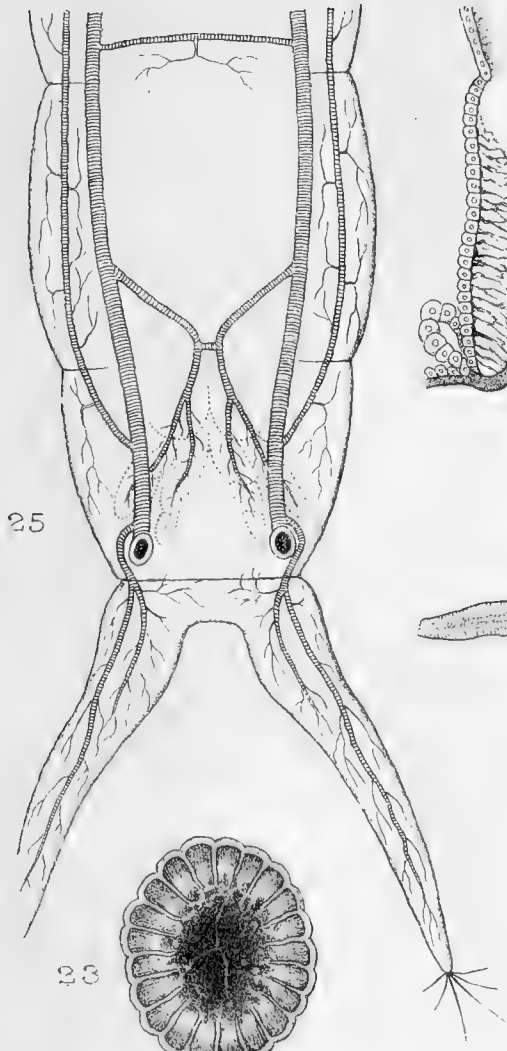


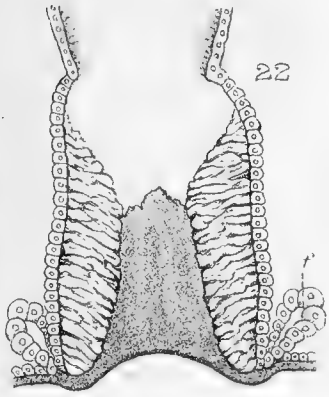
19 20

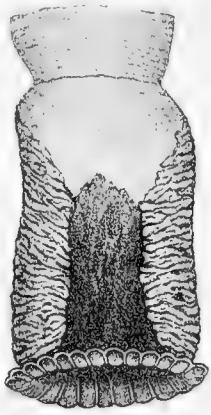
A.R. Hammond lith.

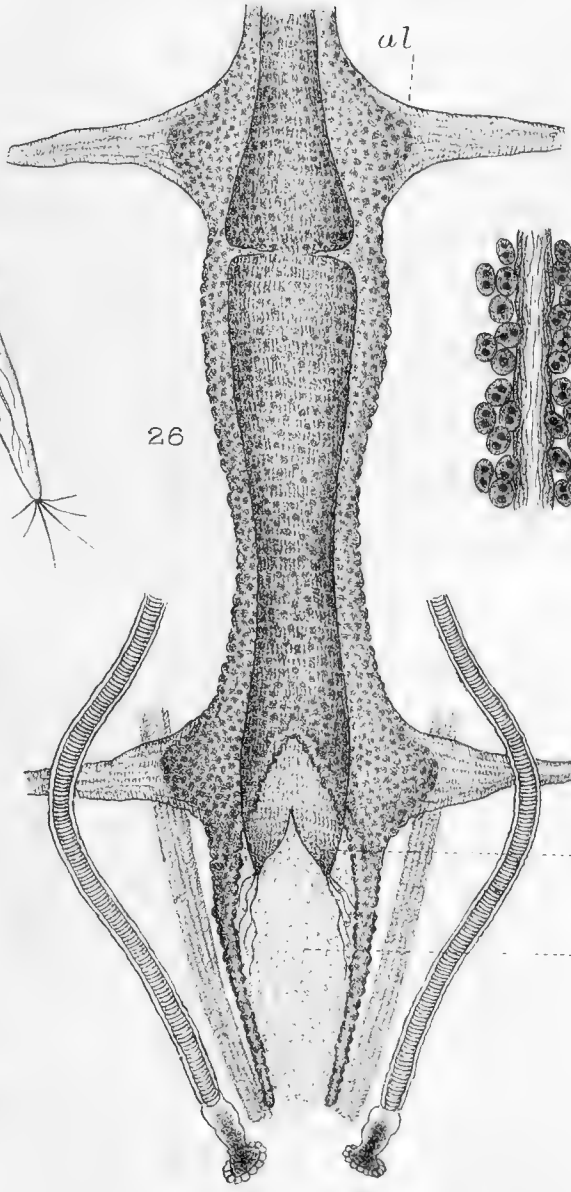
West, Newman imp.

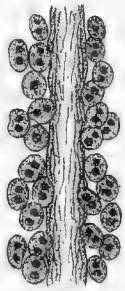
Dicranota.

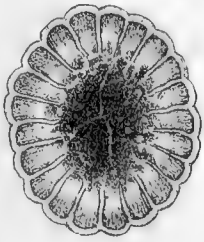


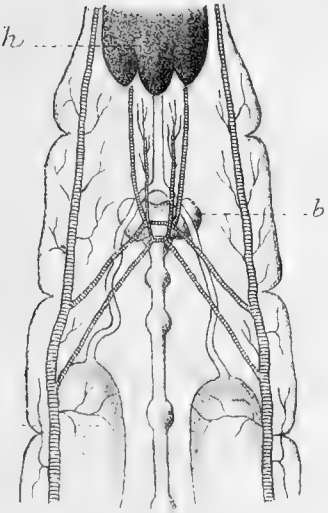








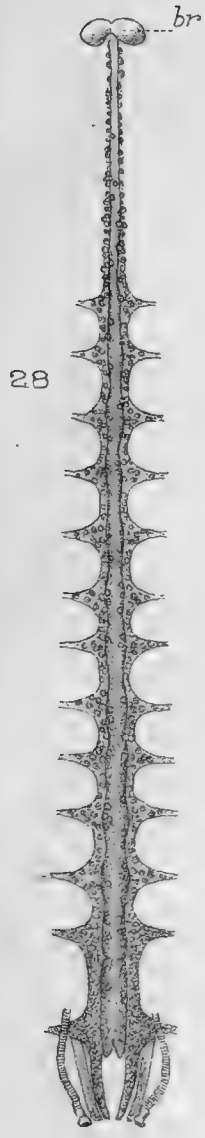




A.R.Hammond lith.

West, Newman imp

Dicranota.



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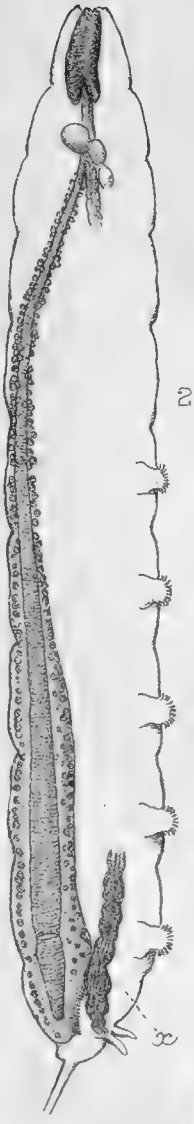

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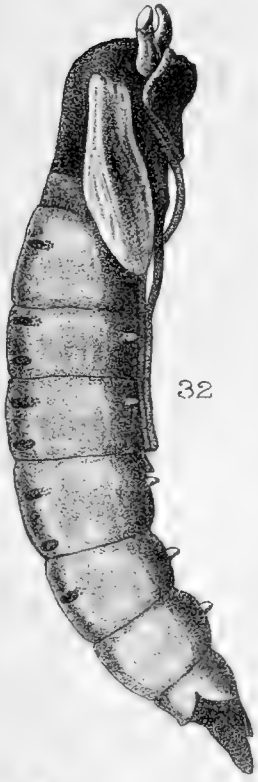

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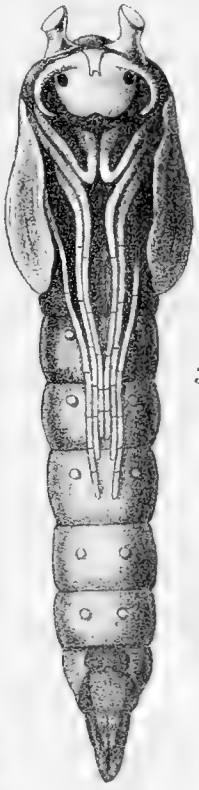

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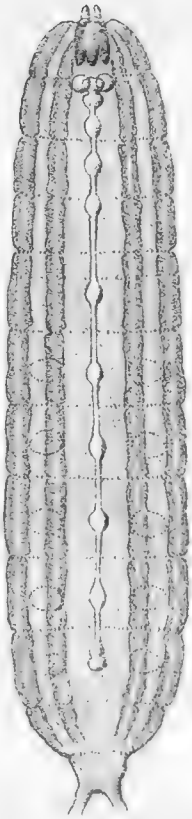

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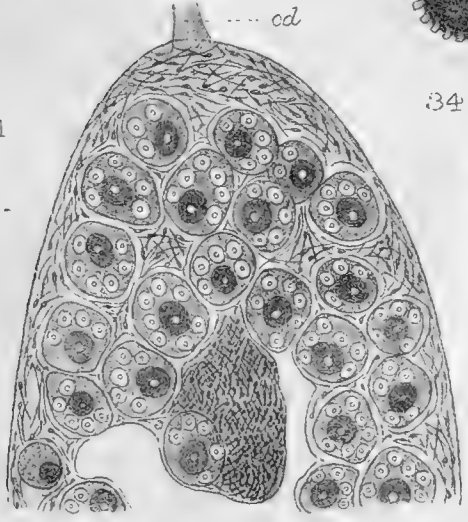

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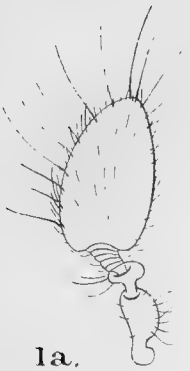
35

A.F. Hammond lith.

Dicranota.



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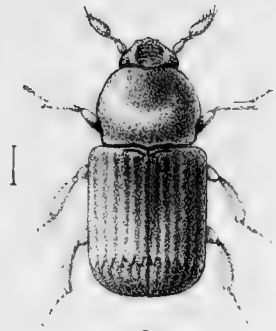

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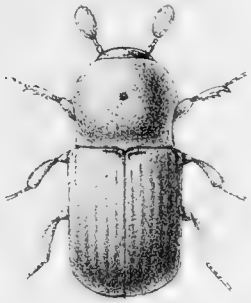

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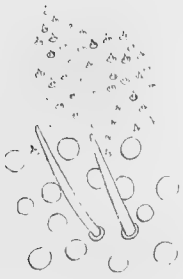

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3.

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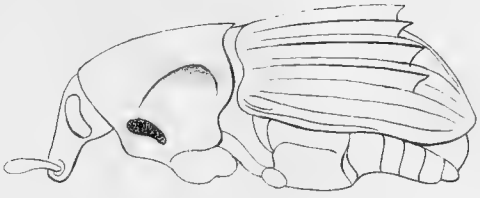

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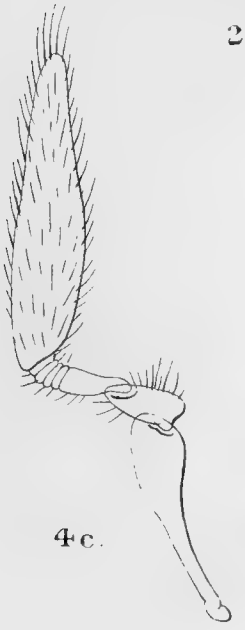

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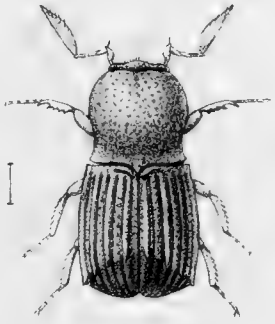

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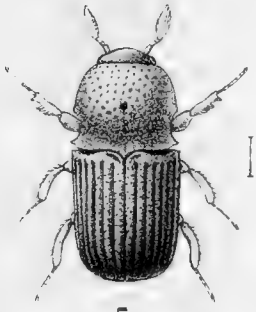

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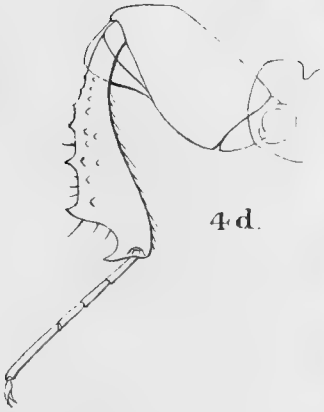

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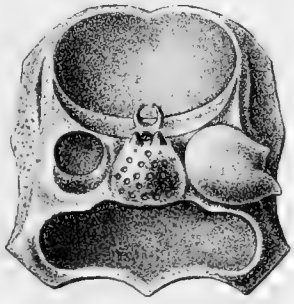


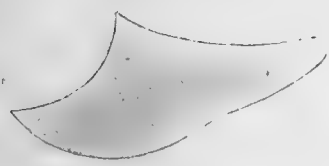
4b

5d.

W.F.H. Blandford. del.

Mintern Bros. lith

Scolyto-platypini.



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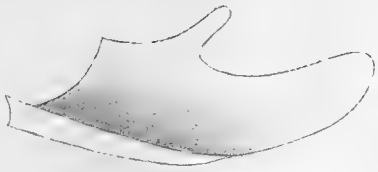

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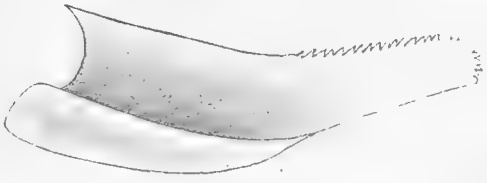

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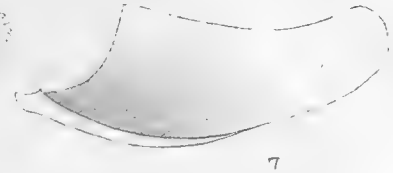

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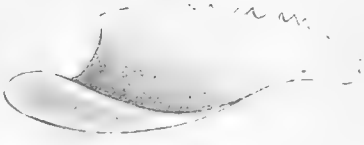

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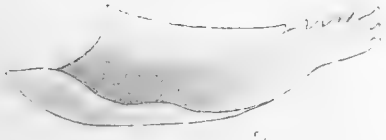

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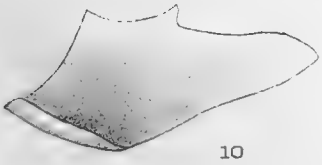

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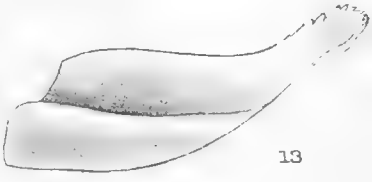

13

J. Edwards del.

West, Newman lith.

Clasps &c: of Œneis.