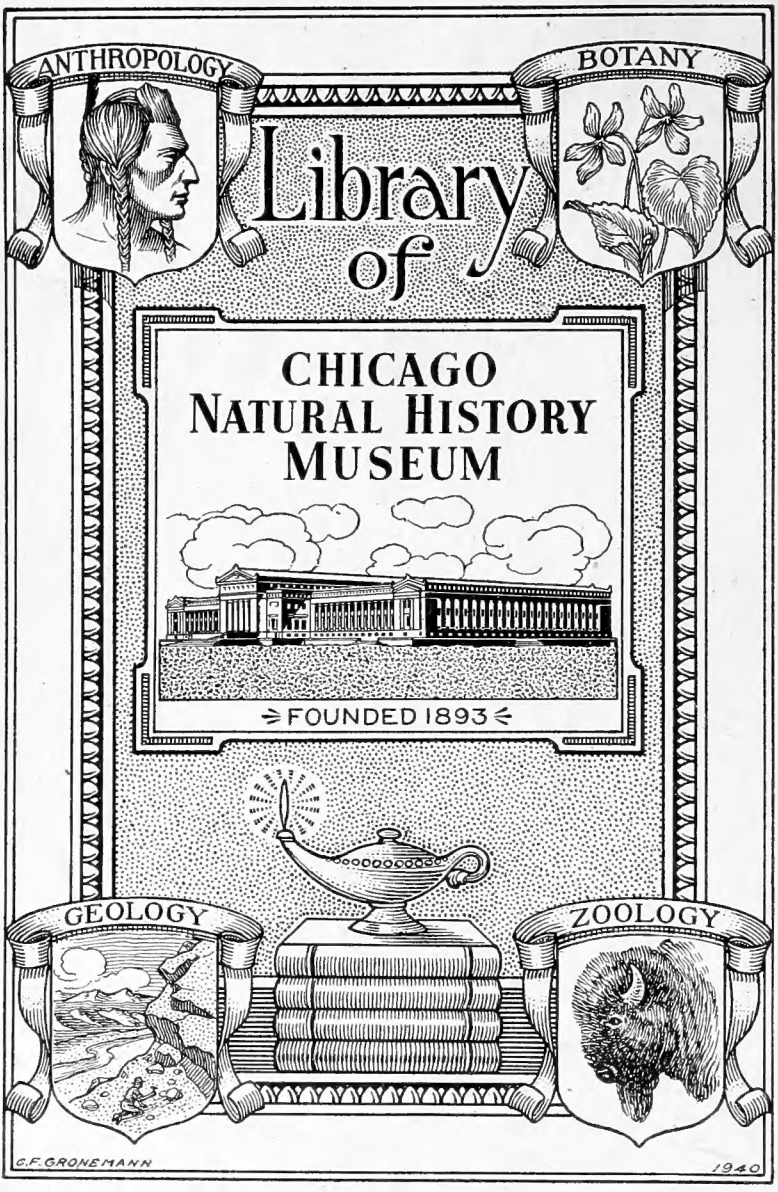

THE SOUTH LONDON
Entomological & Natural History Society,

(ESTABLISHED 1872)

HIBERNIA CHAMBERS, LONDON BRIDGE, S.E.

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1898.

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13, Drakefell Road, St. Catherine's Park, S.E.

THE SOUTH LONDON
Entomological and Natural History Society,

HIBERNIA CHAMBERS, LONDON BRIDGE, S.E.

The Society has for its object the diffusion of Biological Science, by means of Papers and Discussions, and the formation of Typical Collections. There is a Library for the use of Members. Meetings of the Members are held on the 2nd and 4th Thursday evenings in each month, from Eight to Ten p.m., at the above address. The Society's Rooms are easy of access from all parts of London, and the Council cordially invite the co-operation of all Naturalists, especially those who are willing to further the objects of the Society by reading Papers and exhibiting their Specimens.

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1882 ADKIN, R., F.E.S., *Vice-President,* Wellfield, 4, Lingard's, Road Lewisham, S.E. *l.*

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1888 ATMORE, E. A., F.E.S., 48, High Street, King's Lynn, Norfolk. *l.*

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1887 BRIGGS, C. A., F.E.S., Rock House, Lynmouth, N. Devon. *l, m, n, o, British fishes.*

YEAR OF ELECTION.

1887 BRIGGS, T. H., M.A., F.E.S., Rock House, Lynmouth, N. Devon. *l.*

1891 BRIGGS, H. MEAD, c/o Mrs. Pagdain, St. Mary's Road, Ealing, W. *l, orn.*

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1897 BROWNE, H. B., B.A., Godolphin School, Hammersmith, W.

1897 BURR, MALCOLM B., F.Z.S., F.E.S., Bellagio, East Grinstead.

1890 BUTLER, W. E., Hayling House, Oxford Road, Reading. *l, c.*

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1872 CHANEY, W. C., 32, Stroud Road, Woodside, S. Norwood, S.E. (*Hon. member*). *h, l, c.*

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1887 CLARK, J. A., F.E.S., L.D.S., M.P.S., 57, Weston Park, Crouch End, N.

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1884 COOK, A. E., 31, Lower Road, Rotherhithe, S.E. *l, orn, r.*

1885 CROKER, A. J., F.E.S., 90, Albert Road, Walthamstow. *l.*

1898 CROW, E. J., 26, Tindal Street, North Brixton. *l.*

1891 DACIE, J. C., Mayfield, 105, Upper Richmond Road, Putney, S.W. *m, l.*

YEAR OF ELECTION.

1888 DAWSON, W. G., Plumstead Common, Plumstead, Kent (*Life member*). *l.*

1889 DENNIS, A. W., 48, Mansfield Street, Kingsland Road, N.E. *l.*

1890 DOBRÉE-FOX, Rev. E. C., Castle Moreton Vicarage, Tewkesbury. *l.*

1884 DOBSON, H. T., F.E.S., Ivy House, Acacia Grove, New Malden, Surrey. *l, orn.*

1898 DONISTHORPE, H. St. J., F.Z.S., F.E.S., 73, West Cromwell Road, South Kensington. *c.*

1897 DRURY, W. F., F.R.H.S., Upland, Birkenhead Avenue, Kingston-on-Thames. *l.*

1886 EDWARDS, S., F.L.S., F.Z.S., F.E.S., *Hon. Sec.*, Kidbrook Lodge, Blackheath, S.E. *l, e l.*

1896 ELDRIDGE, A., Christ Church Schools, Alpha Road, Surbiton Hill. *l.*

1886 ENOCK, F., F.L.S., F.E.S., 21, Manor Gardens, Upper Holloway, N. *d, mi.*

1889 FARRANT, M., Jun., 137, St. Thomas, Exeter. *l.*

1894 FELL, FRANCIS, 21, Whitehall Road, Anerley, S.E. *l.*

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1872 FICKLIN, A., Norbiton, Surrey. *l.*

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1886 FREMLIN, H. S., M.R.C.S., L.R.C.P., F.E.S., 33, St. Peter's Street, Tiverton, Devon. *l.*

1886 FROHAWK, F. W., F.E.S., 34, Widmore Road, Bromley, Kent. *l. orn, r, gen. zoo.*

1895 FURNEAUX, W., F.R.G.S., "Penlee," Ommaney Road, New Cross, S.E. *l, pond life, gen. zoo.*

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1888 HALL, A. E., F.E.S., Norbury, Sheffield. *l.*

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1888 HILLMAN, T. S., F.E.S., Eastgate Street, Lewes, Sussex. *l.*

1898 HILLSWORTH, E. H. R., 45, Manbey Street, Stratford. E. *l.*

1889 HINCHLIFF, Miss K. M., Worlington House, Instow, N. Devon. *l, e l.*

1888 HOPKINS, H. E., 153, Camden Grove North, Peckham, S.E. *l.*

1889 HORNE, A., F.E.S., Ugie Bank, Aberdeen. *l.*

1886 JÄGER, J., 180, Kensington Park Road, Notting Hill, W. *l.*

1887 JENNER, J. H. A., F.E.S., 4, East Street, Lewes, Sussex. *l, c, d, m, b.*

1884 JOBSON, H., 1, Rock Villas, Maynard Road, Walthamstow. *l.*

1886 KANE, W. F. DE V., M.A., F.E.S., M.R.I.A., Drumreaske House, Monaghan, Ireland. *l, mi, marine invertebrata.*

1898 KAYE W. J., F.E.S., Hastings Road, Leicester, and Worcester Court, Worcester Park, Surrey. *l.*

1884 KENWARD, J., Rosslyn, New Eltham, Kent. *l.*

1888 KNIGHT, E., 2, Lichfield Grove, Church End, Finchley, N.

1894 LAMB, H., Acacia Place, Upper Faut, Maidstone. *b, orn.*

1898 LEMANN, F. C., F.E.S., Blackfriars House, Plymouth. *l.*

1884 LEVETT, C., 107, Brockley Road, S.E. *l.*

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1896 LUCAS, W. J., B.A., 21, Knight's Park, Kingston-on-Thames. *l, o, n, m.*

1890 MCARTHUR, H., 35, Averill Street, Fulham, W. *l.*

1872 M'LACHLAN, R., F.R.S., F.L.S., F.Z.S., F.E.S., Westview, Clarendon Road, Lewisham, S.E. (*Hon. member*). *n.*

1892 MAIN, H., 45, The Village, Old Charlton, S.E. *l.*

YEAR OF ELECTION.

1886 MANGER, W. T., F.E.S., 100, Manor Road, New Cross, S.E. *l, c. cr.*

1889 MANSBRIDGE, W., F.E.S., Nieuwehaven, 132, Rotterdam, Holland.

1885 MERA, A. W., 79, Capel Road, Forest Gate, E. *l.*

1881 MILES, W. H., F.E.S., The New Club, Calcutta, India. *mi, b.*

1888 MITCHELL, A. T., 5, Clayton Terrace, Gunnersbury, W.

1896 MONINGTON, H. W., 8, Weswell Road, Streatham Common, S.W. *b.*

1896 MONTGOMERY, ARTHUR M., 32, The Grove, Ealing, W. *l.*

1896 MONTGOMERY, EDMUND M., 32, The Grove, Ealing, W. *l.*

1880 MONTIERO, Senor A. A. DE C., F.E.S., Rua de Alecreon, Lisbon.

1889 MOORE, H., 12, Lower Road, Rotherhithe, S.E. *l, h, d, e l, e h, e d, mi.*

1887 MORRIS, C. H., School Hill, Lewes, Sussex. *l, c, m.*

1887 NEVINSON, E. B., 7, Staple Inn, W.C. *l, stalk-eyed crustacea.*

1889 NICHOLSON, W. E., F.E.S., Lewes, Sussex. *l.*

1872 OLDHAM, C., 2, Warwick Villas, Chelmsford Road, South Woodford, Essex. *l.*

1891 PALMER, J. F., Ewell Road, Surbiton Hill, Surbiton.

1892 PANNELL, C., East Street, Haslemere. *Conchology.*

1898 PARKIN, E., 3, Birley Street, Battersea, S.W. *l.*

1894 PEACH, A. W., 9, Holly Road, Chiswick. *l.*

1884 PEARCE, A. E., 12, Marius Road, Upper Tooting, S.W. *b.*

1888 PEARCE, J., 4, Borough High Street, London, S.E.

1883 PEARCE, W. A., 88, Croxted Road, West Dulwich, S.E. *l, b.*

1880 PERKINS, V. R., F.E.S., Wotton-under-Edge, Gloucestershire. *l, h, d.*

1888 PERKS, F. P., 41, St. Martin's Lane, Charing Cross, W.C. *zoology, mi, pond life.*

1897 PERRY, G. A., 29, Elmers End Road, Anerley, S.E. *l.*

1889 PERRY, Rev. J. F., Oxford Road, Banbury. *l, c.*

1897 PREST, E. E. B., Belle Vue, Newlands Park, Sydenham, S.E. *l.*

1887 PORRITT, G. T., F.L.S., F.E.S., Crossland Hall, Huddersfield. *l.*

1896 POTTER, A. T., Whangarei, Auckland, New Zealand.

1888 REID, W., F.E.S., Pitcaple, Aberdeen. *l, continental l.*

YEAR OF ELECTION.

1887 RICE, D. J., 13, Great Ormond Street, W.C. *orn.*

1887 ROBINSON, A., B.A., F.E.S., 1, Mitre Court, Temple, E.C. *l.*

1893 ROBINSON, F. J., Jun., 49, Charing Cross, W.C. *l.*

1894 ROBINSON, LEIGH, 54, Boundary Road, N.W. *l.*

1888 ROBSON, H., 5, Winterwell Road, Brixton Hill, S.W. *l, b.*

1890 ROWNTREE, J. H., Westwood, Scarborough. *l.*

1887 ROUTLEDGE, G. B., F.E.S., Tarn Lodge, Heads Nook, Carlisle. *l.*

1895 RYE, B. G., F.E.S., 212, Upper Richmond Road, Putney, S.W. *l c.*

1891 SABEL, E., F.Z.S., F.E.S., F.R.G.S., Linton House, South Side, Clapham Common, S.W.

1886 SALWEY, R. E., F.E.S., Sun Gate, Hook Road, Kingston-on-Thames. *l.*

1897 SANDISON, JOHN, 2, Francis Grove, Wimbledon, Surrey. *l.*

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1873 STANDEN, R., F.L.S., F.E.S., Thorpe Hall, Colchester (*Life member*). *l.*

1872 STEP, E., F.L.S., Portscatho, R.S.O., Cornwall, *b, m, orn.*

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1887 TURNER, H. J., F.E.S., *Hon. Report Secretary*, 13, Drakefell Road, St. Catherine's Park, S.E. *l, orn.*

1886 TUTT, J. W., F.E.S., *President*, Rayleigh Villa, Westcombe Hill, Blackheath, S.E. *l.*

YEAR OF ELECTION.

1887 VERRALL, G. H., F.E.S., Sussex Lodge, Newmarket. *d.*

1889 VINE, A. C., 45, Temple Street, Brighton, Sussex. *l.*

1889 WAINWRIGHT, C. J., F.E.S., 147, Hall Road, Handsworth, near Birmingham. *l.*

1880 WALKER, J. J., R.N., F.L.S., F.E.S., 23, Ranelagh Road, Marine Town, Sheerness. *l, c.*

1888 WALLER, R., 2, Grand Parade, Upper Richmond Road, Putney, S.W. *l.*

1886 WALSINGHAM, The Right Hon. Lord, M.A., LL.D., F.R.S., F.L.S., F.Z.S., F.E.S., etc., Merton Hall, Thetford, Norfolk (*Hon. member*). *l, orn.*

1897 WALTERS, B. H., 48, Finsbury Pavement. *orn.*

1888 WARNE, N. D., 8, Bedford Square, W. *l.*

1888 WARNE, W. F., 8, Bedford Square, W. *l.*

1887 WATERHOUSE, E. A., 23, Spencer Road, Putney, S.W.

1896 WATERS, A. H., B.A., 48, Devonshire Road, Cambridge. *l. m.*

1888 WEBB, S., Folkestone Road, Dover. *l.*

1872 WEST, W., *Hon. Curator*, 8, Morden Hill, Lewisham Road, S.E. *l, c.*

1878 WEST, W., L.D.S., Cyprus Villa, Lewin Road, Streatham Common, S.W. *l, mi.*

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1893 WOLFE, J. J., Skibbereen, Co. Cork, Ireland. *l.*

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1886 WRIGHT, W. H., Secretary's Department, Somerset House, Strand, W.C. *l.*

Members will greatly oblige by informing the Hon. Sec. of any errors, additions or alterations in the above Addresses and descriptions.

REPORT OF THE COUNCIL, 1897.

THE Council of the South London Entomological and Natural History Society, in presenting the Twenty-Fifth Annual Report to Members, is pleased to be able to state that the Society continues to maintain a satisfactory position. The present membership is 173 in number, and composed as follows :—Ordinary, 120 ; country, 44 ; life, 5 ; and honorary, 4. The finances also remain on a sound basis.

Some twelve original papers—several of them being of high scientific value—were contributed by the following gentlemen :—Mr. TUTT, four ; Prof. A. RADCLIFFE GROTE, three ; the Rev. JOS. GREENE, one ; Mr. HEWITT (York), one ; Mr. STEP, one ; Mr. TUNALEY, one : and Mr. TURNER, one. In addition to these two discussions were held, one introduced by Mr. C. G. BARRETT and the other by the PRESIDENT, and two special demonstrations were given with the lantern by Messrs. F. W. CLARKE and A. HARRISON. The Council is much gratified that Members so readily come forward to render the ordinary meetings generally interesting, attractive, and instructive.

The exhibits at the Meetings have been quite up to the average in interest, and the Council is pleased to find that the practice among Members of furnishing concise notes of their observations is becoming more general. It also regards with satisfaction the fact that an increasing number of Members are turning their attention to orders other than Lepidoptera, and that an interest is taken in the fauna of countries outside Britain. With reference to European Rhopalocera, for example, many valuable notes have been contributed on species closely allied to those comprised in our own limited fauna.

During the summer months the Meetings were, if anything, more poorly attended than in previous years, owing,

no doubt, to the fine weather for outdoor work, and to the great national festivals. Yet the balance was more than made up by the full attendance during the remainder of the year, so that the average at the twenty-three Meetings held exceeded twenty-seven per Meeting.

The Field Meetings, which for some years were so attractive and useful to the Society in promoting the social intercourse of its Members, were somewhat in abeyance this year. Only two were held, viz. May 29th *Chalfont Road* (Mr. SOUTH), and July 3rd *Reigate* (Mr. TURNER). The Council hopes for better results in this department in the future; and it is suggested that a Special Committee should be formed of those interested in Field Meetings to organise and arrange these affairs.

At the September meeting of the Council it was decided that in future the "Proceedings" should be issued in two parts; Part I immediately after June, to contain the papers read during the first half of the year, and Part II after the Annual Meeting, to contain the papers read during the second half of the year, together with the reports of the Meetings, &c., &c. It is hoped that this will be more satisfactory both to the authors of the papers themselves and to the Members, who are unable for various reasons to hear the papers read, and who would, under the old arrangement, only be able to peruse them long after date.

Some members of the Council are of opinion that the time has arrived when an Exhibition should again be held, and confidently look forward to the coming year as that in which the Society may once more obtain an accession of strength by giving a grand public demonstration of the attractiveness and interest in a study of the natural objects, animate and inanimate, around us.

The collections of the Society remain under the able care of Mr. WEST of Greenwich, and at the present time consist of a collection of British Lepidoptera, a considerable number of Canadian Lepidoptera, a collection of pupa cases and preserved larvæ of British Lepidoptera, the "Tugwell" Herbarium (a very complete collection of British plants), a large number of Coleoptera and of British shells, and a

type collection of British Orthoptera. Numerous species are wanted to complete the above, especially among the Micro-Lepidoptera and Coleoptera, of which the Hon. Curator will be only too pleased to forward lists and to receive donations. The Council wishes particularly to thank Mr. MALCOLM BURR, F.E.S., for the type collection of British Orthoptera which he so kindly presented to the Society during the year.

The Library has been during the year under the able care of Mr. H. A. SAUZÉ, and the following books and pamphlets have been added, for which the Council desires to tender hearty thanks to the donors:

"British Lepidoptera," Vols. III. and IV., by C. G. Barrett, from the AUTHOR.

"Butterflies of Indiana," from Mr. MOORE.

"Addresses to the City of London Entomological Society," "Entomologists' Record" for 1897, "Alpine Rambles," by J. W. Tutt, from Mr. TUTT.

"The *Zoologist*" for 1897, from Mr. NEWMAN.

"The Entomologist's Monthly Magazine" for 1897, from Mr. M'LACHLAN.

"The Entomologist" for 1897, "Economic Entomologist," by Prof. Smith, from Mr. SOUTH.

"Science Gossip" for 1897, from Mr. CARRINGTON.

"Address to the Entomological Society of London, 1896," by Prof. Meldola, from Mr. TURNER.

"Guide to the British Museum Natural History," "Guide to the Galleries of Mammalia," "Guide to the Reptiles and Fishes," "Guide to the Shell and Starfish Galleries," "Guide to the Fossil Mammals and Birds," "Guide to the Fossil Reptiles and Fishes," "Guide to the Mineral Gallery," "Index to the Collection of Minerals," "Introduction to the Study of Minerals," "Study of Rocks," "Study of Meteorites," "Guide to Sowerby's Models of Fungi," "Guide to the British Mycetozoa," and "Guide to the Geological Department," from the TRUSTEES OF THE BRITISH MUSEUM.

"Knowledge" for 1897, from the PUBLISHERS.

"Larvæ of British Lepidoptera," Vols. VI. and VII., Ray Society, by PURCHASE.

"Favourite Flowers of Greenhouse and Garden," Vols. II. and III., by E. Step, from Mr. WARNE.

"List of Yorkshire Neuroptera," by C. G. Porritt, from the AUTHOR.

"How to Collect Coccidæ," by T. D. A. Cockerell, from the AUTHOR.

The Librarian reports that the MS. of the catalogue of the Library, containing the titles of some five hundred books, magazines, reports, separate papers and pamphlets, is ready for the printers. It is hoped that this may shortly be published, but it would be necessary to make a small charge for it in order to cover the cost. The Council trusts that each Member will look upon it as his duty to take a copy.

The Photographic Album has been enriched by several additions during the past year. Messrs. F. Clarke, Dennis, Brooks (Rotherham), Young (Rotherham), Moore, H. Wood, H. S. Fremlin, and Major Ficklin having kindly given their photographs. There are now about three dozen portraits of past and present Members, including those of many well-known entomologists, and the Council earnestly begs that the gaps may be filled ere long.

The Council looks forward hopefully to the coming year as one in which the work of the Society may be still further extended, and the promises of papers and exhibits from both Members and well-known naturalists warrant them in thus anticipating a very successful year.

THE SOUTH LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY.

BALANCE SHEET FOR THE YEAR 1897.

GENERAL FUND.

Receipts.	£	s.	d.	*Expenditure.*	£	s.	d.
To Balance in Hand	18	5	3	By Rent (1 year)	25 0 0		
,, Subscriptions received, 87 at 7/6 ...	32 12 6			,, Attendance (1 year)	2 10 0		
,, ,, ,, 4 ,, 6/- ...	1 4 0				27	10	0
,, ,, ,, 12 ,, 5/- ...	3 0 0			,, Printing	1 19 6		
,, ,, ,, 22 ,, 2/6 ...	2 15 0			,, Postage, Stationery, and Sundries ...	4 9 9		
	39	11	6	,, Insurance of Library and Collections (Fire)	0 8 3		
,, ,, ,, on a/c of 1898	0	10	0		6	17	6
,, Entrance Fees, 10 at 2/6	1	5	0	,, Entrance Fees carried to Suspense a/c	1	5	0
,, Arrears of Subscriptions received	2	15	0	,, Vote to Library Fund	2	2	0
,, Receipts Reigate Field Meeting	3	1	0	,, Vote to Publication Fund	20	10	9
				,, Expenses Reigate Field Meeting	3	10	8
				,, Balance in Hand	3	11	10
	£65	7	9		£65	7	9

SUSPENSE ACCOUNT.

Receipts.	£	s.	d.	*Expenditure.*	£	s.	d.
To Balance in Hand	6	15	0	By Balance in Hand	8	0	0
,, Entrance Fees from General Fund...	1	5	0				
	£8	0	0		£8	0	0

LIBRARY FUND.

Receipts.	£	s.	d.	*Expenditure.*	£	s.	d.
To Balance in Hand	0	4	9	By Binding Books	0	18	6
,, Votes from General Fund	2	2	0	,, Subscription to Ray Society and Knowledge ...	1	2	1
,, Library Fines	0	7	4	,, Librarian's Expenses...	0	3	1
				,, Balance in Hand		10	5
	£2	14	1		£2	14	1

PUBLICATION FUND.

Receipts.	£	s.	d.	*Expenditure.*	£	s.	d.
To Balance in Hand	2	3	1	By Printing	55	4	6
,, Votes from General Fund	20	10	9	,, Balance in Hand	0	12	0
,, Donations	32	3	8				
,, Sale of "Proceedings"	0	19	0				
	£55	16	6		£55	16	6

ASSETS & LIABILITIES.

Assets.	£	s.	d.	*Liabilities.*	£	s.	d.
To Balance, General Fund	3	11	10	By Rent, Outstanding Accounts, etc.		Nil.	
,, ,, Suspense Account...	8	0	0	,, Balance in Hand	18	9	3
,, ,, Library Fund		10	5				
,, ,, Publication Fund...	0	12	0				
,, Arrears of Subscriptions, £22 1s., valued at say ...	5	15	0				
	£18	9	3		£18	9	3

Examined, compared with Books and Vouchers, and found correct, *January 25th*, 1898.

WM. MANSBRIDGE,
A. M. MONTGOMERY, } *Auditors.*

Corrections and Additions. Part I.

Page 44, line 11, for "negative" read "vegetative."

„ 49, „ 33, for "Handbook" read "Manual."

„ 55, „ 21, for "*Antrocharini*" read "*Anthocharini*."

On same page remove *Pontia daplidice* from the Pierini to the Anthocharini before *Euchloë*.

On Page 59 remove the Chrysophanini to preceding page following the Zephyrini. Subsequent studies, neglected when writing this paper, show that vein IV_1 fuses with the Radius in the Coppers, and that they share this character with the Theclinæ, and are more specialised than the typical Blues in consequence.

Page 59, line 30, for "*Angiades*" read "*Augiades*."

„ 62, „ 16, for "white" read "Whites" (*i. e.* Pieridæ).

Frontispiece &c. see after p. 68.

Notes and Observations on a Holiday in the Black Forest of Scotland.

By Henry Tunaley, F.E.S. *Read February 25th*, 1897.

The Black Forest of Scotland, comprising the forests of Rothiemurchus and Glenmore, lies in a vast amphitheatre having the mountains of Braeriach and Cairngorm on the south-east, Craigellachie Rock on the west, Callart on the north, and Ord Bain on the south. The latter, as its name the "White Hill" implies, is of limestone formation, and differs both in structure and appearance from the wild and rugged Cairngorms whose granite summits rise more than 4000 feet above the sea level.

It is a land of dark pine forest, covering thousands of acres with its sombre mantle, the fringes of which gradually fade and disappear on the sterner slopes of the surrounding heights. A land of moor and glen, river and loch, not to be surpassed in wildness and beauty in any part of Scotland. And, alas! from a collector's point of view, a land of mist and rain, of wind and storm, and treacherous bog. At least such was my experience during my holiday last summer. Day after day one hoped for the fine weather, which came not except in fitful gleams. Each morning one anxiously sought of one's host a forecast of the weather, only to receive the reply long ago crystallised into a Scotch proverb, "Indeed, and it will be just a blink and a drink, whatefer."

The lower and more western part of this amphitheatre is traversed by the Spey, which here races through a sylvan valley of birch and alder. Higher up are the Luinack and Bennie Rivers, at the junction of which stands Coylum Bridge, a small hamlet of three or four dwelling-houses and a shop,—the latter a kind of emporium, the only one for miles, at which may be purchased anything under the sun—except the very article one may happen to want.

It was at Coylum Bridge that I first met Mr. J. F. X. King, by whom I was introduced to this—to me—new district, and in whose society I collected till he left at the end of August.

The chief of my work lay in the highest part of the plateau,—1000 feet above sea level, overlooking the forest, and opposite the gloomy gorge of the Lanig-Ghru, a pass leading over the hills to Braemar. It is a good mile from Coylum Bridge, and three from Aviemore. The district, consisting of a couple of farms, is called Achnahatnick, a word derived from "ailen," the Gaelic for juniper, and signifies the "Place of the Juniper." And a very appropriate name it is if the English tongue could trip it a little more glibly, for the juniper grows thickly hereabouts except in the denser parts of

the forest. Many of the defunct junipers are represented by straggling bare stems, more or less bleached, grey or silvery white. Some are thickly covered with lichens of various shades. Broken and detached stems strew the ground, and intermingle their tints with the variously coloured mosses and grasses in which they are embedded, giving a great variety of surface pattern, of which I shall have more to say presently.

My first day, the 29th July, opened bright and promising, and selecting a low part between the grassy slopes on the outskirts of the forest I simultaneously made my first acquaintance with living *Erebia æthiops* and a Scotch bog, the former to my keen delight, the latter to my discomfort and disgust. For seeing the object of my desire leisurely skimming the long grass a few yards in front of me, I made a sudden rush, and just at the cricical moment, when hand and eye combine in making the unerring swoop, I found myself floundering up to the knees in black and slimy ooze, while *æthiops* jauntily flitted on unconcerned. It is no part of this paper to detail the language which escaped me at that moment, so it is not here recorded. Suffice it to say that when I emerged and surveyed my nether extremities I made a vow, which I kept to the end of my holiday, a much longer period than I can remember keeping any other vow so rashly made, and that was never to wear gaiters again while collecting in Scotland. Allow me one moment to digress for the benefit of those who may venture into the same locality. Leggings are a mistake in a wet country, unless the work lies among brambles and thickets, and are required as a protection. They soon become soaked in the long dewy grass, they take a long time to dry, and are a constant source of danger to health. The proper outfit—assuming of course that they are used—are knickerbockers and a good supply of woollen stockings, changing the latter frequently. On this plan I worked day after day through the wettest holiday I ever spent, and yet never felt the slightest symptom of cold.

But apart from this my mishap was turned to my entomological advantage, for I discovered that if I wanted *æthiops* I must keep close to the margins of the bogs and more or less hidden watercourses which intersected the lower parts of the valleys and open glades. True, in bright sunny weather the males wandered up the higher and drier slopes, but the females were mostly taken in the former situation.

Although Mr. King had taken this insect freely in the same locality two days previously, owing to sudden change in the weather my total capture on this occasion amounted to only five males. For this was my invariable experience, however plentiful on the wing in sunny weather, no sooner was the sun obscured than every specimen suddenly disappeared, and no amount of kicking or beating would induce them to rise. There is no doubt that they descend deeply into the long grass, which towards the roots, in these boggy localities, is of a dark reddish brown, very similar in colour to the under sides of the wings.

I have known even a passing cloud to cause them to disappear from a patch covered with grass only, where a moment before scores were sporting themselves in the sun.

The 31st of July brought us a fine morning, and *æthiops* in abundance, but still all males. These could be taken in the "blinks" between the "drinks" until the 6th of August, when the females began to appear; that is, about a fortnight after the first appearance of the males.

Cold rain and wind now followed in varying amount until the 11th, which was a grand day. Females were now plentiful, and I had a good opportunity of observing some of their curious habits. If the weather was continuously bright they would fly freely, but more leisurely than the males, and generally lower down in the damper parts, and on the margins of the watercourses. If chased, and especially when struck at and missed, they would suddenly drop and take refuge in the grass, but unlike the males, which sometimes did this and clung to a stem or other support, they fell on their sides with closed wings and folded legs. So completely did the secondaries cover the primaries, and so closely did their coloration simulate the varied ground pattern mentioned in the earlier part of this paper, that although under one's eyes they would have frequently escaped detection, had it not been for another curious habit of jerking themselves from side to side by suddenly opening and closing the wings. This would be done each time the herbage was disturbed, the creature throwing itself sometimes several inches to evade capture, always falling on one side or the other, but never assuming an upright position unless by accidentally falling between the blades of grass, and never clasping a stem with the legs.

I would on this point call attention to the varied under sides of the females of this species exhibited to-night. It will readily be seen that they belong to one or other of two aberrant forms described in Mr. Tutt's "British Butterflies," p. 431: the one, *leucotænia*, with more or less silvery grey fasciæ; and the other, *ochracea*, with distinctly ochreous bands. This latter was much the commoner of the two, but both were difficult to see when lying on their sides among the ochreous green of the grass and sphagnum, much of which was reticulated with the partly embedded lichen-covered and silvery grey stems of the dead juniper.

Again, the females were very fond of basking with extended wings in the sun. In such cases the brighter fulvous colouring of the upper surface of the wings rendered them very conspicuous, and I have seen a male in full career suddenly drop, apparently at right angles, on finding itself over one of these females,—ample evidence, I think, of the value of this brighter coloration as a sexual recognition mark.

Sometimes, if the weather were fitful, I have seen the females, with closed wings, resting on a blade of grass, and when disturbed they at once fell on one side, and went through similar evolu-

tions to those above described. I never saw a male attempt this manœuvre.

After the 21st of August the insect was *passé* in the lower glades, although it was taken on the higher slopes until the 8th of September. Indeed, one could have divided the locality into a series of ascending zones corresponding with the appearance of successive broods, which extended over a period of six weeks.

As regards the variation in the number and character of the ocellated spots, the specimens before you are fairly representative, and speak for themselves. They range from three to six on the upper surface of each fore-wing. I am inclined to think that the occurrence of the latter number is much rarer than is commonly supposed. Only a few days ago I heard of a professional collector offering 15*s.* for a specimen with six ocellated spots on each fore-wing, and no doubt he expected to make a profit on his outlay. Out of some hundreds examined I only found one that showed this number, and that on one fore-wing only. Almost as great a rarity is one with five spots on each hind wing, and of this I captured two specimens. Several females showed a tendency towards the aberrational form *flavescens*, while of the males only one specimen approached ab. *obsoleta*.

Cœnonympha typhon was over before I reached Aviemore, and I only succeeded in taking two specimens. *C. pamphilus* was rare. Those I took were paler and duller than our southern form. Of *Chrysophanus phlæas* only one specimen—worn. The black dots were larger than any I have taken in the south. These are all the butterflies I saw.

Sugar was a complete failure, although I persevered night after night—wet or fine,—varying the seductive compounds, the localities, and aspects. The nights were generally cold and windy. The total captures by this means were two *Xylophasia polyodon*, both of them suffused and indistinctly marked, and one *Amphipyra tragopogonis*. These three specimens are the net produce of six weeks of persistent work.

By searching and beating in the daytime were added to these *Noctua castanea*, *Polia chi*—a very light female, from which I obtained ova, and *Charæas graminis*, a single specimen of each. *Celæna haworthii* was plentiful, but by the time I had discovered the locality (September 8th) the species was going over. The males were flying in the sunshine over the heather, and *Myrica gale* in open boggy ground. Their flight resembles that of a bee, especially when circling round before alighting on a flower. About 4 o'clock in the afternoon several pairs were taken in cop.; this was the only way in which I could take the females. At dusk *Tapinostola fulva* was on the wing about the end of August, flying near beds of rushes and grass in boggy localities.

Although I have growled over the inclement weather, I own that in a few instances my captures were augmented thereby. Here is a notable instance. For three days at the beginning of September we

had a real Scotch mist. Every pine needle, every blade and culm of grass hung with fine dew-like drops; water was trickling down the tree trunks, so that the old and porous posts, supporting the numerous wire fences, afforded practically the only dry resting-place. In such situations I took, among others, *Noctua dahlii*, *N. glareosa*, *Epunda nigra*, and *Calocampa solidaginis*. The last has a very peculiar habit of resting. The head is very closely appressed to the resting surface, rough or smooth; and, apparently to enable the insect to do this more effectually, the hind legs are drawn up something after the manner of a grasshopper, and are used to thrust the posterior extremity away from the resting surface at an angle of 30° or 35°. The wings are corrugated towards the hind margin, and thus taper outwards. The dorsal contour is slightly concave, caused by the gradual wrinkling, and therefore crowding of wing material towards the hind margin, so that on a decorticated pine post, grey and weather-worn, it may be mistaken by a casual observer for a deflection of a splinter of the post itself. I was more than once deceived even after I had observed the resemblance. The similarity in colour, too, was most remarkable. I have heard it stated that the insect thrusts its head into the holes or depressions on the trunks of trees. There is, I think, no doubt this is so, for on two occasions I found it in such a position. In the cases to which I allude the surfaces were quite smooth; and what I venture to contend is that, however first induced and acquired, whether by thrusting the head into depressions for the purpose of concealment, protection, or comfort, the habit is as firmly fixed, irrespective of the nature of the resting surface, as is that of a dog who turns himself round and round to arrange an imaginary bed of rushes or grass before lying down on perfectly bare ground.

Among the Geometræ I was more fortunate as regards numbers, although genera were few. One of the most interesting, because new to me, was *Emmelesia minorata*, almost the most local insect I met with in the Highlands. It was confined to a very limited area, but an exceedingly pleasant one to work in after the *æthiops* ground.

An open country of billowy greensward crested with feathery birch, either singly or in clusters. A few huge blocks of limestone, grey and lichen-stained, scattered around; here and there a solitary giant fir, old and grizzled—the sole remnants of the famous Rothiemurchus firs left standing as specimens when the forest was denuded. Below, a panoramic view of the lovely Spey valley fading away to the north-east; while to the south, towering sentry-like above all, was the placid and solitary Ord Bain. Such was the habitat of this delicate little insect, to which Mr. King introduced me one afternoon at the end of July. We found it sporting in the hollows and in the slopes, looking, in the sunshine, like little flakes of silver. The specimens netted were either going over, or the folds of my rather coarse net were too much for an insect so fragile. However, much to my chagrin, the weather changed as usual, the sun was overcast, a fine drizzle

descended, and every specimen disappeared as if by magic, and no amount of sweeping would induce them to rise. Seeking shelter from the increasing rain under one of the great firs, I soon discovered what had become of the little beastie, for the lee side of the trunk was literally swarming with them. So here, again, the anathematised weather enabled one to carefully select and make one of the best bags of the holiday. I found them also on the limestone and on the birch trunks. Sometimes they were very difficult to detect, and my royal friend initiated me into the mysteries of "blowing," at which he was an adept. By compressing the lips and giving short vigorous puffs, directed on to apparently bare trunks, a flutter or turned-up margin of a wing would locate an insect one had hitherto been looking at and yet not seen.

On the 6th August we again visited the same locality, and found very few *minorata* on the tree-trunks. Walking over the patches of eye bright, I kicked up a large number of what proved to be chiefly females, and plucking several stems of the plant I found ova on all of them. The eggs were laid singly near the end of the spike, where the leaves and buds grow closely together. By parting these with the fingers the eggs were seen on the upper surfaces and near the edges of the leaves. I took up several more spikes which females had just left, and found the eggs were oval, white, and under a pocket lens ribbed longitudinally. The following day they had changed to orange. All the books I had with me gave the pabulum of the larvæ of this species as unknown. But there was no doubt whatever that the ova of this insect were deposited on the plant mentioned. It will give you some idea of the lavish occurrence when I say I was unable to pluck a single plant that did not contain ova. I called Mr. King's attention to this, and the fact was confirmed; for after a while he said he had found a flower spike without ova, but on further examination together we discovered a solitary egg. The plants gathered were placed in a glass of water and kept in my room; but on returning from a few days' visit to Inverness my kind hostess had thrown them away, thinking they were only flowers; so unfortunately I obtained no larvæ. Later on we made a further visit to the locality, but this time found only the transparent egg-shells, and yet no signs of larvæ.

My captures are divided into two groups, as you may observe. The first with complete dark bands and suffused with greenish grey; the second lighter, discoidal, and with that part of the dark band surrounding the discoidal spot either pale grey or white, leaving the spot very conspicuous. This form was the more numerous of the two; it was also more ochreous in colour. Among some hundreds examined I only found three or four with the dark band broken transversely.

On the evening of August 23rd, among the alders on Spey side I captured *Melanthia bicolorata* and var. *plumbata*. The type is larger than those I have taken in Kent, and the smoky-blue border is both darker and broader. Var. *plumbata* is intermediate between those of

Forres and Rannoch, being lighter than the former, darker than the latter. During the first three weeks in August the forest swarmed with *Larentia didymata*. The males are much darker than those I have taken in Devonshire, and the females much lighter; on dark surfaces they look almost white. However, their very conspicuousness becomes a species of protective resemblance, for I have frequently mistaken the small light spots of lichen on the fences and tree trunks for a female at rest, and *vice versâ*. *L. cæsiata* was taken freely by Mr. King in July; it was going over when I arrived, and so I obtained few specimens, and none of the dark banded forms which my friend had. *L. olivata*, a single worn specimen, was noted at Loch-an-Eilien.

Cidaria populata was plentiful in the open parts of the wood among *Vaccinium*. I did not work for this so early as I might have done, and I only took one of the dark variety. The type appears to me darker and more suffused with smoky brown than my southern captures. The males were on the wing from about 6 till 8; the females being taken later on the heather bloom, with wings closed over the back, the paler under-sides being conspicuous by lantern light. They were mostly in cop. about 9.30. *C. fulvata*, a single female specimen was seen. *C. immanata*, a long and varied series was obtained, but not without laborious work, chiefly beating the fir and birch trunks with a heavy stick. The first appearance was August 7th, and then onwards until September 10th. *C. testata* was first taken August 11th, and then continuously on the lower parts of the moors, being kicked up as one walked along, especially in the small glens or hollows in which were birch or sallow. No females were taken until the end of the month, and only then by searching with a lantern. They were in good condition, mostly in cop. with worn males; I never saw one flying. All the males were of smoky purple, with a dash of ochreous chiefly along the coast.

Of *Carsia paludata* (*imbutata*) I took only two, although had I visited the locality of this species earlier in August I should have obtained more. When one is working a new district, in which there are species whose habitats are restricted and widely separated, it becomes impossible on a first visit to work all, especially when handicapped by continued climatic disturbances.

I took all the species in the genus *Thera*. *T. variata* was almost *passé*; the few I obtained, however, were typical. They are lighter and more ferruginous than those I have taken in Surrey. *T. simulata*, Mr. King took the first brood in June. The second appeared on the 11th August, and, although not abundant, was met with continuously until I left. *T. firmata* was first noted on 25th of August, an odd specimen or so turning up occasionally until September 8th, when we had just one whole day of glorious weather, and the full brood appeared. It was rather laborious work under a blazing sun, as many of them had to be dislodged from the higher branches of the firs by throwing stones, sticks, or other handy missiles. Many of course were found sitting on the fir trunks, and were very skittish,

flying off when approached. When chased and hard pressed they would suddenly drop; and although one could see the very spot on which they appeared to alight, I seldom found them till I had observed their trick. They fell with closed wings till within an inch or so of the resting surface, and then opening the wings took a sudden turn to one side and rested about ten or fourteen inches from the place they seemed to strike. Many took to the upper regions ten or fifteen feet overhead, and were soon out of sight. They were most abundant among the scattered firs on the outskirts of the forest; very few were taken inside.

The larvæ of *T. juniperata* were obtained by beating the juniper in the open spaces, and it could have been taken in thousands, full fed, from the 21st of August until about the 7th or 8th of September. The pupæ were lightly attached to the leaves of the juniper by a few silken threads, and fell into the beating tray with the larvæ. The first imagines emerged on the 24th of September, the bulk on the 4th, and the last on the 10th of October. I have placed a typical series by the side of some Surrey specimens taken last year by Mr. Auld. The former are smaller, darker, and more smoky in colour than the latter, and the central fascia of the fore-wings is less constant. It is frequently broken transversely, and in many instances terminates in a very dark rectangular spot on the inner margin; in a few cases the inner half of the band is entirely obliterated.

If ants be excepted, the most abundant and ubiquitous insect was *Eupithecia sobrinata*. A single specimen was taken August 3rd. On the 8th it appeared freely, and by the 15th it was swarming, and continued to be plentiful until I left. It is difficult to convey any idea of the lavish profusion of this species. At Loch-an-Eilein it could be beaten out of the firs in hundreds. At one sweep of my net I took fifteen; but of course I did not attempt to box them, for it was impossible to overhaul them for forms. Besides, I had a much better chance when the wet mist came, to which I have already alluded. *Sobrinata* was then common on all the fence-posts, and on one occasion the palm of my hand would have covered five of them. In this kind of weather they were somewhat sluggish, and gave me a chance to examine carefully before boxing. Moreover, at this date, September 1st, they were mostly females, among which the grey form preponderated. The specimens appear to fall broadly into three parallel lines. First, the brown form of various shades and depths of colour, within conspicuous transverse markings; second, the grey form, with an almost white band, and well-pronounced grey and black markings on the nervures, passing through various shades to a unicolorous grey; and third, a group intermediate between the two, having the brown of the one intermingled with the white, grey, and black of the other. The ninth specimen in each group exhibited deserves special attention. Each of the three has a distinct black V mark on the upper wings; the apex is on the discoidal cell, and diverges towards the hind margin. It is very rare in the brown group, and

not common in either of the other two, although many are asymmetrical in this respect.

The larvæ of *E. helveticata* were beaten out of the juniper along with those of *juniperata;* but so close was the resemblance between the two that I did not discover the fact till I reached home.

Larvæ of *Bupalus piniaria* were common. When dislodged they hung from the tree by a silken thread, but never fell to the ground. I think they must both rest and feed ready attached, for they were never taken by surprise, however suddenly the blow was given.

Of micros I can give but a poor account. I was unsuccessful in obtaining many species that I know occur in the locality. I took only twenty-four species. Of the Pterophori, 1; Crambi, 1; Tortrices, 15; Tineæ, 7. *Pædisca ophthalmicana* and *Tachyptilia populella* were very abundant wherever the poplar was found, and I obtained some very nice forms. *Ephippiphora similana* was most local, being confined to a few square feet of scrub birch at a high elevation. By climbing to the locality day after day for a week, in all weather, I succeeded in getting two dozen, never more than three or four at a time.

The total number of species taken was fifty-six, including Rhopalocera, 4; Noctuæ, 14; Geometræ, 14; Pterophori, 1; Crambi, 1; Tortrices, 15; and Tineæ, 7.

To those who go to Aviemore for collecting purposes I would recommend from 1st of June to end of July as being the cream of the season.

A Discussion on the "Protection of Insects in Danger of Extermination."

Opened by C. G. BARRETT, F.E.S. *March 11th*, 1897.

Mr. Barrett, in introducing the subject, said that great indignation had been excited among entomologists in many parts of this country by the rapacity exhibited by a number of collectors who had in the past year assembled in the newly discovered locality in North Cornwall for *Polyommatus* (*Lycæna*) *arion*, where, according to reports received, 500 to 700 specimens had been taken by single collectors, and it was computed that between 2000 and 3000 specimens of this local species had been destroyed.

Some remarks upon the subject by Mr. R. McLachlan, F.R.S., made before the Entomological Society of London, had introduced the question of the probable early extermination of this and other exceptionally local species, and in the hope of finding a remedy that Society had appointed a representative committee for the purpose of obtaining evidence and recommending such measures as should be deemed desirable with a view to the protection of threatened species. He had been requested to act as secretary, and the first work had been to obtain information and suggestions from kindred societies and individual entomologists. In so doing they had received expressions of strong sympathy with their object, and evidence of extreme indignation at the proceedings of the more rapacious collectors, and at the same time hearty promises of assistance.

The committee, after several meetings and very careful consideration of the evidence and suggestions received, had come fully to the conclusion that any attempt to act through the legislature would be futile, and their unanimous opinion was that the only effectual method of influencing collectors was by means of a strong and healthy public opinion and personal influence. To this end their efforts were directed, and in this respect they desired to secure the co-operation of this Society.

The President, Mr. R. Adkin, said that he considered the matter was a most important one, and he hoped that the members would freely express their views upon the subject.

Mr. Auld called attention to the absolutely unnecessary and wanton habit of some collectors to take every specimen, whether worn or not, which they came across, with the result that the worn ones were killed, only to be thrown away. He remarked how much better it was from an educational point of view that species should be bred from the ova, as collectors then acquired a knowledge of the life-history of species, and became truly students of nature.

Mr. Carpenter thought that it was not always the collector who

was to blame, but that very often local circumstances brought about the destruction of a local species, and he instanced *Melitæa athalia*, which in its old locality of Abbot's Wood had suffered greatly in the larval stage from the depredations of the pheasants, now more extensively preserved in that neighbourhood.

Mr. T. W. Hall suggested, as an extreme measure, that a black list of greedy collectors be formed, and even published in the magazines.

Mr. Tutt said that, as a member of the committee, he wished rather to hear opinions from other members than to give his own. He, as a collector in close touch with many other collectors, had no doubt that much over-collecting existed, especially of local species that had a moderately high money or exchange value. He instanced again the practical extermination of *Apatura iris*, *Melitæa athalia*, *Nola albulalis*, and *Melanargia galatea* in Chattenden Woods. The way in which *Scoria dealbata* was systematically collected was quite deplorable. Last year as many as seven or eight men were often on the ground at one time in quest of this species, some of the collectors having obtained specimens for many previous years. He stated that he remembered an occasion when seven or eight men stood in a line and fought for each specimen of *A. iris* as it came up; he had once heard threats of personal violence used to a lad who had taken up what was supposed to be one of the best positions for the capture of this species. The systematic way in which a London dealer set about the extermination of *Nola albulalis* in order to raise its price was detailed, and the over-collecting of *Acidalia rusticata* at Higham was also mentioned. He said that he thought schoolboys did no great harm. They wanted two or three of a kind, and were satisfied. It was the man who wanted three, four, five dozen, or, rather, as many as he could get of such species as *Thecla w-album*, *T. pruni*, *Leucophasia sinapis*, *Lycæna arion*, and so on, that did the mischief. He disagreed with those who thought moral suasion was useless. It was, of course, useless with those men who would collect for collecting's sake, and looked on each specimen as having a money value; but there were thoughtless men who did these things from want of consideration, and these were certainly amenable to reason. The man who got four dozen or six dozen *Lycæna arion* last year, and added something to his collection which he will tell you he could not have got unless he had had the *L. arion*, will go again. You cannot influence him. He is, of course, making a collection in which *L. arion* has a market price, as well as all the other insects it brings in exchange. The same with the men who go to Abbot's Wood for *Melitæa athalia*, and those who year after year so closely worked a well-known haunt of *M. aurinia*, that they finally exterminated it. He had much sympathy with collectors, for he recognised that he himself was essentially a collector, but he wished collectors would collect with their head as well as with their hands.

Mr. Barrett recognised the difficulty of influencing those collectors

who were not members of one or other of the various societies ; but he thought that they too might be reached, especially if when found over-collecting they were tabooed the exchange columns of our magazines. He also said that a suggestion had been made that a list of the particular species in danger of extermination should be freely circulated.

Mr. Fremlin would go further than collectors or even dealers, and lay the chief share of the extermination upon greedy acquirers of insects who would give extreme prices for good specimens of rarities.

Mr. Tutt did not class all dealers together, for there were men among them who would be the very last to exterminate a species ; it was to their interest to preserve, and not to destroy. He further remarked that the struggle for existence of a species was often much intensified by the attack of ichneumons when the species was over-collected ; for the same number of the parasites devoted their attention to the constantly decreasing number of larvæ with a very certain result.

Mr. Mansbridge said that he would like to see some limit put to the reckless exchange of modern times. Year after year he had known the York collectors go after the same insects at the same time. As an instance he mentioned *Epione parallelaria* (*vespertaria*). He had known one man take for exchange as many as 200 of this species in a day, and the same individual would go every day for a fortnight. It was the same with other species. There were but few dealers, but a vast amount of exchanging took place.

In closing the debate Mr. Adkin said that it seemed to be the decided view of the members present that some sort of protection was desirable. In his opinion the best way of effecting this object would be by raising a strong public opinion, and by the use of all possible moral suasion. He thought that the Society could aid the committee by forwarding a resolution supporting their action.

Mr. T. W. Hall then proposed, and Mr. Auld seconded, the following motion, which was agreed to :

" That the thanks of the South London Entomological and Natural History Society be given to the Committee of the Entomological Society of London for the Protection of Insects in Danger of Extermination ; that the Society strongly approve of the work ; and that the members present pledge themselves to use their personal efforts to further the objects of the committee."

HENRY J. TURNER.

Representative Species.

By Prof. A. Radcliffe Grote, A.M. *Read by* J. W. Tutt, F.E.S., *on March 25th*, 1897.

The Noctuid fauna of North America is composed of (1) a palæarctic element showing affinities with the European fauna of to-day; (2) an original North American element; and (3) a tropical American element intrusive from the south. The latter makes itself felt to a considerable extent, owing to the fact that there is a continuous land connection with the tropics through Mexico; while the proximity of the West India Islands to the Gulf Coast, the prevalence of winds from south to north during the summer, the presence of the Gulf Stream, and the circumstance that the extremity of Florida on the one hand, and a portion of Texas on the other, belong in reality to the American tropical region, facilitate its spreading over the North American continent. To the phenomena offered by this tropical element of the North American Noctuid fauna I have devoted much attention, particularly in relation to *Aletia argillacea*, the so-called cotton-worm, which I have shown to have been originally introduced from tropical America, and which still continues yearly to invade our territory. This element, of whose constituent species I have given partial lists, need not detain us here. As compared with Europe the tropical element is much more important in North America, owing to the absence of a dividing sea like the Mediterranean, and to the unbroken extension of the land masses to the south. The purely North American element consists of the peculiar genera. Their sorting out is to some extent a matter of opinion. The theory with regard to this element is that it originated on North American territory, and is the survival of pre-glacial ancestors. The first and largest element, however, is the palæarctic, which, allied throughout structurally to the European Noctuids, affords a greater number of species readily to be distinguished from their congeners in the Old World. It is assumed with regard to this element that it is descended from a common pre-glacial circumpolar or northern fauna which flourished, with local modifications, but more or less uninterruptedly, over the Northern Hemisphere before the setting in of the first "ice age." The change in climate drove the species then inhabiting North American territory slowly to the south, the cold climate still lingering in the north, interposing a permanent barrier on both sides to a further mingling of blood. Henceforward the American Noctuids belonging to the former circumpolar fauna were left to themselves, and the changes

that they have undergone have to be registered by the naturalist of to-day. For more than a quarter of a century I have been studying more or less continuously our American *Noctuidæ*, and have been engaged in resolving by comparison the palæarctic element into groups, and showing the existing affinities with the same element in the European fauna.* From the mass of species which the student readily recognises as distinct arise a small number, the specific distinctness of which from the European is more or less difficult to establish, and a still smaller number of which we can positively state that they offer no distinction whatever. The smaller number offering few and varying differential characters are what we call "representative species," and it is of these that I here chiefly write, referring to a paper upon them read before the German Association at its meeting in Bremen in 1890.

No comparison between American and European species is complete unless all the stages—egg, larva, and moth—are included in the comparison, and hitherto few have been so compared. I have only done this in one instance. I could find no difference in any stage between *Euplexia lucipara* bred in eastern North America and in Germany. I give here a corrected list of the identical species now existing in America and Europe. The fact that some Lepidoptera have been imported by commerce, such as *Porthetria dispar*, *Zeuzera pyrina*, and perhaps *Sesia tipuliformis*, together with the white cabbage butterfly (the history of the introduction of which has been narrated by Mr. S. H. Scudder), as also the introduction of certain species of Coleoptera and Diptera, does not seem to apply to the case of our identical owlet moths. There is no record of such introduction. The habits of the species, the fact that *Euplexia lucipara* is disseminated over the whole country from New York to San Francisco, that *Scoliopteryx libatrix* is found from Hudson's Bay to Virginia seem to preclude the theory of introduction. Again, another fact slides in, and this is the most important fact for the student to remember. The identical species grade insensibly by small shades of difference into the class of "representative" species, just as these latter do into the great mass of species readily separable by the usual specific characters. The theory of unchanged survival since the glacial epoch in the case of these identical species is, therefore, supported by the evidence. Beyond a few Alpine forms of *Anarta*, the identical species so far more or less fully compared, but with present certainty to be assumed, are—*Agrotis prasina*, Fabr.; *Agrotis speciosa*, Hübn.; *Agrotis ypsilon*, Rott.; *Agrotis occulta*, L.; *Agrotis saucia*, Hübn.; *Noctua baia*, Fabr.; *Noctua c-nigrum*, L.; *Noctua fennica*, T.; *Noctua plecta*, L.; *Enargia paleacea*, Esp.; *Scoliopteryx libatrix*, L.; *Heliothis armiger*, Hübn.; *Heliothis scutosus*, Fabr.; *Mamestra trifolii*, Rott.; *Xylophasia lateritia*, Hfn.; *Hillia crasis*, H.-S.; *Dipterygia scabriuscula*, L.; *Euplexia lucipara*,

* See my paper, "On Allied Species of Noctuidæ inhabiting Europe and North America," *Bull. Buff. Soc. Nat. Sci.*, October, 1874.

L. ; *Gortyna nictitans*, L. ; *Leucania pallens*, L. ; *Pyrophila tragopogonis*, L. ; *Pachnobia carnea*, Thunb. ; *Xanthia flavago*, Fabr. ; *Syngrapha hohenwarthi*, Hohn. ; *Syngrapha devergens*, Hübn. ; *Pyrrhia umbra*, Hfn.

We next come to a number of species for which separate names are used in American and European literature, but which may probably fall together. Of the identity of several, perhaps indeed of most, I have a strong conviction ; but, since I have had no opportunity of thoroughly examining a series of any two species, I have kept them usually separate in lists. For convenience of reference I arrange the names in double columns opposite each other.

Europe.	North America.
Mamestra dissimilis, L.	*Mamestra atlantica*, Grt.
Tæniocampa incerta, Hfn.	*Tæniocampa alia*, Gn.
Lithophane lambda, Fabr.	*Lithophane thaxteri*, Grt.
Lithophane ingrica, H.-S.	*Lithophane pexata*, Grt.
Calocampa vetusta, Hübn.	*Calocampa nupera*, Lint.
Lithomia solidaginis, Hübn.	*Lithomia germana*, Morr.
Helotropha leucostigma, Hübn.	*Helotropha reniformis*, Grt.
Plusia ni, Hübn.	*Plusia brassicæ*, Riley.
Calpe capucina, Esp.	*Calpe canadensis*, Beth.

The foregoing list is incomplete, and the species compared seem to differ in varying degrees. No variety of *lambda* equals *thaxteri* with accuracy, and as the forms are now geographically separate, and breed true to type, the conditions of specific rank appear to be fulfilled. On the other hand, I feel tolerably sure that the species of *Lithomia*, *Helotropha*, *Calpe*, and *Plusia* above compared will prove to be identical. Certain North American species of *Caradrina* should be added to the above, as they seem to have very close European allies. We now come to the true "representative" species, which differ in one or all stages, but which have, in varying degree, the unmistakable facies of a common parentage in the past.

Europe.	North America.
Habrosyne derasa, L.	*Habrosyne scripta*, Gosse.
Diphthera orion, Esp.	*Diphthera fallax*, H.-S.
Triæna psi, L.	*Triæna occidentalis*, G. and R.
Jocheæra alni, L.	*Jocheæra funeralis*, G. and R.
Noctua augur, L.	*Noctua haruspica*, Grt.
Noctua triangulum, Hufn.	*Noctua normaniana*, Grt.
Agrotis obelisca, Hbn.	*Agrotis obeliscoides*, Gn.
Mamestra tincta, Brahm.	*Mamestra purpurissata*, Grt.
Dianthæcia magnolii, Bdv.	*Dianthæcia ectypa*, Morr.
Hadena basilinea, Fabr.	*Hadena finitima*, Gn.

Europe.	North America.
Hyppa rectilinea, Esp.	*Hyppa xylinoides*, Gn.
Achatia atriplicis, L.	*Achatia delicata*, Grt.
Heliophila lithargyria, Esp.	*Heliophila pseudargyria*, Gn.
Pyrophila pyramidea, L.	*Pyrophila pyramidoides*, Gn.
Cucullia umbratica, L.	*Cucullia intermedia*, Spey.
Plusia festucæ, L.	*Plusia putnami*, Grt.
Heliothis dipsaceus, L.	*Heliothis phlogophagus*, G. and R.
Catocala fraxini, L.	*Catocala relicta*, Walk.
Catocala pacta, L.	*Catocala concumbens*, Walk.

This list of "representative" species might be extended. The resemblances are of different degrees of intensity. The two species, *N. augur* and *N. haruspica* seem chiefly to differ in the structure of the ♂ genitalia. The variability of the ♂ genitalia within the limits of a single species is not ascertained. If, as has been asserted of *Bombus*, the peculiar construction of the genitalia (hereof the ♀) is such as to present effective copulation between otherwise allied species, the value of the genital structures as a whole has hitherto been underrated by entomologists. On the other hand, as a systematist, I should object to according generic value to modifications of the genitalia as a decisive character, for the reason that otherwise closely related owlet moths are found to have very different types of genitalia, while practically the formulation of the different types seems exceedingly difficult. The genitalic character is now being used with apparent success to separate species which run so closely as to make their distinction on other grounds practically impossible.

The theoretically "representative" species must evidently be the changed descendants of a common ancestor, now widely separated in space, distributed over different geographical regions whither they were brought by natural forces, change of climate inducing migration, cataclysms effecting sudden separation. In the present case we may often have to do with merely parallel species which have ceased to perpetuate themselves in North America or Europe. Deeper studies and comparisons of minute variations in structure may lead to important generalisations, and to additions to the general theory which is here presented in outline merely, and which simply accounts or tries to account for the existence of identical and "representative" species of owlet moths in Europe and North America. Carried into other groups, the same general phenomena present themselves. In the *Platypterygidæ* our few species of "hook-tips" are all of the type of the European *Platypteryx falcataria*, L. The *hamula* type, typical of the generic term, is not represented with us. We have one species allied to *Prionia lacertinaria*. *Cilix* is wanting in the North American fauna, while we have two species of the Northern Asiatic genus *Oreta* (*Dryopteris*), all telling of former relations which have

been actually suspended since the time of the great winter of the years .

The present distribution of certain representative species, descendants of a pre-glacial circumpolar fauna, is a matter of interest. In 1876, my friend Mr. Jas. Behrens sent me the type and a MS. description of his *Saturnia mendocino* for examination, and I determined the moth as absolutely congeneric with the European species of *Saturnia* (see "Can. Ent.," vol. viii., p. 175). I expect this determination to hold. It is one fact in corroboration of my observations that the West Coast fauna contains structural types like the European, which have not spread east of the Rocky Mountains. So the Californian and North-west ocellated Smerinthoid form resembles the European *S. ocellatus* more strongly than our Eastern species. The occurrence of *Bombycia*, *Parasemia*, and typical *Arctia* further illustrate this point. On the other hand, the *Citheroniidæ*, a New World family, absent in the West India Islands, do not occur in California, nor, so far as I am aware, on the west coast of South America. They are found from Canada to Uruguay, east of the mountainous backbone of the continent. They constitute a peculiarly American element in our fauna, and have apparently spread from the tropical region northward and southward. The particulars of their distribution in Mexico are not well known.

The American species of *Heliothis* need a more careful study than has yet been made of them. I believe it to be tolerably certain that *H. scutosus* and the American *H. nuchalis* are identical species. Also that *H. dipsaceus* and *H. phlogophagus* are different and "representative" species. But how about *armiger?* I have not yet seen in any European collection the equivalent of the pale olive-grey or ochreous form I have described as *umbrosus*, and which is figured by Glover. The European examples are dirty ochreous and smaller. But are all the American specimens examples of the var. *umbrosus?* From recollection I believe I have seen in America examples approaching the European form. I think from this we must see that it is important to name varieties. Mr. J. B. Smith draws in all varieties which intergrade with the type; but it seems to me that it is characteristic of varieties that they intergrade. A non-intergrading form would be dimorphic or specific. This method of making mere synonyms of varietal names is a virtual covering up of facts which nomenclature is intended to lay bare. It can only be practised by those persons who believe species to be in nature the insoluble entities they conceive them to be—distinct pieces of a puzzle only fitted in their categories. When they will not fit, such persons are tempted to "destroy" them.

Taking the list of identical and representative species given by Mr. Tutt in the "Stray Notes on the Noctuæ," pp. xii.—xvi., as the standard, the only changes in names there given, necessitated by recent comparisons, are as follows:—(1) "*Agrotis conflua*,"—the American examples cited by me under this name belong to *A. rubifera*,

Grt., a "representative" species of the European *N. rubi*. I had no European examples with which to compare, and called the American specimens in 1874 "*conflua*," according to Mr. Smith's determination of my examples in the British Museum. On the other hand, *perconflua*, Grt., is the true American representative of *conflua*, which latter is not found in America. My name *perconflua*, however, must go down before Mr. Walker's *jucunda*. (2) "*Agrotis chardinyi*,"—the reference of my *gilvipennis* to *chardinyi* was made by Morrison. I had not compared the two, and Mr. J. B. Smith restores my name after examining material in the British Museum. When two Lepidopterists fall out, in America at least, they refer each other's species as synonyms upon the slightest provocation. (3) Mr. J. B. Smith, in 1882, under the name of *Heliothis dipsaceous* (and this peculiar spelling is repeated in the *Catalogue*), identified my *phlogophagus*, as identical with the European species; he afterwards, however, made them representative species. (4) *Tæniocampa incerta*.—The American specimens are considered to belong to a different species, viz. *T. alia*, Guen., by Mr. J. B. Smith; consequently this is a case of a "representative," and not of an "identical" species. I had followed Fitch in considering it identical, not having compared it myself. Other than these the determinations in Mr. Tutt's pamphlet remain uncontradicted by more recent observations.

When species "agree exactly" they are "identical;" when they "differ constantly," or their "normal condition" is to offer a slight change in colour, or marking, or structure, they are "representative" when inhabiting distinct geographical areas.

The fact that these "representative" species, if not occurring on separate continents and inhabiting distinct areas, would be held as "parallel" species, shows that the characters by which they differ are of the kind we are accustomed to in closely allied species. They differ as do *Phalera bucephala* and *P. bucephaloides*, or *Coremia ferrugata* and *C. unidentaria*, &c., in the nearest cases. But in America they shade off very gradually into the class of perfectly distinct species, the resemblance becomes always more vague and general; so that we see that we have not to do with a sharply defined class of species, contrasting with the rest of the American Noctuids as a whole. As it is not always easy to separate the identical from the representative species, so also it is often difficult to say whether a species is representative or simply parallel. The common origin of the North American and European fauna is at once evidenced by this fact. But in the "representative" species the resemblance is often so close, that we must seek some explanation. Why have some species (not introduced by commerce), such as *Scoliopteryx libatrix*, remained unaltered, and others changed a very little? Why, out of all our many Apatelas or Catocalas, are there no identical, but several "representative" species? Now here is my theory: that these "representative" species were once identical species, and lived on common ground before the Ice Age. If we accept this as a

probable theory, together with my characterisation of the differences, then the same causes have evidently in time produced "representative" species as have operated to produce parallel species. But with the first class we can better measure the result, we can more surely prove a change to have taken place at all, if we can say *T. psi* and *T. occidentalis* were one species before the glacial epoch. So that here, too, we should have a proof that species have originated through variation produced by the total surroundings. The identical species have resisted change; they have "survived" under fresh conditions.

Heliothis phlogophagus may be cited as a *typical* "representative" species (of *H. dipsaceus*), because it produces also a "representative" variety. This tendency to produce a variety with yellow secondaries (both the black markings and the yellow ground are very vivid in *luteitinctus*) is an indirect proof of the relationship in my opinion, although yellow is a common colour in the hind wings in this group.

This paper is, I think, a fair summary of the results yet obtained, and I hope exhibits the "present state of our ignorance," as Mr. Tutt so happily expresses it, in an impartial manner.

Some Considerations of Natural Genera, and Incidental References to the Nature of Species.

By J. W. Tutt, F.E.S. *Read April 8th*, 1897.

In spite of the infinite variety of the organic world, the perfection of each separate part and the harmonious completeness of the whole attract all who are searching for truth. It may be taken for granted, I think, that we who are collected here to-night have been bitten, as it were, with the desire to pierce the truths which nature hides from the ignorant and yet unfolds to every earnest worker. Each additional fact added to the sum total of our knowledge forges one more link in the chain, gives us a truer insight into the completeness of the whole, and clears up a dark corner hitherto not understood.

We have got beyond that stage when it was necessary to prove that there is a general harmony in organic creation, in spite of the dissimilarity of the individual creatures everywhere met with. We know that it is possible to recognise an unity of type among creatures apparently differently formed, and certainly very widely apart as regards their habits and functions. The progressive development of animal life is known to all but the absolutely unlearned and ignorant. The observation of the first rudimentary structures and instincts in the lower animals, of the gradual processes by means of which they are developed until they reach their higher phases, their maximum of excellence in the highest organic types, are brought to our knowledge in our pupilage as naturalists, and the tracing of the details relating thereto, the investigation of the structural advancement we observe, the explanation of such new facts as we may discover, are the work of the naturalist. When such facts and explanations as relate to structure are given, the naturalist must set forth the methods of classification suggested thereby to his mind, the method propounded being, of course, one which will accord with the various constitutional changes which have been observed by him, and which will characterise the relationships that he has been able to discover.

Every system of classification, then, must be based upon the facts observed, and must adapt itself to all the various phenomena giving rise to these facts, and on these considerations alone should any scheme be exclusively deduced. To attempt to do this without a previous training is absurd, and yet we find men who build up schemes first and then attempt to fit facts to the schemes; men who select an individual species which they miscall a type, and afterwards search the fauna through to find the species most closely agreeing with it. Bacon writes, "It cannot be that axioms, established by

means of reasoning only, should be of any value for the discovery of new results, because the subtlety of nature far exceeds the subtlety of the reasoning power; but axioms duly and orderly abstracted from particulars, in their turn easily point out and mark off new particulars, and so render the sciences active." It is necessary to keep this well in mind, lest, trusting to theory only, and neglecting the facts which alone can be derived from a wide, comprehensive, and direct observation, we pervert the latter (facts), by trying to make them fit into our preconceived notions of what ought to be, and entirely overlook what is.

It is very necessary to point out these general ideas before entering upon the detailed consideration of the arrangement of the creatures we study, *i. e.* their orderly and natural classification, for from our infancy we are indirectly suckled on erroneous notions of the facts relating to organic existence, so that when we commence our work independently, we have, often unwittingly, very strong preconceived notions of what ought to be, and which have to be rooted out completely before we can bring our mind to the proper consideration of the facts, and deduce our conclusions solely from the facts before us.

Among the various names adopted for the definition of the different subsidiary zoological assemblages, none is more likely to be misunderstood than that of the "genus." Our most conservative naturalists have at any rate a general idea and perception of what is meant in an abstract sense by the term "species;" but the nature of a genus is often entirely misunderstood, more especially by those men who give their attention particularly to synonymy and nomenclature. But until this has been really grasped, the claims for the annihilation or retention of genera will be based on no sound principle, and will, on the other hand, add to the general confusion, and prevent the advance towards the model and ideal system we desire.

Probably the most difficult erroneous notion to uproot is that in which the "genus" and "species," through having been so long associated with the same things in our minds, are regarded as of equal importance, and hence both are often looked upon as of equal (or even of the same) value, and the true idea of the "genus" is then altogether lost, being, as it were, blended entirely with the specific. This curious result is followed out to its logical conclusion by those who would, on specific characters alone, give two names to every species, or by those who, on a specific character, are ready to separate a species from its natural associates, and find a new generic title for it. Such do not comprehend that genera represent certain natural groupings of units (species), which units, although differing in certain particulars *inter se* (which, indeed, makes them recognisable as units), yet possess characters that unite them into a more or less homogeneous whole, *i. e.* the genus. The application of this general principle can be further applied to tribes, sub-families, and families;

for the principle is the same, the differences being merely relative, not absolute.

We have already assumed that certain relationships do exist among organic beings, that certain species are more nearly united by blood than others, and that therefore groupings of these naturally allied individuals are possible. By collecting all the most nearly allied species together we obtain various genera; by collecting the most nearly allied genera we get tribes, and so on.

The closely allied individuals which form a genus will, as it were, congregate around a certain individual, which will possess more features in common with the others than any other one of them will, and could we detect this individual, we should have the natural type of the genus; but we know that various physical phenomena—floods, rising and sinking of the land, volcanic action, &c.—have, in the course of ages, rendered many species extinct, and we are also aware that our own knowledge, even of existing species, is so fragmentary, that the search for the typical individual of each natural group, *i. e.* the centre from which the group has sprung, is a difficult one, and, in many cases, practically hopeless at the present time. Such a type would be, as it were, placed in the centre of a sphere; whilst the species included in the same genus with it would represent complete, incomplete, aborted, or branched radii, striking out in all or any direction towards the surface of the sphere.

It will be seen, then, that the "genus" and the "species" differ in significance. The genus is indicative of the relationships held by a group of various closely allied individuals to other similar groups in the organic world, and depends upon the various structural peculiarities which the individuals comprising it possess in common, whilst the "species" indicates the actual creature itself; in other words, the one applies to several individuals or races with distinct peculiarities, though bound together by broad structural characteristics, the other applies to a single individual race alone.

One may be met by the query—already in reality answered in the earlier part of the paper—why, if the specific name indicates the species, do we want a generic name at all, for the former indicates the animal itself? and this was the position of those who, more than half a century ago, brought forward the "Mononomique Méthode" of nomenclature. Such reasoning may be at once met by pointing out that not only do we want a name (specific) to designate the individual itself, but also another name (generic) to show its relationship to the creatures immediately allied to it, and yet others (tribal, sub-family, and family) to indicate its relationship to those more distantly allied.

The misconceptions of the generic theory which end in the belief that genera are either (1) purely imaginary, or (2) have a definite and isolated existence, are undoubtedly responsible for the assumption that a mononomic system is possible, and the latter idea applied to species has also led to gross error, although, because

species usually appear to be somewhat more definite (possibly from having been more studied) than genera, even when their abstract position is considered, the error has been less glaring.

Let us look at this for a moment. It was at one time thought that a species was a specially created entity, a thing complete in itself, and capable of absolute definition as such. Our studies have swept away the notion, for, however true it may be that the study of our insular fauna with all its missing links enables us to congratulate ourselves on the ease with which we can, as a rule, discriminate the individuals which we are pleased to constitute as species, yet our own fauna gives us some difficulty even in this direction. Who can separate absolutely some specimens of *Agrotis tritici* and *A. cursoria;* of *Cidaria russata* and *C. immanata?* yet, because they can, in the mass, be separated with less difficulty than the parallel *Tephrosia bistortata* (*crepuscularia*) and *T. crepuscularia* (*biundularia*), some entomologists will maintain the distinctness of the former, and burke the difficulties presented by the differentiation of the latter by uniting them as one species, a method to be deplored as a sign of ideal weakness. The truth, indeed, is patent. There is no sharp line of demarcation between any of the pairs of species just referred to. Species are not always the entities that we are apt to consider them; they are not always capable of absolute separation nor of exact definition. Yet species vary in degree. In the above examples they are doubtless in process of development, and since they exist largely under the influence of a similar environment, are unable to detach themselves absolutely. Of the specific value of the *Larentia olivata* of our hedgerows and woodsides we have no doubt, nor have we in Piedmont of the Alpine *Larentia aptata.* In Britain, *L. olivata* is a species; in the Swiss Alps *L. aptata* is also a species; but in the Tyrol, where *L. olivata* and *L. aptata* occupy the same ground, they produce every possible intermediate form; and we learn that these two specialised forms have even recently (as such times go) had a common origin—nay, that what are to us normally two distinct species are in other parts of the world but one. It is true, then, that between the most closely allied species there is really no sharp line of distinction, and that the greater the number of intermediate links that have become extinct, the more isolated and distinct the species become.

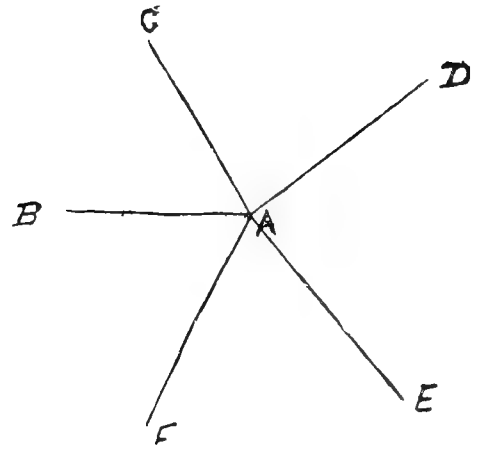
Who can separate all the Alpine Melitæas, the Skippers, the Erebias? Only those who have the most complete knowledge of them, who have seen them in hundreds in their native haunts, know that the forms, distinct enough as species in one valley, may exist as varieties, or even aberrations, in the next; yet our museum men, who have seen a few dried bodies, will separate them absolutely and give *ex cathedrâ* views upon them. It is the old, old saying again of which one is reminded when one reads these absolute views—"Fools rush in where angels fear to tread." Of an earnest worker one can safely say that at five-and-twenty he will know everything; at five-and-

thirty he thinks he may be occasionally wrong; at five-and-forty he knows he is occasionally wrong; at fifty-five he has learned his ignorance, and gives his opinions to the world in fear and trembling. Of course, there are butterfly-catchers whose age reaches the knowledge of ignorance standard, but whose sagacity includes them with those aged five-and-twenty.

This is an excursus, and I apologise. I would only impress on my hearers that species are not quite entities; that they are not absolutely defined by exact limits, but yet that they are sufficiently definable as a rule, that, with a little latitude, a name may be applied to them which will convey to the initiated a more or less clear conception of what the user means thereby.

But if species are not absolute entities, what is to be said of genera? At the outset it must be conceded that although genera are not imaginary creations, yet they are by no means clearly defined, abruptly separated from each other, nor well marked, except by accident, but merge into each other by slow and easy gradations. That genera do merge slowly into each other is no excuse for uniting them into one genus, and hence the necessity for defining a genus by characters obtained from all the stages of existence of its species, for it is only by doing this that the true position of what we may term intermediate species can be obtained. To take a single character, or even characters, common to adjacent groups, so that the various species may be enumerated with equal plausibility under two consecutive groups, and then infer that the groups cannot be upheld, and forthwith proceed to annihilate the genera by blending them into one so-called genus, is a plan much to be deprecated, and is, in reality, an attempt to fall back, to a certain degree, upon the view that species alone are to be recognised in the organic world.

In the early days of zoological science it was to be expected that general and obvious characters would be the first to be taken and used. Hence the massive genera of the older entomologists, to whom all butterflies were *Papilio*, all Lepidoptera with pectinated antennæ were *Bombyx*, all Plumes were *Alucita*, and so on. It took almost a century of slow progress before our entomological ancestors—Stephens, Doubleday, Westwood, and others—worked out the details of the minor characters separating closely allied groups, which gave us a more or less natural system of characters by which we could recognise and separate allied groups. For the last fifty years, however, our advanced lepidopterists have been engaged (1) in the working out of life-histories, and (2) more recently in discovering the phylogenetic characters presented by the creatures they study; and during this time no capable scientist has thought fit to generalise on the material thus collected, and so give us an advanced and natural scheme of detailed classification; nor have our book-makers, who have compiled books from which collectors could name their captures, attempted to set forth the alliances of the various insects described, according to the latest discoveries. Not only has this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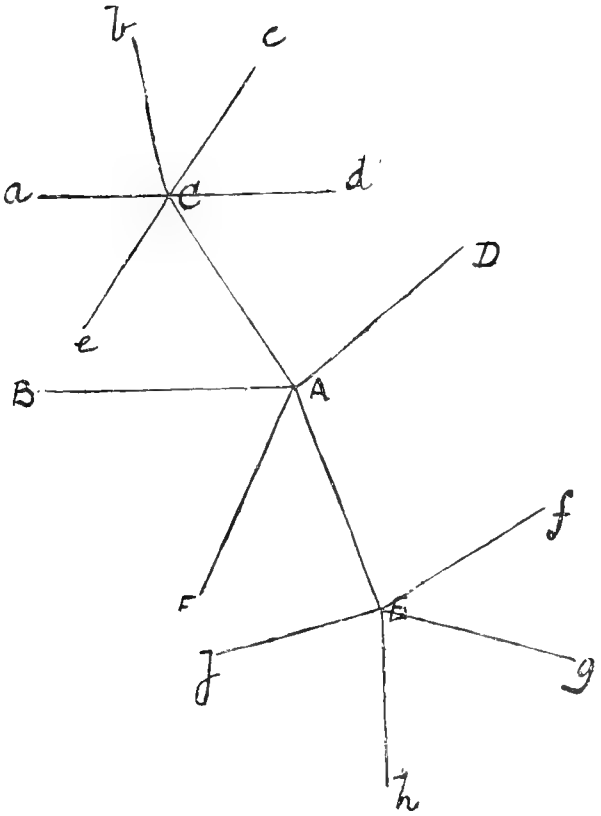
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been so, but such authors have actually attempted to depreciate the work that has been done, on the plea that the retention of names is of greater value scientifically than the truths the names represent.

I read recently, "Classification is largely a matter of opinion. . . . It is only possible to take group after group in as natural a succession as seems to commend itself to the individual writer, with the knowledge on his part that the arrangement is partly the outcome of his own particular views, and that, in all probability, those of other authors are equally substantial." This is worthy of study, as it represents, with slight modifications, the characteristic apology of those whose field work is at a maximum, whose knowledge of previous original work is practically *nil*, and whose powers of generalisation, based on work other than their own, is at a minimum. Such a man represents the antithesis of the individual against whom Mr. Vernon Wollaston inveighs, and whom he describes as "attempting the establishment of propositions and principles from simple dialectics, without a previous training in the practical bearing of the subject;" for these men are not wanting for facts, except such as can only be learned from close and prolonged study, but they are deficient in the logical conception which is required to correlate these facts according to their various values. Classification may be "largely a matter of opinion" to such men. To naturalists it is something very different.

To return to the consideration of the "genus." Let us attempt to understand what the term really includes. We have seen how various species branch off in different directions from a common stem, and how such branches at last may take on special characters, and become more or less indefinitely separated, and form what we call species. Let A represent such a centre, and give off as branches A B, A C, A D, A E, A F, and let the distance that they are from each other represent the amount of separate development that each has undergone. The nearer B, C, D, E, and F are to A, the greater will be the resemblance between the species; but as they get farther from the centre there will be considerable difference between them. They will all vary *inter se;* some on each line, perhaps, resemble more or less those on others, but they will be a natural group of individuals and constitute a genus.

Let us now assume that C and E in their turn develop new branches and characters, whilst F, D, and B remain moderately fixed and unchanged. Then the subsidiary branches, *a*, *b*, *c*, *d*, *e*, will form a genus, *f*, *g*, *h*, *j*, another genus; whilst the original group, B, C, D, E, F, with its subsidiary branches, becomes a tribe. Now there can be no doubt that we often include under the same generic title species which have been developed far away from each other; sometimes, indeed, species of which we have not as yet a clue to their development, and, until the real relationships of our species have been worked out, the term "genus" must be more or less a useful convention, always in a state of flux, liable to change with every new discovery, and as far removed from the ideal "genus" as can very

well be imagined. Here, then, we must face this important fact, that until our knowledge is complete we cannot definitely fix our genera. Fixed genera, therefore, represent ideally a finality of knowledge; and as there is no such thing, it is logical to assume that a fixity of genera, and hence of generic terms, is utterly impossible. Such an apparent result would simply represent a hiatus in scientific progress, and hence something to be dreaded and deplored.

In spite of this apparent instability, which indeed is only due to our ignorance, order and symmetry are the laws of nature. If it were possible to resurrect all extinct species, we should be able to construct a system perfect in its symmetry and in its detail, complete in its entirety, the position of every individual such that it would slide by imperceptible gradations into the parent from which it originated. That harsh lines of demarcation are not always readily discernible between the several groups does not do away with the fact that the groups exist; to assume that the allied divisions are perfectly separate and disconnected is to deny the first principles and axioms of evolution, and to break the chain on which the organic unity, as demonstrated by evolution, depends; whilst to assert that groups cease to be groups when they merge into each other would be to give away the scientific position altogether, and tend to suggest that the differences between two groups which merge on their outer limits are no longer worthy of investigation. These close relationships, this merging of the most closely allied organic beings, one into another, must occur. It is the sole basis of evolution; it exists not only between the larger and smaller groups of objects, but even between the individual objects themselves. It is the law that these changes should be slow and gradual, and the harsh lines of demarcation that exist are the exceptions, and it surely is not correct or logical to be guided by the exceptions instead of by the rule. Our groupings into families, sub-families, tribes, genera, and species are only an attempt to learn the arrangement which Nature has adopted, and to discover the lines along which her forces have moved. What we wish to find out are the natural genera or groups of organic beings, and in attempting to discover these we have to be careful to let all facts have their full value in determining what are really natural lines of relationship, and which only imaginary.

From what has been said it will be gathered that genera are more or less natural groups of species collected about central nuclei, from which the various species have been evolved in the course of ages, the nucleus being as it were the central type. Since, however, any one of these species may, under favourable conditions, itself become a nucleus, and give rise to freshly divergent species, and form, as it were, a new genus, it is clear that the parent genus and offspring genus must merge into each other. It might be convenient occasionally to look upon such a secondary evolutionary group as contained in the first, and consider the whole a genus when the two parts merge insensibly into each other.

If we had all the forms of life that have ever existed before us, it might be urged that the differences in every direction were so gradual that the species might all be considered as belonging to one genus; nay, we may go further, and suggest that we should probably have to admit that all life, all individuals, were of one species. But even granting this, the close resemblances between the individuals comprising the various groups, and also the differences between the individuals of one group and those of all other groups, would still exist, and in spite of the fact that none of these groups would be suddenly or abruptly terminated on their limits, yet the groups—generic, tribal, sub-family, and family—themselves would exist.

I need not labour the point further, that all our studies prove to us that more or less homogeneous groups of species exist, and that this being so, the recognition of genera is necessary. This being conceded, it is clear that as soon as the abstract idea of what constitutes a new genus is formed, the genus must be defined by a name. This name will then convey to the mind two fixed ideas, viz. (1) the assemblage of species included therein; (2) its own relationship to allied groups.

The groups that have been formed at various times and from different causes sometimes agree very exactly with what we consider to be convenient; hence we speak of "a well-defined genus," meaning thereby one in which the species, which should have intergraded with other genera, have from some cause or other become extinct. On the other hand, the gaps are sometimes so well filled, *i. e.* in reality have never been formed, that a large group may show no positions at which we can divide it into genera without separating somewhat closely allied species, and yet the extreme species are much wider apart than the distance that ordinarily satisfies us for different genera. Groups of this kind, in which a large number of species which merge into each other, but which have at their extremes species with different characters, thereby showing the independent development each has undergone, should be carefully studied in order that the subsidiary evolutionary centres may be discovered, and the group thus divided into its natural sub-genera, for it is very inconvenient to have large unwieldy genera in faunistic work.

Here, then, are the two lines on which all our generic work should be based:—(1) The attempt to separate species into natural groups. (2) The subdivision, if possible, of a natural group containing a large number of species into two or more subsidiary but still natural and evolutionary groups for convenience. It must not be forgotten that the natural types of these subsidiary groups are usually quite as far removed from each other as are those of more clearly defined genera around which the extinction of intergrades has taken place.

We can illustrate these two points with the Acronyctas, about the subsidiary groups of which there has recently been so much discussion. We had better, perhaps, do so in Dr. Chapman's own words. He writes: "I tell you that the British Acronyctas split

into several natural divisions with differences of about the value that are often taken for genera, and if you are to subdivide the Acronyctas into genera, then those divisions which I have called respectively *Viminia*, *Cuspidia*, and *Bisulcia* are the three primary divisions." That surely is clear enough as to the biological values of Dr. Chapman's subdivisions. As to the convenience, Dr. Chapman further writes: "Secondarily, if your genus *Cuspidia* is so large that it would be convenient to subdivide it, characters are easily found to do so. This could not be done so definitely in *Viminia*, which is very homogeneous." It will be observed here that the subdivisions are based on characters, not on "opinion."

But in practice our systematists have grouped their species, quite as much as a matter of convenience, as a matter of indicating relationships. Although, from the biological point of view, this idea of genera appears to us an exceedingly absurd one, except so far as grouping for convenience has resulted in the subdivision of an unwieldy genus into its natural sub-genera; yet, as *un fait accompli*, it has to be reckoned with, and in considering it we may grant that the groupings of species *by name* are matters of convenience, and that the name soon carries with it, or expresses, the idea of the relationships existing among the groups themselves. Dr. Chapman says, with regard to these genera of convenience, "You may, as you find convenient, make the whole of the Acronyctids into a genus, *i. e.* *Acronycta* may be your genus. My three main divisions may be your genera; or you may further subdivide *Cuspidia*—all according to convenience, not because the differences are greater or less (*in litt.*, December 22nd, 1895).

This states fairly the position of "genera of convenience," although it seems to me to be rather more at the expense of what we may term "natural genera," or natural groupings, than I should be inclined to allow. For if *Cuspidia* and *Viminia* are, as the Doctor states, "two primary divisions," with differences of about the value that are often taken for genera, I would maintain that these are absolutely the genera; that their union is unnatural so far as it gives us a tribal division with a generic appellation, and that their further subdivision must be trenching on specific characters. As a point of criticism of the Doctor's statement, however, I would suggest that it appears to me that the subdivisions set up in *Cuspidia* are almost as important biologically, and present as important differences as the differences existing between *Viminia* and these various subdivisions. That being so, and since each of the British species included in the various subdivisions of *Cuspidia*, itself forms one of a very natural group of species distributed over the palæarctic and nearctic regions, I am inclined to look upon these subdivisions in the light of natural and well-defined genera.

It will be seen from my remarks that I agree largely with Wollaston, who writes: "With respect to their immediate associates, genera cannot be isolated and distinct, but must of necessity merge

on their own limits. Hence, if such be the case, as I contend that it usually is (the exception to the rule being the result of accident, and by no means a part of the original design), it may perhaps be a problem how far we are justified in rejecting many large and natural assemblages, through the fact that they blend both at their commencement and termination imperceptibly with others, their precise boundaries being dimly defined." It would appear that we are not justified in rejecting any " natural assemblage," but the distinctions between the extremes of two adjacent assemblages should be defined as precisely as possible.

One other point presents itself to me, viz. that groups which appear to be abruptly and distinctly isolated when our knowledge is imperfect, or based on the fauna of a very small area, are very frequently found to be closely united with others when our knowledge becomes more complete, and when intermediate forms from other districts are discovered, so that their separation and isolation are in such cases directly the result of ignorance rather than an actual fact.

The question of convenience appears to me at best an unsatisfactory one. Personally I am inclined to reject it altogether; but when convenience is urged by naturalists, it should, it appears to me, always be with the proviso that it breaks no natural law.

To illustrate this point we may turn to the British Vanessids. Scudder has long since pointed out that all our British species are practically representatives of distinct evolutionary groups, and has characterised them in the egg, larval, pupal, and imaginal stages as distinct genera. It is further well known that if the Vanessids of the world be considered, our British species will fall into various genera belonging to the tribe *Vanessidi*. For example, our comma butterfly (*c-album*) is a member of the great American genus *Polygonia*, consisting of a large number of closely allied species, all with the distinct characters of our single British species. Our British *cardui* and *atalanta* fall into the genus *Pyrameis*, of which there are many species both in Asia and America. The large tortoiseshell falls into an entirely different genus—*Eugonia*—from that of the small tortoiseshell butterfly—*Aglais*, both of which have Asiatic and American representatives. Yet a recent author, writing on these from a purely British outlook, says, "The genus *Vanessa* is now broken up into several sub-genera for the purpose of classifying the numerous exotic species, but for the few that we possess this subdivision seems unnecessary." Surely this was written in pure ignorance of the facts. From 1816 onwards the Vanessids have been properly considered as a tribe, containing in itself many well-defined genera, and the advanced writers of every decade have recognised the fact. The first part of the quotation, too, is incorrect, for Hübner never considered the subdivisions as anything lower than of generic value, and Scudder distinctly diagnoses them as such, and at present I must confess that I am not aware of what this writer means by a sub-genus.

Biologically, I take it a sub-genus is a genus in process of evolution from a parent stock, but our British Vanessids represent well-defined diagnosed generic divisions to which the term "sub-genus" is most distinctly inapplicable. It appears to me that if, when the Vanessids of the world are considered, certain genera or evolutionary groups are discovered with certain specialised characters in each group, and if it be further found that our various British species belong to several of these different evolutionary and structurally distinct groups, it is certainly right and proper to refer each of our species to its own generic group. It is reducing science to absurdity to say that the generic characters which it is necessary to recognise for the purpose of "classifying the numerous exotic species," become simply specific characters when we come to consider the British fauna, because we possess so few species.

It matters not at all if we have only one species in Britain belonging to a certain evolutionary group, that species must be put into the genus, and be known by the generic name which that evolutionary group bears in the faunas of the world. Genera are not mere matters of convenience, as such authors as we have quoted seem to imagine, nor should they be made up of just as many heterogeneous or homogeneous species as the mind can readily remember.

There is no need to go into a detailed explanation of the various factors which have resulted in the formation of what we call well-defined genera. We have already hinted as to how the extinction of intermediate forms may be brought about. We have already pointed out what we consider is the line to be adopted when genera merge insensibly in various ways into each other. It cannot, however, be too strongly insisted upon that if genera are to be rejected simply because they are not abruptly terminated and distinctly isolated, we shall only have genera remaining which have become isolated through purely accidental causes; and to build up generic differences on groupings which are *per se* exceptional, and not normal, is certainly not the way to develop a genealogical tree which shall show natural relationships, but is rather an attempt to point out the isolated groups which are conspicuous because of the absence of close relationship with each other or with any other group.

I think I have pointed out, in a crude and incomplete manner, I am afraid, what I consider should be the basis of natural genera. That it differs absolutely from the genera that we are repeatedly treated to by systematists is perfectly obvious. In genera, as in species, we may detect a certain amount of permanence and instability combined, even in the most ideal and theoretical aspects, the permanence predominating in the "species," the instability in the "genus." There is, as it were, a general permanence combined with the instability of the component parts—

> "Still changing, yet unchanged; still doomed to feel
> Endless mutation in perpetual rest."

Some British Spider Crabs.

By Edward Step, F.L.S. *Read April 22nd*, 1897.

The Spider Crabs inhabiting British seas number a round dozen, and they are characterised by a general resemblance to the *Arachnidæ*. The ambulatory limbs are more or less cylindrical in shape, the joints of pretty equal thickness throughout, and in some species drawn out to a length that suggests the "harvestman" among spiders. Their bodies, too, are much longer than broad, and somewhat triangular in general outline. Another item shared in common by all these Spider Crabs is the tendency to develop innumerable spines and hooks upon the carapace and other portions of their upper surface, and to turn these appendages to the best account.

Although they possess so much in common which distinguishes them from other crabs, these marine "spiders" differ so much among themselves that systematists have arranged them into seven genera belonging to three separate families. Their correct relationship, as fixed by the authorities for the time being, is as follows:

Family.	Genus.	Species.
Inachidæ	*Macropodia*	*rostratus* (L.).
	,,	*longirostris* (Fabr.).
	Achæus	*cranchii* (Leach).
	Inachus	*dorsettensis* (Penn.).
	,,	*dorynchus* (Leach).
	,,	*leptochirus* (Leach).
Maiidæ	*Maia*	*squinado* (Herbst).
	Hyas	*araneus* (L.).
	,,	*coarctatus* (Leech).
	Pisa	*tetraodon* (Penn.).
	,,	*tribulus* (L.).
Parthenopidæ	*Eurynome*	*aspera* (Penn.).

It is not my intention at present to deal with the whole of this list, for the very good reason that I have not an intimate acquaintance with them all. With two-thirds of the number I am sufficiently familiar, through the medium of living specimens from Gerrans Bay, to justify me in offering a few remarks. Most of the others are known to occur on the Cornish coast, and I am hoping to extend my knowledge to several of them during the coming summer.

I have remarked that they make full use of the liberal array of hooks and spines with which Nature has endowed them, and they do so by attaching fragments of weed, zoophytes, sponges, ascidians, etc. If the females of our own race were similarly endowed with

hooks they could scarcely exhibit more intelligence and artistic taste than are shown by these Spider Crabs in disguising their natural beauty. This is the more remarkable because their eyes are so situated and mounted that a very limited portion of their decorated surfaces can be brought within the field of vision. However, some other sense probably comes in to assure them that a satisfactory arrangement of fal-de-rals has been effected; for when a specimen decked out with red weeds is placed in a tank where only green weeds grow, the red is soon stripped off and replaced by green. Some species decorate both carapace and limbs, some the limbs only or chiefly; but in no species with which I am acquainted is any attempt made to improve the natural condition of the under surface, except the broad abdomen of the females when it is distended by ova, but it has then ceased to be a part of the under surface, and needs disguising.

The specimens submitted for your inspection were not set up with a view to this paper, but have been more or less scraped and scrubbed to show the crustacean pure and simple; one or two, however, have not been so carefully cleaned, and one is in full "war paint."

Macropodia rostratus is by far the most common of the spider crabs of this district, and comes up in profusion, its long legs entangled in the meshes of every trammel-net that is shot. The terminal joint of the smaller limbs is slender, curved, and flattened, the lower edge with a dense fringe of short hairs, and is habitually folded up close against the next joint, so that, for holding tenaciously to the finer weeds among which it appears to get a living, these are as useful as the pincer-claws or *chelæ*. So tightly do they hold by this means that it is difficult to dislodge a specimen from a net without causing it to drop several of its legs. This act is performed on the most voluntary principle, so that only a small percentage of those obtained are perfect. These slender legs are in this species sparingly clothed with stiff long hairs, but along the upper surface at regular intervals are other hairs, which are curved in such fashion that the tips as well as the roots are in contact with the crust. All over the crab's back (*carapace*) are a large number of similar hooked hairs, and it is sufficient that the crab should take a small length of weed and draw it over its carapace to secure it there, the hooked hairs holding it in position. But these spider crabs are not content with covering the carapace, the smaller legs are often covered in *M. rostratus*; also the rostrum (where the hooked hairs may be most easily seen), and even the antennæ.

It is singular that only quite recently most writers on the Crustacea agreed that all these foreign substances had naturally grown on the crabs just as they might have done upon a rock. Bell attributes their growth to the sluggish nature of the crabs, and in speaking of *Pisa tetraodon*, which he took in very large numbers at Bognor, he says, "Like all the slow-moving Crustacea, they are very liable to be covered with small *fuci*, so that they are sometimes completely

concealed by a mass of these marine plants growing upon their surface, where their roots find a firm hold amongst the villous coat of the shell and limbs. This is especially the case with the females, which in this as in many other species are less active than the males." And in a foot-note he adds, "Say supposes that the *fuci* which are found covering certain Crustacea are merely entangled mechanically in the hooked hairs by which they are covered; but there is no doubt they actually grow upon them, and are attached by roots. This is evident from the healthy state of the plants, as well as from the direction of their branches."

Such a statement is absolutely startling, coming from Bell, who professes to know the living crab, for it makes clear the fact that his descriptions were not made from the life, but from cabinet specimens; also that he was ignorant of marine botany. Throughout his descriptions he never again mentions these hooked hairs, which are such an important feature of their natural outfit, although he does see and mention the clubbed hairs of *Pisa*. No naturalist with Say's theory before him could make a careful examination of the living crabs without coming to the conclusion that Say was right, and it is very clear that *Fuci* could not be attached by roots, for they have none. Nor does the direction of the branches support Bell's contention as he declares, for it is the nature of marine plants as of terrestrial vegetation to grow up towards the light; but these fragments on the crab's surface take a more or less horizontal direction. But, in truth, a very cursory examination is sufficient to show any one that these weeds have no natural attachment to the crab, and that they are simply caught under the hooked hairs or glued to the straight ones. Nor do these slim-legged spider-crabs affect *Fuci;* they prefer the more delicate Chlorophyceæ and Rhodophyceæ. The only weeds I have found growing *naturally* upon them are those of a low confervoid nature that grow rapidly over any submarine surface. *Maia squinado*, however, does use *Fuci.*

The specimens of animal life to be found upon *Macropodia rostratus* are not numerous, but there is no room for doubt as to the reality of the vital attachment of these. One of the tubeworms (*Serpula*) is frequently conspicuous on the carapace, and some form of Zoantharian; occasionally also a small saddle oyster (*Anomia*); otherwise there is little animal life to be found there.

In order to bring out some of the details of structure more clearly, I have mounted on one card fragmentary portions of *M. rostratus.* From these disjointed parts will be gathered at a glance certain facts: —(*a*) the remarkable difference in the development of the abdomen in the two sexes, its greater breadth and convexity in the female being due to the fact that it has to serve as a pouch to protect a great mass of ova. And here I might mention the fact that the females of this species are sexually mature quite early in life, for they bear eggs when they have not reached one-fourth of their full size; (*b*) the rostrum is much longer in the male than in the female, and the *chelæ*

or pincer-claws are in the male about three times larger than those of the female, and proportionately more robust; (*c*) note also the cells for the reception of the inner antennæ just below the rostrum, and the singular bristle at the apex of the non-retractile eyes. Other points already referred to are illustrated on that same card.

This species is exceedingly abundant in Gerrans Bay, and appears to be largely preyed upon by fishes. Mr. Hailstone, quoted by Bell, observes that of stated numbers taken at one haul off Hastings the proportion of males to females was as two to one. My own observations would lead me to say four to one; yet I do not think this is any evidence of the proportionate numbers existing in the sea, but rather due to the fact that the males may be more inquisitive in exploring trammels and crab-pots than the naturally less active females.

The other species, *Macropodia longirostris*, does not appear to be at all plentiful in this district, though Couch and Spence Bate in their "Cornish Fauna" describe it as "very common at the depth of two to twenty fathoms." The general aspect of the male *longirostris* is very similar to that of the female *rostratus*, if we ignore the prominent abdomen of the latter; it is necessary, therefore, to carefully scrutinise specimens to avoid passing over *longirostris* as females of *rostratus*. The points of specific difference are found in the greater length of the rostrum in the former, which exceeds the peduncle of the outer antennæ; the possession of a series of minute spines on the inner side of the longest joint of the *chelæ*, and two small tubercles between the mouth and each outer antenna, instead of one as in *rostratus*. In addition, the body of *longirostris* is more elongated and the spines of the carapace sharper.

Achæus cranchii I have not yet found here, and suspect it does not occur in Gerrans Bay. Couch and Spence Bate say, "Not common: deep water among weeds." The species was discovered near here by Mr. Cranch, after whom it is named, and who obtained a solitary female specimen whilst dredging off Falmouth. Milne-Edwards says it lives among seaweeds and on oyster beds, and this may explain why I have not yet obtained it: the oyster beds are in the creeks of Falmouth Harbour.

Inachus dorsettensis, the most common of the three British members of the genus, has not yet come in my way, though Couch and Spence Bate record it as common on this coast in crab-pots; yet the less common *dorynchus* and the rare *leptochirus* have fallen into my hands, and are now exhibited. The chief differences between them may be briefly stated, or at least sufficiently so for the purpose of distinguishing them. Just behind the eyes comes the gastric region, and in *dorsettensis* this is occupied by a transverse row of four small tubercles, and a large one a little behind them (⁘). In *dorynchus* the same region is adorned by two small tubercles and a large one a little behind, the three arranged triangle fashion (∴). In *leptochirus* the disposition of the spines and tubercles is very

similar, but the cardiac region in *dorynchus* possesses a rounded elevation on which are three very small tubercles in a triangle with the base forward (·.·). In *leptochirus* the cardiac region is occupied by three spines, but here the *apex* of the triangle is forward (.·.). In addition, *leptochirus* is more substantially built, and grows to a much larger size. By a comparison of the specimens you will observe that in *dorynchus* the joints of the chelæ are swollen and rotund; in *leptochirus* they are more nearly cylindrical, and longer. The "hand" or terminal joint of the chelæ in *dorynchus* is not equal to two-thirds of the length of the carapace, whilst in *leptochirus* it is slightly in excess of the entire length of the carapace. But there is another very important mark whereby the male *leptochirus* may be known at a glance. On the thorax beneath there is a raised tubercle of polished white, which is peculiar to *leptochirus*, though a differently shaped tubercle of similar character marks the Mediterranean species, *I. thoracicus*.

I. dorynchus in my experience delights to cover its upper surface entirely with a slimy yellowish sponge. Nature has only clothed the mountains and valleys of its carapace with a scrubby coating of minute bristles, and I presume it plants a cutting or two of the sponge in the valleys whence they spread until the whole surface is covered with a homogeneous layer. I have not seen this planting done, but the specimens I have obtained have all been coated evenly in this fashion, and have had to be scraped. The covering is applied to the upper surface of the chelæ as well as the carapace. There is a great advantage in covering oneself in this fashion; it is akin to the wisdom of the leaf-rolling larvæ, which gain by one effort a disguise and a series of meals. About three weeks since an individual came into my possession, and I placed it in an aquarium where it had for companions an *Echinus miliaris* and a fine *Galathea strigosa* in a beautiful scarlet coat diversified with lines of dazzling blue. The walls were well draped with green confervæ, whilst *dorynchus*, lesser limbs were decked out with small fronds of deep crimson weeds, and before he had been there many hours he appeared to feel acutely that he was not in harmony with his environment. It is true there was a rough piece of serpentine in the centre of the vessel, in which crimson tints predominated, and he made the most of this by clinging tightly to it, head downwards; but all the time he evidently realised that his yellowish sponge had closer affinity with the green tapestry. Anyway he commenced to strip off his crimson rags, and next morning he had not one on. Some he had eaten, the others were lying on the floor of the vessel. Then he followed the example of the *Echinus*, and tried to cover himself with patches of the green confervæ, but evidently there was not sufficient body in it to serve his purpose, for he gave up that attempt. He clung to his sponge covering, however, or rather he allowed it to cling to him; but after he had been thus situated for a fortnight he began to feel hungry, and then the full beauty of his arrangement came out. Reaching across his carapace

with his pincers he brought away a handful of the sponge and proceeded to eat it. At the time of writing he had supported himself for a week on the produce of his carapace, had cleaned off one of his big claws, and was busy with the other. Fragments are still left in the valleys of his back, and these are probably respected in the hope that they will again spread.

Very few specimens of *dorynchus* have yet fallen to my lot; chiefly, I believe, because my fisher friends do not readily distinguish them from the common *Macropodia rostratus*, of which they consider I have already had enough.

The specimen of *Inachus leptochirus* exhibited is my type at present. At the moment of writing I have access to no recent notices of the species. Bell mentions only four or five specimens as having been taken up to the appearance of his "History," but whether later naturalists have been more successful with it I cannot say. I note that Stebbing merely mentions that there is such a genus comprising six species, of which three (named) are British, but gives not even a generic description. At present I can add nothing to what is apparently the very scanty knowledge of *leptochirus*, except that Gerrans Bay must henceforth be included among its localities.

Maia squinado I had occasion to bring under your notice nearly two years ago. I have living and dried specimens I could send you, but they are large and awkward, so I content myself with sending photographs of the upper and under sides. I shall not go over old ground again, but will briefly say it is the largest and most prickly of all our spider-crabs. The entire carapace is thickly covered with broad-based substantial spines, which reach their highest development around the antero-lateral margins and along the median line from front to back. Every one of these conical spines has the base surrounded by a circle of hooked bristles for the purpose of securing three- or four-inch lengths of *Halidrys siliquosa* and *Zostera marina*. The upper sides of the legs are thickly coated with these hooked bristles for a similar purpose, and wherever it is possible to find space unoccupied by these, stiff sharp bristles are planted that will enter the flesh of the naturalist as readily as do the hairs of Cacti. These straight bristles serve to hold all sorts of rubbish in the shape of mud, sand, *débris* of rotting *Fuci*, &c., in which the numerous tribes of worms, sand-stars, amphipods, anemones, sponges, polyzoa, mollusca, &c., may find congenital quarters. I could write you a paper upon the fauna of a *Maia's* carapace, and I think it would have to be quite as long as the present essay. On one occasion I detached seven specimens of the anemone *Cylista viduata* from the back of the particular *Maia* whose portrait is before you, and I have not yet found that species elsewhere in this neighbourhood, though I have been fairly successful in working out the anemones of the district. The photographs are from a male. The female has proportionately shorter and more slender chelæ, but the abdomen is so highly developed that it entirely covers the thorax—its lateral margins (it is oval in form)

slightly overlapping the basal joints of all the limbs, and the anterior portion overlaps the base of the maxillæ. In the male the under surface is smooth and polished like porcelain, but in the female it is covered with a dense pile of short, stiff hairs. A character sketch of this species from my pen appeared in the "Leisure Hour" for July, 1896.

Neither of the two species of *Hyas* from these waters has yet come into my possession, and of the next genus I have obtained but one of the two—*Pisa tribulus*, which I exhibit. It had, unfortunately, met with an accident before it was caught, by which its rostrum was injured. The fisherman to whose sympathy with my weakness for what his tribe are pleased to call "curios" I am indebted for this specimen, was somewhat startled to see a mass of red sponge walking along where it had fallen from the crab-pot, and it was handed to me as a curious sponge, to see if I was sharp enough to detect its real nature. I "spirited" it at once, just as it was, without detaching the sponge, which, however, I have since touched up with colour to make up for that which the spirit dissolved out. Observe that all its limbs are short—that is, for a spider-crab. It keeps them well hidden away under its load of sponge (which has shrunk from its original dimensions), but it disguises them by attaching bits of weed, etc. Note how its æsthetic sense has been gratified by placing small pieces of the white calcareous sponge, *Leucogypsia*, on each leg. Is this to create the optical illusion of detaching the legs from the body? We know how important a part white spots play in protective colouring, and it looks much as though the crab had a similar purpose in view here.

Pressure of other engagements prevents me from proceeding further with this subject just now, but I trust you will forgive the brevity of this paper, and regard it merely as an introduction to the specimens exhibited. Few field naturalists appear to be working at our indigenous Crustacea, though I fancy there is a good deal yet to be learned concerning them. I hope before long to trouble you again with some brief notes on other of the crabs of Gerrans Bay.

Notes on a Variety of Portunus marmoreus.

By Edward Step, F.L.S. Read *May 27th*, 1897.

Hearing that the ground seans were being worked on Pendowa Beach one evening at the end of March, I wandered up in the hope of finding a few specimens of no value to the fishermen. It was quite dark when I arrived, but had it been a night too dark to see anything I should have found the exact locality of operations, owing to the barking of four or five dogs that were keenly interested in the affair, and getting under everybody's feet. It was the right moment, for the men were just hauling in the long net and picking out the meshed mackerel and "flats." I saw the fish all cleared out and shared, the sean carefully heaped on the sand-dune far above high water, and the fishermen depart to their homes. Then came my turn. I wanted some specimens of *Corystes cassivelaunus*, the long-armed or masked crab, and should have brought a lantern with me to aid in the search. A few matches were all I had in the way of a light. Seeking the "cod" or bag of the sean, and striking a match, I saw several large shore-crabs (*Carcinus mænas*) and velvet fiddlers (*Portunus puber*), all active and noisy, and then a fine male of *Corystes*. Several other specimens of *Corystes* were obtained, but having exhausted my matches, it was easier to get a painful nip from the savage fiddlers than to find the more friendly long-arms. Having previously learned that two other seans had been hauled higher up the bay, I determined to defer further collecting until the following day.

A more careful examination of the three seans next day yielded not only a number of specimens of *Corystes*, but also several of *Polybius henslowii*, Leach, and *Portunus marmoreus*, Leach, both desirable finds, for I had not previously obtained good specimens of either, they being pelagic in habit. *Polybius* is *the* swimming crab *par excellence*, for all its limbs with the exception of the powerful *chelæ* are flattened for swimming, and the terminal joints of the fifth pair are admirable swimming plates half an inch across, and three quarters of an inch long, looking as though they had been hammered out thinly to make the most of the material. Then the entire shelly matter is everywhere exceedingly thin and light, to suit its habit of mounting to the surface waters, and chasing such active fishes as the mackerel, to whose back it clings, and from which it carves its dinner.

But I am getting away from my subject, which is *Portunus marmoreus*. Judging from the specific diagnosis given by Bell, he is right in the supposition that *P. marmoreus* and *P. holsatus* are forms of one species; and not greatly differing forms, for without reference types it appears to me that the chief distinction between the two is the comparative breadth and length of the terminal joints of the last pair of limbs. According to this slight foundation upon which to build a new species, my specimens are all referable

Portunus marmoreus, *Leach*. Var. Nat size.

to *P. marmoreus*, for the length of this terminal joint in them is more than twice the breadth.

The colour and disposition of the markings in *P. marmoreus* are different in almost every individual I have seen, and consist of a mottling of red and white spots and lines of various sizes and intensities of colour. In some the white is not pure and bright, and yet not sufficiently debased that one could describe it as bluish or greenish or yellowish white; in others it is clear and bright like white porcelain. So likewise with the reds: these may be pale brownish, bistre, Indian red, or dull crimson; laid on as a network over the white, or sprinkled in dots of several sizes and tones.

In this individual those portions of the carapace covering the gastric, the cardiac, and the genital regions are solidly coloured with a dull crimson. Seeing how accurately this coloration corresponds with the boundaries of these regions, I concluded that some diseased condition of the organs beneath had caused the aberration, but on taking off the carapace and examining the tissues beneath I could find not the slightest indication of any cause for the abnormal condition of the exterior. I am at a loss to explain the variety, but shall keep a sharp look-out for further examples of the species, to find out if this is a recurring variation. Meanwhile I think it is of sufficient interest to be recorded in our "Proceedings."

Whilst on the subject of swimming crabs I may note that a male specimen of the beautiful *Bathynectes longipes* (Risso), or long-legged swimming crab, has been recently added to my collection from deep water near here. It is a Mediterranean species, of which the first recorded British specimen was dredged in Cornish waters by Edward Forbes in 1848, and later individuals appear also to have been taken west of Plymouth. The entire upper surface and much of the lower are uniformly coloured bright brownish red. The carapace is somewhat boldly sculptured, and its extreme breadth twice the length of its depth from front to back. A prominent ridge extends right along this longer axis, and ends at each extremity in a long and strong spine. The limbs are much longer in proportion to the trunk than in any members of the genus *Portunus*—where this was formerly placed; the hinder pair, though flattened for swimming, do not indicate that the crab is a surface swimmer, but more probably a denizen of the redweed regions at about fifteen fathoms. It is curious that this, the only specimen I have yet obtained, should also be a singular variety. Normally the antero-lateral margin of the carapace is five-toothed, of which the long spine previously mentioned forms the hindmost of the series. Now in my specimen the first and second of these teeth are one, the intervening space being filled up in the course of development.

When an opportunity arises for attending a meeting I hope to bring these and other specimens of local Crustacea with me, but I am fearful of entrusting them to the tender mercies of the Parcel Post officials.

Spring Butterflies on the Riviera.

By J. W. Tutt, F.E.S. *Read May 27th*, 1897.

I have long recognised that a proper study of the time of appearance of the Lepidoptera along the Mediterranean littoral in spring was the only means of understanding some of the peculiarities relating to the time of appearance of our own species. In this way the hybernating stages of *Colias edusa* and *C. hyale* have been set at rest, whilst some light has been thrown on those of *Pyrameis cardui* and other butterflies. It might be urged that the climatic conditions prevalent along the Mediterranean littoral are so different from those of our own islands, that different habits might well result, even in the same species, when the southern races of butterflies are compared with our own. But these differences are of degree rather than of kind, and although frosts are rare during the winter, and thus many delicate species of insects exist in these southern latitudes that cannot live with us, yet there is a distinct winter, *i.e.*, a resting period, when deciduous trees lose their leaves and herbaceous plants are at a standstill, when nights are cold and life is in a static condition, which results in maintaining the hybernating habits in a more or less fixed manner, which we recognise in our latitudes as normal for the various species. Thus *Aglais urticæ*, *Eugonia polychloros*, *Polygonia c-album*, and *Gonepteryx rhamni* go into hybernation as with us; whilst *Pyrameis atalanta*, which puts off hybernation with us as long as possible, may be seen on any fine day throughout the winter enjoying the sun, and demonstrating that its torpidity is very different from that of *Aglais*, *Eugonia*, and *Polygonia*. Besides, it must be borne in mind that the difference between the summer and winter temperatures of Nice, Hyères, Cannes, &c., is quite equal to, if not greater than, that of our own; and if the average winter temperature is high, the average summer temperature is much higher, and a difference is thus maintained.

But if these differences result in the maintenance of similar habits of wintering in the various species common to the British Islands and the Mediterranean coasts, it produces one marked difference, viz. the development of regularly double or triple broods in species that are normally single or only partially double-brooded with us. This is due essentially to the fact that spring commences earlier, that vegetation is on the move earlier, and progresses at a more rapid rate than with us; whilst the higher temperature that moves the vegetation so quickly, and thus provides food for lepidopterous larvæ, also develops the eggs of Lepidoptera more quickly, promotes the more rapid growth of wintering larvæ and the more rapid development of wintering pupæ, whilst hybernating imagines are tempted from their

hiding-places earlier, and set about the business of egg-laying at a time quite impossible in Britain.

The study of a collection of Lepidoptera made by Dr. Chapman during the last week of February, throughout March, and the first fortnight of April, at Cannes, Grasse, and the neighbourhood has perhaps helped to emphasise these points. From this collection one would surmise that whereas in February very few diurnal Lepidoptera are moving, and that this month thus resembles April with us, the rapidity with which emergences follow each other in March suggests that three weeks at Cannes at this time is sufficient to comprise the whole gamut of development which occurs with us in May and early June, the middle to the end of April seeing at Cannes the termination of what may be called the purely spring species, the advent of the summer ones, and the rapid growth towards maturity of the larvæ of second broods of the early spring species—*Spilothyrus alceæ*, *Thanaos tages*, *Syrichthus malvæ*, *Chrysophanus phlæas*, *Cyaniris argiolus*, *Everes argiades*, *Polyommatus icarus*, *P. baton*, *Nomiades melanops*, *N. cyllarus*, *Papilio machaon*, *P. podalirius*, *Pieris daplidice*, *P. brassicæ*, *P. rapæ*, *P. napi*, *Anthocharis belia*, *Colias edusa*, *C. hyale*, *Melitæa cinxia*, *Argynnis lathonia*, *Pararge egeria*, and *P. megæra*. These feeding larvæ are the progeny of the eggs laid in March and early April, and they will produce a second brood during the summer months, some as early as May and early June. These in turn will, in due course, produce in some species a third brood in July and August, the progeny from which will go over the winter.

As a supplement to these remarks, which are based on a series of letters from Dr. Chapman and the examination of the specimens captured, I append a complete list of the diurnal Lepidoptera seen or captured by him during the spring of this year, chiefly at Cannes.

In February.—*Lampides boetica*, *Callophrys rubi*, *Pieris rapæ*, *P. napi*, *P. brassicæ*, *Anthocharis belia*, *Pararge egeria*, *P. megæra*, *Polygonia c-album*, *Euvanessa antiopa*, *Eugonia polychloros*, *Pyrameis atalanta*, *P. cardui*.

In March and April (to the 12th).—*P. egeria*, *P. megæra*, *Pieris daplidice*, *P. rapæ*, *P. napi*, *P. brassicæ*, *Callophrys rubi*, *Cyaniris argiolus*, *Cœnonympha pamphilus* and ab. *lyllus*, *A. belia*, *Colias edusa*, *Thais medesicaste*, *T. polyxena*, *Euchlöe euphenoides*, *E. cardamines*, *Gonepteryx rhamni*, *G. cleopatra*, *Polygonia egea*, *P. c-album*, *Melitæa cinxia*, *Leucophasia sinapis*, *Thanaos tages*, *Syrichthus malvæ*, *S. alveus*, *S. sao*, *Polyommatus baton*, *Everes argiades*, *Brenthis dia*, *Polyommatus icarus*, *Nomiades melanops*, *N. cyllarus*, *Papilio podalirius*, *P. machaon*, *Spilothyrus alceæ*, *Erebia epistygne*, *C. hyale*, *Chrysophanus phlæas*, *Argynnis lathonia*, *Polyommatus bellargus*.

The British Day Butterflies, and the Changes in the Wings of Butterflies.

By Prof. A. Radcliffe Grote, A.M. *Read September 23rd*, 1897.

At this time, when different systematists are spreading their classificatory nets over the Lepidoptera, some fixing their webs to the pupæ like Dr. Chapman, others to the larvæ like Dr. Dyar, while again others, like Mr. Meyrick, adopt what may be called the aëronautic plan, and float their fabrications in a general atmosphere of opinion, I have thought it of advantage to study the progress and direction of the changes in a single organ, and that organ the wings. It has so happened that I have been constrained to publish the results hitherto reached by me in German; and while glad to embrace the opportunity of expressing myself in my native tongue, I may do so here at the expense of some repetition, for which I apologise.

And first as to the method employed in bringing out a clear and accurately proportioned picture of the neuration. Mr. J. Alston Moffat has recently drawn attention to the fact that I commenced to publish photographic plates illustrating new species of Lepidoptera some three-and-twenty years ago. From these plates, 1874–6, to those recently published in the "Mittheilungen of the Roemer Museum," in 1895–6,* there is certainly a great progress, which is commensurate with the advance made during this period by the art of photography, and the methods of reproduction itself. While there may be some question as to the merits of the photographic process over engraving when the perfect insect is to be represented, there can be none, I believe, where anatomical preparations are to be considered, such as the neuration of the wings. If there were any such question, I think with deference that it may be considered as settled when we compare, for instance, the drawings say of the venation of *Colias* and *Pamphila* and *Argynnis*, given by Mr. Meyrick in his recently published "Handbook," and the photographic impressions in the "Butterflies of Hildesheim," issued this year.

From the preparations of the neuration laid simply upon glass, enlarged photographs are first made, and then mounted on cards for study. After undergoing secondary processes these impressions are transferred to zinc or stone to be printed. For my study of the day butterflies, the general results of which are briefly given in this paper, such photographs were prepared of all the species which I desired to study. Of each form I usually had both male and female; but, since sexual differences in the neuration itself (I am not now speaking of the swelling of the veins in the males of certain Nymphalids or

* "Die Apateliden" (1895); "Die Saturniiden" (1896).

Satyrids, or of the instances of peculiar structure in the same sex among certain *Agaristidæ*) are hardly known to me as yet, a single preparation will commonly suffice. The variation in the neuration of a single species is usually very slight. Where it is perceptible it falls under two heads : (1) the tendency to form extra fragmentary veins, or again, the sudden obliteration of a part of a normal vein ; (2) a variation in the position of the veins which is found to fall in with the general direction taken by the neuration in evolution. The first may be characterised as *abnormal*. Its cause is obscure to me ; and while the sudden appearance of a stump of a new vein may be looked upon as a display of negative growth, the disappearance of a part of a normal nervure or vein may be directly owing to failure in the supply of nutrition. But the *normal* variation cited under (2) is by far the more interesting. By it I have been furnished with proof that the general direction and progress detected by me in the specialisation of the wing is correct. Thus the individuals of a single species would present different grades of specialisation, just as the assemblages of individuals which we characterise as species present different grades of the same specialisation when compared with each other. Instances of the *abnormal* class of variation have occurred to me in the genera *Melitæa*, *Endromis*, *Smerinthus*. From an examination of a series of *Copismerinthus ocellata* I have been able to establish various grades of *normal* variation in the position of the branches of the media.

But I am anticipating. The mounted photographs of all the forms proposed to be studied I arranged in lines on shelves, one after another, so that while walking before them I could compare the pictures, note the changes assumed by one and the same nervure in all of them, and alter their sequence. Up to this moment I had been generally content to note merely the differences in the location of the veins. In no paper or book accessible to me was there any indication of a plan or order of these differences having been observed. Always were the changes stated as a mere matter of description,—this vein was thrown off by that one, and so on. Even in the best work we have on the subject, that of Professor Comstock, there is no distinct recognition that in different parts of the wing there is a regularly indicated specialising direction and progression, and that there are here offered distinct gauges of the amount of specialisation exhibited in each of these special cases.* But now, as I made, day after day, these comparisons, the rigid network clearly showed a plastic movement in certain directions ; the evolution of the lepidopterous wing thus became clearer to me. And the principal nervure influencing, seemingly by mechanical means, these changes appeared to me to be the radius, so that a study of the radius was here pressed upon my attention. From its position in the wing the strength of the downward stroke would be naturally registered by the

* My obligations to Comstock's work are very great ; no other source has been in a general way more helpful to me.

radius; while the mode of flight, by quick up-and-down beats, or again by a sailing and gliding through the air, could not fail to leave some indication in the framework of the wings as to which mode of progress was chiefly favoured by the insect.

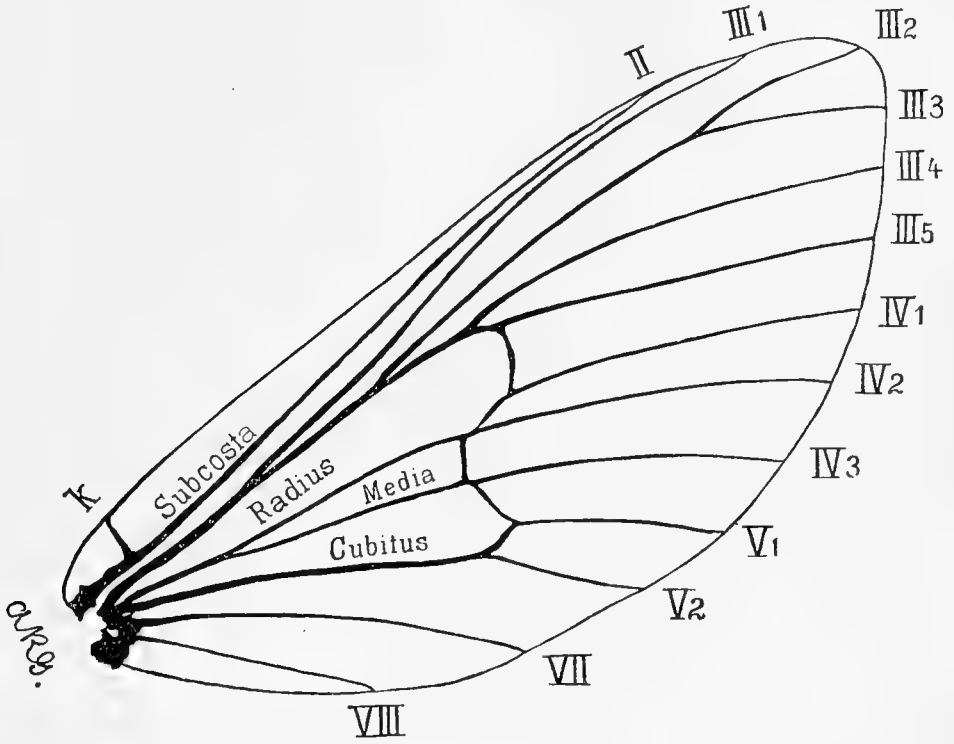

Fig. 1.—A Generalised Wing (typical).

Hind-wing of *Hepialus humuli*, enlarged. The impression obtained by photography, and with the veins all named and numbered, according to the system Redtenbacher-Comstock. Radial nervures = III; Medial nervures = IV; Cubital nervures = V.

A study of the Neuroptera and the more generalised types of insects, together with a comparison of *Hepialus*, shows that in the primitive butterflies the fore and hind wings must have been equally developed, and placed further apart than we find them to-day. The specialisation has proceeded in the direction of a diminution in size of the hind thoracic ring, and a consequent bringing of the front and hind pair of wings together. It has further continued to progress by the greater specialisation of the hind pair over the front pair of wings in the neuration of one and the same individual. For in *Hepialus* the hind-wings have a five-branched radius as well as the fore-wings, while almost all other Lepidoptera have the radius three- to five-branched on the front wings and only one-branched on the secondaries. The only exceptions so far known are the Micropterygides, and perhaps also certain Tineids, such as *C. familiella*. Therefore, in this main point, the hind-wings are generally the more

specialised as compared with the primaries. An explanation for this I have offered in that the hind-wings bear more of the weight of the body (abdomen), and that they also check the downward stroke of the primaries. The cause is thus mechanical, and a parallel is suggested with the four-footed Vertebrates in which the hind limbs are the more specialised. More than this, in the two principal directions by which the evolutionary progress is expressed, it is in the hind-wings that the direction is usually, if not always, accentuated. It is as if, as I have said elsewhere, "a wave passed over the wings, coming from the hind pair and breaking over the primaries, carrying these frail creatures farther along their airy paths into their unknown future."

Having thus briefly sketched the general progress of the wings, we come now to the special directions which this progress takes in the neuration, and which revealed themselves through my comparative studies by means of enlarged photographs.

The first of these directions is expressed by the changes in the media and its branches. A glance at the accompanying figure of the hind-wing of *Hepialus* (so far as the points here to be considered are concerned, it matters not whether we take the fore or hind-wing) shows us the media as a furcate vein traversing the median cell from the base of the wing to the cross-vein. From the cross-vein three separate branches reach the exterior margin. According to the embryological studies of Spuler the cubitus is two-branched, so that the present three separate branches belong to the media. Now this whole series of the media is undergoing a systematic change in the direction of disappearance.

Let us take the base of the media first. In most of the specialised Lepidoptera this base has already ceased to have any function; it has degenerated into a scar, or it has quite vanished. In some forms there are little spurs running back from the cross-vein, indicating where the basal portion of the nervure used to join on; but there is no more any connection with the base of the wing, and the nutriment for the branches is supplied through the cross-vein of the cell. The base having gone, the cross-vein itself is the next to disappear. The same process is repeated, the vein parting between IV 1 and IV 3, so that in the more specialised day butterflies and emperor moths the cell opens, and finally all trace of the cross-vein is lost. According to my friend Dr. Seitz, the disappearance of the cross-vein in the butterflies is a recently acquired character. Now what becomes of the three branches running from the cross-vein to the external margin of the wing? We must compare as many wings as possible to fully answer the question. It at last appears that the solution lies with the fate of the middle one of the three, with vein * IV 2. We

* The use of the word "vein" to designate the tubular rods which support the membrane of the wings has been properly objected to, since these structures are not homologous with the veins of the higher animals. The word "nervure" has been proposed, but this word in its origin from "nerve" would

must first arrive at a conception of the most generalised position for this middle branch. Again appealing to *Hepialus*, we find this position to be a central one. But in many forms the branch is drawn towards the radius ; in others towards the cubitus. Whereas, in

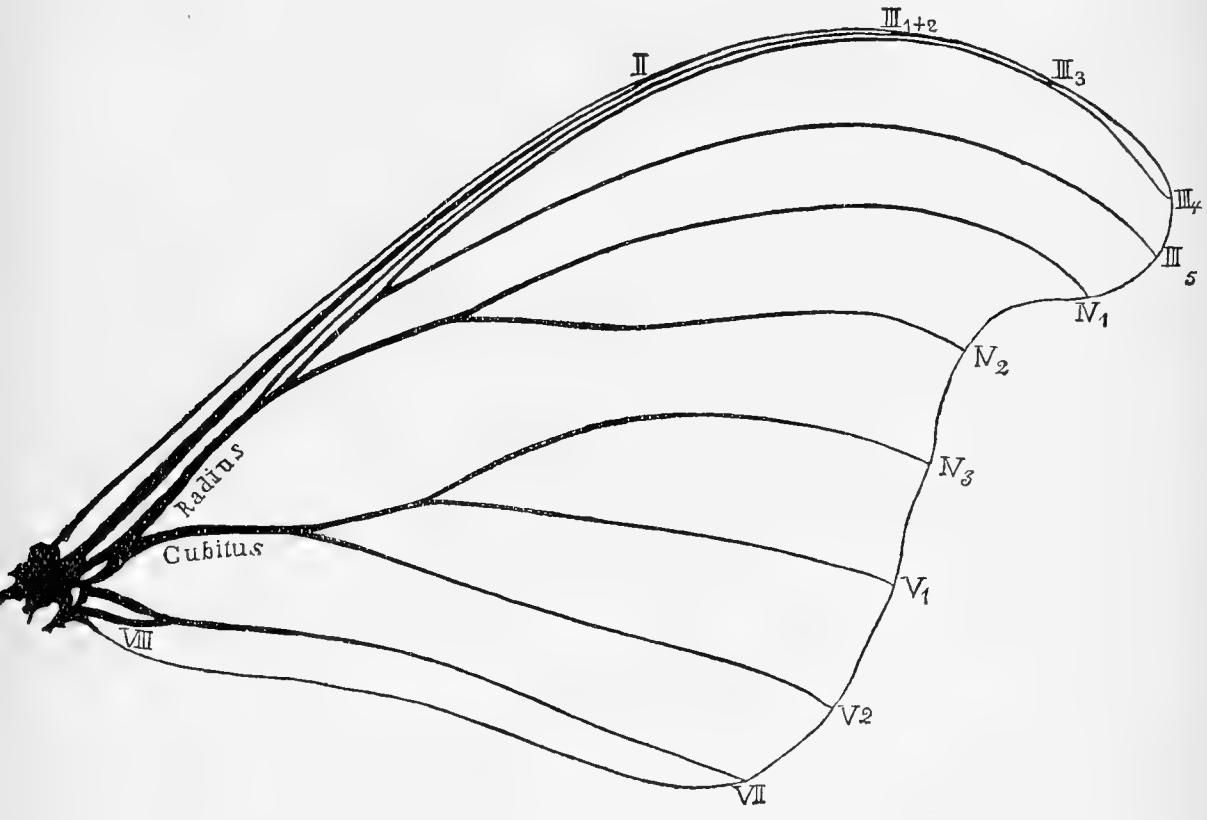

Fig. 2.—A Specialised Wing (typical).

Fore-wing of *Attacus atlas*, natural size, from a photographic impression (to illustrate the first and second directions of evolutionary change). The middle branch of the media, vein IV 2, has yielded to the attraction of the radius. The cross-vein has disappeared. All traces of the media as a distinct system have vanished. The two upper branches have become completely fused with the radial system; the lower branch, IV 3, with the cubital. Absorption of the upper radial veins has also commenced. The branches III 1 and III 2 are represented by a single vein, III 1 + 2. The vein III 3 is greatly reduced, and indicates an absorption by III 4.

the breaking up of the cross-vein, the upper branch *always* follows the radius except in *Hesperia*, where it shares the isolated fate of IV 2, and the lower follows the cubitus, the middle branch is some-

also not be perhaps strictly applicable. The word "vein" is used in a popular sense for these structures, as also for the ribs of the leaf. In German they are called "Rippen," *i.e.* "ribs," but of course they are equally not homologous with bony structures. The word "vein" is not only shorter, but it seems to be familiar, and universally understood when used in this connection. It is here hardly a matter of using a word securing a better definition of the object as between "vein" and "nervure." My aim here, as always, is to be understood by using plain terms.

times pulled this way and sometimes that way. Therefore the evolution of the branches of the media may be described as running up into a contest between radius and cubitus for the possession of these, the residue of the medial system, after the disappearance of the base of the nervure traversing the cell, and of the cross-vein connecting the main systems above and below the media and supporting its three branches.

But this struggle is not in every case decided as between radius and cubitus. Sometimes, as in the Lycænidæ and Hesperiadæ, the cross-vein retires on either side of the middle branch, leaving it stranded. It thus maintains its generalised and central position, resisting the attractions of both of the opposing systems. It is left to its certain fate. Deprived of nutriment by the degeneration of the cross-vein, it dwindles to a fold or scar, and finally disappears altogether. The breaking up of the medial system is not stayed. The upper and lower branches become part and parcel of the radial or cubital systems, and if the middle branch yields and goes over finally to one or the other, its existence as a vein is prolonged, otherwise not. Evidently, therefore, we have in the condition and relative position of this middle branch of the media, vein IV 2, a gauge for the amount of specialisation. The more it becomes united with either the radial or cubital system, the greater the extent of specialisation. In a general view this process of the evolution of the medial system may be regarded as one of absorption, either through degeneration or a fusion with other veins or systems of veins. So that here, and before dismissing our consideration of this *first direction* in which we find a movement among the veins of the wing we can set up our thesis—*the extent of the absorption is everywhere the measure of the specialisation.**

We now come to the *second direction.* It affects the radius of the fore-wings especially, which we have seen to be three- to five-branched, and it relates to the disappearance of these branches. The more generalised condition of the radius is clearly that in which it has five branches reaching the margins of the wing. But in the more specialised of the forms one or two of the branches have disappeared. These branches are those which arise from the upper side of the radius, and which reach to the costa and apex. We find this disappearance in *Parnassius*, *Pieris*,† *Thecla*, and the emperor moths. The radius remains five-branched in *Papilio*, *Nymphalis*, *Hesperia*, *Sphinx*. I am merely citing prominent examples. We have a condition in which all five branches are distinct and separate (*Hesperia*), then one in which III 4 and III 5 are furcate, etc.; then various combinations, principally affecting veins III 3 to III 5, the

* "Can. Ent.," 29, 175.

† It is perhaps on account of this suppression of the radial veins that Mr. Meyrick brings *Lycæna* and *Pieris* together, in any case overlooking the fact that the plan of the Pierid wing is Nymphalid; the plan of the Lycænid wing is Hesperid.

latter remaining constant and apparently forming the final or main extension of the radius, and corresponding to III of the hind wings. This process of absorption seems to be carried furthest in the common *Mancipium brassicæ*, for which we have to use the three-branched formula: III 1, III 2, III 3 + 4 + 5. Again, sometimes III 1 and III 2 are represented by a single vein, III 1 + 2, as in *Parnassius* and certain emperor moths. On the lower side of the radius the *first direction* comes into play. The first medial branch, IV 1, which, in *Nymphalis* and the four-footed butterflies generally, is still attached to the cross-vein, now leaves this position, and travels along the lower side of the radius, as in *Pieris* and *Nemeobius*, until the point of its emergence therefrom approaches the extremity of the nervure. In this movement of IV 1 we have also a gauge of the amount of specialisation, and *Pieris* and *Nemeobius* are undoubtedly in this respect highly specialised. We are here not concerned with the physiological process underlying all these changes. We are endeavouring to determine the phylogeny by means of ascertaining the amount of progress in the specialisation of the neuration. Here, as elsewhere, the direction must be first established, then the order in which the changes in the position of the veins follow one another, and lastly the mode and method of evolution.

Leaving these two prime directions, the *first* of which is still in action on both wings, whereas the second would seem to have culminated for the hind-wings by the attainment of a single branched radius in the bulk of the Lepidoptera, we may briefly consider other changes by absorption in the network of the wings. On the hind-wings the veins II and III are more or less fused at base. Evidently the forms in which this fusion is slight or even wanting (*Leptidia*) are less specialised than those in which it is carried up to the point of emergence of the short spur representing vein I. On this excess of specialisation I have founded the sub-family Nymphalinæ, and I see by the figure of *Basilarchia astyanax* in Prof. Comstock's beautiful "Handbook," that this character obtains for the North American genera also. It has, therefore, a meaning, and this meaning must be expressed by a classificatory term.

On the hind-wings, also, the point of juncture of the cross-vein with the cubital system varies. In the more specialised four-footed butterflies, the Nymphalidæ and the first sub-family I have established in the Meadow Browns (Agapetidæ = Satyridæ of authors, the latter name being preoccupied according to Scudder), the Pararginæ, this juncture is effected at or excessively near the furcation of the first cubital branch, V 1. In the more generalised Agapetidæ and in the Limnadidæ the juncture is effected with the lowest branch of the medial system itself, vein IV 3, and this method is characteristic also for the Pieridæ; so that here again we have a character of specialisation by which to guide our phylogenetic researches. Other points are offered by the suppression of the internal veins, such as we find in the absence of vein VIII of the hind wings in the

Parnassi-Papilionidæ. All changes of position by the moving veins should be noted and appreciated through comparison.

Having thus attained in outline a general knowledge and conception of the direction of specialisation in the wings of the Lepidoptera as a whole, let us apply it cautiously to a single group, the day butterflies. On comparing all these forms it becomes at once evident that these directions, above described by me, arise independently on different lines of general structure and probable descent. They are therefore to this extent secondary. We are not to throw all the three-branched forms and all the five-branched together, which is what would be perhaps done by uncritical students. Along with all the other general points of agreement the evolution of the neuration goes hand in hand. It claims in classification no preponderant part, but one of equal consideration. A system must be sought which will avoid contradictions from any side.

Perhaps a clear example of the secondary value of the neuration is offered by the suppression of the radial veins in the Parnassiidæ, the Lycænidæ, and again in the Pieridæ. This direction is taken identically in separate groups not otherwise nearly related, or possibly arising directly together, just as (and I agree here with my excellent friend Dr. Chapman) the abbreviate male fore-leg has plainly developed itself independently in the Blues from the appearance of a similar but more developed abortive structure in the Nymphalids. The ancestors of both we safely assume to have been possessed of six unabbreviated legs, but their common ancestry is a remote one. In the same way the suppression of the radial veins has commenced independently in the Parnassians, in the Whites, and in the Blues, these groups having all clearly possessed a five-branched radius, as is proved by its present retention and occurrence in many of the existing generalised forms. The Pierids, as is shown by the general fashion of the wing, represent rather a continuation of the main or Nymphalid-Hesperid stem, the Blues a development of the specially Hesperid branch, as I judge from the same considerations, the grounds for this view being given in some detail in my "Butterflies of Hildesheim."

That the action is unequal, sometimes hastened, sometimes retarded, that the same wing presents in its different parts a different degree of specialisation, we can see by the particular study of *Papilio*. On the primaries the radius is five-branched, and thus generalised as compared with *Parnassius*. The media and the medial system is generalised by the closed cell and central position of the middle branch; on the secondaries the middle branch already yields to the cubitus, and is therefore here more specialised. Whether the curved internal vein of primaries is a generalisation or not is uncertain; it may be admitted as probable. On the hind wings the suppression of vein VIII on the internal margin is a distinct specialisation over all the other butterflies. From the neuration, then, the Parnassi-

Papilionidæ, which two groups hang together, compare favourably with the Nymphalidæ, in which the radius is always five-branched, and which have not lost vein VIII of the secondaries. Alone in the direction of the suppression of the media are the Nymphalids clearly advanced and ahead.

Leaving these instances of general application, we come to the lessons to be derived from our studies in the direction of genera and groups having these genera as their bases, groups having the genus as the unit, just as the genus has the species, the species the individual. And here we shall both more easily illustrate the use of our observations and subserve the earnestness and honesty of science if we review what has been recently published without this knowledge —published with the air of possessing it, and going wrong with a great show of going right.

In Mr. Meyrick's recently published "Handbook of British Lepidoptera" we find no higher grouping of the genera of the meadow browns, the Agapetidæ or Satyridæ, such as we have seen above to be warranted from a study of the neuration of the secondaries. Further, we find a genus *Pararge*, which contains two species, *P. ægeria* and *P. megæra*. Now these two species belong to the group of meadow browns which we have called Pararginæ, and in which the cross-vein of hind-wings joins vein V 1, although they differ between themselves sufficiently structurally to warrant our calling the second species *Lasiommata megæra*.* Not only is the value of the character of the hind-wings lost by placing them between genera (*Satyrus*, *Melanargia*) which do not possess it, but we are favoured on the preceding page with a phylogenetic tree in which *Pararge* is derived from a genus (*Epinephele*) which does not possess the character (which is credible), but gives birth to a genus (*Melanargia*) which is just like the presumed ancestor (*Epinephele*) in also not possessing it (which is simply incredible). And it is the same with all the phylogenies of Mr. Meyrick that I have been able to examine at all carefully. The reason for this is plain: Mr. Meyrick is without any gauge to measure specialisation, hence his approximations rest on opinion more or less idle. The same objection applies to his phylogeny of the day butterflies and of the Nymphalidæ. Not one of the figures of neuration given by Mr. Meyrick appears to me correct, so far as I have been able to compare the originals. Not a few of them (for instance, among the day butterflies those of *edusa*, *adippe*, and *sylvanus*) are caricatures. For any purposes of study they are inexact and misleading. The delicate differences cannot be given by such loose sketches, and it is perhaps natural that Mr. Meyrick's text hardly

* It is a want of ordinary discrimination which allows Mr. Meyrick to associate these species in a single genus, and which also permits him to classify *Brephos* among the "Monocteniadæ." There are, however, many rules of nomenclature which he breaks, and many common-sense conclusions as to analogy and affinity which he affronts in the "Handbook." There is no warrant in Darwinism for his blind treatment of a class of facts as to which any collector is better informed.

alludes to these drawings. The purpose of their presence in the "Handbook" is therefore unexplained.

In the Geometridæ a series of figures have been given by Mr. Meyrick in the "Transactions of the London Entomological Society," in which an additional internal, short, downwardly curved vein is given on the fore-wings which I cannot find in nature. This vein is, moreover, omitted from a number of the drawings of the neuration of Geometridæ in the Handbook. Further than this, the short vein VIII, which forms a loop to VII at the base of the wing, is figured by dots, which should indicate a scar or fold. But in nature I find instead a true tubular vein. Relying upon Mr. Meyrick's figures, I had supposed a possible relation between the *Parnassi-Papilionidæ* and the *Geometridæ*, which I must now consider illusory after examining the neuration of the latter group myself.

It may be said that other authors make similar mistakes, that Spuler, for instance, in his "Inaugural Dissertation," Taf. xxv, fig. 25 *a*, contrives to insert an entire extra branch running to the external margin of the fore-wings of *Pieris brassicæ*. It may be said that Mr. Meyrick's fantastic and unreasonable general arrangement of the order, his meagre diagnoses, his unexplained nomenclature, with its absence of types and dates, his arbitrary phylogeny, may be matched (though I doubt it) elsewhere. Finally, the critic may be met with the commonplace, *Quot homines tot sententiæ*. But almost anyone will readily follow me here; no other writer has ventured before the public with such a preface to such a book. In this Mr. Meyrick applies the ill-sounding adjective of "pseudo-scientific" to the mainly descriptive work of the late M. Guenée. Much more than to the work of this well-meaning and industrious writer might this wrongly used term apply to the publications of Mr. Meyrick, with their incorrect figures and unfounded, dogmatically worded conclusions. For what M. Guenée gave was *real*, not *false* science, and may readily be seen to have been useful and even necessary. The "Spécies Général" is the beginning—it may be considered the feeble beginning—of a descriptive work upon the butterflies of the world, and it requires a singular want of insight in the progress of lepidopterology not to recognise this merit. *Real* science Guenée gave us, although it may not always be science of the first order. For this, indeed, we have no lack of modern authorities, and we can quite afford to leave M. Guenée in his little niche in the temple of fame unbesmirched. One difference between M. Guenée and Mr. Meyrick lies in this, that in *his* preface the French author modestly apologises for the failings of his book, which he finds much less perfect than he had allowed himself to dream; while in *his* preface Mr. Meyrick finds no room for any such regret. More than this, Mr. Meyrick ventures upon the remark that "it is perhaps not very creditable to British lepidopterists that so little progress should have been made meanwhile in this direction," *i. e.* between the publication of "The Origin of Species" and the appearance of Mr. Meyrick's "Handbook." And then Mr.

Meyrick proceeds to give us this needed progress. Who that has read Darwin, the carefully recorded facts, the modest style, the inferences appearing quietly as of themselves, and arising naturally and even unobtrusively out of the same facts, can find any resemblance at all between Darwin and Meyrick? Or does Mr. Meyrick suppose that unsupported statements such as "It is an offshoot of *Chloroclystis*," "A development of *Tephroclystis*," &c., &c., constitute Darwinism? Of the spirit of Darwinism, its constant appeal to reasonableness, its ability to recognise the requirements of scientific proof, Mr. Meyrick appears to have caught indeed very little. But of the letter, and that one thing must have emerged from another thing, Mr. Meyrick seems to have caught enough, only he applies what he has in an arbitrary manner, a manner which must unfortunately arouse suspicion and convey distrust.

In our studies of the venation of the day butterflies we have found nothing to warrant in any decided fashion the pre-eminence given by Bates to the Nymphalidæ. These lag behind the Pierids in that the radius remains in a generalised condition, and is five-veined. They show an advance in the movement of the middle branch of the media towards the radius, in the opening of the cell and the erasure of the cross-vein in the more specialised genera; but the upper branch of the media is in no instance, so far as I am aware, fused with the radius, as it is in *Pieris* and *Nemeobius*. In the hind wings the Nymphalids are more specialised (in addition to the above characters of the primaries, which apply to the secondaries also) by the greater extent of the fusion of II and III at base. In the more specialised groups (Nymphalidæ, Pararginæ, Libytheidæ) the cross-vein retires to the point of issuance of the first branch of the cubitus, showing a greater amount of absorption apparently than we find in the Pieridæ, in the Agapetinæ or more generalised meadow browns, and in the Limnadidæ (Danaidæ). The Libytheidæ overlap the more generalised Satyrids.

The only grand division among the Diurnals which the neuration calls upon us to make is a separation of the Parnassi-Papilionidæ from the rest of the butterflies, including the Hesperiadæ. For in the first-named group we find a strongly marked, short, and downwardly curved vein at the base of the primaries on internal margin. In the Pieri-Hesperiadæ this vein is wanting. Instead there is an upwardly curved, short vein, or scar of such a vein, or again obliterated, which coming from the base of the wing joins the vein VII at its outer end, forming a loop. Thus the direction of the two veins is diametrically opposed. Whether I am right in numbering these internal veins differently, or whether they are homologous, notwithstanding the difference in position and direction, does not alter my position that thereby a diphyletic origin of our day butterflies is indicated. A reply to those who assign a low rank to *Papilio* is further found in a specialisation of the secondaries in its group, one by which vein VIII has become lost. The Parnassi-Papilionidæ

differ from all the other butterflies in this respect, so far as known to me. The arguments of Mr. Wallace and Mr. W. H. Edwards as to the supremacy of *Papilio* appear to me somewhat fanciful, but I agree that there is no good reason for altering the main Linnæan arrangement of 1758, so far as a linear series is concerned. Only since I have demonstrated that the Parnassians are more specialised than the Papilionidæ, I would commence to arrange the Papilionides in a linear classification by the enumeration of the forms of the Parnassiidæ, while I must insist that these two families are directly related. They both have the curved internal vein of fore-wings and the suppressed vein VIII on secondaries.

I venture to give here a list of the British day butterflies. I have taken as a basis the list published by Mr. Tutt in the "Entomologists' Record," vol. vii, p. 300. The generic nomenclature is that corrected by Mr. Scudder, with the exception mainly of certain names in the Blues, where I follow Mr. Kirby. But I must protest, with Mr. Scudder, against the further use of the name "*Plebeius*," and the crediting of such a name to Linné, in whose works it is not to be found. The plural form "*Plebeii*" is not used by Linné in a sense corresponding with that of a genus. I have ventured to retain the name *Melitæa*, since it dates from 1807, and cannot fall before *Melitea*, which, according to Mr. Scudder ("Historical Sketch," p. 215), dates from 1809. As between *Lemonias*, Hübner, with the hardly certain date 1806, and *Melitæa*, we should prefer the Fabrician designation which has the sanction of established usage. It is to be regretted that there is no unanimity between Mr. Scudder and Mr. Kirby as to generic types in the Blues. The whole matter seems to depend on the type of *Polyommatus*, Latr., and *Cupido*, Schrk. The use of the former for *coridon*, and the latter for *minima*, determines the use of *Lampides* for *boetica*. Since Latreille figures *coridon*, and there is an argument, however "far-fetched," for Schrank's intention, I follow Mr. Kirby.

Super-fam. . **PAPILIONIDES.**
Fam. . . . PAPILIONIDÆ.
Sub-fam. . . PAPILIONINÆ.
Gen. . . . *Papilio*, Linné, 1758.
Typ. . P. machaon.

1. machaon, Linné.

Super-fam. . **HESPERIADES.**
Fam. . . . PIERIDÆ.
Sub-fam. . . PIERINÆ.
Trib. . . . **Pierini.**
Gen. . . . *Mancipium*, Hübn., 1806.
Typ. . M. brassicæ.

2. brassicæ, Linné.

Gen. . . . *Pieris*, Schrank, 1801.
Typ. . P. rapæ.

3. rapæ, Linné.
4. napi, Linné.
   Gen. . . . *Pontia*, Fabr., 1807.
   Typ. . P. daplidice.
5. daplidice, Linné.
   Trib. . . . **Aporini.**
   Gen. . . . *Aporia*, Hübn., 1816.
   Typ. . A. cratægi.
6. cratægi, Linné.
   Trib. . . . **Rhodocerini.**
   Gen. . . . *Colias*, Fabr., 1807.
   = Gonepteryx, Leach, 1815.
   Typ. . C. rhamni.
7. rhamni, Linné.
   Trib. . . . **Eurymini.**
   Gen. . . . *Eurymus*, Swains., 1829.
   = Colias, Auct. (nec Fabr.).
   Typ. . E. hyale.
8. hyale, Linné.
9. edusa, Fabr.
   Trib. . . . **Antrocharini.**
   Gen. . . . *Euchloë*, Hübn., 1816.
   Typ. . E. cardamines.
10. cardamines, Linné.
    Sub-fam. . . LEPTIDIINÆ.
    Gen. . . . *Leptidia*, Bilberg, 1820.
    = Leucophasia, Steph., 1827.
    Typ. . L. sinapis.
11. sinapis, Linné.
    Fam. . . . NYMPHALIDÆ.
    Sub-fam. . . NYMPHALINÆ.
    Trib. . . . **Limenitini.**
    Gen. . . . *Limenitis*, Fabr., 1807.
    Typ. . L. camilla.
12. sibilla, Linné.
    Sub-fam. . . ARGYNNINÆ.
    Trib. . . . **Apaturini.**
    Gen. . . . *Potamis*, Hübn., 1806.
    = Apatura, Auct. (nec Fabr.), Typ. bolina.
    Typ. . P. iris.
13. iris, Linné.
    Trib. . . . **Vanessini.**

Gen. . . . *Vanessa*, Fabr., 1807.
= Pyrameis, Hübn., 1816.
Typ. . V. atalanta.

14. atalanta, Linné.

15. cardui, Linné.
Gen. . . . *Polygonia*, Hübn., 1816.
= Grapta, Kirb., 1837.
Typ. . P. c-album.

16. c-album, Linné.
Gen. . . . *Eugonia*, Hübn., 1816.
Typ. . E. polychloros.

17. polychloros, Linné.
Gen. . . . *Euvanessa*, Scudd., 1889.
= Scudderia, Grt., 1873 (preocc.).
Typ. . E. antiopa.

18. antiopa, Linné.
Gen. . . . *Hamadryas*, Hübn., 1806.
Typ. . H. io.

19. io, Linné.
Gen. . . . *Aglais*, Dalm., 1816.
Typ. . A. urticæ.

20. urticæ, Linné.
Trib. . . . **Melitæini.**
Gen. . . . *Melitæa*, Fabr., 1807.
= Lemonias, Hübn., 1806 (date not quite assured).
Typ. . M. cinxia.

21. aurinia, Rott.

22. cinxia, Linné.

23. athalia, Rott.
Trib. . . . **Argynnini.**
Gen. . . . *Dryas*, Hübn., 1806.
Typ. . D. paphia.

24. paphia, Linné.
Gen. . . . *Issoria*, Hübn., 1816.
Typ. . I. lathonia.

25. lathonia, Linné.
Gen. . . . *Argynnis*, Fabr., 1807.
Typ. . A. aglaia.

26. aglaia, Linné.

27. adippe, Linné.
Gen. . . . *Brenthis*, Hübn., 1816.
Typ. . B. hecate.

28. selene, Linné.

29. euphrosyne, Linné.

Fam. . . . AGAPETIDÆ.
= Satyridæ auct. (nom. præocc.).
Sub-fam. . . PARARGINÆ.
Gen. . . . *Pararge*, Hübn., 1816.
Typ. . P. ægeria.

30. egeria, Linné.

Gen. . . . *Lasiommata*, Westw., 1840.
Typ. . L. megæra.

31. megæra, Linné.

Sub-fam. . . AGAPETINÆ.
Trib. . . . **Agapetini.**
Gen. . . . *Agapetes*, Bilberg, 1820.
= Satyrus, Latr., 1810 (nom. præocc.).
= Melanargia, Meig., 1829.
Typ. . A. galathea.

32. galathea, Linné.

Trib. . . . **Hipparchiini.**
Gen. . . . *Hipparchia*, Fabr., 1807.
Typ. . H. hyperanthus.

33. hyperanthus, Linné.

Trib. . . . **Erebiini.**
Gen. . . . *Erebia*, Dalm., 1816.
Typ. . E. ligea.

34. æthiops, Esp.

35. epiphron, Knoch.

Trib. . . . **Cænonymphini.**
Gen. . . . *Cœnonympha*, Hübn., 1816.
Typ. . C. œdipus.

36. tiphon, Rott.

37. pamphilus, Linné.

Trib. . . . **Maniolini.**
Gen. . . . *Pyronia*, Hübn., 1816.
Typ. . P. tithonus.

38. tithonus, Linné.

Gen. . . . *Maniola*, Schrank, 1801.
Typ. . M. ianira.

39. ianira, Linné (iurtina, L.).

Trib. . . . **Eumenini.**
Gen. . . . *Eumenis*, Hübn., 1816.
Typ. . E. semele.

40. semele, Linné.
    Fam. . . . NEMEOBIIDÆ.
    Gen. . . . *Nemeobius*, Steph., 1827.
    Typ. . N. lucina.

41. lucina, Linné.
    Fam. . . . LYCÆNIDÆ.
    Sub-fam. . . THECLINÆ.
    Trib. . . . **Theclini**.
    Gen. . . . *Callophrys*, Bilberg, 1820.
    Typ. . C. rubi.

42. rubi, Linné.
    Gen. . . . *Thecla*, Fabr., 1807.
    Typ. . T. spini.

43. pruni, Linné.

44. w-album, Knoch.
    Trib. . . . **Zephyrini**.
    Gen. . . . *Aurotis*, Dalm., 1816.
    Typ. . A. quercus.

45. quercus, Linné.
    Gen. . . . *Zephyrus*, Dalm., 1816.
    Typ. . Z. betulæ.

46. betulæ, Linné.
    Sub-fam. . . LYCÆNINÆ.
    Trib. . . . **Lycænini.**
    Gen. . . . *Lampides*, Hübn., 1816.
    Typ. . L. bœtica.

47. bœtica, L.
    Gen. . . . *Everes*, Hübn., 1816.
    Typ. . E. argiades.

48. argiades, Pall.
    Gen. . . . *Lycæides*, Hübn., 1816.
    Typ. . L. ægon.

49. ægon, Schiff.*
    Gen. . . . *Polyommatus*, Latr.
    Typ. . P. coridon.

50. icarus, Rott.

51. bellargus, Rott.

52. astrarche, Bergs.

* *Rusticus argus*, L., which is difficult to distinguish from *Lycæides ægon*, except by the absence of the claw to the front tibiæ, is not listed from England. It is not certain that the species of *Polyommatus* differ structurally from *Rusticus argus*.

53. coridon, Poda.
Gen. . . . *Nomiades*, Hübn., 1816.
Typ. . N. semiargus.
54. semiargus, Rott.
Gen. . . . *Lycæna*, Fabr., 1807.
Typ. . L. arion.
55. arion, Linné.
Gen. . . . *Cupido*, Schrank, 1801.
Typ. . C. minima.
56. minima, Fuess.
Gen. . . . *Cyaniris*, Dalm., 1816.
Typ. . C. argiolus.
57. argiolus, Linné.
Trib. . . . **Chrysophanini**.
Gen. . . . *Heodes*, Dalman, 1816.
Typ. . H. phlæas.
58. phlæas, Linné.
Gen. . . . *Chrysophanus*, Hübn., 1816.
Typ. . C. hippothoë.
59. dispar, Haw.
Fam. . . . HESPERIADÆ.
Sub-fam. . . PAMPHILINÆ.
Gen. . . . *Pamphila*, Fabr., 1807.
= Carterocephalus, Led., 1852.
Typ. . P. palæmon.
60. palæmon, Pall.
Gen. . . . *Erynnis*, Schrank, 1801.
Typ. . E. comma.
61. comma, Linné.
Gen. . . . *Angiades*, Hübn., 1816.
Typ. . A. sylvanus.
62. sylvanus, Esp.
Gen. . . . *Adopæa*, Bilberg, 1820.
Typ. . A. thaumas.
63. actæon, Esp.
64. thaumas, Hufn.
65. lineola, Ochs.
Sub-fam. . . HESPERIINÆ.
Gen. . . . *Hesperia*, Fabr., 1793.
Typ. . H. malvæ.
66. malvæ, Linné.
Gen. . . . *Thanaos*, Boisd., 1832.
Typ. . T. tages.
67. tages, Linné.

The above arrangement of the British butterflies is based upon the specialisation of the neuration within the groups. I have taken the families as I found them, and I have used the specialisations of the wing as a guide by which to arrange the genera within the families. I have merely tried to avoid the course of Mr. Meyrick, of deriving a specialised from a generalised genus, and then reversing the process and making the specialised give birth again to a generalised group. Where I have fallen short it will be found either that my guide has forsaken me (as in the Blues, where the neuration is so uniform that I have not studied it in all the species, and thus not so thoroughly as I should), or that I have not properly attended to its teachings. I state this as plainly as possible, in order to avoid the repetition of the reproach that I have taken an "artificial" character to the detriment of a "natural" classification, though what there is "artificial" about the neuration I do not at all comprehend. What these critics mean, probably, is that I have leaned too strongly upon a single character or class of characters; and I have tried to show above that this criticism arises from the critics not understanding what I have chiefly done. But I have certainly not rejected the main evidence of the neuration where it has been overwhelming, as in the case of *Nemeobius*. A critic in "Psyche" cites my founding a distinct family upon this type as a fatal instance of my reliance on a single character. But I suspect that this critic himself may have so conspicuously neglected the neuration, and the lessons to be derived therefrom, that I should be able to find, perhaps, North American Nemeobiidæ among his Erycinidæ or Riodinidæ. So far from entertaining any undue partiality for the neuration otherwise than as a means to an end, viz. the comprehension of the phylogeny of the butterflies, I have at once allowed the Riodinidæ to stand, although they are quite on a level with the Zephyrini, and their separation from the *Theclinæ* must be urged mainly, I think, on other grounds than the condition of the wings. The case of *Nemeobius* is that unless we throw the structure of the wings entirely overboard, and neglect its teachings altogether, we must agree that here we have so distinct a type, as compared with the Lycænid, that the character is sufficiently strong to support a family separation. For if the wing of *Nemeobius* were studied by itself, it would be thought to be that of a five-branched Pierid. A parallel suggests itself with the Megathymidæ. This North American group is a highly specialised one, an offshoot from the Hesperid type, in some respects retaining perhaps ancestral features, perhaps specialised through what we are apt to call degeneration,—as, for instance, are the Citheroniinæ also. In *Megathymus* the middle branch of the media has abandoned its indifferent original position, and has succumbed to the attractions of the cubitus, as I see from Prof. Comstock's beautiful and reliable figures. As to the position of *Papilio*, we can at once understand how flagrant a mistake it is to place it between *Lycæna* and *Hesperia*, when we see that the Lycænid wing is deducible from the Hesperid and the Papilionid wing is not nearly related to either.

Having thus, I hope, made good my position as against my critics, let us briefly review the phylogeny of the British butterflies as it presents itself in its fragmentary condition, with so many gaps, so many unrepresented groups. And first let us admit, at the outset, that the evidence for the probable phylogeny of the Lepidoptera is only circumstantial, and has merely a certain and shifting grade of probability to sustain it. Often it is only a bare possibility, and we see how Mr. Meyrick treats such probabilities or possibilities with his dogmatic phrases, "an offshoot," &c.; "a development," &c.; when in truth he knows nothing positively as to what he affirms, and in misunderstanding the neuration, and producing defective studies upon it, really neglects what might put him upon the right track.

Having thus schooled ourselves to regard our discoveries as evidence not positive, but circumstantial merely, led us to see what the neuration teaches us as to the British butterflies especially, and the Diurnals in general. First we must separate the Papilionid phylum, and for the reason that it presents a character, the downwardly curved internal vein, which all the other butterflies do not share. Next we find that the other, Hesperid phylum, offers, in the Pieridæ, an example of specialisation in two directions; the breaking up of the media and the diminution of the radial veins. The Pierini overreach here the highest group of the four-footed butterflies or *Nymphalidæ*, since the radial veins are reduced at times to three, while at the same time the reduction of the media and its system is well progressed. The *probable* phylogeny of the Pierinæ stands thus: *Mancipium* and *Pieris* are nearly related and probable developments of each other, *M. brassicæ* seeming to be the youngest form. We then come to *Pontia*, which appears to be a more remote development on the ancestral line of the five-branched *Anthocharini*, which latter would represent an older phase of the *Pierinæ*. Between the three and four branched and the five-branched genera come, as lateral and peculiarly specialised offshoots, *Colias* (*Gonepteryx*) and *Eurymus* (*Colias*). The grounds for the view that *rhamni* represents a specialised mimetic form may probably strike every one. A long way from all these stands *sinapis*, a strangely isolated form, perhaps in its turn a specialisation of an older type of the Whites, and retaining some ancestral features, with the middle branch of the media leaning turned towards the cubitus on hind wings, an odd reminder of *Papilio*. Leaving the Pierids, we come to the Nymphalids, and here we find our characters for rank mainly determined by the perfection which the breaking up of the media attains, and the amount of the absorption of II by III on the secondaries. A character to separate the purple emperor from the meadow browns, with which Mr. Tutt associates it, is found in the position of veins III 4 and III 5, which are given off to the outer margin as in *Vanessa*. The swollen vein in the male may indicate a lost line of connection between the Nym phalids and Satyrids, or it may be an independent acquirement. This beautiful butterfly appears to be more specialised than *Vanessa*,

through the greater suppression of the media and its system, and should therefore head the list after the *Nymphalinæ*. These latter butterflies are only represented in Britain by *Limenitis;* they differ from all the other true forest butterflies by the amount of absorption of II by III on the secondaries above alluded to. All the other Nymphalidæ have vein II only absorbed by III to a varying point, but one below the point of issuance of I. The other Nymphalids lie here behind *Limenitis* and *Nymphalis*. *Argynnis* is the most generalised genus. From *Argynnis*-like ancestors *Melitæa* seems to have proceeded. This is rendered likely by the actual fusion of III 2 with the radius in *Melitæa* at a point only indicated in *Argynnis*. The Satyrids are certainly less specialised than the forest butterflies. They fall into two groups, of which it seems to me that the Pararginæ (*Pararge* and *Lasiommata*) are the most specialised. A sequence of the other minor groups of meadow browns is difficult to establish from the neuration, it is so uniform. The *Agapetinæ* resemble the white in the position of the cross-vein of secondaries, and also by the same character the *Limnadidæ*—the latter an exotic group, evidently more generalised than the meadow browns, and introduced by Mr. Tutt into the British lists upon the strength of the fact that *Anosia archippus*, or, as Mr. Scudder calls it, *Danaida plexippus*, has been found in England under the circumstances which botanists call "escaped from gardens." That it is "now established" appears to me very difficult to credit. These "four-footed" butterflies are evidently an offshoot from the "six-footed" stem. They have been developed laterally from it, and in other regions have proved themselves a great success, and apparently found their profit in, to us, an incomprehensible character—the abortion of the front pair of legs. As a whole, the *Nymphalidæ* proper stand out from and appear more specialised than the other "four-footed" butterflies.

We come next to the Hesperid branch proper, which in its specialised forms, the Blues and *Nemeobius*, assumes also a partial atrophy of the front feet. And here I must be brief, both because of the length of my paper and because I have elsewhere very fully discussed the probabilities of the case. I have, I believe, proved in particular as against the summary published by Reuter, that the Lycænid type may very well be a derivation or specialised offshoot from the Hesperid type. Both are old, the middle, and often the upper branch of the media as well, are wearing out by the lapse of time and the consequences of isolation. The middle branch of the media has resisted the attractions both of the radius and cubitus, and persisted in a generalised central position. But in *Nemeobius* and *Megathymus* it has given way, and these types have perhaps the future of the stem in their keeping. For the reign of this branch of the butterfly phylum has probably reached its maximum. It has separated into innumerable species, feebly differentiated, and has conquered an immense territory. It has waxed, and it will wane, with all the rest of that nature amidst which we stand for the moment, and enjoy the attainment of consciousness.

A Gregarious Butterfly, Erebia nerine (a Reminiscence of the Mendelstrasse). With some Notes on the Lepidoptera of the Serpents of the Mendelstrasse.

By J. W. Tutt, F.E.S. *Read September 9th*, 1897.

Steep and precipitous, the rocks rise some three or four hundred feet perpendicularly above the Mendelstrasse, and then by steep and dangerous slopes continue up to the summit of the Penegal, some two to three thousand feet above. Hewn in the solid rock is this part of the Mendelstrasse, the steep rocky road that climbs the side of the Penegal, and leads from Bozen, at the lower end of the lovely Brenner valley to the Mendel Pass, which runs over the mountains between the Penegal and Monte Rowan into the Val di Nonne, and thence into Italy.

Some two or three thousand feet below us is the broad fertile plain of the Adige. The large town of Kaltern lies directly below, and the straight lines which cover hundreds of acres of the plain show the vines from which the inhabitants of Bozen and Kaltern draw their immense wealth.

Wild and savage enough are our immediate surroundings on this rock-hewn path, over which the precipitous walls hang threateningly, and from which every breeze dislodges stones which fall with a thud and rebound in a manner that augurs ill for any one they may strike. Here steep watercourses have cut almost perpendicular paths through the rocks, and their water is carefully directed into large tunnels which pass under the road on which we stand. A strong stone wall edges this dangerous path, and as we glance over we observe a steep slope of loose skrees, running from one to two thousand feet down to the edge of the wood that covers the slope and runs out to the edge of the valley. There is but little vegetation on these slopes. To a nature-lover the place presents a picture of wild and rugged grandeur, of savage untamable magnificence, but life is about the last thing he would expect to find in this apparently hopeless and impossible spot. The watercourses are brightly tinted with flowers, and now and then one catches a glimpse of the higher slopes richly clad in verdure, but there is nothing here to tempt insect visitors to give it a passing visit. Yet this is the home of the magnificent *Erebia nerine*, one of the largest, handsomest, and most local of this Alpine genus.

You look around. The sun pours down its hot midday beams upon the bare rock. The road and the rocks are burning. The

glare from the white road at midday is almost blinding, as indeed it is from all the roads in the "Dolomites," as this part of the Tyrol is called.

A brown patch on the bare upright face of the rocky wall looks odd, and I walk towards it. "Cover them" comes from one of my friends, but before the net is ready for action two butterflies flit off. "Male and female," I mentally ejaculate, "I shall not be done that way again." Another brown patch, the net is over it, and two butterflies are in my net. The upper wings are of the richest velvet, deep brown-black in colour; a fulvous band runs parallel to the hind margin of the fore-wings, and near the apex in this band are two ocellated spots with blue-white centres, another ocellated spot being situated lower down in the band. The hind-wings have a narrower band, with four similar ocellated spots, one between each pair of the nervures that reach the outer margin. The under sides are rather remarkable; those of the fore-wings are broadly fulvous with a black margin, and the ocellated spots of the upper sides repeated beneath. The hind-wings are coal-black, with countless wavy transverse lines, the spots (from the upper side) being almost lost in the reticulations. I examine these carefully for sexual distinctions, and am surprised at their similarity. A moment's careful examination shows me that they are both males; and "I thought they were paired at the time I caught them," I silently murmur.

Soon the sport waxes warm and furious. Twos, threes, fours, fives, sixes, and sevens, sit together in little coteries with outspread wings basking in the hot sun. The little bands are huddled together, but not a single female is to be found among them. They are all males, enjoying bachelor society in the most approved fashion.

We have soon captured enough males, and then the query arises, where are the females? But a member of our party—there are three of us—has already been to work. He is leaning over the stone wall frantically striking with his net at such specimens on the sloping skrees below as come within reach. Among the skrees grows a coarse kind of grass, thin and spare, and over this certain *E. nerine* flutter about busily. The few specimens he brings up are all females; so there can be no doubt that, whilst the males are enjoying their siesta on the burning rocks, the females are busy with the duties of egg-laying. There is no following *E. nerine* on these slopes, no one in his senses would attempt it; and so, whilst the young Peregrines coo their delight at our helplessness from the rocks above, the lady *E. nerine* flutter tauntingly over the rocks below.

But the male *E. nerine* does not leave the perpendicular cliffs when the sun goes off them, and there can be no doubt that these are the natural roosting-place of the males. An odd one in a crevice, or little parties of from two to seven in number, are scattered here, there, and everywhere, long after the sun has disappeared. Later, towards evening, they may be found in the crevices, or under an overhanging ledge, generally now singly, although several may be at

no great distance from each other, and they appear thus to remain until the morning.

It is remarkable that in these little coteries of this butterfly the insects rest head to head, and form frequently a very striking flower-like patch, with the central antennæ reminding one much of living stamens. Now and then a couple sit with their heads turned away, and the suspicion at once arises that the insects are paired.

The difference in habit between the sexes of this species has developed very different-looking under sides in the males and females respectively. In fact, it is doubtful whether any other species of *Erebia* shows such a striking sexual difference in this direction. The underside of the hind-wings and the tips of the fore-wings (the only part shown when at rest) of the male are coal-black, of the female a clear ashy-grey, which renders this sex particularly inconspicuous when the insect is at rest on the rocky skrees which it haunts. I cannot tell why the under side coloration of the male is so dark; certainly it is very conspicuous on the upright and comparatively newly-hewn rocks of the Mendelstrasse. Its habit of crawling into crevices may be sufficient protection, or may be it resembles some dark flinty matter on the skrees; but I made no observation on this point. The gregarious habit indulged in on these rocky faces we may consider as probably an old one, as the steep exposed rocky faces (often of immense height) are the main feature of the Dolomite mountains.

This short paper is intended only to deal with the peculiar habit of this species on the Mendelstrasse. We observed no similar tendency in the males of this species a week later at Cortina, where we again found the species; but certainly the dry rocky watercourse at the foot of the Sorrapis, and the old quarry on the Croda di Lago, the two localities they haunted, did not present the necessary conditions. In the latter place, too, the under sides of the females were almost white; and here, too, we captured several females with comparative ease resting on flowers during the early morning from 8.30 to 10 a.m.

I may add that there is much difference in the abundance of the spotting. In the males three (or occasionally four) ocellated spots are quite the normal number for the fore-wings; whilst the female rarely has less than four, usually five or six.

Such are the peculiar habits of this grand insect on the Mendelstrasse. Our search on the rocks there gave us many other interesting insects, whilst the habits of the *Polistes* wasps were always worth studying.

After passing the rocky precipices just described, and where, as we have seen, *Erebia nerine* abounds, the path leads by steep zigzags up the steep mountain face, which is indeed a veritable wild-flower garden, among which pines, larches, alders, hazel, and almost all our common forest trees grow in scattered fashion, forming a wealth of verdure and blossoms which must be seen to be appreciated. The upper part of the Mendelstrasse is formed of several such sharp

zigzags, and these are known to the natives as the "Serpents" of the Mendelstrasse. The flowery slopes between these zigzags abound with insect life.

I am of opinion that almost the whole of the British butterfly fauna exists here. I saw nearly every British species that could possibly be on the wing during the last week of July, whilst I was there, and in addition many butterflies of which in England we know nothing.

Start early in the morning, before the sun has become too powerful, while the dew yet hangs on the grass and breaks up the sunlight. Walk in the cool, and then collect slowly back towards Mendel as the heat increases. If you are not satisfied with your catch, you must be a lepidopterist not easily satisfied.

Sailing along on outspread wing, gently, smoothly, comes *Papilio podalirius*. You net it, and it is probably *minus* one tail, a very common form of variation. You see an empty pupa-case of its relative, *P. machaon*, on the rocks, and sure enough the butterfly itself soon passes by, although he loves best to gambol round the grassy summit of the Penegal. A white butterfly, with heavy flight and semi-transparent wings, proves to be a ♀ *Aporia cratægi*, the larvæ of which also are abundant in their inconspicuous white silken webs on the hawthorn bushes. *Pieris brassicæ*, *rapæ*, and *napi* occur; but the last is typical, and bears no resemblance to the large yellowish form (approaching, but not so dusky as the ab. *bryoniæ*) that occurs a couple of thousand feet above on Monte Rowan. *Leucophasia sinapis* threads its way through the bushes, the ♀'s of the form known as ab. *erysimi*, although some immense examples as large as normal *P. rapæ* are evidently Ruhl's ab. *sarthi*. *Colias edusa* is only once or twice observed, but we see many specimens of *Colias hyale*.

On a steep slope covered with sedums, *Parnassius apollo* abounds, many in fine condition, several with red spots on the upper side of the fore-wings. At the corner of the third zigzag from the top of the pass is a bed of thistles, and here *Dryas paphia* is abundant. This species flies also about the tops of the trees that rise from the precipitous walls of a watercourse below. One or two pairs are disturbed *in copulâ*, and I observe that the male flies with the female, although the opposite is the case in *Melitæa phœbe*. The ab. *valesina* occurs, but is rare. The under-sides of the males of *D. paphia* are beautifully marbled with purple, and those of the female are intensely green. The *Gonepteryx rhamni* examined show no trace of variation in the extent of the orange spot.

A footpath leads from this corner into a shady part of the wood. Here *Petasites* grows to giant size, and a huge *Platyptilia* is disturbed therefrom. Here, too, I find *P. zetterstedtii*, and the many-ringed *Pararge achine* flutters slowly among the trees, followed by *Erebia æthiops*. The latter species is comparatively rare here, though commoner on the slopes (opposite the Goldener Adler Inn) that lead

up to the Penegal. Another bed of *Petasites* produces *Ephippiphora grandævana*, and *Hipparchia semele* is not uncommon, resting on the tree trunks.

We get back to the slopes again. The sun now pours hotly down. *Argynnis lathonia* fans her lovely wings on the knapweed flowers, whilst *A. aglaia*, a thorough gourmand, is so busy with his gastronomic exercises that he allows himself to be picked off between finger and thumb. *A. adippe* is more rarely seen, and *A. niobe* not at all, although it occurs near the summit of the Penegal. Several species of *Melitæa* occur—*athalia* and *phœbe* among others; so also do *Melanargia galatea* and *Epinephele ianira*. All the British Vanessids are seen—*Polygonia c-album*, *Eugonia polychloros*, *Aglais urticæ*, *Vanessa io*, *Euvanessa antiopa*, *Pyrameis cardui*, and *P. atalanta*. *Limenitis sibylla* is, however, replaced by *L. camilla*. *Argynnis daphne* and *Satyrus hermione* both occurred on the steep path leading down to Kaltern.

But the insect of the slope is *Libythea celtis*. See it mount in the air, up, up over the tallest trees, and away like the wind. This is one of the insects I came to catch, and (I dare say it now) came away without catching. There are two probable causes why I did not catch *L. celtis*:—(1) because I could not; (2) because my friends had caught all the easy ones before I arrived on the spot. I have an impression that the latter must be the correct reason. At any rate, I did see *L. celtis* (two), and I did not catch *L. celtis*. At the end of July and commencement of August I suspect *L. celtis* must be nearly over for the year. Mr. Merrifield caught it as early as the end of May in 1894, and it appears to have continued on until the end of July. Searching the celtis trees for larvæ ended in complete failure; and it appears probable that the butterfly hybernates and does not lay its eggs until the spring. There was a "quelle" or spring on the Mendelstrasse, and, in middle July, what my friends could not do by skill they performed by strategy, for they made a big puddle in the road—an awful mess for respectable pedestrians to wade through,—but *L. celtis* was attracted thereby. In this way they caught a few good specimens during the early part of their stay. I of course did not think much of *celtis*; possibly *celtis* did not think much of me.

"Blues" were decidedly scarce. *Polyommatus corydon* was abundant; and then in order of abundance came *Nomiades semiargus*, *Cupido minima*, *Polyommatus icarus*, *P. astrarche*, and an odd specimen each of *Cyaniris argiolus* and *Everes argiades*. There were no "coppers," but *Thecla spini* was not uncommon on the saxifrage flowers.

As on the other side of the pass (*vide* "Entom. Record," vol. vii, pp. 49 *et seq.*), *Thymelicus lineola* and *Pamphila comma* were the two most abundant species—closely followed in numbers, however, by *Syrichthus alveus* and *S. sao*.

Among the moths many interesting captures were made. *Macroglossa stellatarum* fed on quivering wing, whilst *Lithosia complana*

and *L. lurideola* almost buried themselves in the capitula of scabious or knapweed. *Callimorpha dominula* was sometimes disturbed, and on one occasion Dr. Chapman brought home a beautiful, freshly emerged *C. hera*. On the flowers that edged the rocky walls lower down, the handsome *Syntomis phegea* was found, and *Acidalia dilutaria* (*holosericata*) proved common on the slopes. The rocks naturally yielded an abundance of Gnophids—melanic *G. furvata* and *Dasydia obfuscata* among many others; but these, when they are worked out, well deserve a separate paper. I trust, however, I have written enough to convince you that we found plenty of sport on the slopes between the "serpents" at the upper end of the Mendelstrasse.

Recent Examples of the Effect on Lepidoptera of Extreme Temperatures applied in the Pupal Stage.

By F. Merrifield, F.E.S.

(Summary of a paper read October 28th, 1897.)

Mr. Merrifield first exhibited the examples shown by him at the Royal Society's Soirée early in the year, and since placed on view for some months in the Insect Gallery of the British Natural History Museum; these were as follows:

P. atalanta, 3 forced, 1 cooled, then forced, 3 cooled; *V. io*, 1 forced, 1 cooled; *V. urticæ*, 6 forced, 6 cooled, 1 var. *ichnusa* for comparison; 1 *V. polychloros* cooled; *C. phlæas*, 4 forced, 4 cooled, 2 cooled, then heated; *P. daplidice*, 2 cooled, 2 forced; *P. napi*, 2 forced, 2 cooled; *C. edusa*, 1 cooled; *A. levana*, (*a*) winter pupa, 4 normal, 4 forced; (*b*) summer pupa (*levana* form), 5 normal or forced, 3 cooled (resembling winter pupa form), 8 intermediate (*porima* form); *A. caja*, 2 heated, 2 cooled; *E. autumnaria*, 3 heated, 3 cooled; *S. carpini*, 2 heated, 2 cooled; *D. falcataria*, winter pupa, 2 heated, 2 cooled; *Z. punctaria*, (*a*) winter pupa, 2 forced, 2 normal; (*b*) summer pupa, 3 forced, 3 cooled; 2 first cooled, then forced; *Selenia bilunaria*, (*a*) winter pupa, 2 forced, 2 cooled; (*b*) summer pupa, 2 forced, 2 cooled; *S. lunaria*, (*a*) winter pupa, 2 forced, 2 cooled; (*b*) summer pupa, 2 forced, 2 cooled. Of *S. tetralunaria* (*illustraria*) many were exhibited, embracing winter pupa forced and normal, including some which had been cooled and then forced, resembling in their markings those which had been cooled, but in their colouring approaching those which had been forced.

With reference to the species exhibited, and especially those of the genus *Selenia*, he quoted the following extract from the Royal Society's Soirée Catalogue:

"The temperatures were mostly three, viz. (1) *forced*, about 80° to 104° F.; (2) *cooled*, about 43°—52° F.; (3) *iced*, about 34° F. Summer pupæ are generally much more affected than winter pupæ, which in most species are not affected at all. The pattern appears generally to be most affected by temperature in the early pupal stages; the colouring often in later pupal stages. In the summer pupa of such a species as *S. tetralunaria* the combinations of winter pattern with summer colouring, and summer pattern with winter colouring, of which examples are exhibited, can thus be produced on moths proceeding from the same parents."

He then exhibited specimens of *Aporia cratægi* and *Argynnis paphia* which had recently been successfully operated on by him,

showing that in both species the examples which had been cooled were much darkened.

The general results of his investigations on the changes produced by temperature were, he thought, "mainly of three kinds, viz. (1) general change, often striking, in the colouring without material alteration in the pattern or form of the markings, but often with much enhancement or diminution in their intensity; (2) change caused by the substitution of scales of a different colour, either singly and generally distributed so as to be scattered, or so grouped as to form a material change of pattern; (3) change in general appearance, caused by imperfection in the development of scales or of their pigment. No. 1 seemed a direct effect of temperature, not affecting vigorous development. Under No. 2 were to be ranged the most radical changes in pattern (as in the extreme case of *Araschnia levana-prorsa*, which had been explained on the theory of reversion to an earlier form). In No. 3 the wings were often somewhat reduced in size, the scales were scanty, irregularly placed, and often misshapen and deficient in pigment, the membrane of the wing showing between them, so as to give the insect a shining 'greasy' appearance. Of course, the three were more or less combined in many cases. Also he thought that in general the principal changes were produced along the margins and at the base and apex, and often along the nervures of the wings; perhaps there was some connection between this and the fact ascertained and lately published by Mr. Mayer, that these were the parts of the wings in which the pigment was the last to develop" ("Proc. Ent. Soc. Lond.," 1897).

Mr. Merrifield then went on to briefly describe the more recent methods of treatment in the pupal stage, submitting pupæ to intermittent cold. First he gave the method adopted by Dr. Standfuss, under which the insects exhibited by him (Dr. S.) at the Royal Society's Soirée and at the Natural History Museum were produced. The pupæ had been for five, six, or seven successive days subjected to a reduced temperature of from 4° F. to 14° F., kept for one hour at the lowest temperature, and then gradually raised to 32° F. The results were very remarkable, and in nearly all cases more extreme than his own, especially in the fusion together in one very large spot of the second and third black costal spots in the *Vanessas*—*V. urticæ*, *V. io*, and *V. polychloros*,—and in *P. atalanta* the total disappearance of the large white costal spot. The second method of treatment referred to was that of Mr. E. Fischer of Zurich. The pupæ in this case were for eight successive days reduced three times a day to a temperature of 27° F., at which, however, they were only kept some few minutes. Then they were raised to about 37° F. The results of these experiments appeared to have been as remarkable as those produced by Dr. Standfuss's methods.

The most sensitive period of the pupal stage was generally the early part immediately after it had become tolerably hard; this in warm weather would occur in about twelve hours. But very con-

siderable changes were sometimes produced in the later pupal stages, when the insect, having passed the central period of inaction, which in winter pupæ was of very lengthened duration, was developing towards the imago stage; these were usually only changes in general colouring, and were quite considerable in *S. bilunaria* and *S. tetralunaria*, also in *Z. punctaria*, in which species also the marginal blotches indicative of the summer pupa could be produced by exposure to a high temperature during the last few days of the pupal period, after very long exposure to cold. He had never found, however, that any effect on colouring or markings in any species had been produced after the colouring of the perfect insect had begun to show itself through the pupa-case. Extreme results had been rarely obtained by him unless where the exposure had been so long that a little more would have crippled or killed the insect, and in fact did cripple or kill a large proportion. Very marked effects, however, were often produced without any approach to crippling; such effects in many species are invariably produced by an exposure short of that which endangered crippling. He had only obtained the very extreme results in a moderate percentage, say five per cent. of those operated on, and he gathered that the experience of Dr. Standfuss and Dr. Fischer, at least so far as their experiments had been published, was somewhat similar. Their experience, however, had been much greater than his, as they had operated on a very much larger number of individuals. He understood that Dr. Fischer was now obtaining a much larger percentage of results by improvements in the processes employed.

Turning to the more philosophical bearing of these results, the following views of Mr. A. G. Mayer, of Cambridge University, U.S.A., as given in a recent number of "Psyche," were read by Mr. Merrifield :

"I know of only one experiment upon the effect of *excessive* heat upon Lepidoptera, and that was performed upon the pupæ of *Vanessa antiopa* by Fischer ('95), who, it will be remembered, subjected them, when fresh, for three hours, and then daily for two to three hours to a temperature of 104° F. to 108° F., keeping them at all other times at 85° F. to 90° F. The butterflies which issued resembled those which would have resulted from exposure to cold of 32° F. to 34° F.

"It has occurred to me that in this remarkable fact we may have a clue to at least a partial explanation of the action of cold upon seasonally dimorphic Lepidoptera. It is well known, from the researches of Dutrochet, Rossbach, and Plateau, that if organisms be subjected to gradually increasing heat the metabolic processes as evinced by increased excretion in protoplasm, and more rapid rate of development, become more and more active, until suddenly all movements cease and heat rigor sets in. This is not death, however, for if the organism be now cooled down, recovery takes place, and the life processes return with normal vigour. According to Plateau, the temperature of heat rigor in different insects varies between 90° F.

and 110° F. It is highly probable, then, that the high temperature of 104° F. to 108° F. produced *heat rigor* in the pupæ, and therefore the metabolic processes were checked, exactly as they would have been by the benumbing influence of cold. If this be true it becomes probable that the peculiar colour aberrations caused by cold are only an expression of the *decreased metabolism* in the pupæ. It will be remembered that heat of 85° F. produces an aberration in *V. antiopa* which is just the reverse of that caused by cold. In this case the peculiar coloration could be explained as one of the results of the increased metabolism in the pupæ.

"Now it may well be that it is an advantage to a pupa which is destined to withstand the winter's cold to *inherit* a tendency towards a low metabolism, for resistance to the cold would naturally require the possession of low metabolic processes; hence those pupæ which already possessed low metabolism would be in a better condition to withstand the effects of cold. Natural selection would then operate to weed out all pupæ having high metabolic processes, for they would be more likely to freeze; whereas those individuals in which the metabolism was low would be preserved. Also this inherited tendency in the over-wintering pupæ to possess low metabolic activity might become so strongly fixed that it would be found difficult to alter it by the mere subjection of the pupæ to a high temperature, such as 78° F. to 85° F. Moreover it would doubtless be of advantage to the insects if they had the power to resist the influence of such warmth, for there are often hot periods of weather in the autumn, through which the over-wintering pupæ must pass; but their development must not be hastened thereby, for if the butterflies emerged they or their progeny would probably perish of the cold.

"In conclusion, in Lepidoptera of the temperate regions it is an advantage for the summer pupæ to possess *high* metabolic processes, for under these circumstances their development is rapid. On the other hand, it is an advantage to the over-wintering pupæ to possess a *low* metabolic process, for under these circumstances they would be the better able to withstand the influence of warm periods of weather in the autumn; for if the butterflies emerged at this time they or their progeny would probably perish of the cold. Moreover, in order that the pupæ may withstand the influence of the winter's cold, it is essential that they possess a low metabolism. Natural selection would then operate to cause all summer pupæ to *inherit* a high metabolism, while all over-wintering pupæ would be forced to *inherit* a low metabolism. Pupæ which possess a constitutional tendency towards high metabolism give rise to the summer form of imago, while those pupæ which possess a constitutional tendency toward low metabolism give rise to the over-wintered form of butterfly. The summer and winter forms of imago are only expressions of this difference in constitution of the summer and winter pupæ."

The Drinking Habits of Butterflies and Moths.

By J. W. Tutt, F.E.S. *Read November 11th*, 1897.

In "Rambles in Alpine Valleys" I note the habits of the various blue butterflies that I observed to collect in large numbers around the little puddles that were frequently met with on the path that leads up the Val Ferrex on the Piedmont side of Mont Blanc. I there write, "The puddles in the road are surrounded with living gems of beauty. See that beautiful flower of various shades of blue. The white-ringed stamens move up and down with all the symptoms of life, the blue petals now quiver and now rest, as if moved by vital force; one of the petals moves independently of the others, as if fanned by a gentle breeze, and the slight change in its position makes its sapphire beauty appear quite iridescent in the sunlight; but as you stretch out your hand to pick up the flower it disappears, breaking into fragments, whilst a little cloud of blue butterflies rises around you, leaving in the road a little wet spot at which they were slaking their thirst. It appears, then, that butterflies require drink as much as we do. In this hot temperature the fluids of our bodies are rapidly reduced by perspiration, and probably the butterflies suffer in a somewhat similar manner. How helpless they often are at noon! the bright activity and remarkable energy of the early morning have then disappeared, and they hang listlessly sucking nectar from the flowers around, allowing themselves to be picked up by the fingers; or else they seek a stream or puddle from which they imbibe the muddy liquid until satiated. The more filthy the puddle, the more certain usually is one to find these brilliant little gems, not 'daintily fed on honey and sweet dew,' but sucking up the noisome liquid of a manure heap or other vile excrement. Wherever such spots are to be found, there these lovely little creatures abound also, ruining that marvellous character which has been built up around butterfly life through long ages."

These were my impressions some two years ago, and it is because I have progressed no further, but am rather inclined to doubt whether my views are quite correct, that I venture to bring the matter before you, so that some farther light may be thrown on a simple habit not so easily to be explained as at first may appear.

In my early entomological days I remember no paper the reading of which gave me such pleasure as Kirby's translation of an essay by Piepers which had been published in the "Proceedings of the Entomological Society of Holland," vol. xix, and which has recently been reprinted in his work, "A Handbook to the Order Lepidoptera," vol. i, pp. lxii to lxxiv. It was this paper that first awakened in me the idea that there was as much, or more, pleasure to be obtained from

observing, as from catching, Lepidoptera, and I hope in some small measure, at least, I have profited by the knowledge. It is not, however, of the habits of Lepidoptera in general that I would now speak, but of one particular habit, which probably every one has observed, viz. the fondness for water—in various degrees of purity and impurity—exhibited by many species of Lepidoptera.

One of the first observations of this kind that I remember having made was the persistent and regular habit exhibited by *Pieris rapæ* and *P. brassicæ* of following the water-carts along the streets, settling on the wet patches, and greedily imbibing the moisture. On one occasion in the busy streets of Greenwich, on another in the streets of Deal, I saw them in dozens busily engaged in this manner. In Susa (in Piedmont), during the last summer, little congeries of *P. rapæ*, ten or twenty in number, would rise from a puddle by the side of a road, or from a wall through which the irrigating water from the vineyards was oozing. Years ago I remember being delighted with the sight of a little band of *Polyommatus corydon*, all males, congregated round a small puddle on the footpath on the cliffs near the South Foreland lighthouse. Still it must be confessed that the habit is, in this country, rarely sufficiently well marked to attract the attention of the casual observer.

When one commences to collect Lepidoptera abroad, especially in Alpine districts, one soon recognises what a large number of species are to be taken in the neighbourhood of a running stream. One may also disturb many species from the stones lying dry in the bed of a shallow stream, and one may frequently observe little swarms of blue butterflies of various species rising from the runnels that so frequently cross an Alpine track, or from puddles left by the rain or formed by any other cause. Many species frequent the filthy streams that run from a manure heap, whilst others may be found on ordure in the most unexpected places. Seated on the banks of a little streamlet, near Digne, towards the end of April last (1897) with Dr. Chapman and Mr. Edwards, I was astonished at the number of species and individuals that made their way down the course of the stream. It was a veritable highway for *Euchloë cardamines*, for *Leucophasia sinapis*, for *L. duponcheli*, and *Gonepteryx rhamni*, whilst the males of *Nomiades cyllarus*, true to the instincts of the race, sat on the stones and imbibed most freely in the hot sunshine. In August, 1896, whilst collecting in Dauphiné, I witnessed a sight which, for mere numbers of specimens, I had never before, nor since, seen equalled. This I have already recorded ("Ent. Record," ix, pp. 80, 81), but it will bear repetition:

"On the pathway between Bourg d'Oisans and Bourg d'Aru, well up the Vénéon Valley, on a wet spot about a square yard in extent, I saw at the same time 3 *Papilio podalirius*, 1 *Euvanessa antiopa*, 2 *Leucophasia sinapis*, and hundreds of *Polyommatus damon* and *P. corydon*, with a few *P. bellargus*, and *P. astrarche*. The damp ground was just one seething mass of insect life, the different shades

of blue looking brilliant in the sun, whilst the *P. podalirius*, with their wings drawn up closely over the back, and the tails stretched out behind, just clear of the damp, were very remarkable-looking objects." On another occasion, drinking from the runnels that crossed a pathway over an Alpine pasture on the mountains behind Bourg d'Oisans, I once saw *P. corydon* and *P. astrarche* in incredible numbers ("Ent. Rec.," ix, p. 80), and in my various notes on Alpine butterflies I have mentioned many similar facts. These lovely wayside pictures have been excellently described by Kane, in his pictures of butterfly life in Switzerland ("Handbook to the European Lepidoptera"). He says, "The astounding profusion in which butterflies are met in Switzerland will readily be acknowledged by all who have visited the Engadine, who have seen the mountain path, when moistened by some overflow of pasture irrigation, paved like a lapis-lazuli mosaic for perhaps a yard or two with hundreds, nay, thousands of 'Blues' with expanded wings, taking a Turkish bath of moist vapour upon the hot damp soil, or, as some say, drinking in safety from the wet clay upon which they find secure footing."

One observation that I made, however, when in the company of Dr. Chapman has not yet been recorded. After a stormy night in the Cogne valley in August, 1894, the pathway next morning was covered with small puddles, and in almost every one of these large numbers of *Cidaria populata*, *Larentia cæsiata*, and some other species were lying dead on the surface of the water. I could not surmise the cause, but it was Dr. Chapman's opinion, I believe, that they had come to the water to drink, and were unable to rise from the surface and were drowned.

That there may be another view of this matter I am well aware. Many have recorded *Pieris brassicæ* and *Pyrameis cardui*, when migrating, as resting on and rising again from the surface of the water. Sheldon reports that *Eupœcilia affinitana* and *E. vectisana* rise from the water with perfect ease and fly away. *Calamia phragmitidis* floats with the greatest ease on the surface of the water, and Rowland-Brown noticed specimens of a Geometrid moth, common in the adjacent pine-woods, dipping themselves like swallows on the surface of the Lake of St. Moritz. Gardner records that whilst watching the great horse-shoe falls of the Skjalfandafljot, near Ljosavatn, in Iceland, he saw moth after moth fly deliberately into the falling water and disappear, the gleaming falls seeming as attractive as artificial light. Piepers relates that whilst he stood on the bank of the river just above the beautiful waterfall of Maros, in South-west Celebes, he saw a specimen of *Papilio helenus* come flying over the water, when suddenly it half closed its wings and dived down, so that the whole body and about a third of the wings, which slanted upwards, were immersed. It then raised itself again out of the water and flew away. Are we to suppose that these instances really do show that certain Lepidoptera voluntarily bathe, and that the internal bath of some species is as needful as the external bath of

others? Or are these insects simply attracted by the sparkling water as others are by light, and that destruction thus frequently ensues to the individuals so attracted?

The drinking habit is as common among the Lepidoptera of America as among those of Europe. Bethune writes from Port Hope, Ontario: "On the 3rd of August, 1869, a lovely bright warm morning after an excessively wet night, I drove about ten miles along country roads. Every few yards there was a patch of mud, the effects of the heavy rain, and at every patch of mud there were from half a dozen to twenty specimens of *Colias philodice*—at least one, I should think, for every yard of distance that I travelled." Bates writes that when at Obydos, on the north side of the Lower Amazons, he observed, as the waters retreated from the beach, vast numbers of sulphur-yellow and orange-coloured butterflies congregated on the moist sand. The greater part of these belonged to the genus *Callidryas*. They assembled in densely packed masses, sometimes two or three yards in circumference, their wings all held in an upright position, so that the beach looked as though variegated with beds of crocuses. He further observed that all the individuals which resorted to the margins of the sandy beaches were of the male sex. The females, he says, are much more rare, and are seen only on the borders of the forest, wandering from time to time and depositing their eggs on low mimosas which grow in the shade. Wallace says that at Patos, on the Tocantins, the most abundant insects were the yellow butterflies, which often settled in great numbers on the beach, and when disturbed rose in a body, forming a complete yellow and orange fluttering cloud. Afterwards, when he was at Manaquery, he says that several rare butterflies were found sitting on the river-side, in the morning, on the margin of mud left by the retiring waters. At Guia, again, he found the rarest butterflies on the river-side. Scudder writes, "Every one must have noticed, at the brink of road-side pools left by a recent rain, how the yellow butterflies will start up at one's approach, flutter about for a few moments, and then settle down again to their repast. On favourable occasions you may find them ranged by hundreds along the edge of a puddle, with wings erect, crowded as closely as they can be packed. The little azure butterflies congregate in the same way about moist spots in the roads through woods; but as they choose less frequented places this is not so common a sight. Our Tiger Swallow-tails throng about lilac blossoms, and become so intoxicated that on one occasion a friend of mine caught sixty of them at once between his two hands."

It would appear that this habit is general in hot countries, and hence we find the records of this drinking habit frequently noticed by those who have collected in such districts. In Piepers' paper, already referred to, we read that "in the East India islands, where the clear mountain streams rush foaming over masses of rock, especially where the rivers flow swiftest and purest, down waterfalls, or near water broken by the irregularities of the bed, the haunts of the great

butterflies are to be found, and there we can feel sure, when there is no want of sunshine, of seeing one's self surrounded by many forms of these children of the sun, whose number and beautiful colours would amaze the northern collector. . . . . If we walk along the sandy or gravelly bed of a nearly dry stream during the hottest part of the day, we shall disturb butterflies at almost every step, especially *Papilionidæ* and *Pieridæ*, which sit there on the damp ground to refresh themselves with visible pleasure, but with wings closed so that they are scarcely discernible, and you suddenly see swarms of such butterflies fluttering up into the air before your feet. I was once travelling in South-west Celebes when my companion suddenly exclaimed as we were crossing a nearly dry brook, 'Oh, look, what a beautiful flower!' And on looking where he pointed, I saw in the bed of the stream amongst the damp gravel a beautiful orange-coloured flower, with a white centre, about ten centimetres in diameter. The strangeness of the occurrence led me to step nearer in order to observe it more closely, when what did I see? The flower consisted of two concentric rings of butterflies (*Callidryas scylla*) which had closed their wings, which are yellow and orange beneath, and were busily sucking up the moisture from the damp sand, and thus represented, in the most closely deceptive manner, the petals of a flower. They surrounded five of another white species of *Pieris*, similarly occupied, which thus seemed to form the white centre of the flower. I still remember the amazement of my travelling companion when, on my nearer approach, the whole flower dissolved into a swarm of butterflies. . . . . I afterwards saw in another part of South-west Celebes another beautiful flower of the same kind, in which the petals were composed of a number of the red *Pieris zarinda* along with some yellow and white Pieridæ."

I have myself noticed the resemblance that the chance arrangement of the blue butterflies may bear to a flower when several of them are collected round a tiny damp spot with their heads almost meeting towards the centre.

In "Nature" (May 17th, 1883, p. 55) appeared a letter from Mr. E. Dukinfield Jones, in which he stated that he had observed "a kind of moth" in Brazil engaged in sucking up water in large quantity through its proboscis. This brought a very interesting paper from Baron, who, writing from Antananarivo, Madagascar, says, "This strange habit is not confined to the moth in question, as I have observed the same thing in two species of butterfly, *Papilio orizaba* and *Appias saba*, and imagine that the phenomenon is by no means rare. These two butterflies are very common by the sides of streams and damp places on the Ankay Plain of Madagascar.

"One morning, whilst sitting by the side of one of these streams, I noticed the *Papilio*, which is an insect measuring four inches across the wings, resting on a wet bank, and, wishing to procure it as a specimen, I approached it as gently as possible, the creature being apparently so absorbed in what it was about as to be totally uncon-

scious of my proximity to it. Noticing strange and unaccountable movements—sundry jerks and probings with its proboscis—I quietly sat down near it, in order to watch it more closely. I observed that every second or two a drop of pure liquid was squirted (not exuded merely) from the tip of its abdomen. I picked up a leaf that was lying near, and inserted the edge of it between the insect's body and the ground, so as to catch the liquid. Unfortunately I had no watch with me at the time nor means of measuring liquids, but I reckoned that about thirty drops were emitted per minute. I held the leaf for about five minutes, as nearly as I could reckon, and at the end of that time there was caught in it about a salt-spoon full of what seemed to be pure water, without either taste or colour. After watching the butterfly for a time I seized it by the wings between my thumb and fingers with the greatest ease, so utterly lost did it appear to be to what was going on near it. In another spot I saw as many as sixteen of these large butterflies within the space of a square foot, all engaged in the same strange action. Some of them emitted the liquid more frequently than others; and one of them squirted the liquid so as to drop fully a third of an inch beyond the point on the ground perpendicular with the end of its body. It was at this spot that I saw the second species of butterfly alluded to, *Appias saba*, also engaged in the same curious proceeding."

It is many years ago since I first saw a fine male *Apatura iris* drinking from the water that had collected in a rut by the side of one of the rides in Chattenden Woods, but this it would seem is a frequent habit of this species. Hewitson writes that at Kissingen in Bavaria, in July, 1839, after a long flight on the outskirts of the wood the "Emperors" would enter its more shaded recesses, and, settling wherever moisture was to be met with, would protrude into it their long trunks, and were soon heedless of his approach. Seating himself near a swamp-hole, he selected the finest specimens as they settled down, and watched them as they closed their wings. So intent were they on their occupation that they would usually permit him to take them between his finger and thumb, and they were so numerous that he had no less than seven under a small net at one time, and even then they showed but little anxiety to get away. De Nicéville, too, has noticed the habit among the Sumatran Apaturids, and says that the males of *Apatura sumatrensis* like to go to muddy or swampy spots on the roads; whilst the females are never seen on the roads, but fly through the jungle. *Junonia atlites*, too, is very fond of water, near which if it be running, or in the neighbourhood of ditches, it may always be found. Regarding the love of *Apatura iris* for moisture, Kane says, "It settles down on a moist spot to drink, or upon dung, or upon decaying animal matter, which seems to attract it. Kirby quotes the experience of a German naturalist who, collecting in South Russia and perspiring freely, became an object of attention to numbers of this insect which settled upon his clothes."

Mitchell observes that in July, 1887, whilst collecting in the New

Forest, he was much struck with the fact that *Apatura iris* showed a marked predilection for settling on fir-cones that had been moistened by a fine rain in the morning.

Melvill reports that on June 26th, 1882, whilst walking from Visp to Zermatt, soon after passing Stalden the road crossed a small mountain stream. Here disported a perfect flock of *Aporia cratægi*. A step or two farther on he saw what at first sight seemed to be a living and moving white flower in the road, but it dispersed and flew off in various directions at his approach, with the exception of three or four individuals which he carefully watched upon perceiving that they were feasting with extended probosces on the juices of a fallen comrade of their own species that had been evidently trodden under foot that morning. These three or four it was impossible to drive away, they only flew a yard or so and then returned.

As I have before pointed out, one of the most difficult insects to capture on the wing is *Libythea celtis*, yet, on the Mendelstrasse, Dr. Chapman and Mr. Lemann captured several specimens by making a large puddle in the road, to which the thirsty creatures came to drink.

De Nicéville gives some interesting facts relating to this habit in "The Butterflies of Sumatra," and also to the fondness of certain species for the neighbourhood of streams. With regard to the latter he says, "The beautiful *Parthenos gambrisius* is found not only in the high forest, but also in small strips of forest and jungle always accompanying the smaller streams. It is very fond of, and is only found near water. In a boat journey up the Bedagei river, both banks of which were covered with the flowers of a snow-white lily, Martin noticed *P. gambrisius* settling in considerable numbers on the flowers—a beautiful sight for a lover of nature." The same author states that the specimens of the common *Hestia lynceus* are nearly always seen in pairs, and are very fond of flying over the small streams so common in the forests of Sumatra; and Martin says that all the Zeuxidias are met with only in the high forest, near small streams whose borders are clothed with bamboos. Wallace also notices the fondness of some Brazilian species of the large blue Morphos for water, observing how they flitted over the water of the river Capine or settled on the leaves by the river bank.

With regard to the drinking habit itself, De Nicéville says, "Even the wary *Atella sinha* is often caught when settled on a moist spot in a forest road;" whilst of the interesting *Cynthia erotoides* he says, "The males are exceedingly abundant, and are to be found all the year round in forest roads, where they congregate around moist spots, and to which they will return if disturbed; the females are as rare as the males are common, and are only to be found in the forest. That there is any actual disparity in the numbers of the sexes is improbable, but it is clear that the habits of the male bring him into much greater prominence." Other Sumatran species that have this habit strongly developed are *Limenitis procris*, *Athyma*

larymna, *A. idita*, and *Cirrhochroa bajadeta*. *A. larymna* is a very rare species, and has never been taken except at moist spots on the forest roads or on fæces, with the exception of two or three specimens a year taken on the muddy banks of the Svengei Diski river, near Paya Bakong.

I have just mentioned that *Limenitis procris*, *Athyma larymna*, and other Sumatran species were to be found on fæces in roads, and this is also a common habit of *Satyrus hermione*, which one may disturb in large numbers on almost all the lower Alpine roads of Central Europe. The numbers of Lycænid butterflies, too, gathered on the manure heaps about the high Alpine châlets are sometimes quite inconceivable, not that they congregate on these because they prefer the filthy fluids to water, but because there is at hand no other spot where the requisite drink can be obtained. Wallace says that in the Brazilian forests every particle of animal matter in an open pathway is sure to be visited by a number of different species of butterflies. *Discophora necho* is another Sumatran species which frequents the fæces on roads, from which they will fly into the jungle when disturbed, but return again as soon as danger is past.

Euvanessa antiopa and several of its relatives love the sugar that has been put on trees for moths the previous night; *Apatura iris* has been attracted by the same means. Many Vanessids love the decaying fruit in orchards, and others again the sap flowing from a *Cossus*-affected tree. The Sumatran species of the Satyrid genus *Mycalesis* are very fond of fæces of all kinds, but they also abound on crushed pieces of sugar-cane, from which they extract the juice, and showing a more depraved taste still, they are also very partial to the red saliva of the betel-chewing natives. All the Sumatran Thaumantids are fond of the ripe fallen fruit of the sugar-palm (*Arenga saccharifera*), on which they regale themselves in the shadow of the tree. *Euthalia dirtea* revels in the filth of Sumatran kitchen middens. The Zeuxidias are so fond of sweets that a piece of rotten plantain fruit (pisangs or bananas) is an almost certain bait by means of which they can be attracted. *Neorina lowii* and *Melanitis bela* are exceedingly fond of the juice or sap that exudes from certain of the forest trees when the bark is cut or wounded. This has also been repeatedly noticed of our British *Eugonia polychloros*. Alderson states that in the New Forest in July, 1895, a year in which this species was particularly abundant, a tree from which sap was exuding was always a safe draw for it. Wallace observes that the beautiful indigo-blue butterfly, *Callithea leprieurii*, was found abundantly about Montealegre, on stems of trees from which a black gummy sap was exuding.

Bouskell records that at Brockenhurst, in August, 1892, he took at sugar *Dryas paphia* (4), its ab. *valesina* (1), *Eugonia polychloros* (4), *Vanessa io* (3), *Pyrameis atalanta* (1), *Limenitis sibylla* (6), *Apatura iris* (1), *Pararge egeria* (4), *Epinephele ianira* (1), *E. tithonus*, and *Enodia hyperanthus* (1). Surely these actually came for

the sweets, and not for the liquid, of which there would be little remaining on the trees the day after the sugar had been put on.

There may at first sight appear no very great stretch to connect the various sources of supply of the drink of butterflies into a regular series—flowers, sap, decaying fruit, the manure heap, water ; yet one hardly likes to suggest that these are only various sources from which the Lepidoptera obtain the requisite amount of fluids for their tissues. Still there is no reason why this should not be so, and it is quite probable that the *Thecla w-album* butterfly and Zygænid moth are as much attracted to the luscious privet blossom by the supply of water that its nectar yields as by the sugar that is in solution. Yet we hardly like to say that this is so, and have a suspicion that the flowers are attractive rather from the sweets in the nectar, than the necessity of fluids for the system ; and the same suspicion holds good both for the attractive power of sap, decaying fruit, or midden heap. In what way ordure is attractive I have no suspicion, except that it seems to me that in Alpine districts it is the fluids that the insect imbibes.

The drinking of water by certain species is beyond question. That they drink infinitely more than is required by their tissues under any possible conditions appears certain. Baron's note already quoted is sufficient proof of this ; whilst we have known *Polyommatus damon* to sit for more than an hour motionless, except for the slight movements of sucking up and discharging the moisture almost continuously. What this internal bath may really mean we cannot even surmise.

Another important factor as to this drinking habit is a strange one ; the " thirsty souls " are, so far as my own observations go, and so far as De Nicéville's and Bates' remarks show, almost entirely males. Why is this drinking habit confined to one sex, and why is it indulged in whilst the females are away egg-laying, or presenting the strange phenomenon of a perfectly different habit from that indulged in by their lords and masters ? It is of course quite reasonable to suppose that, if a number of exact observations be made, females in small numbers do visit puddles, and pools, and streams for drinking purposes. Certain it is that females come to sugar equally with males, but this we take it is for food, and not for drink, and it is just in this that our difficulty lies. We know that moths and butterflies that visit sugar, over-ripe fruit, and similar dainties are of both sexes. They come, it seems, for food ; but males alone seem to be attracted by pure water. Does their extra activity give them a greater need in this direction ? and has a habit which was at first (and still is in a measure) a necessity become so pleasurable that excessive drinking has literally become a vice ?

The Wing and Larval Characters of the Emperor Moths.

By A. Radcliffe Grote, A.M. *Read January 13th*, 1898.

A controversy has arisen with regard to the classification of the emperor moths, which is of special interest in so far as one of the species, *Saturnia pavonia-minor*, is British, while the question in its larger aspects has so profound a bearing upon the value of taxonomic character in the Lepidoptera that this must be my apology for bringing it before the Society.

At the outset it is necessary to free the controversy from all irrelevant and side issues, and to state the matter plainly. Are we to classify the common Continental tau emperor moth, *Aglia tau*, according to the wing characters, which is my contention, or are we to ignore these, and give weight to the fact that the larva bears a single dorsal tubercle on the ninth abdominal segment, which is Dr. Dyar's opinion?

Incidental to the publication of Dr. Dyar's classification, and in the progress of the controversy, I have been accused of not fully appreciating the neurational characters of *Aglia*. It is Dr. Dyar's opinion that this does not necessarily contradict that of *Saturnia*. Upon this point I must be here quite clear. I must sustain my original position, and I must also show that Dr. Dyar's attempt to reconcile the wing characters of *Aglia* with his classificatory scheme based on the larval tubercle, is due to his want of familiarity with what are probable or even possible modifications of the courses of the veins of the wing upon one and the same phylogenetic line.

The controversy is made doubly sharp by the fact that it includes the position of the American genus *Hemileuca*, which, from analogous reasons, I refer to the Saturnians, and Dr. Dyar, on the contrary, as belonging to the same family with *Automeris*. Questions of classification become cosmopolitan, for the reason that they cannot be answered from the study of the fauna of a single country. In this case, owing to the extent of the British Empire, all the American genera in question inhabit Her Majesty's dominions.

The wing of *Aglia* is very nearly the exact copy of the wing of the American genus *Automeris*, with which I would associate it. It has every main feature of its distinctive pattern. It merely differs from *Automeris* by being slightly more specialised. The slight changes are parallel to those explained elsewhere by me in discussing the different actions accompanying the suppression of the median system of veins. Vein VIII of the hind-wings has become lost or absorbed

in *Aglia* as in *Automeris*, upon which latter type *Aglia* constitutes a very small advance. Both forms must have had a common ancestor.

If we now turn to *Hemileuca* we find that this fulfils every requirement, which *Aglia* disappoints, of the Saturnian type of wing. Already veins IV 1 and IV 2 are furcate upon a long stem. This stem represents, not the cross-vein between IV 2 and IV 1, but that portion of the cross-vein lying between IV 1 and the radius, exactly as in *Saturnia* and *Attacus*. But on the secondaries vein VIII is retained. Now this is just what we should expect from a generalised Saturnian form, because vein VIII of hind-wings is retained by most Lepidoptera, and is dropped by specialisation. The corresponding form for *Aglia* and *Automeris*, retaining vein VIII, we find in the Citheroniadæ, which latter take the place of *Hemileuca* in this character upon the Aglian phylum. The Citheroniadæ are of interest in this controversy, because here vein IV 1 leaves the cross-vein to become absorbed by the radius outside the cell. This change is one impossible to be entered upon by *Hemileuca* and the Saturnian type, because IV 1 and IV 2 are here upon a long stem, and cannot reach by any means the radius to ascend it. The two veins gradually approach and meet upon this long stem, and this is their evolutionary direction and progress. But in *Aglia* and *Automeris* vein IV 1 is free to ascend the radius, because it has not left the cross-vein. The Citheroniadæ run parallel in this development with the Smerinthinæ, in which the movement of IV 1 from the cross-vein to the radius is normal.

The genus *Hemileuca* appears to me to represent the ideal of an ancestral form of *Saturnia*. It fulfils every requirement we should demand.

To place *Hemileuca* with *Automeris* is a palpably hazardous undertaking. *Hemileuca* has retained vein VIII, while *Automeris* has lost it. Hence *Automeris* should also show us a more specialised type in the disintegration of the media, which it does not. Indeed, it shows us a totally different type. To derive *Automeris* from *Hemileuca*, the stem of IV 2 and IV 1 must retreat backwards, and the plan of evolution be entirely changed. How can the stemless *Automeris* be related to the stemmed *Hemileuca*? The ancestral type of *Automeris* had undoubtedly vein VIII, but it had evidently a vertically closed cell, and could show no disposition to form a stem out of the cross-vein between IV 1 and the radius. It is inconceivable that these two opposed evolutionary types could have been loosely held by a common ancestor so near in time to the present forms as to excuse our placing them in one "family." More than this, not the faintest reason can exist for the specialist to bring them so together upon neurational grounds. If this is so, and so I believe it to be, then either the neuration, as a source upon which we can rely to form natural family groups, must be disregarded, or it must replace, as a better authority for classification, the larval characters as presented by Dr. Dyar.

While the general character of the wings of *Aglia*, *Automeris*, and *Citheronia* is the same in being confined, rigid, the veins not spread-

ing apart, recalling *Sphinx* and *Castnia*, that of *Attacus*, *Saturnia*, and *Hemileuca* is, on the contrary, flowing, the veins separating, so that the media and its system finally entirely drop out, as such, from the centre of the wing, and we are reminded of the Nymphalidæ by this circumstance. The wing of *Hemileuca* prophesies the coming extinction of the media, that of *Aglia* or *Automeris* lends itself to no such intention. *Aglia* has gone as far as it could go in this general direction, and resists the giving up of a central position for IV 2.

Leaving the neuration, I think the feeble simple female antennæ of *Aglia*, *Automeris*, and *Citheronia* show an affinity to exist between these groups. Nor am I able to find any character to contradict my classification until we come to Dr. Dyar's statements as to the larval tubercles. Upon this question I must be silent, because to enter upon it fully would require material which I do not possess, and experience I have not acquired. I, however, by producing figures of the neuration, enable my statements to be controlled by any one, whereas Dr. Dyar's lack this method of appeal.

An apparent way out of this difficulty might be thought to exist in multiplying the families. We might take *Aglia* as type of the Agliadæ, *Automeris* as type of the Automeridæ, *Citheronia*, of the Citheroniadæ (this latter I am quite willing to grant). But none the less would the pattern of neuration teach us that the three families are phylogenetically related. So we might also take *Attacus* as type of the Attacidæ, *Saturnia* as type of the Saturniadæ, *Hemileuca* of the Hemileucidæ. Equally here are the families connected. It is not a matter of technical classification, but one of phylogenetic arrangement. The Saturniades are, in my opinion, diphyletic, and the three minor groups on either side represent different grades of relationship upon the same lines. The evidence upon which the two stems are united is inconclusive against equal negation. It is a matter not of certainty, but at the most of probability. But in no case can we allow ourselves to bring *Automeris* and *Hemileuca* together, and fasten them by a categorical clothes-pin, as Mr. Reuter does in an analogous case with the Papilionidæ and Pieridæ.* The moment we take the pin away the groups fall apart. The family *Hemileucidæ* of Dyar contains material which evidently has come from two different sources, and is, in my opinion, therefore, a classificatory freak. I must naturally object to Dr. Dyar's pulling the veins about in and out like a telescope, to suit his theory of the larval tubercles. The estimate I have been inclined to place upon these latter as aids to a phylogenetic classification is given in my original paper on "The Butterflies of Hildesheim" pp. 15, 16, and I have seen no ground to change it. No attempt to discredit my interpretation of the venation will, I

* Mr. Reuter calls his clothes-pin "Papiliones," *vide* "Ueber die Palpen der Rhopaloceren," 555. The original bringing together of *Automeris* and *Hemileuca* in one group is due to Grote and Robinson, "Lepidopterological Contributions," "Ann. Syc. N. H. N. T.," viii, 376, 1866. But we had not studied the neuration.

think, in this case be successful. No process of "reconcilement" will, I think, here entice these stray sheep into the Dyarian fold. *Hemileuca* will go over to its companions the true emperor moths, as already given by Hübner, and *Aglia* will remain an isolated specialised Old World type of the Citheronian phylum, as originally stated by Dr. Packard.

The answer to the question why *Hemileuca* is a Saturnian is, then, that veins IV 2 and IV 1 are on a long stem, and that vein IV 1 can never be absorbed so as to issue from the lower side of the radius beyond the cell, and leaving IV 2 behind on the cross-vein. The answer to the question why *Aglia* belongs with *Automeris* and *Citheronia* is that veins IV 2 and IV 1 are stemless, separated, arising from the cross-vein, and the possibility is offered for IV 1 to ascend the radius as it does in the Citheroniadæ. From these answers I come to the conclusion that we must reject Dr. Dyar's arrangement of the groups of the Saturniades. These latter are diphyletic, and the question of whether we are entitled to fundamentally connect the two lines upon Dr. Dyar's formula for the mere position of the larval tubercles is one independent of the present question of the mixing of the groups. Here I conclude that either Dr. Dyar's estimate of the larval characters is a wrong one, or that these are insufficient to bear the weight imposed upon them, and are not to be relied upon. Having given the facts as they appear to me, I do not feel at all called upon to reconcile them with Dr. Dyar's statements. The need for such a reconcilement should be felt by Dr. Dyar, whose larval theories seem already so valuable that our dependence upon them should not be weakened by their failure in the present instance.

To change *Hemileuca* into *Saturnia* we have hardly to do more than remove vein VIII of secondaries. To change *Saturnia* into *Attacus* (figured *ante*, p. 47) we have only to open the cell, to erase the already degenerate cross-vein between IV 2 and IV 3, and to round off the base of vein of IV 2 where it furcates with IV 1, the piece which intervenes being still a piece of the cross-vein physiologically in *Saturnia*. All these are normal successions, constantly repeated changes, in the neuration throughout the Lepidoptera. Nowhere in the Saturnian series can the wing of *Aglia* fit in or find a place. But in the Citheronian series of changes *Aglia* fits in, finds a place, and is explicable. More than this, all the exotic forms of the emperor moths which I have examined fall under one of the two wing patterns of venation as explained by me; they are either Saturnians or Aglians.

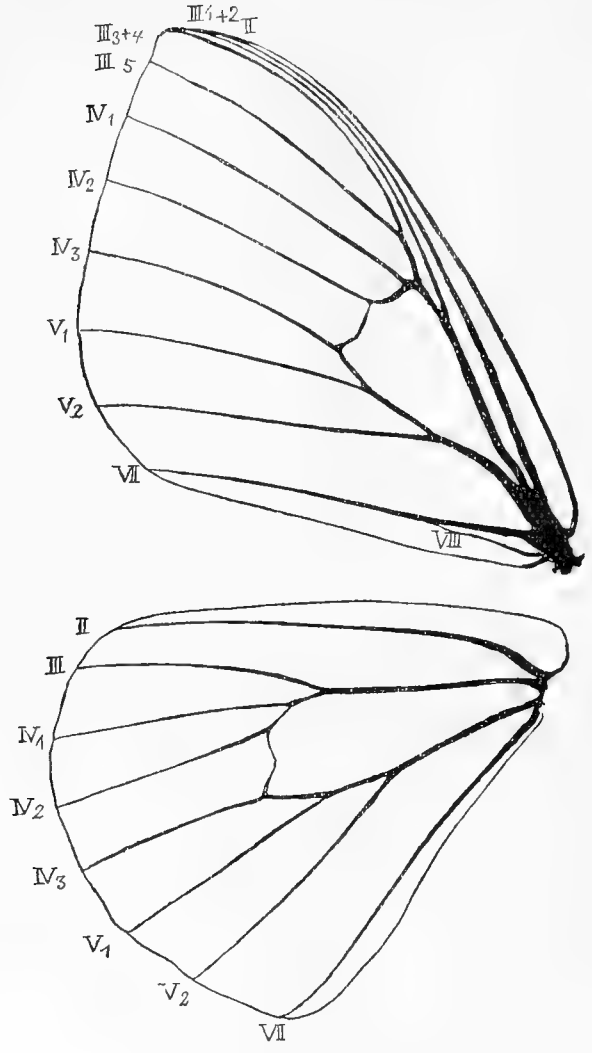

Fig. 1.

Automeris io.—A specialised wing with the veins straight, stiff, equidistant; vein VIII of secondaries has been lost by absorption. The ancestral form probably possessed this vein. Cells closed, cross-vein transverse. The median branches retain their primitive generalised position. Vein IV 2 is central on primaries, on secondaries (as usual) it has slightly yielded to radius. Vein IV 1 remains on cross-vein close to radius. If this type had descended from *Hemileuca*-like ancestry this position of IV 1 could not possibly have been acquired. Vein III 1 + 2 is further advanced than in *Hemileuca*, but III 3 + 4 has a longer fork, hence here more generalised. The absence of any intention to form a stem for the two upper branches of media characterises this type. Compare with Fig. 3, *Aglia tau*, and contrast with Fig. 2, *Hemileuca maia*. This wing is more specialised than *Hemileuca* from the point of origin of III 1 + 2, being farther removed from base of wing, and the disappearance of VIII on hind wings. It should therefore, according to Dr. Dyar's classification, be developed from it, which I hold to be an impossible process.

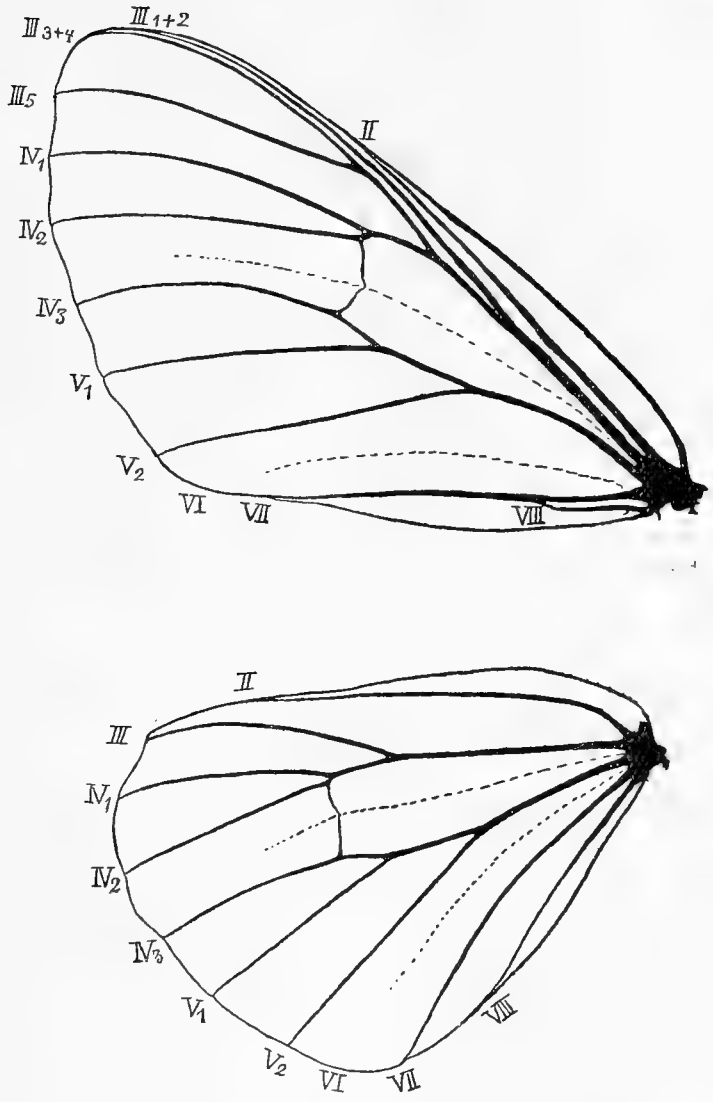

Fig. 2.

Hemileuca maia.—A generalised wing with the veins curving, tending to separate unequally, vein VIII of secondaries retained, traces of base of media and vein VI. Veins IV 1 and IV 2 on a stem, which latter belongs morphologically to the cross-vein. The two upper branches of the media furcate, approaching at base; the portion of cross-vein between them is still angulate, and reveals its origin. For an instance of the complete vanishment of this angulate piece see figure of *Attacus* (*ante*, p. 47). This wing is then more generalised than that of *Automeris*, but the disintegration of the median system has proceeded upon a different plan. Vein IV 2 has left its central, generalised position, and is drawn to radius. The cross-vein between IV 2 and IV 3 has lengthened; the whole cell is differently shaped and formed from that of the Aglian type. Compare with Fig. 4, *Saturnia pavonia-major*, and contrast with Fig. 1, *Automeris io*.

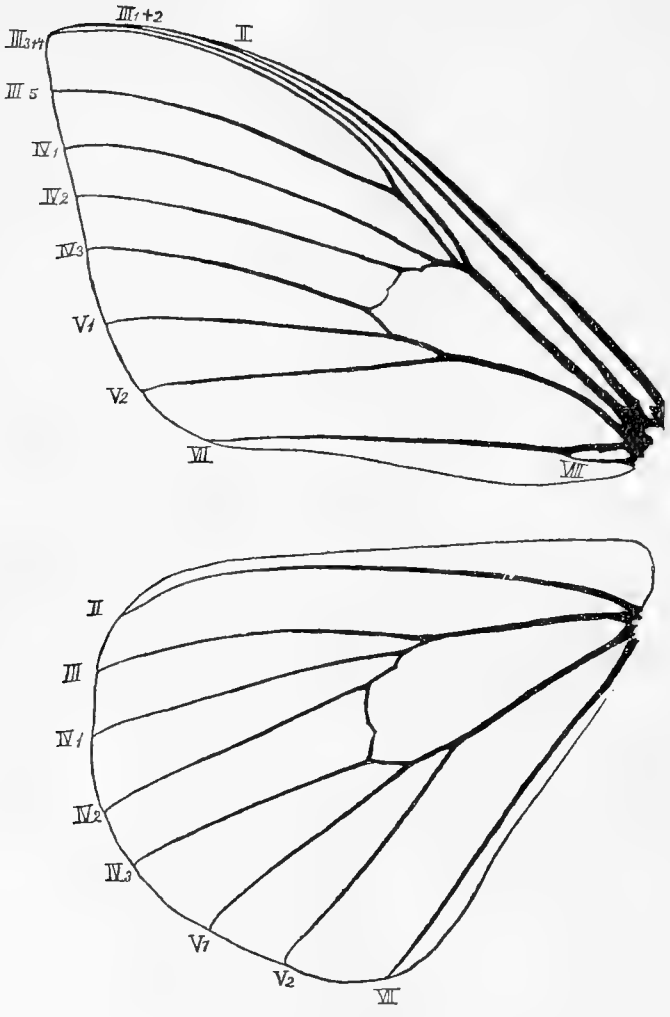

Fig. 3.

Aglia tau.—A specialised form slightly advanced beyond the stage of Fig. 1, *Automeris io*, but exhibiting every distinctive feature of that type of wing. The specialisation is seen in the more advanced point of origin of III 1 + 2, in the fact that the transverse cross-vein has become slightly oblique. No intention is manifested to form a stem or to approach IV 2 to IV 1 at base; on the contrary, the cross-vein has here an unevenness, indicative rather of an approaching break. The central position of IV 2 is to be further retained. This position of IV 2, and the strong equidistant veining give the moth a hovering flight. *Aglia* flies in the early year (April to June) in beech woods, very quickly, hardly more than one or two feet above the dry brown leaves which strew the bed of the woods. In this way, in the daytime, the males seek the resting females, which remain quiet near the place of emergence, low down on the boles of the beeches. The colour of the moth against the brown leaves acts protectively, and its flight is here difficult to follow; it seems to vanish every instant. Compare this figure with Fig. 1, *Automeris*, and contrast with Figs. 2 and 4.

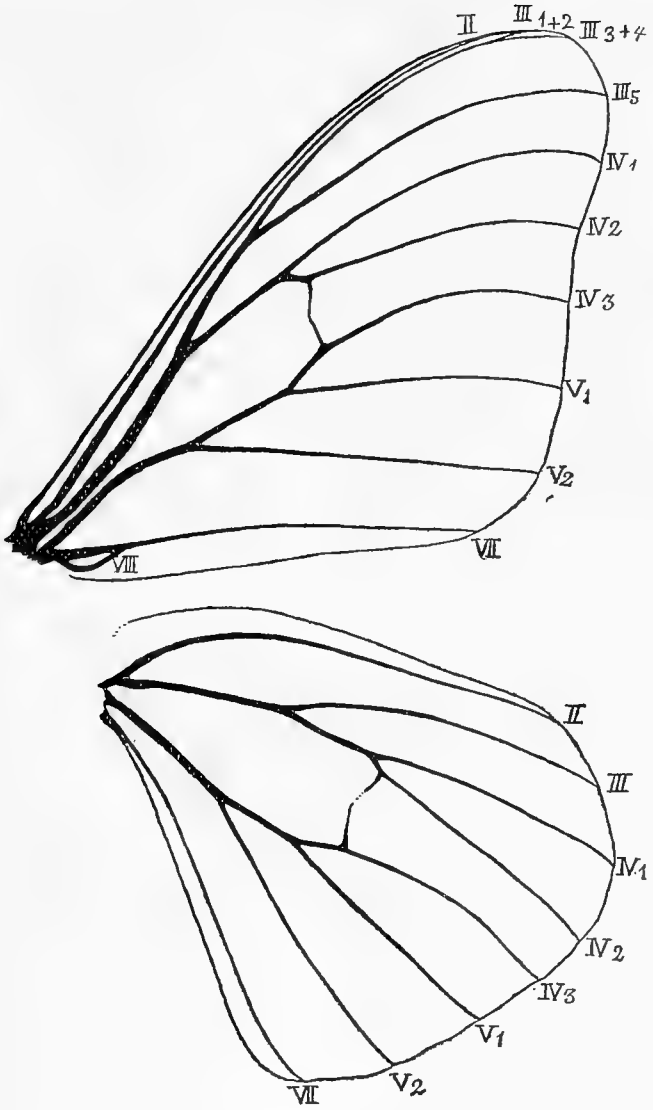

Fig. 4.

Saturnia pavonia-major.—A specialised wing, vein VIII of secondaries absorbed, veins IV 1 and IV 2 on a long stem, furcate, the piece between IV 2 and IV 1 still remaining angulate, and morphologically belonging to the cross-vein. Compare with figure of *Attacus* (*ante*, p. 47), where, under a further advance in specialisation, this piece has become absorbed, rounded, and represents base of IV 2. As compared with *Hemileuca*, vein III 1 + 2 has progressed from above cell to nearly tip of wing, and is absorbed by III 3+4 —a clear and expected specialisation. The cross-vein is long between IV 2 and IV 3, and shows signs of breaking in the middle, which it finally does in *Attacus*. It is thus seen that fundamentally the wings of *Saturnia* and *Hemileuca* agree in pattern and *modus* of evolutionary development. The slightly shorter stem of IV 1 and IV 2 in *Hemileuca* precedes the longer stem of *Saturnia*. It is quite impossible that this stem, in both cases prophetic of *Attacus*, could be related to the stemless separate upper median branches of *Automeris* and *Aglia*.

Notes on Hybrids of Tephrosia bistortata, Goetze, and T. crepuscularia, Hb.

By J. W. Tutt, F.E.S. *Communicated October 28th*, 1897.

The specimens of *Tephrosia bistortata* and *T. crepuscularia*, together with the hybrids between these species that I exhibit to-night, are the results of a series of experiments carried out by Mr. A. Bacot and Dr. W. S. Riding during the past summer.

As there has been considerable discussion as to the specific distinction of these species, it may be well to premise my notes on the exhibit by saying that the difference between those who hold that these are one and the same species, and those who hold that they are distinct, is merely a matter of terms. Even Mr. Barrett, the strongest supporter of the one species view, does not fail to find sufficient distinction to enable him to speak of them as "varieties" or "forms" and to the evolutionist the scientific result is not affected by the term applied to them. So long as they are distinct and recognisable as distinct forms it is not worth while arguing as to whether they are what is termed one species or two; as I have said, it is only a difference of degree, not a difference of kind.

It will be seen that there are considerable differences between the two insects operated on by Mr. Bacot and Dr. Riding. These differences may be summarised as follows:—(1) *Tephrosia bistortata* is of an ochreous (often tending to ferruginous and fuscous) ground colour; it occurs in the British Islands in March to April, and again in July; it is widely distributed in the southern and western counties of England and in Scotland, and is found in the greater part of the Palæarctic and Nearctic regions. Its second brood differs from the first in being usually smaller, of a dead white colour, and without the ochreous suffusion of the first brood. The warm-tinted early brood of this species is known as var. *abietaria*, Haw.; the Scotch (Perth and Moray) specimens are the nearest approach we have in Britain to the more fuscous Continental type = *bistortata*, Goetze; the small, pale second brood is known as var. *consonaria*, Stephs. (2) The second species, *T. crepuscularia* (*biundularia*), has a white ground colour; it occurs in the British Islands in May and June, *i.e.* its time of appearance falls between the two emergences of *T. bistortata*; it is never double-brooded in nature, is widely distributed in the midland and northern counties of England, is found throughout Ireland, overlaps *T. bistortata* in the southern and south midland counties of England, and so far is unknown in Scotland. It appears to be widely distributed in Central Europe, but has not yet been re-

corded from Northern or Southern Europe, nor from extra-European territory.

The specimens I exhibit are—(1) The broods of *T. bistortata*, *T. crepuscularia*, and *T.* ab. *delamerensis*, from which Dr. Riding selected the parents for his experiments. (2) Those used by Mr. Bacot for the same purpose. (3) The hybrids obtained by Dr. Riding. (4) The hybrids obtained by Mr. Bacot. A few remarks on each of these may now be useful.

I. *Parents used for Pairing in Dr. Riding's and Mr. Bacot's Experiments.*

By a little judicious treatment in February and March, 1897, Dr. Riding obtained the emergence of *T. bistortata*, *T. crepuscularia*, and *T.* ab. *delamerensis*. These insects were the broods from which the parents of the hybrids were selected, and were obtained by Dr. Riding as follows:

(1) *T. bistortata*.—These were (*a*) from eggs laid by a female of the second brood in July, 1896, captured at Clevedon (Somerset). (*b*) Eggs laid by female (second brood) bred by Mr. Bacot, also from Clevedon ova. The imagines emerged between February 17th and March 27th, 1897. A selection of these are exhibited. These are of the well-marked southern form, with suffused ochreous ground colour, distinct basal and subterminal bands, and strongly shaded on either side of the wavy antemarginal line = ab. *abietaria*, Haw. 7 ♂ and 10 ♀; the latter more strongly banded and less suffused than the males.

(2) *T. crepuscularia*.—These were reared from ova laid by a female from the York district, the ova having hatched June 3rd to 4th, 1896. The melanic form appeared with the type in almost equal proportions. The imagines emerged between March 7th and the end of the first week of April. These are of a rather more suffused form than those from our southern woods; this is probably due to the influence of the melanism that has produced ab. *delamerensis*, a form that probably appears as a part of every brood in the York district, whence these were obtained. The use of this rather suffused type-form has complicated the colour difficulties in dealing with the hybrids, but has made them more interesting. 8 ♂ and 10 ♀.

(3) *T.* ab. *delamerensis*.—These were the imagines from pupæ bred from ova laid by a ♀ *T.* ab. *delamerensis*, captured in the York district. The eggs hatched May 30th to 31st, 1896. Imagines of the typical form appeared with those of the melanic form from this batch of eggs; there were no real intermediates between the two forms; emergence took place between February 26th and April 27th (few came out before March 9th, and some as late as April 27th). Blackish grey in colour, deeply suffused, but with irregular grey patches, the white antemarginal line not particularly strongly marked.

(4) Besides the above I also exhibit for Dr. Riding a series of *T. bistortata* (second brood). These are the progeny of specimens

of brood 1 (above). They emerged between June 7th and June 24th, 1897. These exhibit the dead grey colour and ill-developed markings that characterise the second brood of the species, which is known as ab. *consonaria*, St. These are specially useful as showing the progeny of *T. bistortata*, uncrossed by *T. crepuscularia*. The broods are those from which the parents of the hybrids were selected.

The specimens exhibited, and used by Mr. Bacot as the parents from which his hybrids were obtained, were from the same localities as those used by Dr. Riding, viz. Clevedon (Somerset) for *T. bistortata*, and York district for *T. crepuscularia*.

II. *Hybrids obtained by Dr. Riding.*

Reciprocal Crossings obtained.—The reciprocal crossings obtained by Dr. Riding were as follows:—Fertile reciprocal crosses from broods 1, 2, and 3 (above), viz.—

1. *T. bistortata* ♂ × *T.* ab. *delamerensis* ♀.—*a*. Paired March 11th; ova deposited March 15th; hatched April 26th to 27th.

2. *T.* ab. *delamerensis* ♂ × *T. bistortata* ♀.—*a*. Paired March 9th; ova deposited March 14th; hatched April 18th to 19th.—*β*. Paired March 9th; ova deposited March 13th to 14th; hatched April 18th to 19th.

3. *T. bistortata* ♂ × *T. crepuscularia* ♀.—*a* and *β*. Two pairings on March 17th; ova deposited March 20th to 22nd; hatched April 25th to 27th.

4. *T. crepuscularia* ♂ × *T. bistortata* ♀.—*a*. Paired March 7th; ova deposited March 16th; hatched April 21st to 22nd. *β*. Paired March 14th; ova deposited March 20th; hatched April 22nd to 23rd.

Crossings that failed were—(1) *T.* ab. *delamerensis* ♂ × *T. bistortata* ♀, two pairings, February 28th and March 12th. (2) *T. crepuscularia* ♂ × *T. bistortata* ♀, three pairings, March 7th, 10th, 14th.

Hybrids.—I. *Hybrids between* ♂ *T. bistortata* (Clevedon) *and* ♀ *T.* ab. *delamerensis* (York).—No. 1 in list above. One batch of eggs hatched April 26th to 27th; 100 imagines emerged between June 12th and October 22nd, 1897; 48 ♂ and 52 ♀.

II. *Hybrids between* ♂ *T. crepuscularia* ab. *delamerensis* (York), *and* ♀ *T. bistortata* (Clevedon).—No. 2 of above list. Two batches of eggs obtained; hatched April 18th to 19th. The two broods were fed up together, the imagines exhibited being a mixture of both broods. Sixty-one imagines are exhibited (60 ♂ and 1 ♀). These emerged between June 12th and September 19th, 1897.

These two crosses represent the reciprocal crosses of *T. bistortata* and *T. crepuscularia* ab. *delamerensis*. The percentage of a form approaching ab. *delamerensis* in the two crossings are 60 and 40 per cent. respectively; the crossing in which *T. bistortata* was the male parent has produced by far the larger and more vigorous offspring.

III. *Hybrids between* ♂ *T. bistortata* (Clevedon) *and* ♀ *T. crepuscularia* (York).—No. 3 of above list. Two batches of eggs obtained; hatched April 25th to 27th; larvæ fed up together. 121

imagines emerged between June 17th and November 3rd, 1897. These consist of 65 ♂ and 56 ♀.

IV. *Hybrids between* ♂ *T. crepuscularia* (York) *and* ♀ *T. bistortata* (Clevedon).—No. 4 of above list. Two batches of eggs obtained; hatched April 21st to 23rd; larvæ fed up together; 40 imagines emerged between June 16th and November 1st, 1897. These consist of 40 males and no female.

These crosses III and IV are the reciprocal crosses of typical *T. bistortata* and *T. crepuscularia*. The most noticeable point is that cross III produces 47 per cent. of females, and cross IV no female. The earliest specimens to emerge (of both sexes) were pale, those longest in the pupal stage were the darkest.

III. *Hybrids obtained by Mr. Bacot.*

Reciprocal Crossings obtained.—Fertile reciprocal crossings obtained were—

1. *T. bistortata* ♂ × *T.* ab. *delamerensis* ♀.—Paired March 9th.

2. *T.* ab. *delamerensis* ♂ × *T. bistortata* ♀.—Three pairings. α. Paired February 26th; ova hatched April 6th. β. Paired March 5th. γ. Paired March 9th; ova hatched April 7th.

3. *T. bistortata* ♂ × *T. crepuscularia* ♀.—Two pairings. α. Paired March 9th; hatched April 8th to 9th. β. Paired March 9th; hatched April 8th to 9th.

4. *T. crepuscularia* ♂ × *T. bistortata* ♀.—Paired February 27th.

Crossings that failed were—(1) *T. crepuscularia* ♂ × *T. bistortata* ♀. Paired February 27th. (2) *T.* ab. *delamerensis* ♂ × *T. bistortata* ♀. Paired March 4th.

Hybrids.—1. *Hybrids between* ♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*.—(Ova received from Dr, Riding. They are part of Dr. Riding's cross marked 1.) Eggs laid March 15th; hatched April 26th to 27th. Twenty-one specimens emerged—11 males, 10 females.

II. *Hybrids between* ♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*.—No. 2 α above. One batch of eggs, hatched April 6th; some larvæ full-fed by May 9th; larvæ mostly like that of the ♀ parent (*bistortata*), only a few having the apex of the ∧ open like the larva of *T. crepuscularia*. Most of the larvæ pupated about the middle of May. Imagines commenced to emerge early in June, at first rapidly and afterwards more slowly, until end of June; there was then a break until July 16th, when they again commenced to emerge, and continued to do so at intervals until the first week in September; one specimen emerged during the last week in October. Fifty-eight specimens emerged, all males—twenty-nine pale and twenty-nine dark specimens.

III. *Hybrids between* ♂ *T. bistortata* × ♀ *T. crepuscularia*.—Of this cross there were two different broods. Of the first, α (marked 3 α in Bacot's pairings), the larvæ for the most part followed the ♂ parent (*bistortata*), only a few have the apex of the ∧ mark open as in ♀ parent; full-fed from about 16th to 20th May. Twenty-two speci-

mens emerged—14 ♂ and 8 ♀. These emerged in June, with the exception of two (which came out in July).

β (♂ *T. bistortata* × ♀ *T. crepuscularia*). Of the other brood of this cross (marked 3 β) a fair number of the larvæ fed up and pupated very quickly, but others fed up slowly, and did not go down until the earliest specimens had commenced to emerge ; larvæ unhealthy, large proportion died. Nine specimens emerged—six males and three females. Four minute specimens—$\frac{1}{16}$ in. (♂), $\frac{1}{16}$ in. (2 ♀), $1\frac{1}{8}$ in. (1 ♀). These small specimens emerged in late June, two normal specimens in early June, one on September 29th, and two late in October. It may be well to mention here that these tiny specimens are not infrequent in inbred *T. bistortata*. Such a brood as this last is practically useless for comparative purposes.

IV. *Crossings obtained from Hybrids.*

Besides obtaining reciprocal crossings of the parent species, pairings of the hybrids were obtained by Dr. Riding between June 13th and 26th, as follows:—(1) ♂ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*) × ♀ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*). (2) ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). (3) ♂ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*). (4) ♂ (♂ *T. crepuscularia* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*). (5) ♂ (♂ *T. bistortata* × ♀ *T. crepuscularia*) × ♀ (♂ *T. crepuscularia* × ♀ *T. bistortata*). Of these different crosses twelve pairings in all were obtained, eleven of which gave ova, and yet of these eleven batches only two were fertile, both crosses of ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). Later pairings of ♂ (♂ *T. crepuscularia* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*) also proved infertile. Dr. Riding, however, obtained four inbred pairings of ♂ (♂ *T. bistortata* × ♀ *T. crepuscularia*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*) ; one of these produced no eggs, another was infertile ; the two others were only partially fertile.

In addition to the first crosses already summarised, Mr. Bacot obtained the following more or less fertile crossings of the various hybrids reared from the already described broods :

(1) ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*). Two pairings :—α. June 10th ; β. August 6th.

(2) ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). Two pairings on June 10th (eggs mostly fertile).

(3) ♂ (♂ *T. bistortata* × ♀ *T. crepuscularia*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). Paired June 11th.

He further obtained the following inbred pairings :

(4) ♂ (♂ *T. bistortata* × ♀ *T. crespuscularia*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*). Four pairings :—α. June 10th. β. June

10th. γ. June 14th. δ. June 17th. (A large percentage of the eggs infertile.)

(5) ♂ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). One pairing, June 13th.

The following pairings of a hybrid with one of the parent species were also obtained:

(6) ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ *T. bistortata* (second brood). Paired June 15th. Only one or two ova hatched, remainder infertile.

(7) ♂ *T. crepuscularia* (second brood) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). Paired July 4th.

The following crosses entirely failed:—(1) ♂ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). Paired June 12th. (2) ♂ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*). Paired June 14th. (3) ♂ (♂ *T.* ab. *delamerensis* × ♀ *T. bistortata*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*).

v. Second Generation of Hybrids.—♂ (♂ *T.* ab. *delamerensis* × ♀ *bistortata*) paired with ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). The parents taken from Dr. Riding's crossings 11 and 1 above respectively. Two batches of eggs, hatched June 27th–30th; forty-four imagines exhibited; emerged between August 21st and November 3rd, 1897. It is almost impossible to classify these.

vi. Inbred Hybrids.—♂ (♂ *T. bistortata* × ♀ *T. crepuscularia*) × ♀ (♂ *T. bistortata* × ♀ *T. crepuscularia*).—Dr. Riding obtained two batches of eggs:—(1) Paired August 10th; ova laid August 12th; hatched during the fourth week of August, some only fertile. (2) Paired August 13th; ova laid August 15th; hatched first week in September. By October 22nd, all except thirteen larvæ had pupated. The first two imagines emerged on November 4th, five full-fed larvæ at that date not having gone down. Five specimens exhibited, three ♂ and two ♀; emerged between November 4th and 10th.

Mr. Bacot obtained two similar crossings, both from parents belonging to his batch III *a*, the parents being in each case normal for that brood. *a*. Pairing took place on June 17th, 1897; twenty-two imagines emerged, twelve ♂ and ten ♀, between the middle of August and end of October. β. Of this brood, eight imagines, four ♂ and four ♀, emerged during August, and continued until end of October.

vii. ♂ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*) × ♀ (♂ *T. btstortata* × ♀ *T.* ab. *delamerensis*).—The parents of this brood were both taken from Bacot's batch 1. They paired on June 13th, and produced, in September, only two small round-winged imagines—one a ♂ (1⅛ inches in expanse) suffused with ochreous-fuscous, and with distinct transverse lines; the other a ♀ (1¼ inches in expanse), whitish ground colour, with basal and median bands, and well-developed submarginal lines to fore-wings, and median and outer bands to hind wings. Both specimens show traces of a fine black longitudinal line on median nervure at outer point of discoidal cell, and

a small black costal blotch at upper end of the basal line. This latter is most marked in two males of *T. crepuscularia* (second brood) bred by Mr. Bacot.

VIII. HYBRID CROSSED WITH ♂ OF PARENT RACE.—♂ *T. crepuscularia* (second brood) × ♀ (♂ *T. bistortata* × ♀ *T.* ab. *delamerensis*). The progeny is, therefore, three-fourths *T. crepuscularia* and one-fourth *T. bistortata*. The female hybrid chosen for this experiment was of the *delamerensis* form, and taken from Bacot's batch 1. Pairing took place on July 4th. Forty-nine imagines resulted and were exhibited, thirty-eight ♂ and eleven ♀. These emerged during September and October. Only two ♀ were present among the first thirty-seven emergences, and nine among the last twelve. These consisted of thirty-one pale and eighteen dark specimens. With the exception of seven females, the remainder of this brood are, to all intents and purposes, *T. crepuscularia*. Only one who has made a very special study of these could tell that the latter specimens had been obtained from parents that had been crossed with *T. bistortata*.

AN ADDRESS TO THE MEMBERS

OF THE

South London Entomological and Natural History Society.

THERE are, in the ordinary progress of all institutions, and particularly in that of societies such as ours, times of inflation and of depression; in either case the retiring president is furnished with a theme on which to found his address: in the former many points for mutual congratulation will readily present themselves; the latter may possibly induce something more in the form of an admonition.

The reports of the Treasurer and the Council that have already been submitted to you have put you in possession of the main points that have occurred in connection with the affairs of the Society since the last Annual Meeting, and you will have gathered from them that there is no very exciting topic on which it will be necessary for me to address you at any great length. On some minor matters, however, I should like to say a word or two in passing.

From the Council's report you have heard that the finances of the Society maintain a satisfactory position, and from the Treasurer that his cash balances are smaller than any for some years past. At first sight these may appear to be contradictory statements, but a small amount of investigation will show them to be quite in harmony, the very fact of the smallness of the balances being, in this instance, an indication of progress. For many years past it has been the custom to allow the papers read before the Society to accumulate for the year, and to publish them with the "Abstract of Proceedings" during the following year. This was a convenient method in so far that it was known before the time of publishing just what balance remained over and was available for the purpose; but it was open to one great

objection, namely, that a paper, no matter how important or pressing its contents, read say in February, had no chance of publication for at least a year, and more probably fourteen or fifteen months after date. It was felt that this delay was a standing source of weakness to the Society, that authors of papers of any special interest could not afford to let their work remain hidden away so long before seeing daylight, and that to attract the more interesting and important class of papers we must give greater facilities for earlier publication. Owing chiefly to the energy of our Honorary Reporting Secretary, the matter was thoroughly taken up by the Council, and it was eventually decided that for the future the "Proceedings" of the Society should be published in two parts, the first part to contain the papers read during the first half of the year, the second part to contain those read during the second half, together with the reports of meetings, list of members, balance-sheet, &c.

Owing to some amount of detail having to be arranged with regard to the altered method of publication, it was somewhat late in the year before the Council were justified in passing the scheme, but upon its completion no time was lost in taking advantage of it, both the Honorary Reporting Secretary and Mr. South, who has very generously acted as Editor for some time past, pressing the publication forward with all possible speed, with the result that Part I of 1897, containing papers read up to the middle of September, was in the hands of members during the autumn. The printer's bill for this Part I of the "Proceedings" has been paid within the year instead of after its completion, which, you will see, readily accounts for the smaller cash balances, and of course there will be proportionately less of last year's printing to be paid for in the present year's accounts. You will, I think, agree with me that the two apparently contradictory statements referred to are in reality quite in harmony.

There has been some change in the personnel of the Council during the year. It is not my intention to dwell upon the details, but I take this as a fitting opportunity to put on record the sympathy felt by the Society with one of its members, who, owing to severe domestic affliction, found it impossible to retain his seat upon the Council. I would also take this same opportunity to offer our congratulations to one other member, whose preferment to an important position as a medical officer necessitated his removal from London to a distance too great to admit of his continuing

his connection with the Council. The vacancies caused by these and other retirements were duly filled up as provided by the bye-laws.

One of the functions of a natural history society is the holding of field meetings, and if I mistake not such meetings are among the prescribed objects of this Society; but it appears to me that the letter rather than spirit of the law has been acted upon during the past year or two. Meetings have been duly held and, as a rule, fairly well attended; and I may add -and I do so from personal experience—that those members who have been present at any of them have thoroughly enjoyed them; but I think there is yet a good deal more to be made of them. The controllable elements necessary to a successful meeting are the selection of a suitable site and thorough organisation. Weather is an uncontrollable element, and may therefore be at once dismissed from our calculations; we have no alternative in any case but to take the risk of it. Despite the rapid growth of "greater London," and the closing of many of the tracts of land on its borders, there are still within the compass of a Saturday afternoon's outing many thousands of acres of heath and woodland, marsh and downs, open for all practical purposes, and easily come-at-able by the numerous railway systems having their termini in London. Many of these railways, moreover, are quite willing to give facilities in the way of reduced fares, and so forth, to parties travelling together, and there are but few places within the prescribed area where it is not possible to make the necessary commissariat arrangements for a very considerable party; there should, therefore, be no great difficulty in making the selection of a suitable site. Organisation consists largely in making such arrangements as will be convenient to the largest number of members, and showing them that there is something to be gained in return for their expenditure of time. Matters of detail must of course be left to those who have the carrying out of each particular meeting. I know of no better opportunity for friendly intercourse among members than is offered by field meetings; the restraint of the meeting room is thrown off, and there is a feeling of freedom in the open country that seems to give us fresh energy, fresh interest in the things around us, and I venture to hope that the question of field meetings may receive the early attention of the Council, and that they will be enabled to make such arrangements as will secure the attendance of an increased number of members.

It has been the custom with many of my predecessors to incorporate in their addresses an annotated list of additions to the British insect fauna, new books, &c. As to the desirability of such lists in the Society's "Proceedings" I have no doubt, but I am not equally clear that this is the right place for them, and am inclined to think that they might more appropriately form the subject of a separate paper. However, as on the present occasion they are unusually light in volume, I have decided to include them.

Four species of Coleoptera have been added to the British list during the year, viz.:

Aleochara succicola, Thoms., appears to have been confused with *A. mœsta*, and was detected by Mr. Champion. It appears to be a fairly common and widely distributed species. "Ent. Mo. Mag.," xxxiii., 97.

Exomias pyrenæus, Seidl., had been taken by Mr. J. H. Keys, near Plymouth, occasionally since 1888, but has only just been identified. "Ent. Mo. Mag.," xxxiii., 134.

Homalota pruinosa, Kr., was taken by Mr. E. G. Elliman among grass at Chesham in May and early June. "Ent. Mo. Mag.," xxxiii., 274.

Platystethus alutaceus, Thoms., was originally taken by Mr. Champion many years ago in Surrey, and recently by Mr. Keys near Plymouth, and has now been identified by the former gentleman. "Ent. Mo. Mag.," xxxiii., 98.

Mr. Champion has also been able to confirm as British the minute species *Tachys parvulus*, Dej., from specimens taken by himself in Gerran's Bay, Cornwall, in June or July last. "Ent. Mo. Mag.," xxxiii., 213.

That there should be one species only of Diptera to record is probably owing to the paucity of workers rather than any want of material. The one addition is *Phorocera incerta*, Mead, a species new to science. "Ent. Mo. Mag.," xxxiii., 223.

Hemiptera has two additions, viz. *Kermes variegatus*, Gmelin, "Ent. Mo. Mag.," xxxiii., 267; and *Pœciloscytus vulneratus*, Wolff, "Ent. Mo. Mag.," xxxiv., 15.

Hymenoptera heads the list in point of numbers, there being no less than eleven new species to add, viz.

Acampsis alternipes, Wesm.,	"Ent. Mo. Mag.,"	xxxiii.,	150
Allantus distinguendus, de Stein,	,,	,,	210
Cilissa melanura, Nyl.,	,,	,,	229
Dolerus æriceps, Thoms.,	,,	,,	210
Hedychridium coriaceum, Dahlb.,	,,	,,	181
Mesochorus tetricus, Holmg.,	,,	,,	257

Neoneurus halidaii, Marsh, "Ent. Mo. Mag.," xxxiii., 149
Polyblastus annulicornis, Giraud, ,, ,, 150
Psen concolor, Dahlb., ,, ,, 252
Tenthredopsis nassata, L., ,, ,, 210
,, *spreta*, Lep., ,, ,, 210

For the lepidopterist the past year has in no sense been a brilliant one; none of the "occasional visitors" have shown up in any great force; indeed, with the exception of a few *Colias edusa* scattered over the southern counties, an occasional capture of a stray example of some of the larger Sphingidæ, and the remnant of a brood of *Deilephila galii* discovered on the west coast sand-hills, we may dismiss this sometimes prolific source of rarities from our calculations. We may take some consolation in the fact that *Plusia moneta* appears to continue to extend its range with us, and that the year has not been an absolute blank as to new species, the following addition having been made, viz.—

Platyptilia tesseradactyla, L., was detected by Mr. Barrett among some insects sent from Ireland by Mr. Kane. It was taken at Clonbrock in June, 1895, in some numbers, but had remained unidentified. "Ent. Mo. Mag.," xxxiii., 25; "Entom.," xxx., 74.

Mr. Meyrick mentions *Crambus perlellus*, var. *rostellus*, Lah., which he met with in Ross-shire in September, as probably being a well-marked local form, although regarded by many Continental authors as a species. "Ent. Mo. Mag.," xxxiii., 255.

Prodenia littoralis, Bdv., a Mediterranean species of Noctuæ, has again been bred in this country, its sponsor this time being Mr. Bartlett of Bristol. The former specimen was bred by Mr. Boden ("Proc.," 1891, p. 139). There is no reason for throwing the slightest doubt upon the *bona fides* of these records, but the occurrence should be regarded as a case of accidental importation rather than as a permanent addition to the British fauna.

Books on various branches of natural history, good, bad, and indifferent in their composition and style of production, continue to issue from the press at such a pace, that to give a complete list of them would occupy more than the whole space at my disposal, and no useful purpose would be served by so doing; I prefer, therefore, to err rather on the side of brevity, and to mention only those that appear to me to have some special interest for us.

"With Nature and a Camera," by the Brothers Kearton (London, Cassell & Co., Ltd.), deals largely with birds as

seen in their native haunts. It is a particularly fresh and pleasantly written volume, founded on the actual observation of the authors, and cannot fail to interest anyone, whether he be old or young, who has any taste for natural history.

"An Illustrated Manual of British Birds," by Howard Saunders, F.Z.S., &c. A second edition of this particularly concise work is being issued in one shilling parts by Messrs. Gurney and Jackson.

"British Birds; their Nests and Eggs," by various well-known authors, continues to appear regularly in monthly parts. The part just issued deals with the latter portion of the order Anseres, for which Mr. John Cordeaux is responsible; and the first portion of the Columbæ, which Mr. W. B. Tegetmeier has in hand. The full-page illustrations by Mr. F. W. Frohawk fully maintain their high order of excellence.

"The Vivarium; being a Practical Guide to the Construction, Arrangement, and Management of Vivaria, containing full information as to all Reptiles suitable as Pets, how and where to obtain them, and how to keep them in Health," by Rev. G. C. Bateman (London, L. W. Gill). Contains many hints on the management of reptiles in confinement, and should prove useful to those whose tastes run in this direction, whether the creatures are kept for amusement or for study.

The Ray Society's publications maintain their usual standard of excellence. They consist of "The Tailless Batrachians of Europe," by G. A. Boulenger, F.R.S. Part I; and the "Larvæ of British Butterflies and Moths," by (the late) William Buckler, edited by Geo. T. Porritt, F.Z.S., &c. Vol. VII. The plates of this latter volume are produced by chromo-lithography, and show a vast improvement over the hand-coloured productions of the earlier volumes. The larvæ dealt with are the first portion of the Geometræ.

"A Handbook of the Order Lepidoptera," by W. F. Kirby, F.L.S., &c. Vol. V., Moths. (London, Allen & Co., Ltd.) This is one of Allen's Naturalist's Library Series, and the volume completes the Order Lepidoptera.

"The Lepidoptera of the British Islands," by Charles G. Barrett, F.E.S. (Lovell, Reeve, & Co.) Part XLVIII., recently issued, brings the work well on towards the latter portion of the Noctuæ.

"The Young Beetle Collector's Handbook," by Dr. E. Hofmann, with an Introduction by W. Egmont Kirby, M.D.

Although hardly so simple as its title would imply, may yet form a useful stepping-stone to the more advanced works on Coleoptera.

"Descriptive List of the British Anthomyidæ," by R. H. Mead, F.R.C.S., &c. (London, Gurney & Jackson.) Is a welcome contribution to the literature of the much-neglected British Diptera. Rumour has long been rife, but when may we hope to see some thorough monograph of this, at present, little-worked order?

"Farm and Garden Insects," by Prof. Wm. Somerville. (London, Macmillan & Co., Ltd.) As its title implies, treats of the economic section, and contains much practical information.

"Favourite Flowers of the Garden and Greenhouse," by Edward Step, F.L.S.; the Cultural Directions edited by William Watson, F.R.H.S., Assistant Curator, Royal Gardens, Kew. (London, Frederick Warne & Co.) Although this book may be said to trench on the ground of the Horticulturist rather than that of the Naturalist, the authorship of Mr. Step is a sufficient guarantee that the scientific aspect has not been lost sight of, the brief generic descriptions and histories being all that can be desired in this respect. It is fully illustrated by well-executed coloured plates of representative species.

Although, from the foregoing, we do not find any particularly startling events in connection with the past year, in some other respects it has been one of especial interest. The year 1897 will undoubtedly come to be regarded as one of those epoch-marking years that form the milestones on the path of time. Men of light and learning, from the ends of the earth, have been gathered together in this country to celebrate the sixtieth year of the reign of our Queen. The attention of the whole world has been directed to the events of those sixty years, events the like of which are not to be found in any similar period of the world's history. Arts, manufactures, science, have progressed as they have never progressed before; and natural science, the branch with which we are more particularly interested, has not lagged one whit behind.

Improved means of communication, additional postal facilities, and the increase in the number of local societies dealing with various branches of natural history subjects, have all tended to increase free intercourse between individuals. Life is far too short to give the isolated worker much hope of successfully dealing with the innumerable

problems that present themselves to his mind, but by free interchange of views with others much may be learned and much accomplished. In this connection too much cannot be said in favour of properly constituted local societies; they afford opportunities of bringing together multitudes of honest, though it may be humble workers, the result of whose work would otherwise be lost. They can take up the working out of many matters, possibly minor matters in themselves, but which collectively are of the utmost importance; and they can induce among their members that spirit of *systematic* procedure that is essential to trustworthy results, and which fits them for taking up more advanced work should opportunity arise. The banding together of local societies under the auspices of such institutions as the recently started South-eastern Union of Scientific Societies, and kindred institutions of longer standing, are further signs of the progress that has been made in this direction.

Expeditions for the exploration of little-known parts of the world, such as that undertaken by the Government in sending out a biological staff on board the "Challenger" in 1872, and by numerous private individuals at no small amount of expense and hardship to those concerned, have produced a vast amount of material, and brought to light many new facts.

The establishment of technical institutions has done much to encourage the study of natural science, not the least important among them being the Marine Biological stations. While on this subject it is particularly gratifying to note that the solution of one of the most perplexing and difficult problems—one that naturalists have been striving for years, perhaps centuries, to work out—should have been made known during the past year. It had long been known that the common eel of our ponds and rivers did not breed in fresh water, or even become mature there. Eels were further known to go down the rivers to the sea, and not to return, but elvers, or young eels of about two inches long, to come up the rivers from the sea in myriads. Grassi, whose work has been carried out at Messina, in Sicily, has been able by his careful research to complete the life history of this interesting creature. He tells us that the eel on leaving the river makes its way into very deep water, where it undergoes great change in both appearance and structure, and lays its eggs in water of not less than one thousand five hundred feet depth. The young which issue from the eggs are quite unlike the eels of our rivers. After a time they

cease to feed, and undergo transformation, then commence to feed again, come to the surface, and enter the mouths of rivers. The difficulties to be overcome in successfully carrying out research such as this are enormous, and the surmounting of them is a worthy example of the care and perseverance of the naturalist of the present day.

But perhaps the greatest of all achievements of modern times—that which has done more for the advancement of natural science than has ever been done before—has been the establishment of the principles of evolution. As, in the last century, Linnæus by his systematic work gave naturalists an intelligible method of procedure, as Buffon by his pompous writings attracted wide-spread attention, and Gilbert White by his simple story of nature's wonders drew multitudes of observers into the field, so Darwin, by his scrupulously accurate observations and elaborately supported theories, raised the whole world of naturalists, some in anger, some in incredulity, but the vast majority to renewed exertions and the ultimate acceptation of the doctrines that he had propounded.

That the theory of evolution is not accepted by all I am well aware. There are men among us—men of capability and powers of keen perception—who will have none of it, who cling to the theory of special creation, who will not admit that the whole universe is in a state of transition.

The ancients fondly believed that the earth was a flat disc of land surrounded by a great world-river. No doubt all that their senses could show them proved to their minds that this was so. But we must not be led into error as they were by accepting just, and only just, what appears on the surface. Nature's methods are often deeply hidden, and need much diligent seeking.

One of the chief difficulties in the way of the acceptation of the theory of evolution by those of opposite opinions is, no doubt, the preconceived idea that this world of ours has been in existence some six thousand years or thereabouts, and that its facial aspect has always been much as it now is. But nature knows no limits of time in the sense that we know them. To adequately appreciate the situation we must first disabuse our minds of the cramped ideas that our every-day life has instilled into them. So admirably was the situation described by Sir Charles Lyell in his address to the British Association at their Bath meeting in 1864, although he was then speaking of events of a comparatively modern period, that I am tempted, even at the risk of

repeating words familiar to many of you, to reproduce the following passage:—"When speculations on the long series of events which occurred in the glacial and post-glacial periods are indulged in, the imagination is apt to take alarm at the immensity of the time required to interpret the monuments of these ages, all referable to the era of existing species. In order to abridge the number of centuries which would otherwise be indispensable, a disposition is shown by many to magnify the rate of change in prehistoric times by investing the causes which have modified the animate and inanimate world with extraordinary and excessive energy. It is related of a great Irish orator of our day that when he was about to contribute somewhat parsimoniously towards a public charity, he was persuaded by a friend to make a more liberal donation. In doing so he apologised for his first apparent want of generosity by saying that his early life had been a constant struggle with scanty means, and that 'they who are born to affluence cannot easily imagine how long a time it takes to get the chill of poverty out of one's bones.' In like manner we of the living generation, when called upon to make grants of thousands of centuries in order to explain the events of what is called the modern period, shrink naturally at first from making what seems so lavish an expenditure of past time. Throughout our early education we have been accustomed to such strict economy in all that relates to the chronology of the earth and its inhabitants in remote ages, so fettered have we been by old traditional beliefs, that even when our reason is convinced, and we are persuaded that we ought to make more liberal grants of time to the geologist, we feel how hard it is to get the chill of poverty out of our bones."

In an earlier part of these remarks I referred to the difficulties that beset the isolated worker; still less hopeful are our prospects of obtaining satisfactory results of our investigations if we attempt to study one particular branch of natural history to the exclusion of all others. I do not wish to imply one word against specialists,—on the contrary, they are of the utmost importance to accurate work; but let them so freely interchange their views with each other that they are in constant touch with each other's work.

As an illustration of my point I can take no better example than the order Lepidoptera;—it is one of the most popular orders for study, it affords opportunities for experiment that few if any others offer, and is one with which the majority of you are intimate. What greater pleasure

have we experienced during our lives than the butterfly hunting of our schoolboy days? with what joy did we secure our first "red admiral"! what breathless excitement attended the capture of our first "clouded yellow"! Possibly we were first impelled by a sheer inbred love of sport, or it may be that it was simply their bright colours and airy flight that attracted our attention; but we had not grown much older before our heedless captures began to interest us. We became conscious that our pastime had a fascination for us. In our anxiety to amass a complete collection we set to work with increasing energy; our collecting expeditions were frequent, we learned how and where to get many species reputed good, we became adepts at rearing larvæ, we even went so far as to make fragmentary notes of any matters that appeared to us likely to be useful for our future guidance. We became quite proficient in the differentiation of species, and held very strong views on the right of certain forms to specific rank or otherwise.

The average lepidopterist of half a century ago probably seldom got much beyond this point. He generally had a very good knowledge of field work; was well up in the habits of insects; knew something of botany in so far as it was an assistance to him in his entomological work; he could tell you the history of each specimen in his collection, although he disdained the use of labels, and had some crude ideas on the question of classification, founded chiefly on his observations in the field. Sundry problems did no doubt present themselves to his mind from time to time, and were answered so far as his intimate knowledge of the Lepidoptera and preconceived ideas would allow, their explanation being regarded largely as matters of individual opinion rather than of fact.

There is an old saying that "familiarity breeds contempt." However true this may be in its broad bearing on things of every-day life, it will not apply to the works of nature. The more intimate we become with them the more do they interest us; the more are we impelled to seek their meaning.

This is just the case with the lepidopterist of the present day; the numerous problems that have presented themselves to successive generations have so persistently forced themselves upon his attention that he can no longer ignore them; he busies himself in seeking their solution among the many facts that are continually coming to his knowledge. Almost at his first step, however, he feels that "chill of poverty," he sees only too plainly the hopelessness of finding

their solution within the narrow compass of his own work. He confers with his fellow-workers in other orders, and finds that they too are seeking the solution of similar problems in the orders which they more particularly study, no matter whether they be plants, mammals, reptiles, or what not; they, too, have experienced similar difficulties; evidently they are working in a common field, the same laws are in operation throughout. By common consent a wider view of the situation is taken. Among others the geologist is consulted; it is learned from him that this fair earth of ours was in remote ages—ages so remote that our present cramped ideas of time will not let us say how long ago,—was in a condition quite incapable of supporting life in its present form, yet living things did then exist upon it, and further, that in "modern" times the greater part of these British Islands, together with a considerable portion of the continent of Europe, were for a considerable period covered by a great ice sheet, which rendered the existence of their present fauna and flora impossible. The embryologist also has found that many creatures, which in their more mature condition have no resemblance to one another, are in their earlier stages so similar, both in appearance and behaviour, that it is almost impossible to distinguish between them. And even the chemist, whose sphere of operations would appear to lay quite outside the region of natural history, shows that some living organisms have in themselves the necessary elements for producing certain colour changes that we know actually do take place in nature. Thus does the light begin to dawn upon his work. He sees that difficulties which appeared to him to be insurmountable are capable of explanation by natural laws; he takes fresh heart, and accomplishes that which in his solitude appeared impossible.

You are all of you familiar with the motto on the cover of the "Entomologist:"

> "By mutual confidence and mutual aid
> Great deeds are done and great discoveries made."

We have looked upon these two lines so often that, I fear, we have come to overlook their import, but it has been by the mutual interchange of views and mutual assistance given that the great advance of the last half-century has been made, and so it will be by this same mutual confidence in each other's work, and mutual aid to a common end, that the great discoveries of the future will be brought to light.

We have lost three members by death :

W. T. Sturt died November, 1896, but, owing to some unfortunate reticence on the part of his relatives, his decease was not made known to us until recently. He was elected a member of the Society in 1889, and was for some time a frequent attendant at the meetings.

Joseph William Dunning, M.A., F.L.S., F.Z.S., F.E.S., died somewhat suddenly on 15th October last. He was elected an honorary member of the Society in 1886, and was known to many of you as a large-hearted genial friend.

George Christopher Dennis, F.E.S., died December, 1897. He was elected a country member of the Society in 1890.

In conclusion I desire to express to you, gentlemen, my appreciation of the honour you did me in electing me your President, and to the officers of the Society my sincere thanks for their untiring courtesy and assistance throughout my term of office, and in vacating the chair in favour of Mr. Tutt, whose good qualities as an energetic and persevering naturalist are too well known to you to need any comment at my hands, I look forward with the greatest confidence to the increased usefulness of the Society and its consequent prosperity.

ROBERT ADKIN.

ABSTRACT OF PROCEEDINGS.

JANUARY 14*th*, 1897.

Mr. R. SOUTH, F.E.S., *President*, in the Chair.

Mr. Routledge exhibited specimens of *Acronycta menyanthidis* from Carlisle, somewhat dark in colour, but with a white thorax; examples of *Xylophasia rurea* from North Devon and Pitcaple, the former being light grey, with very fine lines for markings, the latter uniformly covered with dark blotches; a specimen of *Agrotis segetum*, from Carlisle, the fore-wings being silvery with black lines, while the hind wings were unusually white; a variety of *Noctua c-nigrum*, in which the black c mark was broken up into two spots, and the pale area much reduced in size; and a specimen of *Triphæna pronuba* from Epping, showing a black lunule on the hind wings.

Mr. Adkin exhibited, on behalf of Mr. W. F. de Vismes Kane, four examples of a very dark form of *Dianthœcia capsophila* from an island off the Kerry coast, together with others from Howth and Aran Isle, off Galway, and read the following extract from a letter sent with them :—"The four *D. capsophila* are of a series of seven (the others of which are fully as dark as the most obsolete of those sent) bred from larvæ obtained from an island off Kerry (whence my black *Camptogramma bilineata* came—extinct now, I fear). They are, as you see, remarkably melanic. One imago or two I took formerly were similar to these, so that it is evident the race is a local one, and it is therefore plain that the influences affect more than one species of Lepidoptera. Also for comparison I place in the box one dark one from the Aran Isle, off Galway; but there the rock is limestone, not the black conglomerate of the Kerry Isle: and it is a large island, with a good deal of herbage, and plenty of shelter for moths to hide in; the specimen is therefore not so suffused or blackened. All are bred specimens."

Mr. Hewitt, of York, exhibited seventeen female and eighteen male *Tæniocampa munda*, selected from more than two hundred specimens captured at sallows in March, 1896,

near York. These showed a considerable range of variation, and included a fine mahogany-coloured form; two varieties of *T. cruda* from York, one of them melanic, the other rose-coloured; twelve beautiful bred varieties of *Abraxas grossulariata*, selected from more than twelve thousand larvæ; one of them was the variety *varleyata*, two others were very light varieties, and the remaining nine were unusually dark; fifteen varieties of *Arctia lubricipeda* from York; three of them were referable to var. *eboraci*, four to var. *fasciata*, and eight were fine intermediate forms; fourteen varieties of *Abraxas ulmata* from Yorkshire, one of which was a fine melanic specimen, and three others were very light; three female *Odonestis potatoria* from York, almost as darkly coloured as the males; one dark male *Saturnia carpini*, and an example of the same sex with the left hind wing very pale in colour; also a female of this species, the coloration of the hind wings of which approached that of the male. Mr. Hewitt also exhibited a preserved larva which he had reared from ova deposited by a female *T. munda*, taken in cop. with a male *T. stabilis*.

Mr. Barrett exhibited two *Boarmia repandata*, one being var. *destrigaria* = *murana*; *Miana fasciuncula*, *Phothedes captiuncula*, and *Aciptilia tetradactyla*, all captured in Ireland by Mr. W. F. de Vismes Kane.

On behalf of Mrs. Hutchinson he also exhibited specimens of *Eupithecia consignata*, being some of the produce of an inbred race, which had existed since 1874, with the introduction of a wild strain on one occasion only some ten years ago. The specimens had grown smaller each year until the introduction of the wild strain and the sleeving-out process, when they increased in size and in depth of colour.

Mr. Tutt exhibited a series of *Acherontia atropos*, bred by the Rev. Mr. Borroughs, of Rainham, from larvæ obtained in that locality. The only marked variation was in the colour of the "skull" mark on the thorax, which varied from almost white to a very dark blackish brown. He stated that absence of the band on the secondaries was very rare in this country, but commoner in Germany; and that he also considered that the species was not adapted to exist as a native of this country. The specimens had been forced,—in fact, almost boiled. Mr. South said that he had a specimen which emerged in July without forcing.

Mr. Young, of Rotherham, exhibited a large number of specimens of *Spilosoma lubricipeda* var. *zatima* and var.

fasciata, together with a form closely resembling var. *deschangei*. Mr. Barrett remarked upon the number of intermediate forms, and noted that although entomologists in this country had bred them somewhat freely, German entomologists only obtained them rarely. Some of the English radiate and fasciate forms were very beautiful.

Mr. McArthur exhibited a living larva of *Aplecta occulta*, and a short series of *Heliothis peltigera*, bred from larvæ found in Dorset in 1895 by Mr. Nevinson.

Mr. Bacot exhibited varied series of the *Tephrosias*.

Mr. R. Adkin exhibited short series of *Tephrosia biundularia*, Bork., bred May 3rd to 26th, and of *T. crepuscularia*, Hub., bred March 30th to April 17th, both from parents taken at West Wickham Wood; also a series of the latter species bred by Mr. B. A. Bower in March and April, 1896, from ova obtained from a moth taken at Boxhill on July 19th, 1895; and a series of the summer brood, the offspring of the above, bred June 11th to 19th, 1896, many of them being fully as large in size as the spring examples.

W. Hewett exhibited over one hundred specimens of *T. crepuscularia* from the following localities:—Swansea, Willesborough, Oxton, Devon, Clevedon, and Reading, including several specimens of the summer brood, and twelve examples of var. *passettii* from Swansea; also fifty-six *T. biundularia* from York, and thirty-nine var. *delamerensis*. These ninety-five specimens had been carefully selected from captures made during five years in one locality. Two var. *delamerensis* from Sledmere, Yorks, two from Skipwith, Yorks, four from Delamere Forest, six from Swansea, also one second brood specimen of var. *delamerensis* from Swansea. In addition there were forty-one specimens of *T. biundularia* from Reading, Swansea, Clevedon, Oxton, Willesborough, Barnsley, West Wickham, Epping Forest, Trefin (North Wales), Rotherham, Enniskillen, Monaghan. Preserved larvæ of both species were also shown. Specimens from Perth which Mr. Hewett considered referable to *T. biundularia*, but which Mr. Tutt thought to be *T. crepuscularia*. These were quite distinct from typical specimens of either *T. biundularia* or *T. crepuscularia*.

He also exhibited, on behalf of Messrs. de Vismes Kane, of Monaghan, and Robertson, of Cheltenham, long series, the former of *T. biundularia* from numerous Irish localities, and the latter of both *T. biundularia* and *T. crepuscularia* from Swansea.

Mr. Hewett then read an interesting and exhaustive paper

on *T. biundularia* and *T. crepuscularia*, being a *résumé* of the opinions of several entomologists of the country who up to the present time had turned their attention to this species (printed "Ent. Record," vol. ix., 1897, pp. 107—109, 142—144, 171—175).

In the discussion which followed Mr. South asked two questions:—(1) Did any character exist by which the species could be separated with absolute certainty? (2) Which was the commoner species? To the former no answer was forthcoming, but to the latter all members were agreed that *T. biundularia* was undoubtedly the more common, in fact the dominant form; while *T. crepuscularia* was everywhere very local, and very restricted in its distribution. Mr. Tutt said that *T. crepuscularia* did occur in Scotland, for some time since for three or four years in succession he had received considerable numbers from the neighbourhood of Perth. The specimens were of the Continental form, and the larvæ were identical with the English larvæ in every respect. These two could be broadly separated, and it was a matter of convenience to give them names. How else could we compare with Continental entomologists? No doubt here, as elsewhere among the Lepidoptera, we have examples of recent evolution,—in fact, species in the making. He instanced the experiments of Mr. Fletcher with species of *Zygæna*, and asked if we should lump them together because they freely crossed and produced perfectly fertile offspring. It would be most inconvenient to do so. He insisted that the comparison of dates in one year with dates in another year was worse than useless; it was absolutely misleading. He then referred to the ova, and stated that the ova of nearly all the Geometers had no characters by which they could be distinguished. Naturally the oval stage would be less modified than other stages, but added to this the group as a whole was in the oval stage the least modified section of the Lepidoptera. As regards the larvæ he disagreed, for both Mr. Bacot and the late Mr. Tugwell had shown broad distinctions in the later stages. In concluding he wished to express his high appreciation of the careful and impartial manner in which Mr. Hewett had put forward the evidence, and considered that from the study of closely allied species, as these were, more biological good would accrue than from the detailed examination of an isolated species. Mr. Barrett said that he possessed the drawings of Mr. Tugwell, and for his part saw but very slight distinctness in the larvæ,—in fact, only a shade distinction. In his opinion Mr. Hewett's

paper had cleared away all distinctions between the two forms. Mr. Bacot said that he had bred both species, and noted their distinctions very minutely. The larvæ were absolutely identical until after the third moult. Then *T. biundularia* had a V mark, but the point of the V was very distinctly open. *T. crepuscularia* also had a V mark, but this was nearly always closed, and the point considerably produced. Occasionally a gap did occur in this species, but it was never so wide as in *T. biundularia*, and always undoubtedly distinguishable.

Mr. Hewett in reply said that he entered the discussion without prejudice, with the idea of unveiling the truth. He would say in reply to Mr. Bacot that Dr. Riding asserted that careful examination of the larvæ showed no distinctions whatever. He thanked those gentlemen who had so readily come forward to his assistance, and expressed the pleasure it had been to him to read his paper before the Society.

JANUARY 28th, 1897.

ANNUAL GENERAL MEETING.

Mr. R. SOUTH, F.E.S., *President*, in the Chair.

This evening was wholly devoted to the business matters of the Society. The Report of the Council and Officers was read, the Balance-sheet was received and adopted, and the Officers and Council for the ensuing year elected as follows:

President.—Mr. R. Adkin, F.E.S.

Vice-Presidents.—Mr. R. South, F.E.S., and Mr. J. W. Tutt, F.E.S.

Hon. Treasurer.—Mr. T. W. Hall, F.E.S.

Hon. Librarian.—Mr. H. A. Sauzé.

Hon. Curator.—Mr. W. West (Greenwich).

Hon. Secretaries.—Mr. Stanley Edwards, F.L.S., &c.; Mr. Henry J. Turner, F.E.S.

Council.—Messrs. C. G. Barrett, F.E.S., A. W. Dennis, H. S. Fremlin, F.E.S., W. Mansbridge, F.E.S., A. W. Mera, Hy. Tunaley, F.E.S., and Col. C. E. Partridge.

The President then read an Address, and votes of thanks to the retiring Officers were passed.

FEBRUARY 11th, 1897.

Mr. R. ADKIN, F.E.S., *President*, in the Chair.

Mr. Barrett exhibited specimens of a species of the family *Pterophoridæ* taken in the west of Ireland by Mr. de Vismes Kane, and which he recognised as *Platyptilia tesseradactyla*, a well-distributed Continental species. The specimens shown were more grey in appearance than the usual German form, which was of a brown tint.

Mr. Routledge exhibited a variety of *Dianthœcia nana* (*conspera*) bred from Orkney larvæ obtained by Mr. McArthur. The black markings were absent, and the specimen was of a general ochreous tint, nearly all the usually white markings being of a greyish colour. It was referable to var. *ochrea*.

Mr. Tutt exhibited several dead larvæ of *Hepialus lupulinus*. These had been attacked by a fungus, and were quite brown and stiff. The individuals were obtained by Mr. E. A. Bowles, M.A., F.E.S., at Waltham Cross, and were all found within the area of a square foot at the root of a *Pæonia officinalis*. Mr. Tutt also exhibited living larvæ of the same species, also received from Mr. Bowles, and remarked that the appearance of the fungus-attacked individuals suggested that the living specimens had been nibbling the corpses.

On behalf of Mr. Fletcher, of Worthing, Mr. Tutt exhibited a series of hybrid *Zygænidæ*, and contributed the following note:—"It is in the memory of you all that Mr. W. H. B. Fletcher has bred hybrids between *Z. loniceræ* and *Z. filipendulæ*, and between *Z. loniceræ* and *Z. trifolii* (the progeny of the latter proving fertile for four generations). In my pamphlet 'Notes on the *Zygænidæ*' I described fully two very distinct Zygænids which had been united by Standinger under the name of *Z. trifolii* var. *dubia*. These were *Z. medicaginis* and *Z. ochsenheimeri*,—the former a five-spotted species closely related to, but larger than *Z. loniceræ*, the latter a six-spotted species clesely allied to *Z. filipendulæ*, aberrations of which have been erroneously referred to this species. Whilst we were at Courmayer, Piedmont, in 1894, Dr. Chapman sent eggs of *Z. ochsenheimeri* to Mr. Fletcher. These duly hatched, and when the imagines emerged a female *ochsenheimeri* was paired with a male *filipendulæ* from the Sussex Downs. Eggs were obtained, and a part of the moths resulting from the cross I now exhibit. Mr. Fletcher

adds that the hybrids (or mongrels) paired *inter se* and the larvæ duly hatched. You will observe that the true *Z. ochsenheimeri* shows considerable sexual dimorphism, the male being smaller than the female, with a distinct concavity on the outer margin of the hind wing, which is largely accentuated by the reddening of the rather broad black margin at this area. The females show the same peculiarities, but less markedly than the males. It is well seen that the males of the cross exhibit very markedly the characters of the male *ochsenheimeri*, the sixth spot in all but two of the specimens being much reduced, and in a majority of the specimens the hind wing is like that of *Z. ochsenheimeri*. On the other hand, the females, with two exceptions, are strikingly *Z. filipendulæ*, and the hind wing character is almost entirely lost."

On behalf of Mr. Prince, of Lancashire, Mr. Tutt exhibited a considerable number of specimens of Lepidoptera from the Cheshire coast, and contributed the following notes upon them :

"The insects which I exhibit for Mr. Prince were captured on the Wallasey sand-hills. The following particulars about them may be interesting.

"*Nyssia zonaria*.—These insects are remarkably uniform at first sight, and yet when carefully examined exhibit considerable variation. In some specimens the darker areas of the wings are but faintly developed, and the specimens have a very pallid and unicolorous appearance. At the opposite extreme the transverse basal line is continued up to the costa, and the space between this and the next transverse line is filled in with dark grey shading, forming a more or less distinct transverse band. In other specimens the basal transverse line is almost or quite obsolete, and leaves the whole area from the discoidal lunule to the base of the wing with only the two dark longitudinal neurational markings. On the hind wings there is an equal range of variation, the palest having scarcely any trace of the three transverse bands, which are very distinctly marked in the darkest specimens. The apterous females show no important variation.

"*Triphæna orbona* (*comes*).—A moderately variable series, approaching the range of variation found among the Scotch specimens. Of the colour aberrations you will notice var. *adsequa* (pale grey), ab. *grisea* (dark grey), ab. *ochrea* (pale ochreous), and ab. *rufo-ochrea* (pale ochreous tinted with red) ; at the same time it will be observed that two or three

specimens closely approach the ab. *connuba* and var. *subsequa* (for descriptions see 'Brit. Noct.,' ii., 96—98). This is probably the usual range reached in our southern and midland English counties.

"*Noctua xanthographa*.—Among these we get the usual range of variation, extending from the pale grey ab. *cohæsa*, the typical *xanthographa*, the pale reddish-grey ab. *rufescens*, and an approach to ab. *obscura* without reaching the range to which the Scotch specimens often go.

"*Triphæna pronuba*.—The range in this series comprises some of the more usual forms. There is the pale grey type; ab. *ochrea* (greyish ochreous); ab. *brunnea* and ab. *ochrea-brunnea*. Altogether the series tends to the darker aberrations.

"*Mellinia circellaris*.—The series of this species is composed of about half each of the greyish-ochreous type and the ab. *ferruginea*. The suffused ab. *macilenta* is not represented.

"*Orthosia lota*.—A most uniform series of the insect. Of the thirteen insects eleven are quite of the typical coloration, whilst one shows a tendency to approach the ab. *rufa*.

"*Apamea basilinea*.—The four specimens sent are very fairly typical.

"*Ematurga atomaria*.—These specimens were captured on Thurstaton Common, by the river Dee, in May, 1896. They are rather smaller than our southern form, and more nearly approach in size and in their dark coloration those from the northern moors.

"*Hypsipetes ruberata*.—These were captured at Flaybruck Hill, near Bidston, in May, 1896. They make an interesting series, and are somewhat smaller than the Wisbech form. Most of them show the transverse markings fairly well, whilst only two examples exhibit the pale central band so conspicuous in the two allied species, *H. trifasciata* and *H. sordidata*."

On behalf of Dr. Chapman, Mr. Tutt also exhibited living larvæ of *Bryophila perla* on the rock *in situ*, showing the way in which they pass the winter, and remarked that the stage in which this took place was the penultimate one. The silken retreat could be observed into which the larva retires during the day. He stated that the larvæ hybernated in this cocoon, but from the size of some of the larvæ they had evidently done some feeding before the first week in February, when they were taken.

Mr. McArthur exhibited a living example of *Aplecta occulta* which he had just bred from a Rannoch larva.

Mr. Robert Adkin exhibited two series of *Aplecta occulta* from Rannoch: the one consisted of captured examples which varied in colour from almost black to the lighter shades of grey; the other of bred specimens, all of which were of the black form, and in this respect closely followed the female parent, which was one of the darkest of the moths captured: one of them had subdiaphanous hind wings. The larvæ from which they were reared were fed up on dock, and the moths appeared between 14th September and 3rd December last.

Mr. Frederick Clark exhibited in the lantern a series of sixty photo-micrographic slides of insect anatomy, giving short descriptive notes with each subject.

A brief outline of the method employed to prepare these was illustrated by diagrams.

Commencing with the antennæ, those of *Hybernia defoliaria* and *H. aurantiaria* were compared, followed by those of the gnat, vapourer moth, small tortoiseshell butterfly, and cockchafer. The well-known blow-fly proboscis at three magnifications, the higher one giving the structure of the pseudo-trachea very clearly. Tongues of the small white and tortoiseshell butterflies, the latter showing the barrel-shaped organs of taste. Tongue of the cricket, with one of high magnification, the beautiful wavy lines of this object being much admired. Portion of the compound eye of *Hydrophilus piceus*, showing facets and eye of the drone-fly in section. Wings of humble-bee placed in position to illustrate the method by which the fore and hind wings are attached by means of hooklets. Feet of blow-fly and dung-fly; fore-leg of *Dytiscus* highly magnified, showing the small suckers. Feet of humble-bee with "bread-basket." Saws of the saw-fly, sting of bee, and a portion of tail of larva of May-fly, a beautiful object in which the ramifications of the air-tubes are most tree-like in appearance. Spiracle and tracheæ of *Dytiscus*. Hairs of larvæ of vapourer moth and *Dermestes*. Scales of *Polyommatus icarus* (*alexis*) with battledore forms, and portion of wing to show the mode of arrangement of scales in the Lepidoptera. Scale of *Podura*, the well-known test object at high magnification, the "exclamation" marks being well seen.

Lastly, the parasite of the stickleback, one of the species of fresh-water fish-lice of the order Entomostraca, remarkable for its complex structure, being provided with an armament of hooklets and suckers for the purpose of attaching itself to its "host." Male and female speci-

mens, as well as a cast skin of this interesting creature, were shown.

FEBRUARY 25th, 1897.

Mr. R. ADKIN, F.E.S., *President*, in the Chair.

Mr. Bishop, "Lulworth," Grove Lane, Kingston-on-Thames, was elected a member.

Mr. Billups exhibited for Mr. Sauzé a considerable number of species of some six orders of insects, the most noticeable being *Bombus hortorum*, v. *subterraneus*, from Deal, July, 1896; *Nomada ochrostoma; Cleptes semiauratus*, from Deal; *Mesochorus fulgurans* (from Dipterous cocoon out of lepidopterous larva of *Abraxas grossulariata*); the very rare saw-fly *Allantus temulus*, and the Dipterous *Oxycera pulchella*.

Mr. Tutt exhibited specimens of *Aglais urticæ* var. *ichnusa*, from Corsica, and drew attention to the fact that although Mr. Merrifield had been able, by the application of high temperature to the pupa of this species, to obtain imagines which showed the reduction of the black discal and inner marginal spots to the point of obsolescence characteristic of this variety, and had also obtained an approximation to its brilliant colour, yet the result was only an approximation, and the specimens produced artificially were distinctly separable from South European individuals.

Mr. Tutt also exhibited specimens of *Thais cerisyi* and its var. *deyrollei* from South-eastern Europe.

Mr. R. Adkin exhibited series of *Pachnobia hyperborea* (*alpina*) from Shetland and Rannoch, the majority of the examples having been bred from collected pupæ. He said that in comparing the two series it would be noticed that the ground colour of the wings of the Rannoch specimens had a tendency to a bluer shade of grey than those from Shetland, and that the form having a dark longitudinal streak was much more frequent in the Shetland than the Rannoch series. With regard to the occurrence of the species in Britain, he said that he believed the first specimen was taken so long ago as 1839 by Mr. Douglas, and after an interval of fifteen years a second was secured by Mr. Foxcroft; then a period of sixteen years passed by without a record, until Mr. Eedle captured the third in 1870, the fourth falling to the lot of Mr. Allin, and the fifth to Mr. Carrington in 1874. In 1876 the moth appears to have been found in comparative abundance by several collectors who were working in the Rannoch district, and has been taken

chiefly in the pupal stage in greater or lesser numbers at irregular intervals since. But even during periods over which the species may be said to be fairly plentiful it is only in every other year that any numbers are found, exceedingly few arriving at maturity in the intervening years.

Mr. Barrett remarked that he understood that the larval stage lasted more than one year, and Mr. McArthur had confirmed this from his observations. Mr. Tutt spoke of the unusual occurrence of this intermittent habit of appearance, and could not explain why there had been no retardation or acceleration of development, so that the species might be obtainable every year. No doubt the species was one which had spread from the north, and had retained its boreal habit of a two years' larval existence. Perhaps it had not been sufficiently long in its present southerly habitat in these islands to have responded to its environment. Mr. Adkin referred to the similar intermittent habit of *Retinia resinella*, which he said was absolute, not a single specimen being obtainable every other year.

Mr. Mansbridge exhibited a smoky variety of *Spilosoma lubricipeda* from York, obtained before the advent of the present race of var. *radiata*.

Mr. Tunaley exhibited a large number of species of Lepidoptera to illustrate his paper, which was entitled "Notes and Observations during my Holidays in Scotland" (*ante*, p. 1).

In proposing a vote of thanks to Mr. Tunaley, Mr. Tutt remarked that the observations in his paper were extremely interesting. He was particularly interested in the observed habits of *Erebia æthiops*, and stated that in the Tyrolean Alps near Cortina, where the species abounded on grassy sloping inlets into the pine-woods, he had noticed the sudden appearance and disappearance of this species from and into the grass, with the advent or disappearance of a gleam of sunlight. He remarked that in the same locality *Erebia ligea* was common, and disappeared in the same sudden manner, but this latter species went up into the trees, and on the appearance of the sunshine the specimens came fluttering down from the trees to mother earth like great soot flakes. He also observed that *Epinephele ianira* had a similar habit in Britain. *Hipparchia semele*, on the contrary, had a habit not unlike that of *E. æthiops*.

As to the ocellation of *E. æthiops*, Mr. Tutt explained that he had entered fully into the mode of its arrangement in a paper printed by the Society (Proceedings, 1895, p. 77).

He quite agreed that six was a most unusual number of spots for the fore-wings and five for the hind wings.

The habits of *Emmelesia minorata*, as described by Mr. Tunaley, were very similar to those of the same species on the Alps of Piedmont and Dauphiné. Mr. Tutt considered that the specimens of *Thera juniperata* var. *scotica*, B. White, were very extraordinary and interesting, as also were the magnificent aberrations of *Eupithecia sobrinata* and *Cidaria immanata*.

Mr. Barrett seconded the vote of thanks, and referred to the habit of *Celæna haworthii* of flying rapidly between the grass stems, and suddenly pouncing on one tall stem and running down swiftly to the ground for concealment. He had frequently observed *Epinephele ianira* roosting in oak trees after sunset. Mr. Mansbridge stated that he had seen *Erebia æthiops* rise up out of the grass as soon as the sun came out, and as quickly disappear when the sun was obscured. In North America he had seen a species corresponding to our *E. æthiops* gradually fly higher and higher up the fir trees, as the sun went lower and lower below the horizon.

MARCH 11th, 1897.

Mr. R. ADKIN, F.E.S., *President*, in the Chair.

Mr. Lucas exhibited living nymphs of the dragon-fly, *Pyrrhosoma minium*, from Oxshott. The nymphs differ from the larvæ in having wing-cases, but are equally active.

Mr. Tutt exhibited a pine branch with a nest of a gregarious Eupterotid moth attached, which he had received from Dr. Chapman, who had cut it from a tree in the neighbourhood of Cannes the previous week. He did not know which species it was—one member suggested *processionea*—as he was quite ignorant of the larvæ of the members of the genus to which they belonged. The larvæ were busy feeding, some being outside the web at the time that the exhibition was being made. Mr. Tutt said that when not feeding the larvæ retired within the web. He also referred to the urticating properties of the hairs that these larvæ were said to possess, but stated that although he had handled them he had experienced no ill effects. The nest was afterwards ascertained to be that of *Cnethocampa pityocampa*.

Mr. Tutt communicated the following notes:—"I exhibit eggs of *T. bistortata*, eggs of *T. crepuscularia* (*biundularia*), and eggs of ♀ *T. bistortata* that had been fertilised by a

♂ *T. crepuscularia* (*biundularia*). The first two sets showed considerable differences, which were exhibited by drawings made under the microscope by Messrs. Rowe and Baty. The eggs of *T. bistortata*, as exemplified by the batch that had been examined, were long and cylindrical with rounded ends. Those of *T. crepuscularia* (*biundularia*) were of only from half to two thirds the cubical contents of those of *T. bistortata*, and although exhibiting considerable variation were of a somewhat oval form, or inclining to the shape of a hen's egg. To the naked eye there did not appear to be much difference in colour, both being a pea-green, but those of *T. crepuscularia* (*biundularia*) were of a somewhat yellower tint. Under the microscope, however, the difference of colour became more marked, that of *T. bistortata* appearing of a pearly-green hue, those of *T. crepuscularia* being yellow; and whilst the shell of the former was iridescent and slightly transparent, the latter was somewhat opaque. There were also faint traces of longitudinal ribbing just round the shoulder of the micropylar end in the egg of *T. bistortata*, such traces not being discernible in the egg of *T. crepuscularia*. The egg of *T. bistortata*, too, was also noticeable for small irregular depressions which occurred on the surface, and which appeared to be due to the contraction of the protoplasmic contents of the egg. These were not to be seen in the egg of *T. crepuscularia*, the shell of which appeared under a high power to be minutely pitted. Another character of differentiation in the two sets of eggs observed was in the position of the lateral depression which is so characteristic of many Geometrid eggs. In the egg of *T. bistortata* the depression was placed well toward the micropylar end, whilst in the egg of *T. crepuscularia* it is placed much nearer to the centre.

In the set of *T. bistortata* eggs examined, which had been fertilised by a male *T. biundularia*, the general shape, colour, and appearance were very similar to those of the first set of *T. bistortata*. The eggs were, however, slightly smaller, and tended to be a little more rounded at one end than the other, showing some trifling variation between the two sets, and one or two of the eggs out of a considerable number examined exhibited a most complete oval shape. They were, however, still very distinctly *T. bistortata* eggs, as apart from those of *T. crepuscularia*. In colour the cross-fertilisation seems to have had some effect, for the eggs were, under a good power, certainly yellower than the other batch of *T. bistortata* eggs. This may, however, have been due to a

slight difference in age. The lateral depression of this batch of eggs was puzzling, but after a number of eggs had been repeatedly examined it was found that it was placed well up towards the micropylar area, but was somewhat obscured by the depressions, described as being characteristic of *T. bistortata*, being often placed in close proximity therewith. These eggs, like those of many other species that are laid in crannies, &c., *e.g. Orrhodia*, &c., appear to be capable of much modification in shape by pressure, the moth pushing the egg into a cranny, and the soft egg being affected more or less by the pressure, and so becoming somewhat similar in shape of the cranny into which it is pushed.

It is very probable that the eggs of these two species have never before been examined side by side under the microscope, owing to the different dates at which the insects usually appear. The chance of doing so now is due to Mr. A. Bacot, who, by forcing the pupæ of *T. crepuscularia*, brought out the imagines at the same time that those of *T. bistortata* were appearing in the breeding-cages. By this means also he obtained pairings between ♀ *T. bistortata* and ♂ *T. crepuscularia*, although it appeared that they would not cross in any other way. This is, of course, exactly the parallel to Dr. T. A. Chapman's experiment when he forced *Amphidasys betularia* to appear in March, and then obtained pairings between that species and *A. strataria*, and not only obtained fertile ova but bred the hybrid imagines.

Mr. Barrett suggested that the iridescence observed was, perchance, due to the ova being near the point of hatching, but Mr. Tutt said that the ova were laid on the same day as they were examined, and added in reply to a further question that he did not know whether the eggs were the product of one female of each species or not. Mr. Barrett did not see how the mere pairing could affect the shape and form of the ova, but thought that the intermediate character of these cross-fertilised eggs merely showed that the slight difference of shape between those of the two so-called species arose from individual variation.

Referring to the alleged occurrence of *Tephrosia biundularia* in Morayshire, Mr. Tutt said that it had been stated, on the strength of a specimen in Mr. Adkin's possession, and another in Mr. Horne's, that *T. biundularia* was found in Altyre Woods, in Morayshire. He had examined Mr. Adkin's specimen, and so also had Mr. South and Mr Adkin. Mr. South and himself were all inclined to refer it to *T. crepuscularia* (*bistortata*). He now exhibited Mr. Horne's

specimen, captured on April 10th, 1892, on the trunk of a pine tree in Altyre Wood. This, a male in fine condition, is identical with the Perthshire race, which, as has been pointed out, is more nearly allied to the Central European typical form of *T. crepuscularia* (*bistortata*) than any other form occurring in Britain. Mr. Tutt further said that although he had not yet seen specimens of *T. biundularia* (*crepuscularia*) from Scotland, he suspected that the southern counties at least would produce the species. Mr. Adkin stated that Mr. Horne's specimen was a very fine one, and dark. His (Mr. Adkin's) specimen had been sent to him alive, and having spent some hours in a chip box had injured itself considerably, but he had been fortunate in obtaining a few eggs, which produced larvæ in due course. He expected the imagines shortly now.

Mr. A. M. Montgomery exhibited living larvæ of *Mania maura* from Rotherham. The parents were taken in côp. last August, and the larvæ were kept on living plants of dock, &c., during the winter. They had undergone their last moult, but would grow about a quarter more than their present size.

A discussion on the protection of insects in danger of extermination through over-collecting then took place, Mr. C. G. Barrett, F.E.S., opening (*ante*, p. 10).

MARCH 25th, 1897.

Mr. R. ADKIN, F.E.S., *President*, in the Chair.

B. H. Waters, Esq., 48, Finsbury Pavement, E.C., was elected a member.

Mr. McArthur exhibited a series of *Melanippe hastata*, including specimens from York, Darenth, Rannoch, Hebrides, Orkney, and two specimens reputed to be from Shetland. This latter statement he doubted, as he had never taken the insect there, nor was he aware that the food-plant occurred there. The two specimens mentioned agreed with the form of the species found in Norway.

Rev. E. Tarbat exhibited a gynandromorphous specimen of *Melanargia galatea* taken at Swanage. The markings of the under side followed those of the upper. In size the specimen was somewhat small, and in this respect agreed better with the male than with the female.

Mr. Mansbridge exhibited a bred series of *Anchocelis rufina* from Huddersfield. The specimens showed considerable variation in the depth of colour, and were not so

uniformly tinted as are the southern examples of this species.

Mr. Tutt exhibited specimens of *Phigalia pedaria* taken near Bradford by Mr. Butterfield. This gentleman had informed him that this year he had found a much larger percentage of dark forms than in any previous year, and attributed the variation to the scarcity of food brought about by the vast numbers of spring larvæ of all kinds. It was noted that the specimens were poorly scaled besides being small. Mr. Butterfield had reported that the largest of the dark specimens only just reached the size of the smallest of the typical forms taken at the same time. Mr. Adkin suggested that the species might possibly have developed a tendency towards a black form, and that this was favoured by want of food.

Mr. Mansbridge remarked that these specimens were not so dark as those he had taken and seen from the West Riding; in fact, the black was of a different kind. He agreed that the scales were less dense, and that the specimens had a more or less starved appearance, and suggested that they seemed to correspond with those individuals taken by Colonel Partridge in Epping Forest.

Mr. Tutt reported that the particular wood which Mrs. Bazett had asserted did not produce *Tephrosia crepuscularia* had done so this year. Mr. Clarke had taken the species there, and so confirmed the statement made by Mr. Henderson in October last. The Rev. E. Tarbat had specimens of the same species from woods close to Reading; they were of a somewhat dark form, and this year for the first time he had taken a form similar to the Reading one near Weybridge.

Mr. Turner exhibited larvæ of *Cleora lichenaria* taken by Mr. Edwards and himself at Forest Row, Sussex. They bore a wonderful resemblance to the lichen upon which they fed, and it was most difficult to find them. They appeared to like the sunshine although perfectly still during the day, but at night when they were feeding and moving about they would no doubt be much easier to find. Mr. Adkin said that the bishop's fence at Addington was an old and well-known locality for the species near London, but he believed that it was now extinct there.

Mr. Carpenter reported that he had taken *Tæniocampa stabilis* on February 26th, *Amphidasys strataria* (*prodromaria*) on March 20th, both at Sutton, and had also found *Pieris napi* out on March 23rd at Dorking. Mr. Turner had bred

a specimen of *Asphalia ridens* on March 18th, and had been breeding *Tæniocampa pulverulenta* (*cruda*) for three weeks. In company with Mr. Edwards he had been to Ashdown Forest, and had noted that the sallows were everywhere well out. *Gonopteryx rhamni* and *Aglais* (*Vanessa*) *urticæ* were already out of hybernation. The Rev. E. Tarbat had been breeding *Tæniocampa munda* since January, and *Endromis versicolor* was now emerging. His room had a northern aspect.

Mr. Robert Adkin exhibited a series of *Abraxas grossulariata* bred from Perthshire larvæ, which included light and dark forms, and one somewhat remarkable variety in which the usual cluster of black markings at the base of the fore-wings was followed by a broad white band, on which there was a large circular black discoidal spot, and the transverse band of black and yellow markings was much straightened. The ornamentation of the hind wings consisted of an almost central circular black spot, a submarginal row of elongated black blotches, and the marginal row of black spots extending along the inner two thirds of the margin. Two other examples had indications of a yellow stripe on the hind wings. Mr. Adkin said that an impression appeared to have got abroad that the Perthshire representatives of this species were of a dark form; the idea had perhaps arisen from some of the collectors having selected the more strongly marked examples to breed from, and thus obtained more or less darkly marked specimens; but it would be seen from the series now exhibited that both light and dark forms occurred in Perthshire as in other places. He had, at one time and another, had numbers of this species through his hands from various districts, but in no case had he been able to regard any of them as representing a local form.

A paper entitled "Representative Species," by Prof. A. Radcliffe Grote, A.M., was read by Mr. Tutt (*ante* p. 13).

A vote of thanks was proposed by Mr. Mansbridge, and seconded by Mr. Turner.

APRIL 8th, 1897.

Mr. R. Adkin, F.E.S., *President*, in the Chair.

Mr. South exhibited the following Geometrina from Europe and Eastern Asia:

Eustroma (*Cidaria*) *reticulata*, with var. *ærosa*, Butl. The latter was much larger than the type, and golden yellow in colour of ground.

Cidaria silaceata.—Some of the Chinese specimens were larger and others smaller than the European examples.

Cidaria corylata.—The Eastern Asia specimens hardly differed at all from the European.

Cidaria picata.—Some of the Chinese specimens were somewhat larger and more yellow in the ground colour than those from Europe.

Melanippe procellata.—In most of the examples from Eastern Asia the ground colour was suffused with fuliginous to a greater or lesser extent; and some of them were larger than European specimens.

Mr. Lucas exhibited specimens of an exotic species of earwig (*Anisolabis annulipes*, Luc.), and contributed the following note:—"In 1894 Mr. Swale discovered a colony of this earwig in a bakehouse in Tavistock, and it was still in existence there at the end of 1896, but in smaller numbers. This continued to be the only recorded locality in Britain; but on Tuesday last I received a couple of living specimens of the same insect, which I exhibit, from Kew Gardens. It will be noticed that they have neither wings nor wing-cases. One, which I fancy is more adult than the other, has the distinctly ringed femora which give it the specific name. The two white joints near the tip of the antennæ are also good distinguishing marks, as far as British earwigs are concerned. The dark rings on the legs are not quite constant."

Mr. Robert Adkin exhibited light and so-called red forms of *Tæniocampa gracilis* from Rannoch and the New Forest, and called attention to the very different tone of coloration in the two series. He pointed out that whereas the light forms from the New Forest are of a decided pale grey tone, those from Rannoch are of a pale reddish yellow. Of the darker examples, those from Rannoch are of a similar colour to the light forms, but of a much darker shade, while in the New Forest specimens the grey colour is almost completely overcome by the deep red tone.

Mr. J. W. Tutt read a paper entitled "Some Considerations of Natural Genera, and Incidental References to the Nature of Species" (*ante*, p. 20).

APRIL 22nd, 1897.

Mr. R. Adkin, *President*, in the Chair.

Mr. Malcolm Burr, Bellagio, East Grinstead, Sussex, was elected a member.

Mr. Waters exhibited a number of the "casts" of the owl and the rook. These *rejectamenta* were broken up at the meeting, and those from the former bird contained minute bones, more or less perfect starlings' skulls, a wing, &c.: while those from the latter bird contained corn husks, beetles' wings, fur of some animal, &c.

Mr. Barrett exhibited the only known Scottish specimen of *Colias hyale*, which was captured in Dumbartonshire by Mr. Malloch. It was much larger than the usual size, and the dark margins of the wings were unusually complete. He also exhibited a variety of *Crymodes exulis*, which on the continent is considered as a distinct species under the name *Hadena maillardi*. It was somewhat comparable to *Mamestra brassicæ*, and had been taken with a very varied series of what were undoubtedly *C. exulis*, including intermediate specimens, by Mr. Percy Bright in the island of Unst. Ordinary Shetland forms were also exhibited, with one of the intermediates and a Rannoch form and two Iceland examples for comparison. The latter were very different from some of the others, and smaller. Mr. Barrett said that many years ago Dr. Standinger was fortunate in getting an exceedingly variable series from Iceland, which had proved that a number of supposed distinct species were only forms of *C. exulis*, but it did not appear that he had secured the form known as *H. maillardi*. It was remarked that even the Rannoch form had been considered by some entomologists as a separate species, and that it had long stood in the British lists as *Hadena assimilis*, and had been described under that name in Stainton's Manual.

Mr. Auld exhibited a series of *Cucullia chamomillæ* from the Lewisham district, where the larvæ had been found in considerable numbers.

Mr. R. Adkin exhibited a series of *Hybernia marginaria* (*progemmaria*) representative of the progeny of a pair received from Mr. Hewitt of York. Referring to the whole brood, he said that about 60 per cent. of the males were of the black form, and in this respect followed their parents, while the remaining 40 per cent. were of light forms, and therefore quite unlike their parents. The whole of the females reared were of the dark form.

Mr. Mera exhibited a larva of *Callimorpha hera* which had fed throughout the winter, and was in its final skin. Mr. Auld stated that his larvæ had also fed more or less all the winter, and were in the same stage.

Mr. Perks exhibited a specimen of the morel (*Morchella*

esculenta) found by Mr. West in an iron-yard at Greenwich, and also a specimen of *Dedalia quercina*, showing the maze formed by the coalescence of the spore-bearing tubercles of the under surface.

Mr. Step sent for exhibition the following specimens of spider-crabs to illustrate his paper, which was read by the Secretary (*ante*, p. 31):

1. *Macropodia rostratus*, typical male and female, and a very large aged specimen of the same, together with a number of "fragments" mounted to show the sexual differences, the curious hooked hairs on the limbs, the closed position of the claw terminating the legs, the upper and under sides of the chelæ, &c.
2. *Inachus dorynchus*.
3. *Inachus leptochirus*.
4. Photographs of *Maia squinado* (a species previously exhibited).
5. *Pisa tribulus* with a red sponge covering the whole of the carapace.

MAY 13th, 1897.

Mr. R. South, F.E.S., *Vice-President*, in the Chair.

Mr. Stanley Edwards exhibited a large store-box of insects of all orders, captured by himself at Digne, in South France, during the Easter week. He also exhibited a small scorpion which he had brought home alive, but which had since died, and a specimen of the field cricket. He stated that Dr. Chapman, earlier in the year, had sent him larvæ of *Charaxes jasius* from Cannes, and he now exhibited the pupa of this species.

Among the species exhibited were—Lepidoptera: *Papilio podalirius*, *P. machaon*, *Thais rumina*, var. *medesicaste*, *Gonopteryx rhamni*, *Pieris daplidice*, *Leucophasia duponcheli*, *L. sinapis*, *Colias hyale*, *Euchloe belia*, *E. cardamines*, *Melitæa athalia*, *M. aurinea*, *M. cinxia*, *Argynnis dia*, *Nemeobius lucina*, *Erebia epistygne*, *E. nerine*, *Lycæna icarus*, *L. argiolus*, *L. cyllaris*, *L. baton*, *L. melampus*, *Polyommatus phlæas*, *P. dorilis*, *Thecla rubi*, *Syrichthus malvæ*, *Hemaris fuciformis*, *Macroglossa stellatarum*, *Saturnia pavonia*, &c. Coleoptera: *Cicindela campestris*, *Blaps similis*, *Limonius nigripes*, *Omophlus betulæ*, *Trichodes apiarius*, *Telephorus nigricans*, &c. Hymenoptera: *Xylocopa violacia*, *Polistes gallica*. Pseudo-neuroptera: *Ascalaphus coccajus*. Orthoptera: *Gryllus campestris*, *Tettix bipunctatus*, *Aplebia subaptera*.

Mr. Tutt remarked that during the week which Mr. Edwards and he had spent at Digne they only saw two specimens of *Pyrameis cardui*, both evidently just emerged, while specimens of *P. atalanta* were frequently seen bearing every trace of having hybernated. He said that the locality visited was 1900 feet above the sea level, and the condition of the vegetation was very similar to what was to be seen at the same time in our own country. The weather was, however, superb, and the heat intense. In spite of the unadvanced condition of the vegetation, insect life was very far ahead of what it was in England. In one day he had observed no less than fifty-two species of Lepidoptera. They all had the same period of rest as the species in England, but the conditions were much less intense. He specially noted that in one field our three species of *Melitæa* were on the wing.

Mr. Lucas exhibited specimens of *Leucophæa surinamensis*, Linn. (= *indica*, Fab.), from the tropical forcing pits, Kew Gardens. Its original home was India and Ceylon, but it is now common in Mexico and North America (Sauss and Scudd). It is essentially a tropical species, but has been found in British Columbia. One specimen was mature, and two were immature.

Mr. Montgomery exhibited the young larvæ of *Apamea ophiogramma*, *in situ*, and stated that the ova had been deposited early in July along the midrib of the blade of ribbon-grass. The blade had then curled up so as to enclose the ova in a tube, but whether this was caused from the leaf fading in the natural way, or from the action of any substance coating the ova, he was unable to say.

The larvæ emerged in about twelve days, and were grey—almost leaden in colour, short and stumpy, with a large black shining head. They were placed on a very vigorous plant of ribbon-grass in a 14-inch flower-pot. Nothing was seen of them in the autumn, and the plant looked so healthy that the prospect of finding any larvæ in the stems seemed remote. They were, in consequence, not examined. However, in April the grass gave undoubted signs of something wrong. The plant threw up numerous new shoots, which withered away as soon as they became a few inches high. On pulling up some of the old shoots, many were found to be quite hollow and rotten for two or three inches from the root, while others had larvæ hanging out of them. On May 1st they had attained the size of the larger of the two exhibited, and on examining them yesterday evening (the 12th)

it was found that they had all, with the exception of three, disappeared.

Mr. South exhibited a series of *Amphidasys strataria* (*prodromaria*), and stated that the larvæ from which they resulted were very large, while the imagines were exceptionally small. He asked if any suggestion as to the cause of this could be offered. He also exhibited a specimen of *Carpocapsa saltitans* bred from the now well-known jumping seeds of a Mexican species of *Euphorbia*.

Mr. Auld exhibited a series of *Boarmia cinctaria* taken this year in the New Forest, showing the whole range of variation usually observed in the species from that locality.

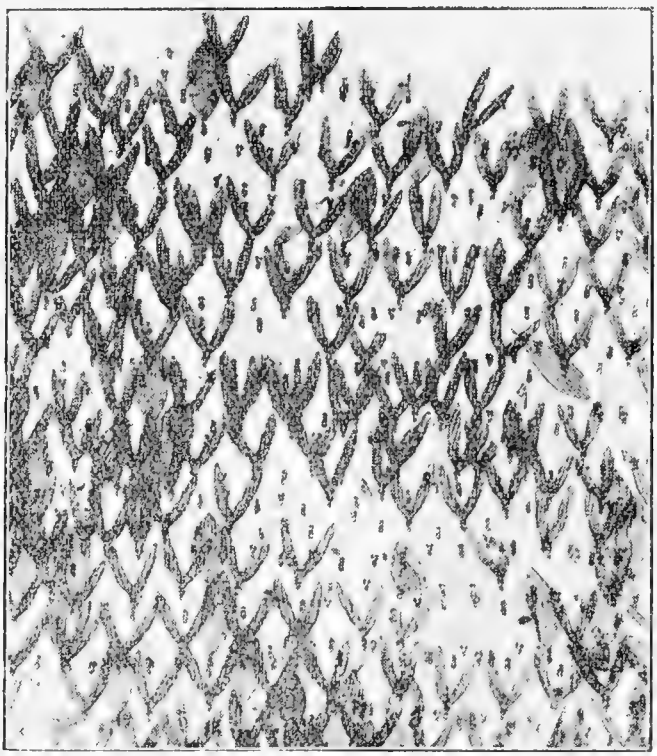

Fig. 1.—Portion of partially denuded wing of *Pseudopontia paradoxa*. × 150 diameters.

Mr. H. Moore exhibited specimens of the rare insect *Pseudopontia paradoxa*, with drawings showing its venation, scales, and the method of arrangement of the scales on the wing membrane, and contributed the following note:

"Some time ago I acquired a small lot of Lepidoptera in papers from Mombasa, East Africa. Amongst them were several specimens of a species which puzzled me, and it was not until recently looking over Kirby's 'Butterflies,'

vol. iii., pp. 76—81, pl. lxxix., that I knew what an entomological puzzle I had secured.

"It is considered a butterfly by the Germans, but a moth by the English. As nothing, however, is known of its metamorphoses, and most of its characteristics are abnormal, its actual position is entirely speculative. Kirby has established a new family for it, 'Pseudopontiadæ,' and in his work referred to above gives both descriptive and historical particulars.

Fig. 2.—Wing-scales of *Pseudopontia paradoxa*. × 300 diameters.

"It was first described in 1869 by Felder from specimens from Calabar, and Kirby alludes to it as a West African insect, but my specimens coming from East Africa, it has apparently an extended distribution.

"Commenting upon Schatz's remark that the scales of the wings have a very curious bifid shape, passing into a simple pointed form towards the margin, Kirby says, 'When the

details of insect morphology have been more systematically worked out, the last-mentioned character may help us to come to some more positive conclusion, respecting the real affinities of this remarkable insect.' Having a broken specimen, I made a microscopical examination of the wings, and sketched the various forms of scales. The curious bifid scales thinly cover the whole of the wing membrane, and for the most part, particularly towards the nervures, overlap the simple pointed forms; that these simple scales are only found towards the margin is therefore not correct.

"On the nervures the pointed form predominates. All the scales are finely striated, and under condensed light beautifully iridescent.

"Modifications of both forms of scales are present, but the bifid is the characteristic shape" (see Figs. 1 and 2).

Mr. Turner exhibited specimens of *Tephrosia crepuscularia*, sent by Mr. Clarke, of Reading, and taken in the wood where Mrs. Bazett had stated that the species did not occur. They were captured March 22nd—24th of this year (see also p. 125).

MAY 27th, 1897.

Mr. R. Adkin, F.E.S., *President*, in the Chair.

Mr. Bainbridge Prest, of Sydenham, was elected a member.

Mr. Auld exhibited the larvæ of the two British species of *Phorodesma*, *P. bajularia* and *P. smaragdaria*, and remarked upon the very close similarity of the former in its covering of oak remnants to the groups of bursting buds and scales.

Mr. H. Moore exhibited male and female specimens of a remarkable Pierid from Mexico, viz. *Pyrisitia proterpia*, of a very bright and rich orange colour.

Mr. Tutt exhibited some specimens of *Ascalaphus coccajus* from the neighbourhood of Digne. He pointed out that the specimens exhibited two distinct aberrations in the yellow coloration, one being very pale, the other of a much brighter yellow. He was inclined to consider this difference, however, as being due to a difference in development, the paler ones, which were all captured in the early morning, probably not having assumed the mature coloration. He had learned from Mr. R. McLachlan that there was a white or whitish aberration of the species, and further, that a near ally of this species, *A. macaronius*, was first described by Scopoli as a

butterfly. The species flew rapidly with a zigzag flight by day in the bright sunshine from about 9 a.m. until 4 p.m., on the sides of the mountains, hovering over the bushes, and frequently settling on the flowers and grass. An allied species had been captured in the Cogne valley in August, 1894, where it frequented cultivated meadows just above the village of Cogne. The notion of Kirby and Spence that the species of *Ascalaphus* fly "among fir trees" is not at all correct for the habit of these two species.

Mr. Adkin exhibited series of *Cidaria suffumata* bred from ova obtained from parents taken at Loch Laggan, together with examples from Forres, Dover, and Boxhill for comparison. The Laggan specimens were all darker than the usual southern type, and included numerous examples of var. *piceata*, and of a form intermediate between that variety and the type.

Mr. Tunaley exhibited a specimen of *Retinia resinella* which had just emerged from a resinous nodule of pine sent him from Aviemore. He showed sections of several nodules, and said that the females had emerged before the males, which was a somewhat unusual circumstance in the Lepidoptera. He had noticed that the head of the pupa was just near the surface of the nodule, and only separated from the air by a thin layer, while around the pupa the nodule was much harder. The channels in the nodule where the larva had wandered were filled up with further resinous matter, and no doubt the hard cocoon prevented this new exudation from unduly pressing on the pupa. The cocoon was lined with a soft but tough silk. The pupa case thrust itself out mechanically to just beyond the wing-cases, and quite 90 per cent. of the cases were finally dragged away during the struggles of the imago in emerging. In answer to Mr. Adkin he stated that he could not succeed in ascertaining how the pupa successfully broke the thin resinous wall of the nodule. (See also "Proc.," 1888–9, p. 160, and pl. i.)

Dr. Chapman exhibited among other insects a living specimen of *Charaxes jasius* which had emerged from pupa, the larva having been taken at Cannes.

Mr. Step communicated a short paper entitled "Note on a Variety of *Portunus marmoreus*, Leach" (*ante*, p. 38), and also a coloured drawing of the variety with the type form for comparison.

Mr. Tutt read a paper entitled "Spring Butterflies on the Riviera" (*ante*, p. 41).

JUNE 10*th*, 1897.

Mr. R. ADKIN, F.E.S., *President*, in the Chair.

Mr. Jas. Nicholson Smith, 28, Eastdown Park, Lewisham, was elected a member.

Mr. Mansbridge exhibited a larva of *Tephrosia crepuscularia* beaten from yew, and a short series of imagines bred as a second brood from larvæ taken at the same place last year, also from yew.

Mr. Malcolm Burr exhibited a few insects from the island of Socotra, and said that at a casual glance the fauna seemed to represent a transition from the Palæarctic region to the Ethiopian region. The butterflies and spiders in the collection were being worked out, and among them several were new to science.

Mr. H. J. Turner exhibited specimens of the flowers of bog-bean (*Menyanthes trifoliata*), and the cinquefoil (*Potentilla comarum*), a rather uncommon plant, both from the neighbourhood of Woolmer Forest, Hants.

Mr. W. J. Lucas exhibited several ichneumons which he had bred this year from last year's cocoons of *Zygæna trifolii;* also two specimens of an earwig (*Chelisoches morio*) recently taken in Kew Gardens, they had come from Mauritius in sugar-cane. In the discussion which ensued it was generally agreed that parasites emerged at a time when the larvæ of the host were likely to be found. Mr. Tutt gave an instance, in the case of *Melitæa aurinia*, of a parasite having three separate emergences during the larval stage of the host. He said that he had just bred some ichneumons from the larvæ of *Cnethocampa pityocampa*, the imagines of which did not emerge until August. How did these parasites live? He suggested the necessity of another host, and said that it was well known that some species had numerous hosts. Mr. Hall said that he had experience of a certain ichneumon being confined to the young stage only of *Cucullia verbasci*.

Mr. R. Adkin exhibited a series of *Tæniocampa gothica* from Loch Laggan, Inverness-shire, consisting of captured examples which largely followed the *gothicinia* form, and bred specimens which were without exception typical. He said that this series was a very fair representation of his experience of many attempts to rear the *gothicina* variety. He had on several occasions during recent years had well-defined examples of the variety sent to him alive, obtained

ova from them, and fed up the resultant larvæ, but among the many hundreds of moths that he had reared from them only some three or four individuals approached the variety, and even in these the "gothic" mark was not entirely absent. He found that, as a rule, the progeny followed their respective female parents somewhat closely in general appearance, and he was completely at a loss to assign a reason for the apparent failure of heredity in respect to the special character, the suppression of the "gothic" mark.

JUNE 24th, 1897.

Mr. R. Adkin, F.E.S., *President*, in the Chair.

Mr. W. H. Drury, F.R.H.S., of Kingston-on-Thames, and Mr. G. Sandison, of Wimbledon, were elected members.

Mr. B. H. Waters exhibited a long series of the eggs of the guillemot, some twenty-four in number, showing the great variation to which the eggs of this bird is subject.

Mr. South exhibited three series of *Zygæna filipendulæ* taken in a Middlesex locality on June 12th, and representing the form *hippocrepidis*, Steph., the type form and intermediates, and said that he was unable to draw any fine distinction between the first and last (for full details of this exhibit see "Entom.," xxx., 181).

Mr. R. Adkin exhibited a series of *Cyaniris* (*Lycæna*) *argiolus* bred from ova and larvæ obtained at Eastbourne last autumn ("Proc.," 1896, p. 110). He said that twelve individuals reached the pupal stage; from these he reared seven perfect specimens, one slightly deformed, three very badly crippled, and one pupa died. He attributed the large proportion of deformities to the fact that several of the larvæ pupated on the central portion of the upper side of the ivy leaves, which in drying somewhat closed up on the pupæ, causing a pressure on the pupæ, and preventing the imago detaching its wings from the pupa skin. The one slightly deformed he found in this position before its wings had dried, and on being freed from the pupa skin it almost completely expanded its wings. The crippled examples were similarly liberated, but their wings were too much dried to expand on being set free.

JULY 8th, 1897.

Mr. R. ADKIN, F.E.S., *President*, in the Chair.

Mr. A. Perry, Anerley, S.E., was elected a member.

Mr. Lucas exhibited three nymph-cases of the dragon-fly *Anax formosus*, out of about twenty taken by himself and Mr. W. Prest at the Black Pond, near Esher, on June 17th and 21st, 1897.

Mr. Winkley exhibited a specimen of the carnivorous slug, *Testacella haliotidea*. Some time ago he had turned down several that had been given him by Mr. Briggs. He presumed that this was one of them, although he was quite unable to explain how it had succeeded in escaping the gulls and teal which were kept in his garden, and were free to run all over the ground.

Mr. Auld exhibited a fine bred series of *Phorodesma bajularia* from the New Forest.

Mr. Malcolm Burr exhibited a small collection of Orthoptera from the Persian Gulf, collected by Mr. J. H. Hiles. They were chiefly European species (see "Entomologist," July, 1897).

Mr. Ficklin exhibited three specimens of *Dianthœcia luteago*, var. *barrettii*, taken in Cornwall this year. They differed considerably from the Irish form, being very grey in colour.

Mr. Mera exhibited a bred series of *Hadena dissimilis* (*suasa*) from Essex. In one specimen the usual markings were but little in evidence, the whole wing being streaked longitudinally.

Mr. Turner exhibited a bred series of *Cleora lichenaria* from Ashdown Forest; also series of the following Coleoptera:—*Strangalia melanura* from Ranmore Common, *Cryptocephalus aureolus* and *C. hypochœridis* from Reigate, *Cionus scrophulariæ* from Chalfont Road, *Œdemera nobilis* and *Œ. lurida* from Reigate, *Rhynchites conicus* from Loughton, and *Leptura livida* from Canvey Island.

Mr. Robert Adkin exhibited a series of *Eupithecia satyrata*, var. *curzoni*, bred from larvæ taken in the Shetland Isles in 1896. He said that this variety was first obtained by Mr. McArthur while collecting in Shetland nearly twenty years since, but being subsequently taken by Mr. Curzon was described and named after him by Mr. Gregson, of Liverpool, as a new species, although the original specimens were at the time being worked out by others, and have since proved to be a very marked variety of *E. satyrata* ("Entom.," vol. xiv., p. 303; and xvii., p. 230).

JULY 22nd, 1897.

Mr. A. W. DENNIS in the Chair.

Mr. Ashdown exhibited a living specimen of the rare and local Longicorn *Oberea oculata*, taken at Wicken Fen a few days previously.

Mr. Turner, on behalf of Mr. Kedgeley, exhibited a specimen of the dragon-fly *Æschna cyanea*, which had been taken in the Borough on the 18th inst.

AUGUST 12th, 1897.

Mr. R. ADKIN, F.E.S., *President*, in the Chair.

Mr. McArthur exhibited a short series of *Toxocampa craccæ*, bred from larvæ found in North Devon.

Mr. J. N. Smith, on behalf of Mr. Fitzgerald, exhibited a remarkable smoky variety of *Melanippe montanata* from near Dursley, one of two beaten from the same hedge (see "Entom.," vol. xxx., p. 266).

Mr. Tolhurst exhibited larvæ of *Eristalis tenax* from a tank containing foul water in his garden at Beckenham.

Mr. West, of Greenwich, exhibited specimens of the Hemipteron *Atractotomus mali*, which he had taken on whitethorn at Lewisham.

Mr. South exhibited two bred specimens of *Peronea permutana* from Eastbourne, and remarked that they differed very considerably from the Wallasey type.

Mr. Adkin exhibited specimens of *Abraxas grossulariata*, bred from a peculiarly marked female taken at Lewisham, and pointed out that none of the peculiarities of the parent were transmitted to the offspring.

Mr. Harrison exhibited a specimen of the rare and local liliaceous plant *Simethis bicolor*, which had been found growing in the Greenwich marshes near the entrance to the Blackwall Tunnel. The only other recorded stations for this plant are Bournemouth, and near Derrynane, in Ireland.

Mr. R. Adkin exhibited a specimen of the parasitical plant, the dodder, *Cuscuta epithymum*, which he had found attacking the furze somewhat extensively at Bournemouth, in many cases covering large patches of its host.

AUGUST 26th, 1897.

Mr. R. ADKIN, F.E.S., *President*, in the Chair.

Mr. Tutt exhibited an egg of *Polyommatus* (*Lycæna*) *corydon* laid by a ♀ on her own hind wing. He remarked that the egg of this species was so far undescribed. Its superficial resemblance, viewed from above, to a dahlia blossom was very remarkable.

He also exhibited a living ♀ specimen of *Mantis religiosa* from Aix-les-Bains, captured on Friday, August 13th. He had fed it on cockroaches since the previous Saturday. It did not even disdain to taste a worm, but the care with which the animal cleaned its feet of the slimy material afterwards suggested that it was unusual.

A further exhibit by Mr. Tutt were three Hymenopterous nests, each of which had been attacked by the larvæ of *Aphomia sociella*. (1) A nest of *Vespa rufa* received from Mr. Tuck, also male, female, and neuter of the wasp. This nest was taken on August 13th, at which time the *Aphomia* larvæ had attacked only the roof and not the body of the nest. It had been removed from a hole about one foot deep in a bank. (2) Part of a nest of *Bombus lapidarius* taken on August 18th, 1897, together with male, female, and neuter specimens of the bee. It had been taken from a rat's hole in a pigsty, the bees having utilised the old nest of the rat. The mass of the whole nest weighed eighteen ounces. (3) A nest of *Bombus latreillellus*. This was taken on August 23rd, 1897, and male, female, and neuter specimens of the bee were also shown. It was found deep in a mouse's hole in a pasture. All the specimens came from Tostock, near Bury St. Edmunds.

Mr. Robert Adkin exhibited series of *Bryophila muralis* (*glandifera*) and *B. perla* from Poole, Dorset, and a series of the latter species from Eastbourne, Sussex, for comparison. Referring to the Poole series, he mentioned that the *muralis* were all taken on walls within a quarter of a mile of the quay, whereas the more inland walls produced nothing but *perla*, hardly any of which species were found on the walls producing the *muralis*. Comparing the two series of *perla*, he pointed out that the ornamentation of the Poole examples consisted entirely of black and grey markings, what little variation there was being caused by the greater or less amount of these colours present, whereas in those from Eastbourne there was the addition of a bright ochreous

shade, which in some cases almost obscured the white ground, and permitted a much greater amount of individual variation.

Mr. West, of Greenwich, exhibited specimens of the Hemipteron *Psallus alnicola*, taken among alders at Lewisham, where it had been found many years ago by Mr. J. W. Douglas.

Mr. McArthur exhibited specimens of *Larentia salicata*, taken in N. Devon, and remarked that they were smaller and darker than the usual form taken elsewhere. He also exhibited a second brood specimen of *Smerinthus populi* reared this year.

Mr. Perks exhibited, on behalf of Mr. W. Rivers, a specimen of *Anastatica hierochuntica*, L. ("rose of Jericho"), from the Levant, a cruciferous plant of marked hygroscopic properties, the whole plant rolling up into a ball and uprooting itself in periods of drought, so that it may be carried from place to place by the wind, unrolling and taking root again as soon as moistened, and in this way also distributing its seeds.

SEPTEMBER 9th, 1897.

Mr. R. Adkin, F.E.S., *President*, in the Chair.

Mr. Spindler exhibited a most remarkable colour aberration of *Epinephele tithonus*, in which the black had entirely disappeared even from the apical spot, while the usual fulvous was as deep as in the ordinary type. This was the more remarkable, as the experiments of Mr. Perry Coste showed that all the reagents used by him did not affect the black without altering the fulvous colour. The specimen was taken at Luggershall, in Sussex, flying over a furze-field, (figured, "Entom." xxx., p. 253).

Mr. South exhibited a few bred specimens of *Spilosoma menthastri*, being the second generation descendants of Moray parents, and remarked upon the extremely dark ground colour of some of the examples.

Mr. Turner exhibited bred specimens of *Lasiocampa quercifolia* from Cambridgeshire, and remarked upon their small size, although the larvæ from which they were produced appeared to be very large; a specimen of *Mamestra abjecta*, of an unusually grey form, taken under a clod of earth in the Gravesend marshes; a small specimen of a red form of *Agrotis tritici* taken in Woolmer Forest in August; short series of under sides of *Epinephele* (*Enodia*) *hyperanthus* from

Carlisle and Chattenden, the former were lighter in colour of underside and not nearly so rich as the latter, four of the former were either var. *arete* or nearly approached that form ; one example of the curious larva of *Heterogenea limacodes* from Westerham ; and larvæ of *Acidalia immorata* from ova laid by a female taken in the Southern Alps. Referring to the latter, Mr. Turner remarked on their undoubted *Acidalia*-like appearance and habits. Mr. Tutt said that from the imaginal appearance he had at first considered the species a *Strenia*, allied to *S. clathrata*. But he observed that the egg had also an undoubted Acidalid form, and was very different from that of *S. clathrata*, which was well distinguished by being studded with white knobs.

Mr. Manger exhibited specimens of the extremely large land shell, *Achatina variegata*, from Ibadan, near Lagos, West Coast of Africa. They were six inches across the mouth, and specimens were known which measured as much as eight inches. The natives prized this mollusc as an article of food. He stated that the eggs were more than one inch in diameter, and possessed a calcareous shell.

Mr. West, of Greenwich, exhibited specimens of a local Hemipteron, *Dictyonota fuliginosa*, taken on broom at Plumstead.

Mr. R. Adkin exhibited series of *Satyrus semele* from Eastbourne and Bournemouth, also examples set in their natural resting positions and affixed to an artificial background to illustrate the manner in which the insect on alighting obtains protection by assuming a position that caused it to harmonise with the rough ground on which it was wont to rest.

Mr. Tutt remarked that the Continental allied species had precisely similar habits.

Mr. Lucas exhibited specimens and drawings of the dragon-fly *Agrion mercuriale*, and communicated the following notes :

" On August 3rd last I came across a colony in the New Forest of the very scarce little dragon-fly, *Agrion mercuriale*, of which I exhibit a male and a female specimen. Mr. McLachlan found this insect rather commonly in a certain locality in the New Forest in 1868, but could not find it again till last year, when he succeeded in taking eight. The locality from which the present specimens came can hardly be the same as that known to Mr. McLachlan, as the stream over which they fly is a perennial one, where they would

have a good chance of holding their own, and his was not. In one part of this stream they were rather common, the males, however, greatly preponderating over the females. On the wing they might be taken for either of the three common Agrions, except that they are a little smaller. As the New Forest is the only known British locality for the species, it will be well perhaps not to describe the habitat more exactly, and so relieve the Protection Committee from the duty of safeguarding it. Mr. Dale has specimens from Winchester and Glanvilles Wootton, but the former haunt is, I believe, no longer known, and the latter has been drained."

Mr. Dennis exhibited, under the microscope, ova of *Polyommatus* (*Lycæna*) *corydon* and *Plebius* (*Lycæna*) *ægon*, the former of which had as yet never been described.

Mr. Tutt exhibited a very extensive series of *Erebia nerine*, together with photographs of the famous Mendelstrasse, to illustrate his paper entitled "A Gregarious Butterfly, *Erebia nerine*: a Reminiscence of the Mendelstrasse; with Notes on the Lepidoptera of the Serpents of the Mendelstrasse" (*ante*, p. 63).

SEPTEMBER 23rd, 1897.

Mr. R. Adkin, F.E.S., *President*, in the Chair.

Dr. Chapman, F.E.S., Elmscroft, Redhill, was elected a member.

Mr. Malcolm Burr presented to the Society's museum an almost complete collection of British Orthoptera, and it was resolved that a vote of thanks for this handsome donation be inscribed in the minutes.

Mr. Auld exhibited a series of *Tapinostola bondii* from Folkestone, of *Caradrina ambigua* from Devonshire, where it has been somewhat common this year, of *Dianthœcia nana* from Shetland, showing white-marked forms as well as uniformly dark ones, and of *Tæniocampa gothica* also from Shetland.

Mr. Robert Adkin exhibited a series of *Dianthœcia nana* (*conspersa*) that he had bred from larvæ obtained in the Shetland Isles. The majority of the specimens were from Cunningsburgh, and varied very considerably in colour, the lightest having the usual white markings well developed both on the wings and on the thoracic tuft, while in the other extreme the whole upper surface of the insect was of a smoky-black shade. Three examples from the Isle of

Mousa, the first, he believed, that had been bred from that island, were all of the darker forms, and showed no special variation from those from Cunningsburgh.

Mr. Adkin also exhibited, on behalf of Mr. W. F. de Kane, a *Larentia* taken by that gentleman in co. Antrim, Ireland; also examples of *L. cæsiata* and *L. flavicinctata* from various localities for comparison. Mr. Adkin said that he had no hesitation in referring the Antrim specimens to *L. flavicinctata*, thus agreeing with the opinion expressed by Mr. Kane as to its identity, and that the capture was interesting as, he believed, it was the first authentic record of this local species from Ireland.

Mr. Tutt exhibited, on behalf of Mr. Dutton, a very fine variable series of *Abraxas sylvata* (*ulmata*), and stated that this species was, as a rule, not prone to show any very great aberration. The present series was a most remarkable one. Many of the specimens were much clouded or smoky, and some might be termed melanic. There was an unusually strong tendency to asymmetry; in some cases one wing was aberrant, while the remaining three were normal. Mr. Dutton had suggested that much of the variation was due to bad scaling, and stated that he found the greatest difficulty in setting the specimens owing to the crumpling of the wings from improper development. He thought that the aberrations were more or less the result of malnutrition.

Mr. Burr exhibited a specimen of *Phyllocrania illudens*, Sss. and *Z.*, a mantis from Madagascar, with the leaves with which it is found. It is an extraordinary example of adaptation to surroundings, being very difficult to find, even when attention is called to it in a small box. The insect and the leaves were collected in Madagascar by Herr Sikora.

Mr. Turner exhibited specimens of a large and beautiful species of hawk-fly, *Asilus crabroniformis*, taken at Seaton, in South Devon, and also a series of the local Hemipteron, *Enoplops scapha*, captured on the leaves of coltsfoot over a very limited area on the cliffs in the same locality.

Mr. Perks exhibited a very prettily decorated nest of the long-tailed tit (*Parus caudatus*). Mr. Winkley remarked upon the numbers of this species which had been seen migrating. Mr. Carrington referred to the fact of the double migration of many species of birds, those representatives of a species which had nested in Scandinavia coming over here to winter, while the representatives of the same species which had nested here spent the winter in Spain and North Africa. Mr. Tutt referred to the very complicated nature of migration,

and said that ornithologists were now turning their attention very largely to the study of this habit. Mr. Carrington described at some length the work of the Committee which had been investigating and gathering statistics as to migration, and remarked upon the great assistance which the persistent observations of lighthouse keepers were rendering to that Committee.

Mr. Tutt exhibited male and female specimens of the bee *Bombus lapidarius*, and also specimens of the parasitic bee *Psithyrus rupestris*, which lives in the nests of the former, and appropriates the cells for its own offspring.

A paper was communicated by Prof. A. Radcliffe Grote, entitled "The British Day Butterflies and the Changes in the Wings of Butterflies" (*ante*, p. 43).

OCTOBER 14th, 1897.

Mr. R. Adkin, F.E.S., *President*, in the Chair.

Mr. Mansbridge exhibited a series of the more noticeable variations of *Abraxas grossulariata* bred this year from larvæ sent to him from Horsforth, Yorkshire. He found the percentage of varieties this year much less than last, for out of some two hundred larvæ he only bred fifteen showing anything beyond the ordinary range of variation. The variation was in the same direction as that which had been observed in the imagines bred from the same locality in previous years, viz. a gradual suffusion of the basal and central areas of the fore-wings with black.

Mr. South exhibited a series of *Acidalia inornata* reared from ova deposited by a female specimen taken at Oxshott, and on behalf of Mr. Sabine, of Erith, two specimens of *Callimorpha dominula*, var. *rossica*, from Dover.

He also exhibited two examples of *Pieris rapæ*, which Mr. Sabine had taken at Folkestone in September last, each of which had a small black spot on the hind wings placed between veins 3 and 4. Referring to this unusual aberration in the species, he stated that he had seen similar spots occupying exactly the same position in examples of the second generation of *P. napi*. In Mr. Leech's collection there were some female specimens of *P. extensa*, var. *eurydice*, and of *P. melete*, var. *mandarina* (both Chinese insects allied to *P. napi*), which had these black spots. In the examples of *mandarina* there were other marks which seemed to indicate that the spots were simply remnants of a band, and this was

made more probable by the fact that two other female specimens had more or less complete broad black borders on the hind wings. He thought that the spot referred to in *P. rapæ* might possibly be an ancestral character.

Mr. A. M. Montgomery, on behalf of his brother, Mr. E. M. Montgomery, exhibited numerous specimens of *Pieris napi*, and communicated the following notes:

"All the specimens exhibited, with the exception of a few of the spring brood, were bred from ova laid on May 26th, 1896, by a female captured at Harefield, Middlesex. All the larvæ of this brood pupated on and about June 20th.

"Twenty-eight specimens (seventeen males and eleven females) emerged between July 4th and 7th; but a larger number remained in the pupal state until the spring of 1897.

"A few more winter pupæ were obtained from ova laid on July 12th by a female captured at Ealing. The larvæ of this lot pupated about August 8th, and none produced butterflies the same year. Most of the pupæ which produced the summer brood were green, whilst the majority of the winter pupæ were of the brown form, and often heavily marked with black.

"Forty-two specimens (twenty males and twenty-two females) emerged between April 21st and May 14th, 1897. The spring insects are rather smaller, and have narrower and more pointed wings than the summer ones.

"The summer males all have the black tip of the fore-wings well developed, and the central black spot large and dark. One has a second well-marked black spot on the upper wings, situated between the usual spot of the fore-wings and the black mark on the upper margin of the hind wings. Three other specimens also have traces of this second spot. The black mark on the upper margin of the hind wings is generally well shown.

"The spring males are much paler. The black tip is usually much broken up between the veins, and is almost obliterated in one specimen. In this specimen the black spots of both fore and hind wings are entirely absent. In other cases these spots are reduced to a few black scales, and in no case are they as well developed as in the summer brood, and none have any trace of a second spot on the upper wings.

"The females of the summer brood usually have the black tips of the fore-wings and the usual black marks very large; but in a few cases the black tip is smaller and greyish, and the spots smaller, but deep black. In the darker specimens

all the veins of both fore and hind wings are blackened for a short distance from the margins, and there are traces of an additional black spot towards the middle of the hind wings.

"In the spring females the dark tips of the fore-wings are smaller and greyish, and the black spots are also smaller. The fore-wings, however, are much more suffused with grey at the base than in the summer specimens; and usually all the veins of both fore and hind wings are strongly marked with grey, giving the insect a radiated appearance. This grey veining often almost takes the place of the dark tips of the fore-wings, and in one instance the dark tip is completely broken up in this way.

"The green veining of the under surface of the hind wings is much stronger in the spring insects than in the summer ones, and in the former the under surface of the fore-wings is also strongly marked with grey, especially in the females. It is noticeable that in the females of the summer brood the green veinings are weakest, while the males of the spring brood are more strongly marked than any others; thus the insects with the strongest marked upper surfaces have the weakest veinings on the under sides, and *vice versâ*."

Mr. Montgomery also exhibited a uniformly xanthic specimen of *Epinephele tithonus*, and a good variation of *Abraxas grossulariata*, in which the discoidal spot of the hind wings was extended into an additional well-defined band.

Mr. McArthur exhibited a specimen of *Arctia caia*, having both fore and hind wing on one side perforated, and a perfectly fringed indentation in the hind margin of the fore-wing. He stated that the larva had been several times disturbed while forming its cocoon, and finally turned to a pupa on the bottom of the cage. The holes were caused by a particle of sand piercing the wing-case of the pupa whilst in a soft condition. This was considered an important observation, as throwing light on similar malformations. It was considered that the indentation of the fore-wing had no doubt been caused by a similar obstruction.

Mr. T. D. A. Cockerell communicated the following note on a curious case of protective coloration:

"At Mesilla, N. M., on August 15th, 1897, I sat down to rest while on a collecting excursion, and my eye fell on a clump of the whitish-green *Baileya multiradiata*, with its splendid orange composite flowers. In the middle of the clump was a Vanessid pupa, while resting on one of the stems, about to cast its skin, was a Sphingid larva. These objects

caused me some surprise, as being (so far as I had yet known) foreign to the *Baileya*, and yet harmonising perfectly with its peculiar colour. The pupa was silver-colour with a faint greenish tinge and a golden lustre, with the dorsal prominences and part of the antennal coverings ruddy golden. A beautiful and conspicuous object in the hand, it was hardly noticeable on the plant. So also with the larva, which was 35 mm. long, pale whitish green, nearly the colour of the foliage; caudal horn very pale blue, with dorsal black specks; seven oblique lateral stripes, spiracular openings orange. Taking the larva home I found that it would by no means eat *Baileya*, but it fed greedily on the foliage of *Solanum elæagnifolium*. It was, in fact, an immature 'tomato worm.' The pupa, on August 21st, gave forth an ordinary example of *Pyrameis cardui;* the larva must doubtless have wandered from an adjacent *Sphæralcea*.

"Now are we to suppose that the Vanessid larva came to the *Baileya* to pupate, and the Sphingid to exuviate, because they realised that they would be protected (*i. e.* inconspicuous) there?"

Mr. Ficklin exhibited a series of *Polia flavicincta*, taken in Cornwall, and noted that they were small and much more brightly marked than usual.

Mr. Edwards exhibited specimens of the eggs of the turtle.

Mr. Lucas exhibited an immature form of a locust which had been sent him from Kew Gardens.

Mr. West, of Greenwich, exhibited series of the Hemiptera *Acanthosoma tristriatum*, beaten from juniper bushes at Boxhill, and *Pantilius tunicatus*, beaten from hazel.

Mr. Robert Adkin exhibited a short series of varieties of *Nonagria arundinis* (*typhæ*, Esp.), the individuals of which ranged from dark mahogany-brown to sooty black in colour, bred from pupæ taken at Shoreham, Sussex; also of typical specimens from Cambridge and Lewisham for comparison, and made the following remarks:

"I take the opportunity of exhibiting this most 'greasy' species, to say a word on the method I have successfully employed for ridding the moths of the 'grease' which so soon overspreads both bodies and wings, and renders them useless for the cabinet, if it is not removed very soon after death. Assuming that the 'grease' has not spread to the thorax or wings, I break off the abdomen, attach one of a pair of numbered labels to it by a very fine pin, the other label being attached to the remainder of the insect, and

drop the abdomen into a wide-mouthed bottle containing 'rectified benzole.' If, however, the 'grease' has commenced to attack the thorax or wings, then the whole insect is dropped into the benzole. As a general rule, from four to ten or twelve days' immersion will clean the greasiest insect, providing that the quantity of benzole is in proportion to the number of specimens placed in it, as of course there must be a point at which it becomes loaded and cannot take up more 'grease;' but a very much longer immersion has no deleterious effect upon the insects treated, as will be seen from the two upper specimens in the Cambridge series now exhibited, both of which have been floating about whole in a bottle of benzole since the winter of 1891–2, and were only taken out on Saturday last, thus having been in 'soak' nearly six years, and show no signs of injury or deterioration in any respect. On taking the bodies, or whole insects as the case may be, out of the benzole, I place them in magnesia, covering them completely with it, and allow them to remain until the following day, the magnesia acting as an absorbent, and thoroughly drying them, so that when lifted out it is seldom that any of it remains attached; but should it do so it is easily blown off or removed by a touch with a camel's-hair paint brush. Benzoline has been recommended by some entomologists as a solvent, instead of the rectified benzole, on account of the lower price of the former; but seeing that benzoline is an impure spirit, and that the rectified benzole when bought by the pint is not very costly, I am inclined to pin my faith to the last-named medium. Similarly plaster of Paris, which has sometimes been used as an absorbent instead of magnesia, appears to me to be less suitable on account of its greater density."

In the discussion which followed, in which Messrs. Mansbridge, Tunaley, South, McArthur, and others took part, it was mentioned that both benzoline and ether had been successfully employed, and that very satisfactory results had been obtained by placing the insects, on removal from the fluid, in a position where a draught of air would pass over them,—as, for example, in front of a partially opened window, instead of using an absorbent.

OCTOBER 28th, 1897.

Mr. R. ADKIN, F.E.S., *President*, in the Chair.

Mr. H. B. Browne, B.A., of Hammersmith, was elected a member.

Mr. Montgomery exhibited a long series of bred *Cidaria truncata* (*russata*). The ova were from three specimens taken at Eastbourne, and were deposited about June 17th. They hatched about June 28th, and fed up in some thirty days. The imagines emerged throughout August and early September. All three of the parent specimens had strongly marked bright flesh-coloured central bands (as in specimen in small box, var. *centum-notata*), but none of those bred were of that form.

He also exhibited a long bred series of *Acidalia dimidiata* (*scutulata*). The ova were from four specimens taken at Ealing, and were deposited on July 3rd. They hatched on July 12th, and fed up in about twenty-one days. The imagines emerged from August 16th to September 16th. Some half-dozen larvæ, however, did not feed up, and evidently intend to hybernate, as they were still quite small. Ova obtained from the above brood hatched September 2nd, and had moulted thrice.

Mr. Newman exhibited two generations of *Arctia caia*, of which the first brood was reared from larvæ taken in lanes around Darenth, and the second brood resulted from this stock (a good deal of heat being used); the imagines emerging between July 10th and August 30th. Considerable variation was shown in the series. The light ground varied much, and in one specimen was very pink. Another had only a few white irregular lines on the fore-wings, the dark colour being much suffused. Two or three specimens showed the partially yellow change in the ground colour of the hind wings, and one was a good example of the yellow form. There seemed but little extension or restriction in size of the black markings of the hind wing. One small specimen was very pale, the richness of the fore-wings had all gone. The extent of variation was less in the second than in the first brood.

Mr. Newman also exhibited the following species and varieties:

Odonestis potatoria, from Darenth, several varieties from about 600 larvæ taken, including a male of female coloration and a mottled form of the male.

Argynnis (*Dryas*) *paphia*, from Goodwood, with symmetrical white patches on all the wings.

Argynnis adippe, with slight extension of the dark markings, also from Goodwood.

Epinephele ianira, from Singleton, two remarkable specimens, the usual fulvous areas being as nearly as possible white.

Smerinthus populi, bred, dark and light specimens, one female, which emerged on July 5th, having a very pink tinge, although the pupæ had been subjected to heat since March.

Mr. Tutt exhibited, on behalf of Dr. Riding and Mr. Bacot, long series of specimens illustrative of his paper entitled "Notes on Hybrids of *Tephrosia bistortata*, Goetze, and *T. crepuscularia*, Hb." (*ante*, p. 90).

On behalf of Mr. Horne, Mr. Tutt exhibited a most remarkable specimen of *Nemeophila plantaginis*, in which the ground colour of all the wings was almost entirely suppressed, the velvety black having spread over the whole of the hind wings, and there were only a few irregular traces of the light marking on the fore-wings. It was bred from a larva found on Scotston Moor near Aberdeen.

On behalf of Mr. Merrin, author of the "Lepidopterist's Calendar," Mr. Tutt exhibited the following species, all from near Gloucester:—A fine series of aberrations of *Melitæa aurinia* from Kimberland, comprising ab. *artemis*, typical *aurinia*, and ab. *præclara*, one of the latter being strongly marked with cream along the inner margin; also under-side aberrations, of which the best had the ground colour uniformly tinted with fulvous, and another with a wide creamy marginal band occupying nearly half the wing; small *Lycæna arion*, measuring one and three quarter inches in expanse; *Epinephele* (*Enodia*) *hyperanthus*, marked as in ab. *cæca* on the under side of hind wings, the fore-wings with small but normally shaped ocellated spots; *Vanessa* (*Aglais*) *urticæ*, with a metallic spot on the under side of each fore-wing, below each of the most basal of the three black costal spots; and *Syrichthus malvæ* ab. *taras*, with band especially well developed on the fore-wings.

On behalf of Mr. Griffiths, of Bristol, Mr. Tutt exhibited specimens of *Tephrosia bistortata* (*crepuscularia*) from Leigh Woods. Some of the females were finely banded and large, and one somewhat suffused with fuscous. He also exhibited a second brood of the same species bred on July 2nd and 3rd, 1897, from eggs laid by a female captured on April 10th in the locality, together with preserved larvæ. Mr. Tutt pointed out that there were also specimens of *T. crepuscularia* (*biundularia*) among the former, so that evidently both these nearly allied species occurred in Leigh Woods.

And on behalf of Rev. W. Claxton, the following insects caught near Romford, Essex:—*Anchocelis pistacina*, ab. *serina* and ab. *venosa*, *Noctua xanthographa*, the dark greyish

fuscous type, and ab. *cohæsa; Hadena protæa*, of a pale yellowish-green hue; *Agrotis exclamationis*, ab. *picea; Xylophasia hepatica*, ab. *characterea; Miselia oxyacanthæ*, ab. *capucina;* and *Hadena thalassina* of the type-form, the latter being rather rare compared with the more uniformly coloured forms in the south of England.

Mr. Moore exhibited a specimen of *Enodia portlandica* from North America, and stated that *hyperanthus*, which was usually placed in *Epinephele*, had recently been referred to *Enodia*, but he was of opinion that the European species was not congeneric with the American *portlandica*.

Mr. Perks exhibited specimens of the fungus *Thelephora laciniata*, from Shirley.

Mr. Robert Adkin exhibited a variety of *Argynnis selene* from Sutherlandshire, in which the ground colour was dull and slightly greenish in shade, and the marginal spots unusually large and pale. It agreed closely with a not uncommon form of *A. aglaia*, but he had not previously seen this phase of variation in *A. selene*.

Mr. Merrifield exhibited a very large number of specimens which he had bred under extremes of temperature in illustration of his paper entitled "Recent Examples of the Effect on Lepidoptera of Extreme Temperatures applied in the Pupal Stage" (*ante*, p. 69).

NOVEMBER 11th, 1897.

Mr. R. Adkin, F.E.S., *President*, in the Chair.

Mr. Tutt exhibited a number of cases of *Psychidæ* taken by Messrs. Edwards, Tunaley, and himself in the forest of Fontainbleau during Jubilee week. (1) *Psyche unicolor* (*graminella*), a male and three female cases, together with a larva-like female; (2) *Epichnopteryx bombycella*, with a larva-like female. From apparently an old case of this species had emerged a larva of a Coleopteron, which was still alive, feeding on the paper of a pill-box; (3) *Psyche opacella*, with grub-like females; and (4) *Fumea nitidella* (*intermediella*), with a male which had emerged after they were brought home.

Mr. Filer exhibited a long series of *Nonagria arundinis* (*typhæ*) bred by Mr. Dennis and himself from pupæ taken at Shiere, in Surrey. Many of the forms were beautifully speckled and mottled.

Mr. Bishop exhibited two specimens of *Vanessa* (*Aglais*) *urticæ*, in one of which the two central spots were very large,

and in the other they were only just perceptible, both taken in Epping Forest; a specimen of *Agrotis exclamationis*, in which the usually well-developed markings were only just apparent; a form of *Melanippe fluctuata*, in which all the wings had a broad, dark marginal band, the rest of the area of all the wings being light, the central band being only represented by a dark, black, costal blotch, reaching one-third across the wing; and varieties of *Fidonia atomaria*.

Mr. Moore exhibited series of specimens, and contributed the following note on the Orthoptera at La Grande Chartreuse:

"Beyond and above the monastery of La Grande Chartreuse, on the slope of the Grand Som, is a park-like pasture running up to an elevation of perhaps nearly 5000 feet, which at the time of my visit in August last was studded with the pretty but poisonous purple crocus. The day continuing fine, I was in hopes the experiences of the morning would be repeated, and that I should have a busy afternoon with the Lepidoptera. It was not to be, for with the exception of a worn *Argynnis aglaia* and a few Pieridæ, *P. napi*, chiefly, butterflies were conspicuous by their absence. But in their stead Orthoptera abounded, and when I returned to the monastery bottle and boxes were choke-full.

"The first to attract attention was *Stetheophyma variegata* in their livery of red and yellow, making a bold show in the sunshine, especially when the males taking a flying leap revealed an ample pair of smoke-coloured wings. The semi-apterous females, though much heavier, were scarcely less active on their legs. It is this species which Yersin fancied 'varied its song with the hours of the clock.'

"As we climb the slope a movement in the grass attracts our attention, then another and another—the great 'wart-biter,' *Decticus verrucivorus* (L.), is here in hundreds. It is a savage creature, and requires careful handling, as I soon experienced, for one bit my finger with such force that in pulling it away it parted with its head. Some seven or eight I brought back alive, and when eviscerating them found they were subject to the attacks of *Gordius aquaticus*. I extracted one from a female six and a quarter inches long. It was located chiefly in the thorax, and as the abdomen contained nearly the full complement of mature ova, I must say I failed to see how the parasite helped to keep down the numbers of its host. I have generally met *D. verrucivorus* as stray specimens, but here, in the course of a few hours, I probably saw more than the average stay-at-home entomologist can

reasonably expect to see in the course of a long life. Associated with it was a sprinkling of a closely allied but somewhat smaller species, with unspotted tegmina and longer ovipositor, which I failed to distinguish until looking over my captures after my return.

"As my available boxes were soon exhausted, I was unable to give much attention to the smaller grasshoppers, but I considered myself fortunate in taking a specimen of *Psophus stridulus*, a dark species with brick-red wings. Its geographical distribution is limited, being confined to the woods and mountain slopes of Central Europe. When disturbed, to borrow from Swinton, 'it makes a crackling sound, resembling the rattle of a night watchman or holiday chasseur of hares.'

"Amongst the smaller species I secured several I have not yet identified, but here and in the neighbourhood within the radius of a few miles *Stenobothrus geniculatus*, *S. declivus*, red-winged *Œdipoda fasciatum*, *Ephippigera* (species ?), and several others were to be seen in more or less abundance."

Mr. Perks exhibited a specimen of the rare gelatinous fungus, *Tremellodon gelatinosa*, found in Addington Woods.

Mr. Adkin exhibited male and female specimens of *Odontopera bidentata*, bred from Westmoreland larvæ, both being black varieties.

Mr. Bishop, in calling attention to the mildness of the season, said that on November 7th he found a female sallow bush in flower on the North Downs, and he exhibited one of the catkins.

Mr. Tutt read a paper entitled "The Drinking Habits of Butterflies and Moths" (*ante*, p. 73).

A long discussion ensued.

NOVEMBER 25th, 1897.

Mr. R. Adkin, F.E.S., *President*, in the Chair.

Mr. Tunaley exhibited xanthic specimens of *Epinephile ianira*, taken in North Kent in 1896. (1) The hind wings wholly pale. (2) A portion only of the hind wings pale. (3) A considerable portion of the left fore-wing pale. (4) A portion of the left hind wing somewhat pale. He also showed a variable series of *Angerona prunaria*, including (1) a uniformly well-mottled form. (2) A specimen unmottled and of a bright orange colour. (3) An example having black-tipped fore-wings. (4) A specimen with a black apical blotch on the right fore-wing. And on behalf

of Miss Miller, of Chelmsford, he exhibited a specimen of *Acronycta rumicis*, having a distinct red tinge on the submarginal area of the wings, some portions of the body being similarly tinted.

Mr. Harry Moore exhibited specimens of Lepidoptera taken in France, and contributed the following note:

"I exhibit to-night a portion of the Lepidoptera collected in France last August while on a cycling tour. The weather was very indifferent; the mornings were usually fine but windy, followed by dull afternoons with anything in the way of rain, from a few drops to a continuous downpour of eighteen hours' duration. The chances for collecting were few and far between, and cycling was more often a matter of exercise than what one can conscientiously term pleasure.

"My route briefly was as follows:—I trained to Paris, and then a little way beyond, to escape the well-known and execrated pavé. From Melun I rode practically through the whole length of the Forest of Fontainebleau to Nemours. From thence to Nevers, Moulins, La Palisse, and Lyons, then on to Voiron and La Grande Chartreuse, back to Les Echelles and the Gorge de Chaille, and then on to Chambéry, and from there back to Paris by train. If it had not been for a little favourable weather when near La Charité and Moulins, and again in the neighbourhood of the Chartreuse, my trip would have been an entomological failure. Upon no occasion was the sunshine of sufficient duration to entice the better sort of insects out in anything like profusion, and with the exception of *Epinephele ianira* generally and *Erebia æthiops* and *E. neoridas* locally, most of the species recognised as common were far from numerous. Nor was there much apparent in the way of variation; a blue female of *Lycæna corydon*, was taken, but proved to be too much damaged to be of any use, and amongst the crowds of *E. ianira* noted, the pale specimen exhibited was the only one at all conspicuous."

Mr. Bristowe exhibited a small collection of Lepidoptera from Japan, from which country he had recently returned.

Mr. R. Adkin exhibited an asymmetrical specimen of *Arctia caia*, in which the left fore and hind wings were much suffused with the dark brown colour, the right wings being normal. The specimen was one of a second brood, and emerged from pupa in October last.

Mr. Harrison, F.C.S., exhibited a large number of lantern slides illustrating "Birds, their Haunts and Nests," and gave explanatory notes.

DECEMBER 9th, 1897.

Mr. R. ADKIN, F.E.S., *President*, in the Chair.

Colonel Partridge exhibited specimens of *Ephyra trilinearia*, and contributed the following note:

"1. Typical female parent.

"2. Specimen of brood from above, all of which were dwarfed and very red. They were exhibited at the Society's meeting on November 12th, 1896.

"3—6. Specimens from the same parents, which stood over in pupal stage and emerged in May of the following year. It will be observed that these are neither so dwarfed nor so red as those that emerged the first year, but are nevertheless of a ruddy type, and the crenulated spots can still be traced, though they are not so conspicuous."

Mr. McArthur exhibited the following varieties of species he had captured or bred in 1897:—*Arctia caia*, yellow, coalesced, and light varieties. *Polyommatus* (*Lycæna*) *bellargus*, blue females. *Abraxas grossulariata*, radiated, light, and coalesced forms. *Bombyx rubi*, with the transverse lines much lighter than usual and very wide. *Polyommatus* (*Lycæna*) *icarus*, blue, white, and splashed females. *P. corydon*, L., under sides with numerous spots absent.

Mr. Mera exhibited a box of *Abraxas grossulariata*, bred at Forest Gate in 1897, which were separable into two distinct groups, a light and a dark one.

Mr. Montgomery exhibited specimens of *Smerinthus ocellatus* and *Cossus ligniperda*, which he had cleansed from grease with the use of benzine and a blowpipe. He stated that the specimens had been in an extremely bad state; but from the perfect condition of the fringes and the hairs of the bodies the operation had been most successful. He also exhibited cases of *Fumea intermediella* (*nitidella*).

Mr. Step exhibited some examples of swimming crabs (Portunidæ) from Portscatho, Cornwall; the species represented including *Portunus puber* (Linn.), *P. depurator* (Linn.), *P. corrugatus* (Penn.), *P. arcuatus*, Leach, *P. pusillus*, Fabr., *Polybius henslowii*, Leach, and *Bathynectes longipes* (Risso). In the course of his remarks upon the exhibit, Mr. Step called attention to the feature that had earned the popular name for the group—the flattening and expansion of the terminal joints of one or more pairs of limbs to adapt them for use as paddles, whereby the crabs might actually swim in mid-water. Each species shows some special modification of

this character according with some difference in its habits; and the maximum of specialisation in this direction is reached in *Polybius henslowii*, in which all the limbs, other than the chelipeds, have their terminal joints flattened and fringed with hairs. Correlated with this adaptation of the limbs in *Polybius* is a lightening of the whole structure, the shelly matter being reduced to a minimum thickness consistent with strength, and remarkably thin when compared with some other swimming crabs. It must not be supposed that these crabs are continually swimming; such a habit would expose them to too much danger from many fishes that already contrive to subsist largely on a crustacean diet, in spite of the many methods of concealment resorted to by crabs of all kinds. The swimming crabs are also diggers, rapidly going backwards into the sandy bottom or beneath stones to be secure from observation, yet keeping the eyes and antennæ free from cover. *Polybius* has the terminal joints of the 5th pair of legs of an oval form, three quarters of an inch long and half as broad; the penultimate joint is also greatly flattened, so that the two constitute a very efficient paddle more than an inch long. But the 2nd, 3rd, and 4th legs, though considerably flattened, have their terminal joints shaped more like the claws of a lion, and rounded behind. This form admirably combines the swimming and digging powers in one instrument. *Polybius* is only found in or on deep water, and it has the reputation among fishermen of chasing fishes so swift as mackerel and pollack. It rests almost buried in the sand at the bottom, and apparently mounts rapidly towards the upper waters when it observes its prey. *Portunus depurator* has hinder limbs very similar to those of *Polybius*, both in shape and size, but the 2nd, 3rd, and 4th pairs are quite devoid of the swimming character, and agree with those of *Carcinus mænas*, whose 2nd to 5th pairs are merely strong "picks" for burrowing. *Portunus puber*, the largest of our native swimmers, has the 5th pair of legs highly developed for swimming; but as this crab spends much of its time under stones and gravel, the terminal joint ends in a sharp point, and is strengthened by a marginal and a central longitudinal band of thicker material. The entire build of this species is heavier and more solid than that of the others. The exhibitor pointed out corresponding differences in the other species exhibited, which he believed were due to slight differences of habit and habitat. The remarkable division of the antero-lateral margin into five teeth or spines on each side is a

character found in all the Portunidæ, and in some genera of other families, though systematists have apparently regarded it as of little classificatory value. Mr. Step considered it had greater value than was generally supposed, and brought the genera *Pilumnus* and *Pirimela* into closer relationship with the Portunidæ than with the Cancridæ, where at present placed. Mr. W. Garstang had recently shown how the spaces between these teeth allow the water to be filtered through the superincumbent sand, and to pass between the flexed cheliped and the carapace to the inhalent openings of the branchial chamber without allowing sand to pass and injure the branchiæ. Such a character, correlated, as it is, with the presence of spines on the cheliped, which fix the distance the latter must stand away from the under part of the carapace, points to a common ancestor for the genera *Pilumnus*, *Pirimela*, *Portumnus*, *Portunus*, and *Bathynectes*.

Mr. Step also exhibited the variety of *Portunus marmoreus*, or *holsatus*, described and figured on pages 38 and 39.

Mr. Robert Adkin exhibited a series of *Epione parallelaria* (= *vespertaria*) from Sutherland, where the species was found in some numbers by Mr. W. Salvage in 1892.

Also examples of *Abraxas grossulariata* in which the markings of the fore-wings, which are usually of a bright yellow, were of a deep dull ochreous. The specimens were sent to him by the Rev. J. Greene, of Bristol, who had reared them from larvæ found on *Euonymus*.

On behalf of Rev. J. Greene, of Clifton, Mr. Adkin exhibited some seventy drawings of varieties of *Abraxas grossulariata* bred during the last six years, and read the following remarks by Mr. Greene upon the specimens represented:—

"With three exceptions (marked by a dot .) the drawings now exhibited represent a portion of the varieties bred by myself during the last six seasons, *i. e.* 1892–7. I have seventy or eighty others, hardly inferior to these. It may be thought that the exhibition of the insects themselves would have been more satisfactory. No doubt, but I was not prepared to run the risk. As to the drawings, I can truly say that I have endeavoured, to the utmost of my power, to *accurately* represent the size, markings, and coloration, &c., of the specimens from which they were copied.

"Prior to 1892 I had never seen more than two or three dozen larvæ in a season, but in the spring of that year I had the good fortune to discover their favourite food, viz. the common *Euonymus*. I will state (approximately) here the

number of larvæ taken, and the number of insects resulting from them.

	LARVÆ.	IMAGINES.
1892 ...	485	338
1893 ...	894	714
1894 ...	1328	1057
1895 ...	1568	1250
1896 ...	1102	882
1897 ...	660	530

"The falling off in the number for the last two years is due to advancing years and ill-health. The result in varieties was simply astonishing. I must now explain the locality. In Clifton and Redland are a vast number of roads bordered on each side by private houses, villas, &c. Nearly all have a small garden in front of the road. On the side close to the footpath each house has a wall about two feet high, with rails inserted. Here are the shrubs of *Euonymus*. There is scarcely a garden without one or more of them. I should be afraid to guess the number of miles I must have walked in going up and down those roads, peering into these shrubs, to the astonishment alike of the owners and the numerous onlookers on foot and in vehicles. During the last two or three years I have become so well known that my proceedings create no surprise, and I am generally regarded as a harmless lunatic. I must not forget to say that all my larvæ were taken within two miles from my house. I will ask you to remember this, as it bears upon the few remarks which follow as to the 'cause' or causes of these 'varieties.' I have read hundreds of pages (I might almost say thousands) on this subject. It must be distinctly understood that I mean varieties pure and simple—not such aberrations from the type as have perpetuated themselves, and are called 'local' forms. Multitudinous have been the conjectures, suggestions, and arguments as to the cause or causes of such variation. The chief, I think, are 'food,' 'light,' or 'darkness'—that is too much or too little of either,—'temperature,' 'smoke,' 'soil' on which food-plant grows, 'wet and dry,' too little or too much, &c. I attach no value to any of these 'conjectures,' 'suggestions,' or 'arguments' for the following reasons. By employing any of the above-mentioned can the collector assure himself of a "variety"? I think no one will assert this. I am ready to admit that, by the employment of unusual heat or cold, there may be a reasonable hope of

producing some difference in the coloration of the insect; but, unless I am utterly mistaken, neither that nor any other (except one to be afterwards mentioned) process can alter the markings as seen in *Arctia caia*, *Abraxas grossulariata*, and many others. My experience during the last six years leads me to believe that all ideas as to food, soil, &c., producing true varieties are mere ideas and nothing more. I entertain this belief, or more properly conviction, on the following grounds:—(*a*) All my larvæ (say 3000) were, without a single exception, fed upon *Euonymus*, and occasionally a few sprigs of the common currant. (*b*) The whole were fed in the same room, day and night, and consequently the same temperature, light and darkness. (*c*) There is no smoke (quite the reverse) in Clifton or Redland. (*d*) Being invariably kept indoors both as larvæ and pupæ, wet or dry weather could not have any appreciable effect upon them. (*e*) No difference of soil within the limited area where they were all collected. And yet under these conditions were produced at least two hundred and fifty varieties, some of which are exhibited in the 'drawings.' But there is another circumstance connected with our efforts to produce varieties in the insect before us, one which I do not remember to have seen brought forward hitherto; it is this:—the extraordinary variation in the 'contour' (if I may use the word) of the specimens,—that is, in the length, breadth, and curvature of the upper wings. A moment's glance at the drawings will show what I mean. No collector can have failed to notice this fact, though, as I have said, I cannot call to mind having ever seen it referred to in the discussions as to the possible or probable causes of varieties. No one, I think, will maintain that any of those causes can produce such a change in the form and shape of the wings. I mentioned that, in my opinion, there is one, and one only method by which we may reasonably hope to obtain varieties. Of course I refer to 'crossing' the imagines, dark with light, &c. And this I firmly believe to be the true cause of the wonderful varieties—at any rate of *grossulariata*. Not a few collectors have tried this method (in captivity) year after year, and have been more or less successful in obtaining first-class varieties. Arguing from this, I hold that the same takes place in nature, and hence the element of good or bad 'luck.' Of the former I have certainly had more than my fair share."

Mr. Hy. J. Turner exhibited specimens of seven species of the genus *Libythea*:

1. *L. celtis*, from Mendelstrasse and Japan;
2. *L. rama*, from Ceylon;
3. *L. lepita*, from Bootan;
4. *L. myrrha*, from Malay Peninsula;
5. *L. geoffroyi*, from Malay Archipelago;
6. *L. labdaca*, from Sierra Leone;
7. *L. motya*, v. *bachmanni*, from U.S. America;

and contributed a paper on the genus, of which the following is an abstract.

Mr. Turner noted the length of the palpi as being one of the most apparent characters which distinguished this group from all other Rhopalocera. He said that the group was most restricted as regards number of species, there being only some thirteen or fourteen, while its area of distribution was most extensive, comprising the whole of the tropical and subtropical regions of the globe. The similarity of the species was very remarkable, while they were easily distinguishable *inter se*. At some length he discussed the relationships of the groups, giving the opinions of all the most prominent systematists. A list of the known species was included with their races and habitats. The life history of even our European species was shown to be very little known, and the attention of those collecting abroad was drawn to this most important desideratum. An account of the fossil species *Prolibythea vagabunda*, discovered in America by Scudder, was appended.

Mr. Tutt said that the European representative of this genus was extremely active on the mountain slopes, flying over the so-called nettle trees, which were some fifty or sixty feet high. He remarked upon the great similarity of the species, and said that no doubt variation had been restricted by their active habits, there being but little necessity to develop any considerable amount of protective coloration. As to the hybernation of the European species, worn specimens had been captured in March and April, and Dr. Chapman and himself had searched for the larvæ in August after the June-July emergence, but had failed to find any traces of the larvæ or their depredations. Mr. Mansbridge said that the American species *L. motya*, v. *bachmanni*, was a most active insect.

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CONTENTS.

MEETINGS

OF THE

SOUTH LONDON

ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY,

HIBERNIA CHAMBERS, LONDON BRIDGE, S.E.

1898-9.

Thursdays—April 14th, 28th; May 12th, 26th; June 9th, 23rd; July 14th, 28th; August 11th, 25th; September 8th, 22nd; October 13th, 27th; November 10th, 24th; December 8th; January (1899) 12th, 26th (Annual).

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MEMBERS exhibiting specimens at the Meetings of the Society are requested to be good enough to hand to the Secretary, at the Meeting, a note in writing of the generic and specific names of all specimens exhibited, together with the names of the localities in which such specimens were obtained, and any remarks thereon which the exhibitors have to make. In the absence of such a note in writing the Secretary cannot be responsible for any errors in connection with his report of such exhibits, or for the omission of any reference thereto in the Proceedings.