City of London Entomological & Natural History Society.

THIS SOCIETY was founded in 1858 under the title of the "Haggeston Entomological Society," and has striven, for nearly half a century, to diffuse the knowledge of Natural History, particularly of Entomology. It has taken an active part in the preservation of Epping Forest and other similar movements for the public good, and also in the suitable housing of the famous "Doubldeday Collection" of Lepidoptera. Its own particular work includes the reading of papers, holding of discussions, and exhibitions, and a special feature of recent years has been the compilation of a London Fauna List, now being published in the Transactions.

The meetings are held on the first and third Tuesdays in each month, excepting in July and August, from 7.30 to 10 p.m., at the London Institution, Finsbury Circus, E.C., which is easibly accessible from all parts; the Meeting-room is exceptionally comfortable and well lighted, and no effort is spared to make the evenings pleasant and profitable. An annual Summer Excursion is arranged by the Society, and occasional Conversazioni. Visitors are welcomed to all the meetings.

There is a good library, containing, among other works, the "Zoologist," "Entomologist," "Entomologist's Monthly Magazine," &c., from their commencement, and also reference collections of Lepidoptera and Coleoptera, to which it is hoped other Orders may be added from time to time.

An Entomological "Exchange Club" is now in process of formation under the auspices of the Society.

The entrance Fee is Two Shillings and Sixpence, and the Annual Subscription Seven Shillings and Sixpence, payable in advance, both being purposely kept low in order that all may avail themselves of the benefits the Society offers. The Society therefore looks with confidence for the support of all who are interested in the study of Natural History.

Further information may be obtained from either of the Hon. Secretaries.

TRANSACTIONS

OF THE

CITY OF LONDON Entomological & Natural History Society.

FOR THE YEAR 1904.

PUBLISHED BY THE
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THE LONDON INSTITUTION, FINSBURY CIRCUS, E.C.

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CITY OF LONDON

Entomological & Natural History SOCIETY,

Established 1858.

MEETINGS HELD AT

THE LONDON INSTITUTION

FINSBURY CIRCUS, E.C.

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AND

REV. C. R. N. BURROWS AND MESSRS. A. BACOT, A. HARRISON, H. A. SAUZÉ AND A. SICH.

TRANSACTIONS

OF THE

City of London Entomological

AND

Natural History Society.

PART XIV.

(1904.)

WITH LIST OF MEMBERS.

THE SOCIETY'S ROOMS, LONDON INSTITUTION,
FINSBURY CIRCUS, E.C.

MAY, 1905.

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Woolley, H. S., 7, Park Row, Greenwieh.

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Anderson, E., "Morningside," Cunningham Road, Toorak, Vietoria, Australia.
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Robson, J. E., F.E.S., Hartlepool.
Walsingham, Lord, M.A., F.R.S., F.L.S., F.Z.S., Merton Hall, Thetford, Norfolk.

REPORTS OF MEETINGS.

Dec. 15th, 1903.—Nonagria neurica bred.—Mr. H. M. Edelsten, a fine bred series of *Nonagria neurica* from larvæ taken in the Norfolk Broads.

Brenthis euphrosyne aberration.—Mr. T. H. Grosvenor, a pale aberration of *Brenthis euphrosyne* from the New Forest.

Cyaniris argiolus of second brood.—Mr. C. P. Pickett, a very fine series of *Cyaniris argiolus* of the second brood, taken at Worthing. The black marginal bands of the females were exceptionally black and heavy.

Manduca atropos bred.—Mr. Montagu F. Hopson, a specimen of *Manduca atropos* that had been bred in confinement and which had gone over the winter. The larva had been taken in September, 1897, and the imago hatched on May 16th, 1898. The pupa had been kept in an attic. The resulting moth was a slight cripple, and had a partial suppression of the inner black band of hindwings.

Lepidoptera from the Irish South Coast.—Mr. W. J. Kaye, a box of Irish insects taken at Tramore, Co. Waterford, and Courtmacsherry, Co. Cork. These included a bred series of *Gortyna micacea* from the latter locality, and *Hydroecia nictitans* var. *lucens*, *Dianthoecia capsophila*, and *Perizoma unifasciata* from Tramore.

Bred Peronea cristana.—Mr. J. A. Clark, a long varied series of *Peronea cristana*, including some new forms.

Zeuzera pyrina in pear.—Mr. A. W. Mera, a pupa case of *Zeuzera pyrina* in the wood of a pear tree. Mr. A. Bacot, in reference to this exhibit, said that *Z. pyrina* fed on the topmost shoots of pear. Mr. Mera mentioned that in the Victoria Park all the elm trees were killed when the park was first thrown open to the public. Mr. W. J. Kaye gave a note as to how he had inserted some hundreds of eggs into an elm tree, and how woodpeckers had taken them all.

Paper.—Mr. A. Bacot, in the absence of the author, read Dr. T. A. Chapman's paper, entitled "Are the ravages of Lepidopterous larvæ beneficial to the plants they attack?" (Printed in *Transactions*.)

Jan. 5th, 1904.—Special exhibition of varieties.—The meeting was specially set aside for the exclusive exhibition of varieties.

Plusia moneta aberration.—Mr. V. Eric Shaw, a very fine aberration of *Plusia moneta*, in which the whole area of the forewing was dark brown, with the reniform stigma alone golden coloured.

Dark aberration of Dryas paphia.—Mr. Sydney Dale, a fine aberration of *Dryas paphia*, with a great extension of black over all four wings. The specimen was caught on July 8th, 1897, at Pond Hill Enclosure, Lyndhurst. He also showed albino specimen of *Polyommatus icarus*.

Spilosoma lubricipeda aberration.—Mr. C. P. Pickett, a remarkable specimen of *Spilosoma lubricipeda* var. *radiata*, with a black abdomen, the extension of black to the abdomen being very rare.

Cœnonympha pamphilus aberration.—Mr. A. W. Mera, a *Coenonympha pamphilus*, with left forewing showing yellow colouration on the underside. Mr. Mera also showed a very fine aberration of *Brenthis euphrosyne*, with a very heavy black central band to forewings, which had been taken at Chattenden in 1890.

Arctia caja aberration.—Mr. Mera, on behalf of Mr. Huggins, some *Arctia caja* aberrations, with forewings showing a suppression of the light markings; also some fine *Arctia villica*, with a reduction of black spots on the hindwings.

Ophiusa stolida and Phryxus livornica.—Mr. J. Jäger, a specimen of *Ophiusa stolida*, caught in South Devon on September 23rd, 1903; also a specimen of *Phryxus livornica*, bred from a larva found at Starcross, which pupated in July, 1902, and produced the moth on September 27th, 1902.

Nonagria neurica ab. dissoluta.—Rev. C. R. N. Burrows, some *Nonagria neurica* ab. *dissoluta* from the Essex marshes. He said this dark form was supposed to have become extinct in Britain a few years ago, but the occurrence of these specimens refuted the assumption.

Aberrant undersides of Melitœa cinxia.—Mr. L. B. Prout, some exceedingly fine bred *Melitoea cinxia*, showing some aberrant undersides; also a couple of *Polyommatus corydon* ab. *syngrapha*, and a remarkable *Melanippe unangulata*, which was wholly brown coloured, with darker markings.

Dwarf lepidoptera.—Mr. W. Bloomfield, a box of dwarf lepidoptera, including an exceedingly diminutive *Pieris rapae*.

Deiopeia speciosa.—Mr. W. J. Kaye, a fine and variable series of forty *Deiopeia speciosa* from Jamaica.

Unicolorous Cymatophora repandata.—Mr. T. H. Hamling, an almost unicolorous brown aberration of *Cymatophora repandata*, from Penarth, Glamorganshire.

Spilosoma lubricipeda var. radiata, etc.—Mr. A. Bacot, *Spilosoma lubricipeda* var. *radiata*, and some fresh bred *Amathes primulae* (=*festiva*).

Special strain of Spilote grossulariata.—Mr. J. Riches, *Spilote grossulariata*, of a strain with a reduction of black spots.

Note on early emergence of Amathes primulæ.—Mr. A. W. Mera inquired if Mr. Bacot's *Amathes primulae* were abnormal. He thought that such early emergences were frequent in this genus. Mr. L. B. Prout said that a percentage always got through abnormally early, even in Nature.

Bred Callimorpha hera.—Mr. G. R. Garland, a long bred series of *Callimorpha hera*, showing equal percentages of red and yellow forms.

Grapta c-album aberration, etc.—Dr. J. S. Sequeira, a box of aberrations, including a *Grapta c-album* without the c- mark, and an immaculate *Pseudopanthera macularia*.

Series of Amorpha populi and Mimas tiliæ.—Mr. J. A. Clark, a long varied series of *Amorpha populi* and of *Mimas tiliae*.

Note on Porthesia chrysorrhœa.—Mr. A. Bacot inquired about *Porthesia chrysorrhoea*, as to how it had fared during the past wet season. Some larvæ had been found still feeding in November. Mr. J. Riches said a friend of his had informed him that no trace of the species was to be found at Eastbourne during the past season.

Successful breeding of Callimorpha hera.—Mr. G. R. Garland was asked by the President if he employed any special means to be so successful in breeding *Callimorpha hera*. Mr. Garland replied that he fed his larvæ on groundsel, as he found white nettle crippled and dwarfed them. When the larvæ were full-fed he isolated them, and gave each a separate chip-box to pupate in. He said he placed the box upside down, and the larvæ immediately settled down. When the moths were ready to hatch, he found it necessary to give them twigs to hang on to on emergence. With these precautions he had found no difficulty in breeding the species.

Jan. 19th, 1904.—Venusia cambrica.—Mr. A. W. Mera, some specimens of *Venusia cambrica* and allied species.

Note on pupal habit of Arctia caja.—Mr. C. P. Pickett, twigs of a plum tree, on which larvæ of *Arctia* had pupated by drawing together the leaves, instead of following the more usual course of spinning up in the angles of the breeding cage.

Venusia cambrica and allies.—Mr. L. B. Prout, a series of *Venusia cambrica*, including a melanic form, together with the nearest allied British species, and *Venusia comptaria* from the United States, and *Venusia* (?) *undosata* from New Zealand.

Forced Manduca atropos.—Mr. J. Riches, a forced bred specimen of *Manduca atropos*.

Paper.—Mr. L. B. Prout read a paper on "Notes on *Venusia cambrica*." (Printed in *Transactions*.)

Feb. 2nd, 1904.—Bred Geometra papilionaria.—Mr. C. P. Pickett, some bred *Geometra papilionaria*, showing slight differences in the green shade.

Exceptionally large Syrichthus malvæ.—Mr. H. M. Edelsten, a remarkable large aberration of *Syrichthus malvae*, resembling the nearly related *Syrichthus alveus*.

Geometra vernaria, etc.—Dr. J. S. Sequeira, *Geometra vernaria* and *Geometra papilionaria*.

Geometra papilionaria aberration.—Mr. C. Nicholson, an aberration of *Geometra papilionaria*, with white patches on the outer marginal portions of both fore- and hindwings.

Manduca atropos aberration—Mr. J. A. Clark, a fine aberration of *Manduca atropos*, with the black bands of the hindwing much suffused and shading into the ground colour. The abdomen also was very dark.

Large exhibit of Geometra papilionaria.—Rev. C. R. N. Burrows, a large number of *Geometra papilionaria*, to illustrate his paper.

Exhibits of Geometra papilionaria.—Mr. J. Riches, *Geometra papilionaria* from Forres. Mr. L. B. Prout, *G. papilionaria*, very weakly marked, from the Lower Engadine. Mr. G. R. Garland, *G. papilionaria* from Epping and the New Forest.

Pupal cases of British "Emeralds."—Mr. A. W. Mera, a box containing pupal cases of all the British "Emeralds" except *Geometra vernaria*.

Continental Lycænidæ.—Dr. T. A. Chapman, a bred series of *Polyommatus amphidamas* from German pupæ, and *Cyaniris argiolus* from Spain.

Paper.—Rev. C. R. N. Burrows read a paper on *Geometra papilionaria* (to be printed in *Ent. Rec.*) of which the following is an abstract. He said that the insect had special claims for our attention: (1) because of its size and beauty, (2) because there was no possible doubt as to the nomenclature to be employed as Linné had named the species and everyone had followed him. Concerning its Geographical Distribution it was widely spread, but in the South of England it could not be considered common. Over the variation presented by the species, the author dwelt at considerable length. Apart from the type that Linné had described, five other more or less well marked forms had been detected. These were ab. *prasinaria:* ab. *herbacearia:* ab. nov. blue green; ab. nov. with white mark in cell, and ab. nov. dull green with a single transverse line. The ovum took from five to nine, and even to sixteen, days to hatch, and the young larva fed slowly till the leaves began to fall. The young larva required as food, the buds of birch and not the young leaves. The moth usually hatched from the pupa between June 6th and July 5th, and was well known to be attracted to light, and late in the evening to sugar. It was distributed over Central and Northern Europe, Northern Asia Minor, The Atlas Mountains, Siberia, and had been taken at Vladivostock and even in Japan. In Britian it was found at altitudes ranging from sea level to 1000ft. It had never been recorded from the Isle of Man. Details were given of the structure of the larva in its different stages, and the presence of special hairs as found in other "Emerald" species was fully discussed, relative to the classificatory position of *G. papilionaria*. It was stated that Linné's type of the species was by far the commonest form, *i.e.*, the form without the basal line on the forewing and with the other two well defined. At the close of the paper Mr. A. W. Mera proposed a vote of thanks to Mr. Burrows, Mr. Nicholson seconded, and said that every gradation between the extremes in spotted species occurred, and it was exceedingly difficult to decide upon any particular number of different forms. Alder, he thought, was a very common foodplant and was always a very good substitute for birch. Mr. A. Bacot thought that the ancestor of *Phorodesma smaragdaria*, *Phorodesma pustulata*, and *Geometra papilionaria* must have been a species with a clothed larva. Several members gave their experiences with this species and its time of flight, and most were agreed that the natural flight was late in the evening. The vote of thanks was then put and carried.

Feb. 16th, 1904.—Preserved larvæ.—Mr. C. P. Pickett, a box of preserved Arctiid larvæ.

Drepana lacertinaria.—Mr. W. J. Kaye, a short but very variable series of *Drepana lacertinaria* from several localities. Attention was drawn to a large unicolorous, pale brown form.

Spanish Arctiids.—Dr. T. A. Chapman, some Arctiids from Spain, including *Arctia fasciata* from Moncayo, *Arctia latreillei*, and *Œnogyna zoraida*.

Pachys betularia ab. doubledayaria intermediates.—Mr. R. G. Benton, some intermediates between type *Pachys betularia* and ab. *doubledayaria:* also a specimen of *Opisthograptis luteolata*, with hardly a trace of the transverse markings.

Syntomis phegea.—Mr. A. W. Mera, some *Syntomis phegea*, and made some remarks on their Zygænid appearance.

Zeuzerid larva.—Mr. A. Bacot, a large Zeuzerid larva of an unknown species from Australia.

Paper.—Mr. A. Bacot read a paper, entitled "Notes on Arctiid larvæ." The special line to which attention was given was the disposition and nature of the tubercles. These were extremely difficult organs to deal with, as they were apt to lead one away from true relationship. Thus *Arctiadae*, *Noctuidae*, and the butterflies became somewhat closely connected upon a study solely of the tubercles, while the atrophy of the primary tubercles made the Arctiids like the Sphingids in that respect. Arctiid larvæ offered no constant characters that could be taken independently for classification. The *Arctiadae* were well separated as a family by the oval characters. The eggs were always sculptured with delicate pittings, and certain larval characters might be taken in support of this basis, but there were many larval characters to choose from. *Syntomis phegea* placed the egg differently from the majority of Arctiids, and more like the Zygænids, illustrating a parallel in habits and habitat. It was interesting to note that all Arctiids hybernated as larvæ, but hybernation was an unstable character in classification. Mr. Bacot closed his paper with a rough scheme for separating certain isolated members or groups. Thus *Spilosoma* offered certain differences, while *Euchelia jacobaeae* was quite isolated by its larva bearing single hairs instead of bunches of hair on the setæ. At the finish of the paper Mr. A. W. Mera proposed a vote of thanks, and alluded to the curious hybernating differences in otherwise very closely related species, and alluded to *Orgyia gonostigma*, that hybernated as a larva, whilst its very near relative, *O. antiqua*, passed the winter in the egg state. Mr. W. J. Kaye seconded the vote of thanks. Mr. L. B. Prout, Mr. Alfred Sich, and Dr. T. A. Chapman also spoke in support of the vote, and the last mentioned made some remarks on the glandular hairs of the larva, saying that in some species all the hairs were glandular, while in others only some were so constructed.

March 1st, 1904.—New Member.—Mr. R. G. Benton, of Waterburg, Wood Lane, Highgate, was elected a member of the Society.

Eupithecia minutata var. knautiata.—Mr. V. Eric Shaw, *Eupithecia minutata* var. *knautiata*, bred from Bury, Lancashire.

Arctia caja aberrations.—Mr. C. P. Pickett, two fine aberrations of *Arctia caja*, one of which had dark brown antennæ, instead of the usual pale colour.

Bred Sesia fuciformis and Ægeria apiformis, etc.—Mr. A. W. Mera, *Sesia fuciformis* and *Aegeria apiformis*, with many of the fugitive scales adhering. He stated that the least flutter was sufficient to cause the insect to loose these scales. Mr. W. J. Kaye, a large number of insects with transparent wings, or with partially transparent wings, including many species from S. America of the families *Syntomidae*, *Arctiadae*, *Aegeriadae*, *Erycinidae*, *Hypsidae*, *Geometridae*, and *Hesperiadae*.

Paper.—Mr. W. J. Kaye read a paper on "Transparency in Lepidopterous wings" (*vide Ent. Rec.*, vov. xvii., pp. 83-86 *et seq.*). Reference was first made to the well-known British species, *Sesia fuciformis* and *Sesia bombyliformis*, and the Aegeriid species, but it was stated that it was in S. America where the phenomenon of transparency had been

so greatly developed, and that there it occurred in a great number of families and sub-families, including the whole of the families comprised by the butterflies. The paper was divided into two parts under the headings: (1) Why has transparency arisen? (2) How has transparency arisen? Under the first the author gave his reasons as the following: (*a*) For increased warning aspect, (*b*) for the reverse or effacive colouration, (*c*) for possibly increased speed on the wing. Following in the wake of all these primary developments, mimicry produced many similar forms. Under the question, "How has transparency arisen?" the remainder of the paper was devoted. A short recapitulation of Professor E. B. Poulton's paper in the *Trans. Linn. Soc.*, 1898, pp. 558-612, was given, followed by the author's own research in other species and groups. Details were given at considerable length concerning two British Guiana groups, (1) one composed of the species *Agyrta micilia* and *Euagra coelestina*, of the *Syntomidae*; *Esthemopsis sericina*, an Erycinid; *Pseudarbessa decorata*, a Geometrid, and *Iostola dirisa* a Hypsid; (2) a group composed of *Leucothyris zarepha*, *Napeogenes*, n.sp., *Ithomia florula*, and *Heterosais sylphis*, all of the *Ithomiinae*, *Lauron partita*, a Hypsid moth; *Hyrmina*, n.sp., a Geometrid moth. *Stalachtis erelina*, and *Stalachtis phaedusa*, Erycinid butterflies. In every case it was found that the greatest development towards transparency was the discal area of the hindwing. The discal area of the forewing followed next, and the apical area showed least and latest development of all. At the close of the paper Mr. A. W. Mera said it was noteworthy that nearly all, if not quite all, the transparent species were diurnal in habits. He thought that the British Sesiides and Ægeriids were extremely difficult to detect on the wing. Mr. L. B. Prout proposed a hearty vote of thanks to Mr. Kaye. He asked, were not hair-like scales ancestral and not a late development, and Mr. A. Bacot seconded the vote, he thought with the author that there must be several different reasons for transparency. He suggested that the smooth membrane of the wing tended greatly to reflect the glare from the sun and unless the pursuing bird was at the right angle the object would not be seen. In some specimens even the body was so clothed that it might also reflect the light as well as the wings. Mr. Alfred Sich supported the vote of thanks, and said that in the lower lepidoptera the hair-like scales were an ancestral character, the scales being developed later. Dr. T. A. Chapman said, as an extension of Mr. Bacot's idea, he thought the retention of transparent scales was probably for this purpose of light reflection. He agreed with Mr. Kaye that in a great number of instances the hair was a later development than the more usual flat scale. It could, however, always be ascertained by the scale sockets, the ancestral hair being set on a round spot only while the highly evolved hair-like scale was set in a cup shaped socket. The vote of thanks was put and carried, and Mr. Kaye replied.

March 15th, 1904.—Bleached Synopsia abruptaria.—Mr. Shepherd, a specimen of *Synopsia abruptaria*, bleached on both hindwings, which was caught flying, also the form *consobrinaria* of *Baarmia consortaria*.

Burrows of Ægeria formicæformis.—Mr. W. J. Kaye, a stump of osier with burrowings of *Aegeria formicaeformis*.

Bred Lycia hirtaria.—Mr. C. P. Pickett, *Lycia hirtaria*, bred after having been two years in pupa.

Large exhibit of Angerona prunaria.—Mr. C. P. Pickett, a large exhibit of *Angerona prunaria* picked from eight different broods.

Paper.—Mr. C. P. Pickett read a paper on "Further notes on collecting and rearing *Angerona prunaria*" (publication delayed). He said that he had, throughout the season of 1903, found insects very scarce and late in point of time of appearance. At Dover, on August 1st, *Polyommatus corydon* was only just appearing, whilst a search on the cliffs amongst Galium failed to give any larvæ of *Pergesa porcellus*, although on former occasions he had never failed to find larvæ sometimes even abundantly. A fresh find for the year, to him, was *Bryophila muralis*, on a wall at Folkestone. *Bryophila perla* was taken also with *B. muralis*. The collecting notes having come to an end, details were then given of the rearing of eight broods of *Angerona prunaria*. The larvæ of six of the broods were hybernated out-of-doors and the remaining two broods were hybernated in a cool greenhouse. Those offered the greenhouse protection did much better than the remainder. A curious habit was noticed of the larvæ, after feeding for about an hour at dusk, hanging on to the side of the sleeve in which they were contained. At the close of the paper Mr. A. W. Mera said he considered that hybernation out-of-doors was usually best. He asked if Mr. Pickett had found the different forms of *A. prunaria* show a preference for one another in the matter of pairing. He had, personally, found this to be the case on a certain occasion in Ipswich.

April 5th, 1904.—Spring Lepidoptera.—Mr. C. P. Pickett, from Oxshott, *Pachycnemia hippocastanaria*, *Brephos parthenias*, and *Asphalia flavicornis*, all of which he found to be just appearing on April 2nd.

General exhibit and discussion on Boarmia repandata.—Mr. L. B. Prout, *Boarmia repandata* of several different forms, including small dark specimens from S. Wales, strongly recalling *Boarmia abietaria*; an extreme sooty black form from Rotherham, and some pale forms from Forres. Mr. V. Eric Shaw, *B. repandata* from several localities, including very black specimens from Huddersfield, and an extremely varied series from N. Cornwall. Dr. J. S. Sequeira, *B. repandata* from the New Forest, including many of the form *conversaria*. He stated that one year he had found the latter form quite common in the locality mentioned. Mr. T. H. Hamling, *B. repandata* from the New Forest and from Methly, near Leeds. Mr. A. Bacot, the same species from Chepstow. Mr. A. W. Mera then started a discussion on the series. He considered that *Boarmia abietaria* and *Boarmia gemmaria* were closer relatives to each other than either were to *B. repandata*. The last was essentially a woodland insect, whereas *B. gemmaria* was especially a garden insect. It was possible that *B. repandata* was unable to exist in a smoky atmosphere. Mr. L. B. Prout spoke upon the *conversaria* form of the species. He said it sat at the roots of heather, and it had been stated that as a larva it fed on heath. It was doubtless true that in Devon and Cornwall the form *conversaria* was plentiful, and it was significant that in those counties there were vast areas of heather country. Although frequently *Boarmia gemmaria* was confused with *B. repandata*, the latter could always with certainty be differentiated by the second angle in the post-medial line, which *B. gemmaria* had never got. Even in melanic forms of *B. repandata* the double angle was always traceable. Apart

from this character, there was a difference in the time of appearance. Mr. W. J. Kaye remarked on Dr. J. S. Sequeira's varied series from the New Forest. He said he had found in a certain part of Leicestershire a particularly pale form, and this almost invariably settled upon dark pine trunks, making it a conspicuous object. Mr. Mera said that in the New Forest there certainly was a great range of variation. The aberration *conversaria* was produced far more commonly in the South and West of England. It was very rare in Suffolk, and years ago rare in Combe Wood, near London. Mr. Alfred Sich remarked that in the New Forest there was gathered together a great admixture of different forms. Mr. A. Bacot said the variation of this species was very wide, and the melanic tendency cropped up here and there. He would like to know if the tendency was pronounced by heredity. Mr. Mera considered that the influence was certainly strong. Mr. T. H. Hamling said he found the melanic tendency very strong from parents of the same dark form in other species. Mr. L. B. Prout referred to parallel strains and the occasional blending or mixing of the two. He thought that the species required extensive breeding to elucidate certain biological tendencies. Mr. G. H. Heath, in speaking of the ab. *conversaria*, said that that might be an older form than the commoner forms without the well-marked band, and that the lines in the latter were mere remnants of the band.

April 19th 1904.—Burning of Wicken Fen.—Mr. C. P. Pickett called the attention of members to the unfortunate burning of a large portion of Wicken Fen, and read a newspaper paragraph thereon.

Hybernated Arctia villica larvæ.—Mr. G. Pearson, larvæ of *Arctia villica* which had been successfully hybernated under domestication.

Ova-laying of Asphalia flavicornis.—Mr. V. Eric Shaw, ova of *Asphalia flavicornis*, on twigs of birch from Chislehurst. The eggs were laid at the small angles on the twigs, and it was noted that not many eggs were laid by a single female.

Note on Lycia hirtaria.—Mr. C. P. Pickett, *Lycia hirtaria*, taken wild on April 18th, in a garden at Leyton. It was stated that the species had again been abundant, and generally of large size.

Tapinostola concolor.—Mr. W. J. Kaye, *Tapinostola concolor*, taken, he believed, near Wansford. He remarked on the little that was known of this obscure species. Mr. A. W. Mera said he took, some years ago, a small wainscot on the east coast, and which had since been identified as *Tapinostola concolor*. The locality was new for the species.

Spring and Summer Broods of Cymatophora gemmaria.—Mr. A. W. Mera, *Cymatophora gemmaria*, from London and Freshwater, showing both broods of each, illustrating how much smaller the latter brood was.

Saturnia pavonia-minor aberration.—Mr. T. H. Grosvenor, a curious male specimen of *Saturnia pavonia minor*, with the orange of the hindwings much reduced in intensity, giving the wing more the appearance of the female sex.

Crambus chrysonuchellus, etc.—Mr. Alfred Sich, *Crambus chrysonuchellus*, from Clandon Downs, taken on June 1st, 1901, also *Lithocolletis alnifoliella* and *Talaeporia tubulosa*.

Paper.—Mr. Alfred Sich then read a paper entitled "An Aid to Lepidopterous Leaf-miners." (Printed in *Transactions*.)

Mr. A. W. Mera, at the close of the paper, said how much he had enjoyed Mr. Sich's lecture on these small lepidoptera. He agreed that the explanation of the mining habit was a protection against drought. Lilac and privit he had noticed to be greatly attacked on the north or shady aspect, but not on the south. Mr. L. B. Prout proposed a vote of thanks to Mr. Sich for his interesting paper. He was himself a little sceptical as to the explanation for leaf mining. Plenty of small animals did not live in water. It was certainly no protection from enemies, as ichneumons were very frequent. Mr. W. J. Kaye seconded the vote of thanks. He agreed with Mr. Sich and the President as to the explanation given for leaf-mining. The case of *Graphiphora populeti* was referred to as a very complete instance of leaf-mining among the higher lepidoptera, except that instead of the larva feeding between the cuticle and parenchyma of one leaf, it fed between the cuticles of two separate leaves. Mr. Sich briefly replied to the vote of thanks already carried, and said that leaf-miners always chose sheltered positions.

May 3rd, 1904.—New Member Elected.—Mr. R. G. Todd, The Limes, Hadley Green, N., was elected a member of the Society.

Spring Larvæ off Heath.—Mr. W. J. Kaye, larvæ of *Psednothrix belgiaria*, *Perconia strigillaria*, and *Lycophotia strigula*, all found on May 2nd, 1904, feeding on Oxshott Heath on *Erica*.

Larvæ of Aphomia grisella.—Mr. V. Eric Shaw, larvæ of *Aphomia grisella*, and made some notes on the habits of this extraordinary moth. He testified to having seen bees carrying off the larvæ of the species from their hives.

Synopsia abruptaria, etc.—Mr. C. P. Pickett, *Synopsia abruptaria* almost normal in colouring, from Leyton, Essex; also *Cepphis advenaria*, inbred for two years, from Leith Hill, and which had remained two winters in pupa. Lastly, a cocoon of *Opisthograptis luteolata*, spun within an empty case of *Pieris brassicae*.

Heliophila favicolor and Tapinostola concolor.—Mr. A. W. Mera, *Heliophila favicolor* and *Tapinostola concolor* from the Suffolk coast. The latter was a remarkable looking specimen, and not quite like the *T. concolor* that were taken inland. Also from Shoeburyness some fine red *Heliophila pallens*.

Bred Graphiphora miniosa.—Mr. Alfred Sich, four *Graphiphora miniosa* from Brentwood, Essex.

Amathes ditrapezium.—Mr. J. Riches, larvæ of *Amathes ditrapezium* from Hampstead. Mr. A. Bacot also showed larvæ of this same species. These latter were all reared from a single batch of eggs, and showed extraordinary variation from being putty-coloured with heavy black marks, to deep red, with most of the black marks suppressed.

Larvæ of Triphæna fimbriata.—Mr. T. H. L. Grosvenor, larvæ of *Triphaena fimbriata*, feeding on clematis.

Burning of Wicken Fen.—Mr. W. J. Kaye said the report concerning the burning of a large portion of Wicken Fen had been confirmed.

Limenitis sibylla in Suffolk.—Mr. A. W. Mera made some

comments on the occurrence of *Limenitis sibylla* in the Suffolk woods. He considered that the species only frequented those woods with broad shady glades, where light and shade were very marked, in order that its own colours would harmonise.

May 17th, 1904.—Delegate for S.E. Union of Scientific Societies.—Mr. V. Eric Shaw was elected to represent the Society at the S.E. Union of Scientific Societies' conference, to be held at Maidstone.

Spring lepidoptera.—Mr. C. P. Pickett, *Lycia hirtaria*, from his garden at Leyton, and some fresh bred *Synopsia abruptaria*: also some *Mimas tiliae*. The *S. abruptaria* were rather darker than the normal, but were far removed from the melanic and deep chocolate forms obtained at Holloway, &c.

Highgate lepidoptera.—Mr. R. G. Benton, *Bombycia ocularis* and *Plusia moneta*, from the Highgate woods. Mr. R. G. Todd said that the former was not very rare there. He had himself taken four specimens.

Ova of Eupithecia nanata.—Mr. V. Eric Shaw, ova of *Eupithecia nanata*. He suggested that there might be a second brood of the species. Mr. L. B. Prout said he thought there was only one extended brood. At Forres he had taken the imago in August, and these were certainly not of a second brood.

Dwarf Catocalas.—Dr. J. S. Sequeira, specimens of *Catocala promissa* and *Catocala sponsa*, some of which were remarkably undersized.

Note on Eupithecia nanata.—Dr. T. A. Chapman remarked on the *Eupithecia nanata* exhibited, and said that it was possible there might be two broods in the south, but it was certain there was only one in Scotland.

Graphiphora gracilis.—Mr. A. W. Mera, *Graphiphora gracilis*, showing the white, red, and intermediate yellowish forms. The last were from Rannoch and exhibited some beautiful phases.

Libythea celtis larvæ, etc.—Dr. T. A Chapman, larvæ of *Libythea celtis* and *Melitaea didyma*, the latter were stated to rest near the top of a flower-stem of plantain, and were wonderfully protected by their great likeness to flowers of the plant.

Retarded emergences.—Mr. L. B. Prout said it would be most interesting if members would record any instances of retarded emergences when the moths were produced this year. It was likely that a great number of specimens would hatch this year that had failed to come out during 1903. Mr. A. W. Mera said he considered that many species had to appear at a certain time and if they failed they died. Mr. Prout was of opinion that certain atmospherical conditions were necessary at a certain stage of the pupa's existence for development, but if that development within the pupa failed the pupa might very often lie over till the same period the following year. But once development had taken place the imago had to emerge or die. Mr. A. Bacot referred to Dr. Chapman's experiments with the Tæniocampid species, when it was found that development took place in the autumn and the moths were ready to emerge with the first warm days of spring. If they failed to hatch they could not go through a second winter and therefore died.

Note on emergence of Pachys betularia.—Mr. A. Bacot made an observation concerning the hatching period of *Pachys betularia*. He found that in nature the moth emerged in the afternoon, but in captivity generally between midnight and early morning. He attributed this to the different variations of temperature, the house temperature being usually highest in the evening owing to the gas, &c., while in the air the maximum usually occurred at about 3 p.m.

Pink lilies of the valley.—Mr. J. Riches, a bunch of pink lilies of the valley. He said they were uncommon, but not much sought after, as the white form was undoubtedly the more beautiful flower.

June 7th, 1904.—Brood of Ematurga atomaria.—Mr. A. Bacot, a series of *Ematurga atomaria* bred from ova obtained from a very pale specimen taken near Leith Hill. The brood, however, showed practically no variation.

Pachys betularia var. doubledayaria.—Mr. W. Bloomfield, a specimen of *Pachys betularia* var. *doubledayaria*, bred from a pupa dug at Balls Pond.

Boring's in an ash stem.—Rev. C. R. N. Burrows, an ash stem bored by larvæ, which he suggested might be *Cirrhoedia xerampelina*. Mr. A. W. Mera, however, stated that it was too late for this species, as a friend of his had received full fed larvæ of this insect three weeks previously. Mr. L. B. Prout thought the larva was possibly *Prays curticellus*.

Dark Pararge egeria.—Mr. S. Dale, a specially dark specimen of *Pararge egeria*.

Larvæ of Ithysia lapponaria.—Mr. A. W. Mera, larvæ of *Ithysia lapponaria* in the last stadium, bred from ova received from a correspondent, and laid by a British specimen. Mr. Mera mentioned that whilst this larva would eat knotgrass and sallow it much preferred birch.

Aberration of Mimas tiliæ.—Mr. C. P. Pickett, specimens of *Mimas tiliae* bred during 1904, including a very reddish coloured female, and a male with the more green colouration usually found in the female. The two specimens had been paired and ova obtained.

Notes on Lars sambucaria.—Mr. Pickett, pupæ of *Lars sambucaria*, which had used an empty pupa case of *Vanessa atalanta* in the construction of their cocoons.

Collecting notes.—Mr. Pickett reported that during a recent visit to Clandon he had found *Nemeobius lucina* very plentiful; *Callophrys rubi* was worn, and *Polyommatus icarus* and *Polyommatus agestis* just coming out. He also saw one *Hemaris fuciformis* and a few *Brenthis euphrosyne*. Mr. L. B. Prout reported finding *Coremia designata* commonly in the neighbourhood of Connaught Water, Epping Forest. No larvæ were found either of *Philoseme retulata* or *Philoseme transversata*, these having apparently pupated. Larvæ of *Triphosa dubitata* were well forward.

Delegate to the S.E. Union of Scientific Societies.—Mr. V. Eric Shaw having written to the effect that he wished to be released from his appointment as the Society's delegate to the conference of the S.E. Union of Scientific Societies, Rev. C. R. N. Burrows proposed, and Mr. A. W. Mera seconded, that Mr. J. W. Tutt be requested to represent the Society. The proposal was carried unanimously.

June 21st, 1901.—Pachys strataria and Pachys betularia.—Mr. A. Bacot, a series of *Pachys strataria*, in connection with which he mentioned that he had obtained two pairings of *Pachys strataria* and *Pachys betularia*, but only one fertile ovum had resulted. This had hatched successfully and the larva was feeding.

Ova of Pterophorus lienigianus.—Dr. T. A. Chapman, ova of *Pterophorus lienigianus*.

Aberration of Argynnis aglaia.—Mr. J. A. Clark, a fine aberration of *Argynnis aglaia*.

Bred Mimas tiliæ.—Mr. S. Dale, a bred series of *Mimas tiliae*, from pupæ received from Mr. C. P. Pickett. The series contained a single rust-red specimen.

Bred Ochryia quadrifasciata.—Mr. A. W. Mera, bred *Ochyria quadrifasciata* from Ipswich and Mucking larvæ.

Angerona prunaria, etc.—Mr. C. P. Pickett, bred specimens of *Angerona prunaria* and *Callimorphora dominula*, the latter from Deal larvæ.

Eupithecia albipunctata, etc.—Mr. L. B. Prout, a series of *Eupithecia albipunctata* bred from Sandown larvæ. These were weakly marked, and some were unicolourous. Also bred specimens of *Venusia cambrica*. These were larger than captured examples, and all but one came under the var. *bradii*.

Collecting at Wicken.—Rev. C. R. N. Burrows reported that a friend had advised him that entomologising at Wicken was a failure.

Sugaring a failure in the New Forest.—Mr. J. A. Clark reported that sugaring in the New Forest in the first week in June this year was a total failure. Also that little better results were obtained in the Folkestone Warren.

Hadena albimacula.—Mr. S. Dale reported the capture of four specimens of *Hadena albimacula* at Folkestone.

Sept. 6th, 1901.—Xylena scolopacina.—Mr. V. Eric Shaw, a fine bred series of *Xylena scolopacina* from larvæ found at Bexley. Mr. A. W. Mera commented on Mr. Shaw's success in breeding such a fine lot. He had himself found the larvæ very much stung with parasites when he had taken them at Highgate. He knew, however, that that was not invariably the case everywhere as Mr. Shaw had demonstrated.

Variable Cœnonympha pamphilus, etc.—Mr. C. P. Pickett, a long variable series of *Coenonympha pamphilus* taken at Dover and series of *Ematurga atomaria* from Clandon Downs and Folkestone. It was remarked concerning the latter series how much the colouring of the two sexes converged.

Eupithecia constrictata.—Mr. W. J. Kaye, a series of *Eupithecia constrictata* from Cornwall. The specimens were very dark coloured. Mention was made of the extreme localness of the species even in localities where it occurred.

Mesotype lineolata.—Mr. A. W. Mera, *Mesotype lineolata* of especially large size, from the Deal sandhills. The specimens were of the second brood. Very little else was observed or captured, and the once famous collecting ground was now largely spoiled.

Synopsia abruptaria.—Mr. J. Riches, aberrations of *Synopsia abruptaria*. Mr. W. J. Kaye remarked on the protracted period the larva of this species takes to feed up in. He had had larvæ feeding for four months, and some were not yet full fed.

Sept. 20th, 1904.—New members elected.—Mr. L. S. Hodson, Maisonette, Palmer's Green, N., and Mr. E. A. Cockayne, 30, Bedford Court Mansions, W.C., were elected members of the Society.

Erynnis comma.—Mr. V. Eric Shaw, *Erynnis comma* from Eynsford, Kent, taken from August 7th up till as late as the first week in September.

Mimas tiliæ aberrations.—Mr. C. P. Pickett, some fine bred aberrations of *Mimas tiliae*.

Vanessa atalanta with parasite.—Mr. Pickett, ova of *Vanessa atalanta*, and cocoons of the parasite that attacks the species.

Agrotis agathina.—Mr. W. J. Kaye, some *Agrotis agathina* found by searching on Oxshott heath, also two bred specimens of the same species from the New Forest.

Drepanid larvæ.—Mr. Kaye, larvæ of *Drepana lacertinaria* and *Drepana falcataria* from Oxshott. The former was in its penultimate skin with its strong resemblance to a bird dropping the latter in the final skin.

Malacosoma castrensis.—Mr. A. W. Mera, a fine series of *Malacosoma castrensis*. It was remarked how constant the female sex was, while the male varied greatly. It was curious also that different years frequently gave different phases of the species.

Notes on Phorodesma smaragdaria.—Mr. Mera made some remarks upon *Phorodesma smaragdaria*. He had that day found the larvæ in little colonies, but that later on in the year the high tides came up and seperated them, and after the winter was over only single larvæ were to be found. Mr. V. E. Shaw enquired how the eggs were laid, and Mr. Mera replied he had no doubt these were laid in batches.

Abundance of larvæ.—Mr. W. J. Kaye and Mr. A. W. Mera both remarked on the abundance of larvæ at the present time (September 20th). Mr. A. Bacot also reported finding larvæ of *Demas coryli* as being quite common in Epping Forest.

Oct. 4th, 1904.—New Member.—Mr. E. Harris, 2, Chardmore Road, Clapton, was elected a member of the Society.

Eupithecia innotata.—Mr. L. B. Prout, a specimen of the very rare British "Pug" *Eupithecia innotata*, bred from a larvæ found feeding on *Artemisia vulgaris*.

Boarmia roboraria.—Mr. V. Eric Shaw, a series of *Boarmia roboraria* taken at light in the New Forest after midnight. Rev. C. R. N. Burrows remarked that the species also came commonly to sugar in its haunts after midnight, but not before.

Pale race of Cymatophora gemmaria.—Mr. W. J. Kaye, two remarkably pale specimens of *Cymatophora gemmaria* from North Cornwall. It was stated that this was the special form usually, if not wholly, found in this district.

Ptilodon camelina bred.—Mr. Kaye, a bred series of *Ptilodon camelina* reared from the egg. The specimens were nearly all of a remarkably small size, due, it was stated, to the larvæ having been subjected to great heat about the period of pupation, as they had been sleeved out of doors on oak, and had plenty of food, and starvation could not be the cause.

Insects from Wicken Fen.—Mr. R. G. Todd, a box of insects secured at Wicken in June, this year, including *Phragmatoecia*

castaneae, *Arsilonche alborenosa*, *Meliana flammea* and *Spilosoma urticae*.

Bred Pararge egeria.—Mr. C. P. Pickett, a bred series of *Pararge egeria*, and a fine caught series of *Maniola janira*, including some fine undersides.

Diminutive Rusina tenebrosa.—Rev. C. R. N. Burrows, a very pale diminutive specimen of *Rusina tenebrosa*.

Cœnonympha typhon.—Mr. A. W. Mera, series of *Coenonympha typhon* from Delamere and Aberdeen, showing extremes in the matter of eye marks, some from the latter locality being extremely pale and weakly marked.

Abundance of Sawfly larvae.—Mr. C. P. Pickett, Mr. A. W. Mera, and Mr. E. Harris, remarked on the great abundance of Sawfly larvæ noticed this autumn.

Notes on the Season's Collecting.—Mr. L. B. Prout gave some notes on his collecting experiences during the past season. He said that many species, especially those that appeared in late autumn, were quite absent, but, on the other hand, some of the commoner species had been exceptionally abundant, such were *Coenocalpe tersata* and *Melanthia procellata*, which had occurred in great profusion in the Isle of Wight. Larvæ of *Eupithecia albipunctata* had been very plentiful, and he had counted as many as 19 on one single flower spike. Some plants seemed especially favoured, though why was not apparent. Mr. V. Eric Shaw reported *Gortyna flavago* in abundance in burdock stems in the Bexley district. The eggs, he said, were laid in the old thistle stems, and it was therefore necessary for the larvæ to change to another plant later on.

Oct. 18th, 1904.—New Member elected.—Mr. Charles Brooke, 1, Berner's Street, E.C., was elected a member of the Society.

Aberration of Argynnis aglaia.—Mr. J. A. Clarke, a fine aberration of *Argynnis aglaia*, which had a well-formed central band of large square blotches. It had been taken at Molescombe, near Brighton.

Second brood of Tephrosia crepuscularia (biundularia).—Mr. Clark also, a specimen of *Trephrosia crepuscularia* (*biundularia*) of the second brood. This was most unusual in this species.

Lycænids of the second brood.—Mr. C. P. Pickett, *Polyommatus adonis* and *Cupido minima*, both of the second brood, also some fine *Polyommatus icarus*.

Aberration of Xanthorrhœ fluctuata, etc.—Mr. G. H. Hamling, on behalf of Mr. Southey, a fine aberration of *Xanthorrhoe fluctuata*, which had a very narrow transverse black band of a dull greenish-ground colour. Also some very fine aberrations of *Amathes ditrapezium* from Hampstead. Several of these latter showed parallel forms to ab. *gothicina* of *Graphiphora gothica*, and had the stigmata much suppressed.

New Forest Insects.—Mr. V. Eric Shaw, *Hylaea prosapiaria* and *Hydrelia uncula* from the New Forest. The latter was reported as being much scarcer in the southern locality.

Caradrina quadripunctata.—Mr. G. H. Heath, a series of *Caradrina quadripunctata* taken during the first half of September at Torquay.

Cossus ligniperda and Zeuzera pyrina.—Mr. J. Riches, *Cossus ligniperda* and *Zeuzera pyrina* from Hornsey Rise, where both species, and especially the latter, were reported to be common. Dr. T. A.

Chapman gave a note as to how he had observed *Z. pyrina* flying in the daytime. Mr. A. W. Mera recorded an experience of his in finding several specimens of this in a water butt, where they might have been attracted possibly by reflected light.

Dianthœcia luteago var. ficklini.—Mr. W. J. Kaye, *Dianthoecia luteago* var. *ficklini* from North Cornwall. Seven specimens were secured, but all in poor condition.

Cidaria cæsiata.—Mr. A. W. Mera, *Cidaria caesiata* from Kinkardineshire.

Thestor ballus.—Dr. T. A. Chapman, specimens of *Thestor ballus* from Hyères, south of France, taken in March and April, 1904.

Paper.—Mr. A. Bacot read a paper on "Variation and Death in relation to Natural Selection." (Printed in *Transactions*.) Mr. A. W. Mera proposed a hearty vote of thanks to Mr. Bacot for his paper. He himself hesitated to totally accept Natural Selection as the agent for the melanic forms of certain lepidoptera to be found in large towns, *e.g.*, *Pachys betularia* var. *doubledayaria*, and considered that it was possible that contaminated air had a physio-chemical effect in the species. Mr. W. J. Kaye seconded the vote, and also lent some support to Mr. Mera's contention. Mr. G. H. Heath and Mr. W. I. Cox discussed the possibility of the variation of the cell as mentioned by Mr. Bacot. The vote of thanks was put and carried by all present. Mr. Bacot, in replying, alluded to that portion of his paper in which he discussed the possible rapid change of environment to certain species. For instance, oak woods giving place to another kind of timber after some geological change, the effect being, that a species that was on the wing when the leaves were on the trees, suddenly found itself appearing when the leaves of another kind of tree had not yet arrived, or when the leaves were falling. These rapid changes would not give a species time to develop intermediate forms, and was an answer for the scarcity of these.

Nov. 1st, 1904.—Protection of plants.—A letter was read by Mr. S. J. Bell from the South Eastern Union of Scientific Societies asking for co-operation in a scheme for the protection of wild plants. Mr. W. J. Kaye said he thought it was quite impossible to provide any effective measures against depredators. The lepidoptera had been nominally protected, but it was notorious that such species as *Lycaena arion* were persecuted without mercy. Mr. L. B. Prout thought that as a matter of form the Society might be said to be not strong enough in Botanists to be able to give any material aid.

Variation in Luperina testacea.—Mr. W. J. Kaye, a box of *Luperina testacea* from Richmond Park. They were taken by searching the grass with a lantern. Attention was directed to the general dark colour of the race as a whole, and especially to certain extra dark individuals, which had been mistaken when at rest with *Thalera cespitis*, with which, however, the species occurred freely.

Dark aberrations of Synopsia abruptaria.—Mr. H. Harris, a brood of *Synopsia abruptaria*, containing normal and extremely dark chocolate forms.

Eurymus croceus aberration.—Mr. C. P. Pickett, a short series of *Eurymus crocens* (*Colias edusa*), one ♀ in which approached nearly to the aberration *obsoleta*.

Photographs of Ova.—Mr. T. H. L. Grosvenor, on behalf of Mr. A. E. Tonge, some fine photographs of ova and pupæ of *Gortyna micacea*, *Pergesa elpenor*, and *Pergesa porcellus*.

Nov. 15th, 1904.—Aplecta prasina.—Mr. V. Eric Shaw, some *Aplecta prasina*, from the New Forest, taken between June 28th and July 3rd, 1904.

Eurymus croceus, bred.—Mr. J. Riches, *Eurymus croceus*, bred from ova obtained at Eastbourne, in 1904. The eggs hatched on August 15th, and by September 14th the first larvæ were ready to pupate. An imago appeared on October 6th. Later on eleven males and ten females of the var. *helice* (three being rather intermediate), and ten ordinary typical females and three cripples were bred. Four butterflies died in pupa.

Aberration of Xanthorrhoe fluctuata.—Rev. C. R. N. Burrows, an aberration of *Xanthorrhoe fluctuata* with an unusual modification of the band of the forewing.

Gortyna paludis, etc.—Mr. Burrows, extreme forms of *Gortyna paludis*, showing both red and brown forms. *Glaea ligula*, with an ant that had died while fixed to the costa, and *Pyrophila tragopogonis* with the nervures marked out by individuals of *Chelytus venustissimus*, a carnivorous *acarus*.

Polyommatus corydon from different localities.—Mr. C. P. Pickett, *Polyommatus corydon* from Worthing and Lewes. From the former the specimens were bright and varied, while from the latter they were dull and constant. It was mentioned that Dover specimens were also very bright.

Cyaniris argiolus from Worthing.—Mr. Pickett, some fine *Cyaniris argiolus* from Worthing, showing females of the first brood like females of the second.

Agrotis ashworthii.—Mr. G. H. Hamling, *Agrotis ashworthii* bred and caught from Penmenmaur, North Wales.

Aberration of Cosmotriche potatoria.—Mr. G. H. Heath, a specimen of *Cosmotriche potatoria* with the spot above the discoidal mark wanting. The hindwings were also unusually dark.

Bred Eupithecia jasioneata.—Mr. L. B. Prout, a series of *Eupithecia jasioneata*, bred from North Devon, also for comparison a series of *Eupithecia castigata*.

Dec. 6th, 1904.—Annual Meeting.—The Treasurer, Mr. C. P. Pickett, read his annual report, showing a balance in hand of £3 10s. 2d. Mr. W. J. Kaye moved as a amendment that the life membership fund instead of being carried forward year by year be invested without delay in the Post Office, either in the name of the Trustees or, if practicable, in the name of the Society. Mr. L. B. Prout seconded the amendment. Mr. S. J. Bell moved the adoption of the amended report, Mr. C. Nicholson seconded, and the amended report was adopted.

The following were elected as Officers and Council. *President*, Mr. A. W. Mera; *Vice-Presidents*, Dr. T. A. Chapman, Mr. J. A. Clark, Mr. F. J. Hanbury, Mr. L. B. Prout; *Treasurer*, Mr. C. P. Pickett; *Librarians*, Mr. G. H. Heath and Mr. V. Eric Shaw; *Curators*, Mr. W. I. Cox and Mr. T. H. L. Grosvenor; *Secretaries*, Mr. W. J. Kaye (temporarily), Mr. S. J. Bell. As members of *Council*, Mr. A. Bacot,

Rev. C. R. N. Burrows, Mr. A. Harrison, Mr. H. A. Sauzé, and Mr. A. Sich.

Exhibits.—Tapinostola fulva.—Mr. W. J. Kaye, some fine and varied *Tapinostola fulva* from Richmond Park, taken in the middle of September. The species had been very plentiful this year (1904).

Larvæ of Triphæna interjecta.—Mr. Kaye, larvæ of *Triphaena interjecta* that were feeding up slowly on Canterbury Bell.

Synopsia abruptaria.—Mr. C. P. Pickett, *Synopsia abruptaria* bred on December 3rd. The specimens were considerably undersized.

Hepialus sylvinus.—Mr. T. H. Hamling, *Hepialus sylvinus* of exceptionally large size from Hampstead.

Dianthœcia capsincola bred.—Mr. J. Riches, *Dianthoecia capsincola* bred in 1904, from Eastbourne larvæ.

Tripaæna orbona.—Mr. A. Bacot, a remarkably fine aberration of *Triphaena orbona* which had a curious admixture of red and black on the forewing. It had been bred from an Aberdeen strain.

Thera juniperata, etc.—Mr. V. Eric Shaw, *Thera juniperata* from Wilmington, near Bexley, bred between October, 13th and 16th 1904, also some *Aporophyla lutulenta* taken at sugar on September 23rd and 25th.

Votes of thanks to President and Officers during year.—Mr. W. J. Kaye proposed that a vote of thanks be accorded the President for his services during the year, Mr. C. P. Pickett seconded, and the vote was carried with acclamation. In like manner a vote was carried for the Officers on being proposed by Mr. A. W. Mera and seconded by Mr. Montgomery.

New Member elected.—Mr. A. E. Tonge, of Grammar School House, Reigate, was elected a member of the Society.

Secretaries' Report for the Year 1904.

The general position of the affairs of the Society is much the same as last year. The average attendance works out at well over 17 per meeting, and compares with 18 for the year 1903. The small difference is probably easily accounted for by the splendid summer just experienced and the attraction to members of spending the greatest amount of time in the field. It is to be hoped, however, that members will still strive after a higher average than 17, good as it is compared with the records for the past six years. The Society now claims 74 members, an increase of six upon last year's total of 68, so that the prospects for the meetings of 1905 are rosy. Nine new members were elected during the year, to which a set off of three has to be deducted through resignation. The most regrettable, perhaps the only regrettable, thing of the year, has been the diminished size of the Transactions. It is comforting to know that it is not a proof of diminished activity. There have been as many papers read before the Society, but they have not been published in our *Transactions*. In some ways this is a boon, in others detrimental. It is a boon when the publication fund is unequal to the demands it should have normally put upon it, it is detrimental as fewer copies are sold to the public, and the work of the Society is improperly gauged by its publication. It becomes increasingly evident that some members who read papers are not satisfied with the limited publicity afforded by the *Transactions* of the Society. Can anything be done to increase the circulation ?

One of our Curators, Mr. W. Ilston Cox, has very commendably during the year endeavoured to make more known our *Transactions*, and he deserves the thanks of all the members. But it is, to our mind, extremely doubtful if anything can be done except very gradually. A large membership roll is of the first importance. Once that is attained wider publicity is bound to follow, and also, what is almost as important, the financial burden of production on each individual's shoulder becomes correspondingly lighter. It should here be added that the *Transactions* for 1903 appear smaller than they really are, as for some reason best known to the printer the paper is thinner than usual. Such alteration was never sanctioned by either of the Secretaries, nor by the Council, and the matter must be set straight for the next volume, not only for appearance, but also because the thinner paper is of considerably poorer quality than that we have had for the past six years.

Of donations the Society has received from Rev. C. R. N. Burrows *The Moth Book*, by Dr. J. Holland; from Mr. A. W. Mera, back numbers of the *Entomologist's Record* to complete the Library set; and from Mr. W. J. Kaye, a copy of his paper on *The Lepidoptera Rhopalacera of Trinidad*. The Society's collection, however, has experienced a blank year as far as donations are concerned. Without doubt the unsatisfactory position of the cabinet has a great deal to account for this apparent apathy towards one of the Society's assets. That the apathy is only apparent we feel sure, and if it were possible to have the collection bodily moved to the meeting room, both it and the members would greatly benefit. Collections, granted the naming and localising of the specimens are the same, are useful in direct proportion to their size and completeness. In the meantime, therefore, we beg of members to do what they can to fill up the blanks and enlarge the series, and perhaps it may be possible at some future date to effect a much needed removal of the cabinet.

The excursions (or excursion) two or three years ago, were so badly attended that it appeared hardly worth while holding them. It is a great pleasure, therefore, to record that on both occasions during the past summer, the two outings were particularly well attended, and, we believe, a source of pleasure and enjoyment to all. The first was held at Oxshott, and the second on the Clandon Downs, to the former Mr. L. B. Prout acted as leader, and, to the latter, Mr. C. P. Pickett acted as leader.

The Exchange Evening, held on the first meeting in November, again proved a popular fixture, so that we may now regularly look forward to an annual barter of specimens.

Of the general conduct of our meetings and the interest shown in the papers and exhibitions we may all well feel proud. The lectures, papers and communications have been well up to the standard now happily maintained for some years past, and even if we cannot point to all of these in our own *Transactions*, members need have no fear to be ashamed of the year's work, for it compares favourably with any within the life of the Society.

The following programme was carried out during the year 1903-1904 :—

1903, Dec. 1.	Annual Meeting, Presidential Address	Mr. A. W. Mera.
,, ,, 15.	Discussion, "Are the ravages of Lepidopterous larvæ beneficial to the plants they attack." Opened by	Dr. T. A. Chapman, F.Z.S., F.E.S.
1904, Jan. 5.	Pocket Box exhibition of varieties	
,, ,, 19.	Stray Notes on *Venusia Cambrica*	Mr. L. B. Prout, F.Z.S., F.E.S.
,, Feb. 2.	*Geometra papilionaria*	Rev. C. R. N. Burrows.
,, ,, 16.	Notes on *Arctiid* larvæ	Mr. A. Bacot, F.E.S.
,, Mar. 1.	Transparency in Lepidopterous wings	Mr. W. J. Kaye, F.E.S.
,, ,, 15.	Further notes on *Angerona prunaria*	Mr. C. P. Pickett, F.E.S.
,, April 5.	Exhibition and Discussion on *Boarmia repandata*	
,, ,, 19.	An aid to the lepidopterous leaf miners	Mr. A Sich, F.E.S.
,, Oct. 18.	Variation and Death in relation to Natural Selection	Mr. A. Bacot, F.E.S.

W. J. Kaye, S. J. Bell } *Hon. Secs.*

TREASURER'S ACCOUNT, Dec. 1903, to Dec. 1904.

GENERAL FUND.

Dr.	£	s.	d.	*Cr.*	£	s.	d.
To Balance from 1903 ..	1	6	4	By Rent of Room, 31st July, 1903, to 31st July, 1904	12	12	0
,, 48 Subscriptions for 1904 at 7s. 6d.	18	0	0	,, Insurance	0	9	6
,, 3 half-Subscriptions for 1904 at 5s.	0	15	0	,, Attendance	0	10	0
,, 3 Subscriptions for 1904 at 5s.	0	15	0	,, Printing and Stationary	1	15	6
,, 7 Entrance fees for 1904 at 2s. 6d.	0	17	6	,, Postage, etc.	1	5	2
,, 1 Arrears	0	5	0	,, Subscription to Entomologist	0	6	0
				,, 2 years Subscriptions, 1903 and 1904, to S.E. Union of Scientific Societies	0	10	0
				,, Back number of Entomologist and Special Index	0	2	6
				,, Binding 9 vols. of Entomologist	0	18	0
				,, Balance in hand ..	3	10	2
	£21	18	10		£21	18	10

Amount of Subscriptions unpaid .. .. £7 17s. 6d.
,, considered good .. .. .. £5 0s. 0d.

LIFE MEMBERSHIP FUND.

To Subscriptions ..	..£10	0	0	By Balance in hand	..£10	0	0

PUBLICATION FUND.

	£	s.	d.		£	s.	d.
To Balance from 1902 ..	2	10	0	By Printing "Transactions"	9	12	6
,, Donations	7	14	6	,, Balance in hand ..	1	3	0
,, Sale of Copies of "Transactions" ..	0	11	0				
	£10	15	6		£10	15	6

Examined and found correct.

THOS. H D. GROSVENOR
GEO. R. GARLAND. } *Hon. Auditors.*

C. P. PICKETT, *Hon. Treasurer.*
London Institution, 6th December, 1004.

PRESIDENTIAL ADDRESS

By A. W. MERA.

GENTLEMEN,—

The time has again arrived for us to make up our yearly accounts, including as it does a Presidential Address, which occasionally is found to be a somewhat arduous task.

In reviewing our work for the past year, I think I may say we have grounds for congratulation, as our Society has maintained its position as a thoroughly practical Society, and, although there has apparently been no great increase in the number of members at its meetings, there has certainly been no falling off in the general interest of our subject. We have secured some really good papers from those members most capable of doing the Society justice in that direction, and of whose membership we are justly proud.

It is also gratifying to record the entire unanimity in which the Officers of the Society and the Council have invariably worked, and, although I hope none of us would resent reasonable criticism, it is most pleasant to work without discord.

The season of 1904, although better in the matter of weather than the year before, has not I very much doubt, been any better for the lepidopterist. Last year we had to record the decreasing number of many of our rarer species, and this season it has been the total disappearance of many. There seems to have been a complete absence of *Leucania vitellina* from the favoured localities in south Devon, where, in recent years, it has been taken in some numbers, and I have heard of very few *Laphygma exigua* and *Leucania albipuncta* having been taken. Evidently these rarities thrive best in hot and dry seasons, which, after all, is quite what we might expect. But as is generally the case, each year seems favourable to something, and this season has been pre-eminently a *Phryxus livornica* year. The records are too numerous to state here, but it is enough to say that the insect was taken frequently in May and June, and again in the autumn, showing pretty clearly that *P. livornica* can breed and arrive at maturity in this country for one year at least. I believe the last

great "livornica" year was in 1870, when my late friend Mr. T. Sturt took one (now in my cabinet), and saw several at Mount Edgcombe, Cornwall. Another uncertain visitor, although not a rarity, which has been more than usually abundant, is *Herse convolvuli*. This has turned up all over the Kingdom and as far north as Moray. There appears to have been a succession of immigrants of this species, for many were taken in August in a worn condition, and those recorded in September are stated to have been in fine condition.

We are used to the varying numbers of those species we consider to be immigrants, such as *H. convolvuli*, *Colias edusa*, *Colias hyale*, even *Pyrameis cardui* and others, and we attribute their varying numbers year to the influx or otherwise of foreigners; but the same phenomenon is observable, as to the abundance or scarcity, of species which are undoubtedly indigenous and as far as we know are not given to migration. For instance, last year, *Notolophus antiqua* appeared to be unusually abundant, and I have also known a decided *Triphaena pronuba* year, and not to mention *Xylena monoglypha*. *Agrotis exclamationis* and others equally hardy and common, each species being in unusual profusion in different years. It is often difficult to account for the unusual abundance of a certain insect, as however bad the season may be generally, some species thrive when all others are nearly exterminated. I might mention two other interesting captures during the year, one being *Nola centonalis*, at Woodbridge, in a moth trap, and the other being *Nola albulalis*, near Weymouth, which also came to light. The last mentioned species has always been looked upon as confined to N. Kent, but as there is nothing in its foodplant, or the nature of the ground on which it is found to account for it being so local, it may yet be in abundance in other places, although still undiscovered.

Perhaps I may be allowed to depart from the collectors stand point of entomology, and even at the risk of getting out of my depth, enlarge on a few of the thoughts that have come to my mind while breeding larvæ during the season. In the paper I read on *Stauropus fagi*, some few years ago, I ventured some remarks connected with an experiment in breeding that insect. The result of the experiment being, that the larvæ corresponded in colour to artificial environment, which, to my mind seemed to justify the opinion that the similarity to environment could not be brought about by Natural Selection, as the influence of heredity played no part in the result. I was told afterwards by a very prominent scientist that I was perfectly wrong, and in fact the points noticed were simply the essence of Natural Selection. Now, gentlemen, I am going to be bold enough to stick to my colours.

The examples that I have before me now are from the larvæ of *Pachys betularia*. The facts regarding them are well known to most entomologists, although to some it may be new. From the batch of eggs laid this spring from one female I had a large number of larvæ, a portion of which I fed from the commencement on sallow, and these larvæ all assumed a light green colour. A second portion of the same batch I fed on birch from the commencement, and these all assumed a dark brown colour. The other surroundings of the larvæ were similar in each case, both being brought up in glass cylinders. The colour of the larvæ in each case was obviously protective, as they all assimilated to the foodplant to a remarkable degree, the green ones to the leaves and stalks of the sallow, and the brown ones resembling the twigs rather than the leaves of the birch.

When the larvæ were about half grown I removed some of those feeding on sallow to the cylinder containing the birch, but at that period of life the colour had become fixed, and as far as I could discover there was no change whatever, and they remained a pale green to the last.

Another larva, which has come before my notice this year, was a beautiful specimen of *Gonodontis Bidentata*. It had been feeding on a tree covered with lichens, and had assumed a most distinctly variegated form, quite unlike the ordinary form, and assimilating exactly to the lichens which surrounded it, although its food was oak. This of course is a precisely parallel case to the *P. betularia*, only that it was found in a wild state. No one could assume that direct inheritance had anything to do with this decided variety, which was protective to the highest degree, as that form is never found on any trees other than those which are covered with lichens. On page 96 of Darwin's *Origin of Species*, I find his definition of Natural Selection. It runs thus: "But if variations useful to any organic being ever do occur, assuredly individuals thus characterised will have best chance of being preserved in the struggle for life and from the strong principle of inheritance these will tend to produce offspring similarly characterised. This principle of preservation, or the survival of the fittest, I have called Natural Selection."

My contention now is that the "strong principle of inheritance" has played no part in the variation that has occurred in these larvæ, as all the *P. betularia* proceeded from the same parents, and the varieties were produced in direct response to environment. But I am told, in language to me somewhat bewildering, that the power to assimilate has been inherited; but when we admit that, it seems to me that the principle of Natural Selection is very far-fetched, and is not in keeping with the above definition.

If *P. betularia* was the only larva that assimilated to its environment we might perhaps then say that the power had been inherited and had preserved it beyond other lepidopterous larvæ, but to any one who has the least knowledge of larvæ, they must know that remarkably few larvæ are unprotected in one way or another. Among others that come to my mind is the larva of *Cidaria dotata*, which resembles the mid-rib of the currant leaf on which it feeds, frequently resting along the mid-rib, and assuming the colour of the stalk and rib of the leaf, rather than the colour of the leaf itself. Other examples of protection are those of *Phorodesma smaragdaria* and *Phorodesma bajularia*, both of which cover themselves with fragments of their foodplant, which afford a perfect protection. The aim of life is the same, protection from its enemies. I might instance numerous other examples of larvæ resembling their immediate surroundings, such as *Geometaa papilionaria*, which resembles the bud of the birch before and after winter, the larva hybernating on the bare twigs of the birch. As the spring advances and the buds and catkins begin to show signs of green, so the colour of the larva alters with each change of skin, until it finally assumes a beautiful green, corresponding exactly with the young leaves of spring. Then we have a large number of stick like larvæ, perhaps the most perfect being the genera *Ennomos*, these larvæ place their fore legs together to represent a small spine on the twig; but many others are equally perfect in the resemblance to a twig.

But these instances do not help my point further than they go to show that practically all larvæ are protected in some way or another, and in those species of larvæ which are in no way protected in colour or shape to their surroundings, many of them conceal themselves from view, and others appear to be unpalatable to their enemies owing to the hairs which they carry. Hence the whole of the lepidopterous larvæ are protected. Then why should *P. betularia* and *G. bidentata* possess any special attributes of inheritance which the rest of the lepidopterous larvæ do not possess, and yet without those special advantages they are able to hold their own.

My conclusion must be that the similarity of larvæ to their surroundings has come about by a direct response in the nervous system of the insect to assimilate to its surroundings, whether in colour or form, and in most cases I should expect that it has come about very rapidly.

Natural selection as a theory is very fascinating, but when we see larvæ like *P. betularia*, *Gonodontis bidentata*, and others, assuming a totally different aspect in one season to suit their environment, it is obvious that these changes have not arisen from an accidental variety with the influence of inheritance to bring about the result. Furthermore, I have a strong feeling that the rapid growth of the melanic forms of lepidopterous insects in the imago state, in certain districts, has been too great for the action of the natural selection to have produced the result in so short a time. This of course is only a matter of opinion, as anything like definite evidence is difficult to get; but in watching *Taeniocampa opima* in my own district it has appeared to me that during a few years, when the ground on which they are found had been repeatedly burnt, that specimens taken during that time were decidedly darker, to correspond with the ground on which they rested. I believe that it was in 1881 that I first saw *T. opima* from here, and then all that I saw were grey, not very unlike the usual Cheshire specimens. I did not see the insect again until 1892, when they were nearly all decidedly darker, and since that time they have been as nearly black as could be, particularly during the time when the ground was most burnt, and last year and the year before they were undoubtedly somewhat lighter again, as both these seasons have been too moist to have any great amount of burning. This of course is only circumstantial evidence, but to my mind it is strong. And, if my observations are correct, it appears that the changes have been too rapid to be produced by natural selection, as its action must of necessity be very slow. Before dismissing the subject we might revert to the protective methods of *Phorodesma smaragdaria* and *P. bajularia*, which I have already mentioned as covering themselves with their foodplant. This supplies all that natural selection is believed to fulfil, but how are we to attribute it to that cause? I confess I am at a loss to see.

Although it is always conceded that to admit the existence of one mystery in nature will not prove the existence of another, yet I cannot help thinking that as the nature of the influence of heredity is surely past human conception, seeing how in one germ it is possible to transmit disease, physical power, appearance, mental capacity, or otherwise, it is not too much to believe that a beneficient nature produces varieties favourable to their continuance, rather than to believe that the whole fabric of nature has been built up on accidental

varieties, which have been favourable to their well being. It now only remains for me to offer my sincere thanks to all the Officers of the Society for the thorough and business like manner in which they have carried out the duties entrusted to them, and I hope that I may be allowed, without being considered invidious, to particularly mention our Secretaries, Mr. W. J. Kaye and Mr. S. J. Bell. The duties, devolving on these gentlemen are considerable, and, I am sure, I am not only expressing my own feelings, but those of the Society in general, when I say their services are most heartily appreciated.

In conclusion I have again to thank the members of this Society for once more doing me the honour of electing me as their President, and whilst fully realising my many shortcomings, it will be my constant endeavour to promote to the best of my ability the well being and success of our Society.

PAPERS READ BEFORE THE SOCIETY.

ARE THE ATTACKS OF LEPIDOPTEROUS LARVÆ BENEFICIAL TO THE PLANTS THEY ATTACK?

(Read December 15th, 1903, by T. A. CHAPMAN, M.D., F.E.S.)

I give you here a very small bit of bread and a great deal of sack. The small item of novelty I have to report to you seems to me to be, so far as my knowledge goes, a rather isolated phenomenon; and I bring it before you in the form of a question, not with any view to a discussion after the manner of a debating Society, but simply to ask for any further items that may be regarded as tacking my observation on to the great mass of facts to which it is related.

I daresay that on reading the question proposed for discussion, a majority of us would incline at once to answer it in the negative, with perhaps a little contempt towards its being asked. I may best perhaps introduce it, by approaching it in the manner in which I was myself induced to consider it.

During several recent seasons at Cannes, I have found the relation subsisting between *Tortrix unicolorana* and its foodplant *Asphodelus albus* (whether I have correctly (or not) named the Asphodel is for the present an unimportant detail), afforded matter for observation and thought. The plant is very abundant in the Esterel, a wild mountain and forest region, not far from Cannes, and the moth is also very common there, it has been well known for over 70 years, but I have not noticed any record of the precise points I desire to call your attention to. The Asphodel is a tall liliaceous plant, with a flower spike some three or four feet high. The leaves come up first in a little pointed bundle, standing erect to a height of four to six inches or so, as they grow longer they fall apart and display the flower spike in their centre, and finally the leaves, twelve to twenty or more inches long, lie about, flat on the ground if on a bare place, and the spike stands erect.

The winter climate at Cannes is traditionally fine and summer-like, and the first season I was there it was so, and *Colias edusa*, *Argynnis lathonia*, *Pieris daplidice*, etc., were on the wing early in February. But this is really exceptional; as a matter of fact, though warmer than with us, the weather is as varied and uncertain as here, and once I saw six inches of snow quite late in the season, and in two seasons there was ice of many inches in thickness in the Esterel, where water trickled over rocks, and a good inch and a half in pools in the streams. In such seasons butterflies did not show freely till April. It is, therefore, only correct for some seasons to say that in early February the asphodel leaves, little more than an inch or two above the ground, are found to have a larva of *Tortrix unicolorana* burrowing amongst them, and ap-

parently completely wrecking the plant. A little later, however, the leaves are five or six to eight inches high, are fastened together by the larval spinning, and the larva is full grown, or even thinking of pupating, one feels little doubt then that that plant is now done for. A little later, however, the leaves are eight or ten inches high, their ends fastened together, but the flower spikes appear beneath this, and between the lower end of the leaves. The plant has already got on better than could have been expected, but of course the flower spike is hopelessly imprisoned. A little later, however, the leaves have grown, the larval spinning now appears to affect only some inches of their tips, and, indeed, except that the leaves are for this distance fastened together, they seem tolerably healthy and normal. The agglutinated tips, containing the pupa of the moth, or with it protruding after the moth's escape, fall to one side or the other, often not very differently to what those of an unaffected plant do, when amongst other herbage, and the flowering stem ascends in quite a normal manner. The injury done by the larva, which, when the leaves were but short, seemed so extensive and destructive, is now seen to be really of a comparatively trivial character.

In at least two seasons in which there happened to have been rather severe frosts, I noticed that the Asphodel flowers had been much injured, and even destroyed, the damage having been done at a time when the flowering stem was still only a few inches long. The top of the young spike being obviously much more delicate than the leaves, either actually or because at an earlier stage of growth, the leaves rarely suffered. I also noticed that the plants affected by *Tortrix unicolorana* escaped this damage almost completely. I was inclined at first to ascribe this to these plants having been later and not exposed to the frost, the loss of vigour, owing to the larval attack, having delayed their development. Further consideration, however, after examining a number of the plants, made me doubt their being materially later, and led to the conclusion that the protection from frost enjoyed by the affected plants was obtained by the tips of the leaves having been fastened together, and so retained over the young flower stem to a late period, forming an effective screen against frost, in precisely the same way as our gardeners protect broccoli and other similar plants. An unattacked plant has the flower stem freely exposed very soon after it appears above ground. One with the leaves fastened together by *T. unicolorana* does not free the spike till it is six or eight inches long, or even considerably more, and, at one stage of the process, one would suppose on examining the plant that it could not free itself at all.

I have little doubt that this is the manner in which the attack of *T. unicolorana* protects the blossom of Asphodel from frost, but at any rate it does protect it in this or some other way. Out of the few times I have visited Cannes, it certainly afforded this protection in two seasons, so that it cannot be at all an exceptional matter for the plant to be thus materially benefitted by this insect.

Whether the absence of frost at the Ile St. Marguerite, and to to a great degree, I imagine, at Hyères, and the consequent want of this relation between the plant and the insect, accounts for the moth being absent from these habitats, I can do no more than speculate. It is replaced at Hyères by an allied species that appears later: I have

had no opportunity of observing it, or how its relation to the foodplant differs from that of *T. unicolorana*.

These observations led me to query how far our general idea that lepidopterous larvæ are always simply injurious to their foodplants was a true one, and how far it was merely a confession of ignorance. When one organism lives upon another, whether they be both animals or plants, or one of each, a certain settled relative abundance of the two usually exist, which we often refer to as the "balance of nature." It will perhaps be simplest to call two such related organisms host and guest, though we might call the predaceous individual, a parasite, a carnivore, or various other names, but in fact the relations are so various that only very general terms, such perhaps as host and guest, will be applicable in all cases, a caterpillar eating a leaf, a lion devouring a bullock, a bacillus causing disease, a man reaping wheat, &c., are difficult to bring into one simple definition. If such a relation be suddenly established, no "balance of nature" has been set up, and it is very possible that the guest may very rapidly exterminate the host. Man has much to answer for in this way, both in his own proper person, and also by introducing European animals into limited localities such as oceanic islands. If time, however, can be obtained for relative adjustment, then the host will probably be able to preserve his existence. This condition is established in practically all the cases we are considering. There are probably many ways of establishing such a balance, but these occur to me as being perhaps the most important.

A very common one arises out of the fact that the guest in one relation is the host in another, and this would settle all difficulties if there always were the lesser fleas, and if these went on according to the rhyme *ad infinitum*. This view of the matter reminds us that to say host and guest, as if we had only two individuals to deal with, gives us no true picture of the complicated relationship of great multitudes of organisms, all more or less interdependent, sometimes as hosts sometimes as guests. Luckily it is not necessary to further consider this aspect of the question before us. The second method of adjustment between the host and guest, is by the host developing various protective devices, and the third is by making the attack useful instead of injurious, and even inviting it. Of the protective devices, cryptic arrangements, a hard or spiny covering and others do not, I think, probably come into the items we may profitably consider. The one that is most related to lepidopterous larvæ, is the modification by which a plant becomes more or less unpalatable to its guest. This is, I think, a device of much greater frequency than we commonly suppose, and is in a way related to our subject. Few larva hunters can have failed to notice in many cases that a healthy vigorous plant is not nearly so usually attacked by larvæ as one that is more or less out of sorts, a plant not thriving from some inherent individual weakness, or because it has been injured, or very frequently a more or less isolated plant which is battling against conditions to which its fellows have succumbed or have not dared to face. This being so it is clear that a healthy normal plant has some quality by which it escapes the attacks of the guest. And we may further conclude that the guest benefits not the plant it attacks, but the species to which it belongs, by clearing off weaklings and so leaving the race stronger, just as the

lion is supposed to maintain the vigour and stamina of the antelope by making prey of those that are in some way below concert pitch, whether in intelligence, senses, activity, strength, endurance, or what not.

It seems very likely, if this hypothesis of a healthy plant being unattractive to its lepidopterous enemies be sound, that some failures we meet with in rearing them, may be due to our falling into the very natural and almost inevitable error, of selecting for our flocks, what we think to be very good, fine, and nourishing material.

I satisfied myself many years ago that such destructive beetles as *Hylurgus piniperda* and *Scolytus destructor* are quite harmless to healthy trees, attacking usually fallen ones, and of standing timber only such trees as have been damaged in health in some way. Once I saw some elm trees attacked that had suffered from a severe drought, possibly assisted by a circumstance that rarely occurs and makes the only exception to the general law of their harmlessness to healthy trees. When a large quantity of fallen timber is collected together, as at the timber yard of a railway station, the beetles may appear in immense swarms, and eating into the bark in great numbers to feed themselves, may so weaken the trees as to enable some to successfully oviposit. This, however, certainly is a rare occurrence.

Again, returning to Cannes for an illustration, I have several times noticed that *Cnethocampa pityocampa* had strongly attacked certain trees to the neglect of others. On one occasion I found two young trees, one of which had some thirty batches of eggs laid on it, and the other nearly as many, whilst all round were hundreds of apparently similar trees without one, and it is very usual with small trees, and even with large ones, to see a good many nests of the larva in one tree and few if any on those near. At Locarno, I once found a tree some twelve or fifteen feet high that had had a number of nests of the larva the previous autumn, so that when I saw it in April it was without a leaf, and the damage so done enabled a weevil (*Pissodes notatus* I think) so to attack it, that its death was certain ; whatever was the inherent peculiarity of this tree that made the moth approve of it, it certainly led to its destruction, a consequence that tended to the elimination of that peculiarity from the race of pines in that locality. If we may assume that the peculiarity amounted to an aberration broadly undesirable for the well being of the race, then we may also assume that the attack of the processionary moth was beneficial.

Such benefit as this, whatever it amounts to, is of a very different character from that that leads the host to invite the attack of the guest, because of a very direct and definite advantage. This is such a widely known agency that I almost fear to touch on it, lest you accuse me of telling a thrice-told tale. Still, as this is the form of relationship that I think exists in the case of the Asphodel and *Tortrix unicolorana*, and which, I suggest, may exist in the case of many other lepidopterous larvæ, if we only fully understood them, I must make some references to it. Probably, most cases of Symbiosis are examples of this relationship that have reached their full development. As such a case I may instance the nitrogen fixing bacilli of the *Leguminosae*.

It is difficult from one point of view to believe that lepidopterous larvæ can fall quite outside the action of this relationship, when we

remember how its action has effected the aspect of life on our planet more than any other force of the same order. The whole of our flowering plants, and a very large number of our insects, owe their existence to the way in which plants found it profitable to encourage the visits of insects desirous of robbing them, first of their pollen, but now chiefly of their honey.

Many plants again found that animals feeding on their seeds were useful as disseminating them, and grew more and more suitable seeds accordingly. They found also that by attracting them, not to the seeds but to surrounding pulp, etc., the services were more cheaply obtained. Hence originated fruits as distinguished from seed-vessels. Many animals thus became professional agriculturists and horticulturists, without, however, of course, having any consciousness of what they were really doing. When man, however, who had no doubt been employed in this manner for ages, acquired the final human characteristic of conscious reason, he began the definite process, by which both he, and the animals and plants on which he preys, have so largely profited, and which results in the latter, and especially the cereals and the ruminants, occupying such a disproportionately large share of the earth's surface.

There are many other forms of this beneficial inter-relationship, of which I may refer to one, as being that of a moth, *viz.*, the Yucca moth, whose life history and economy has been so well worked out by Riley. The benefit conferred by the moth is in fertilising the flowers, not apparently as a secondary result of a desire to feed herself, but of set purpose, as if she knew what she was doing. This appears especially to be so, since the Yucca is practically never fertilised in any other way, and yet, since her larvæ feed on the seeds, they would have no food unless she carefully attended to the fertilisation of the plant. I may say that this moth is one I have often wished I could have an opportunity of observing, since it is an Adelid, yet more strongly reminds one of Eriocraniids in some respects, and as regards its pollen collecting habit, recalls very definitely the procedure of Micropteryx, in eating the pollen of the flowers it visits. Since its host the Yucca is rather low amongst the flowering plants, we may have here, preserved and specialised, one of the earlier stages in the combined evolution of moth and flowering plants, beginning with what we still have a (no doubt modified) representative of, *viz.*, the Micropteryx in a *Carex* or *Luzula*.

As regards the *Tortrix unicolorana*, I have suggested already that where the attack would not be beneficial to the Asphodel the plant had some means of repelling the attack and so won freedom from it. This is merely another way of saying that when the attack is beneficial, the plant is in some way able to invite it. How, it is difficult to suggest.

Reflecting how accidental was my appreciation of this relationship between the plant and the caterpillar, and of what an unusual nature the benefit conferred on the plant is, and what many conceivable forms such benefits may take, it does not seem quixotic to assume that there are probably a good many other such cases still waiting to be observed and understood, possibly some others are already known, though I have not heard of them, or if I have, have forgotten them.

VENUSIA CAMBRICA AND ITS ALLIES.

(Read January 19th, by LOUIS B. PROUT, F.E.S.)

My personal knowledge of the species which I have chosen for my subject this evening—or at any rate my knowledge of it in its native haunts—is of the very slenderest, it only having once been my pleasure to come across it, and on that occasion I found only one single specimen. When I was at Forres in August, 1902, not being generally overburdened with setting—on account of the absolute failure of "sugar"—I not infrequently found myself with an hour to spare in the afternoon, a time of day usually reserved by me for setting, and would fill it up with an easy stroll in the vicinity of the town. It was when so occupied, on the afternoon of August 12th, that I had my first, and thus far my only interview, with the pretty little "Welsh Wave." It was sitting on a pinetrunk (a little to the south of Forres) with wings outspread and looked very conspicuous; I need hardly add that there was plenty of the only known foodplant, *Pyrus aucuparia*, in the immediate vicinity. All I learned of its habits—if I may be said to have learned *anything* from a single specimen—was that it is no less shy than most of its trunk-resting congeners, and it darted off directly I approached with a view to boxing it—I had no net with me. However, it only flew quite a short distance and then seemed to tire and fluttered down into mixed herbage close to the ground, where I succeeded in securing it. It was a male, and decidedly worn, as might be expected at such a late date; and of course it was really of no use, though I was none the less interested to meet with it.

But it is by no means because of this single encounter that I wish to discuss *Venusia cambrica* this evening. It is a species which has possessed unusual interest for me ever since I commenced my study of the genus *Epirrita* (*Oporabia*) some years ago. In spite of a great difference in size, there is really a good deal of resemblance between *Venusia cambrica* and *Epirrita dilutata*, and this does not seem to be *entirely* superficial. At any rate Packard, the pioneer worker amongst North American *Geometrides*, places *cambrica* in the genus *Epirrita* alongside *dilutata* (*Monograph*, pp. 83, *seq.*) He remarks, "It is singular how constantly *E. cambricaria* has been separated generically from *E. dilutata*; though, according to Lederer*, it was regarded by Standfuss as a variety of *E. dilutata*. Why Curtis separated it from '*Oporabia*' does not seem to be plain, as he remarks that 'it is doubtful whether it may not be necessary to remove *Oporabia*† to the genus before us.' He then compares *E.* (his *Venusia*) *cambrica* with *E. dilutata* and *E. multistrigaria*. *E. cambrica* is so close to *E. dilutata* that I had

* It is Freyer, not Lederer, who publishes this statement. (*Neuere Beiträge*, vi., p. 106.)—L. B. P.

† Packard slightly misquotes (see *infra*); Curtis was not quite sueh a muddler as to propose removing an old genus bodily into a new one; he only doubts whether his *least typical* member of *Oporabia* (*multistrigaria*, Haw.), may not have to be removed to *Venusia*.—L. B. P.

regarded it as a variety of that species and referred to it under that name in Hayden's Report for 1874." Meyrick, too, in his revisions, makes *Venusia* come very near his *Asthena*, which embraces *dilutata* and *filigrammaria*, as well as the true *Asthena*, *A. candidata*. It was the work of these authors, and the above-quoted allusion of Curtis himself, which aroused my interest in the affinities of *Venusia cambrica* and made me want to see the egg and newly-hatched larvæ—*Epirrita* (*Oporabia*) and its real ally *Operophthera* (*Cheimatobia*)making such a very compact and readily recognisable group in these stages. I appealed to two or three friends for help, and they were all sure they would be able to obtain me ova, but from some cause or another they all failed me for some years, and in 1902 I found myself still in a condition of "hope deferred." Reading Mr. L. S. Brady's interesting note on the "Abundance of *Venusia cambrica*" near Doncaster, in 1902 (*Ent. Rec.*, xiv., p. 305), I decided to solicit help in this new quarter. I wrote to him explaining my object, and my past disappointments, and he responded most cordially, promising that I should be supplied with the ova even if it neccessitated his making a bicycle-run to his collecting-ground every day while the species were out. On July 12th, 1903, he obtained the first female, which happened to be of the interesting melanic form, and he most kindly sacrificed it for ova on my behalf. As a result he was able to send me fifteen eggs on July 15th, and he still promised to try for further females. The next Saturday, July 18th (the day on which I started for my summer holiday in N. Devon), he took two more, and these he posted alive to my Devon address: each laid me a few eggs, but it does not seem to be a very fecund species.

Having no microscope with me, and having also plenty of other occupations on hand, I did not do so much good with my material as, I suppose you will say, I ought to have done, but I abundantly satisfied myself that *cambrica* is not an *Epirrita*, though I should not like to say that there is not a good deal of relationship between the genera. Of course I had a look at the first lot of ova with the microscope before I left home.

Ova*.—They are laid flat, on the upper side of the leaves of mountain ash, singly or (by chance) two or three close together, generally near the midrib. They are moderately large for the size of the moth, of a pretty regular oval, but depth (as usual) less than breadth, and with a very slight tendency to flattening at one end. They are rather smooth, but there is a distinct sculpturing discernible with a microscope, and this sculpturing struck me as rather peculiar; on the sides it looked pretty regularly *triangular*, the conspicuous series of grooves being three in number, two of the series cutting one another at right angles, the third at the diagonal; in places the clusters of six of these tiny triangles would tend to group themselves into a normal, though of course intersected, hexagon, I suppose through a deepening of the grooves around the hexagon; but in other places this effect was hardly noticeable at all; on the upper side one of the three series was more inconspicuous, resulting in rather the effect of a more diamond-shaped type of sculpturing. I could not find

* Besides Newman's (*Brit. Moths*, p. 76), the only original account known to me of the early stages is Hoffmann's (*Stett. Ent. Zeit.*, xlviii., p. 147); see also Buckler's *Larvae*, vol. vii., pl. cxvi., fig. 7, 7*a*, 7*b*, where three forms of the larva are figured.

the micropyle. The usual sinking in of the upper side takes place as the development of the larva proceeds. When first laid, the eggs are, if I remember aright, of an extremely pale green, but I seem to have carelessly omitted to make any exact note on the point; certainly after a day or two they are of a decided, though still light, green, and somewhat glistening*. The upper surface, as it becomes depressed, also becomes greyer in colour, and the last day or two before hatching there is a reddish spot here. The egg has no stage corresponding to the red winter-stage of the *Epirrita* or *Operophthora* group. The duration of the oval period is about ten to twelve days.

Larva.—I fear my stray notes are here of no value. When first hatched it its fairly stout in proportion to its length, pale greenish-yellow with the head browner, and bears no resemblance—at least superficially—to that of *E. dilutata* or *autumnata*. It grows rapidly under normal conditions, though a friend of mine had some larvæ hang back unaccountably. All of mine were fullfed in just about four weeks from hatching. Like so many of the Larentiids, they have only three ecdyses†, and these divide up the larval life into four almost exactly equal periods, each change being indicated in my diary as taking place just, or just about, a week from the preceding. In *Epirrita* there are invariably four ecdyses. In the second instar‡, *Venusia cambrica* is still without any distinct markings, but is bluer-green dorsally than elsewhere (no clear demarcation, however) and has an ill-defined dark bluish-grey dorsal blotch at the anal end. I noted the segmental incisions as rather dark and the segments as swollen laterally. In the fourth instar the shape and proportions are still much the same, *i.e.*, moderate thickness, segments somewhat swollen laterally, incisions deep. The head is shining light-brown, the body about the colour of *Operophthera brumata* larva in its normal forms. The dorsal area is bluish-green, subdorsal lines and segment-incisions greenish-yellow; to the subdorsal follows another line of bluish-green, below which the lateral area (which is slightly rugose) is mainly green-yellow or yellow-green, but somewhat mottled. There is a thick irregular purple-red line on the sides of the thoracic segments just above the legs, and again in a similar position on abdominal segments 2-4, and a spot of the same colour on the side of the anterior prolegs; some specimens have further three red dots above the red line on abdominals 2-4§. The larva makes a loose cocoon on or near the surface of the earth, in which to pupate; Newman's larva, which pupated among leaves, must, I think, have been quite abnormal; at any rate, I have a friend who found they would sulk and die when not provided with earth, rather

* Hoffmann (*loc. cit.*) describes them as unicolorous whitish-green.

† Hoffmann (*loc. cit.*) evidently overlooked one moult, as he only indicates *two*.

‡ This, I think, must be the stadium overlooked by Hoffmann.

§ Hoffmann (*loc. cit.*) gives a fairly full description of the adult larva which adds some details not recorded by me. Buckler's figures (*loc. cit.*) show three varieties: fig. 7 brightish green, with lateral blotches on meso- and metathorax, and on 2nd and 3rd abdominals (posteriorly), and 4th abdominal (irregular), and dorsal double dashes on the posterior halves of abdominals 2nd and 3rd, and anterior half of 4; fig. 7a is slightly paler, especially posteriorly, where the tint is yellower, has less blotches on its thoracic segments, those on abdominal 2 formed into a narrow transverse belt, the lateral ones on abdominals 3-4 extended and run into one: fig. 7b is very pale, with much of the lateral area reddish-blotched, and a rather narrow dorsal reddish band from metathorax to front half of abdominal 4.

than content themselves with leaves. Hoffmann's experience also supports mine as regards the puparium. The hibernating Geometrid pupæ which do not go to earth are not to be sought among the Larentiids, but rather among Acidaliids (*Cyclophora* = *Zonosoma*) and a few Boarmiids.

Pupa.—The pupa is not at all unlike those of *Epirrita* or *Operophthera*. It is rather stout, reaching its greatest girth at the extremity of the wing-cases, then tapering off rather rapidly to the tail. The eyes are rather prominent. The colour of the abdominal parts is reddish-brown; I cannot possibly describe it as "light yellowish-brown," as Hoffmann says it is (*loc. cit.*), and suppose it must either be variable or he must have described it before the colour was quite thoroughly set. The wing-cases, as he says, are yellowish-green, the head and the thorax are somewhat intermediate between the two colours, the wing-cases shade off more yellow at their outer extremities.

Systematic Position, etc.—*Venusia cambrica*, both as genus and species, was first made known to science so comparatively recently as 1839, by our fellow-countryman John Curtis (*Brit. Ent.*, xvi., fol. 759). It is of course always possible that some as yet unidentified description of an older author may turn out to be referable to it, especially as it is a widely-distributed species, but at present I have no knowledge or suspicion of anything of the kind. Curtis defines his genus thus: "*Antennae* inserted close to the eyes, on each side of the crown, rather short, setaceous, scaly and bipectinated in the male, the rays close, short, clavate and ciliated, becoming very short towards, and vanishing at the apex. *Maxillae* spiral, not so long apparently as the antennæ. *Palpi* very short, not projecting beyond the head, nearly horizontal, slightly curved and scaly, triarticulate? *Head* small, subglobose, densely clothed with close scales; *eyes* moderate, oval. *Thorax* subglobose. *Abdomen* somewhat linear, the apex a little tufted in the male. *Wings* probably forming a triangle in repose; *superior*, subtrigonate-ovate; *inferior*, trigonate-ovate; *cilia* shortish. *Legs* rather long and slender; *thigh* rather long; *tibiae*, anterior short, with an internal spine, the others long and slender, with a pair of short spurs at the apex, the hinder the longest, with a pair also a little above the apex; *tarsi* five-jointed, basal joint the longest; *claws* and *pulvilli* minute." He gives good figures of the ♂ imago—the only specimen he has seen, taken at Hafod in Cardigan, and given to J. C. Dale by Mr. House, of Clifton. Of the antennæ, head, and hind legs; he adds: "This pretty moth appears to be so nearly related to the genus *Zerynthia* (pl. 296)*, that I should not have given a figure and description of it here, had it not been an undescribed and very interesting species, from the approach which it makes to *Oporabia multistrigaria*† ; indeed, I should have included it in that genus, but it is doubtful whether it may not be necessary to remove the *Oporabia*‡ to the genus before us; the antennæ are similar, but the wings have not the contour and texture of the type of *Oporabia* which those of *O.*

* Type *didymata*, L., but embracing also *Coremia*, Gn.; in fact virtually coextensive with *Coremia*, *Dup. Cat.*, *Dbld. edn.* 1, Barrett, *Lep. Brit.*, viii., p. 141.

† Curtis is alone in placing *multistrigaria*, Haw., in *Oporabia*; it is of course the insect we know as *Larentia multistrigaria*.

‡ That is, of course, *multistrigaria*; Packard, by missing the word "the" in his quotation (given above) has missed the sense (*vide supra*).

multistrigaria have; this last species has been included by the author of the *Illustrations** in the genus *Larentia* (*Eubolia*, *Brit. Ent.*, pl. 707), with which it cannot be naturally associated†.

"*Oporabia dilutata* is characterised by very ample superior, and rather elongated and narrow inferior wings, and the masculine antennæ bipectinated, the rays short."

"*O. multistrigaria* has less ample, but similarly formed, wings, with the masculine antennæ bipectinated, the rays short."

"*Venusia cambrica* has more compact wings, formed like those of *Zerynthia*, but the markings bear a greater resemblance to *Oporabia* or *Lobophora* (pl. 81). It is possible that the discovery of the female might lead to the settling of its affinities, but that sex is at present unknown."

The genus *Venusia* has since been re-characterised by Guenée, Meyrick, Hampson, Hulst, Barrett, and perhaps one or two others; but I do not know that any German systematist has yet recognised its distinctness from one or another of its generic allies. A historical sketch will show how much uncertainty has prevailed in regard to its exact position and affinities. Only about seven months after Curtis had erected the species, and evidently before the last parts of his work became known in France, Boisduval (*Gen. et Ind. Meth.*, p. 203) redescribed it as *erutaria*. He placed it in his comprehensive genus *Eubolia*, which embraces nearly all the Larentiids that have pectinated antennæ; it falls into his sixth division, "alæ fasciato-nebulosæ," and is placed next to *scabraria* (*didymata*, L.), so that he too, like Curtis, recognised some sort of affinity between these two‡. Two years later Duponchel, in his *Supplement* (tom. iv., pl. 54, fig. 4), figures our species under Boisduval's name (*Eubolia erutaria*); but in his *Catalogue Méthodique*" in 1845§, where he makes further divisions, it is transferred to his new genus *Eusebia* (*Cat. Méth.*, p. 249), a move of no great importance, as the two genera are none too sharply defined, and *cambrica* does not agree with the characters of either. The type of *Eusebia* is, I believe, *bipunctaria*, Schiff.

In 1848 Freyer (*Neu. Beitr.*, vi., pl. 528, fig. 5) again added to the synonymy, giving us *Acidalia nebulosaria* as a supposed new species, allied to "*Acidalia*" (*Lobophora*) *halterata* and *carpinata*, and in the same year the father of modern imaginal classification, Herrich-Schäffer (*Syst. Bearb.*, iii., p. 111), placed it under Boisduval's specific name of *erutaria*, along with *candidata*, *sylvata*, *luteata*, *heparata*, and *pulchraria* (*blomeri*), in his genus *Hydrelia*‖, under the family *Phytome-*

* J. F. Stephens, *Illustrations of British Entomology*, *Haustellata*.

† Stephens' genus *Larentia* comprises four species, *clavaria* (=*cervinaria*), *chenopodiata* (=*limitata*), *bipunctaria* and *multistrigaria*; he admits (iii., p. 212), that the last is somewhat aberrant, but attacks Curtis' association of it with *Oporabia*.

‡ In later times Aurivillius (*Nord. Fjär.*, p. 224) has placed it next to, and compared it with, *didymata*; like Lederer and Staudinger, he does not separate it generically from *Cidaria*.

§ The title page bears date 1844, and the paper cover 1846, but the work was actually issued about September, 1845; *vide Bibl. France*, September 20th, 1845, p. 490, *Erichs. Bericht* for 1845, p. 275.

‖ *Hydrelia*, Hb., *Verz.*, p. 322, was erected for *sylvata*, Schiff.=*testaceata*, Don.; sole species and, therefore, type. In his earlier, and now little-consulted working out (*Deutsch. Ins.*, p. 106, 1840), Herrich-Schäffer wrongly called this genus *Acidalia*, but he was then unacquainted with *cambrica* and *blomeri*.

tridae—known to modern authors as *Larentiidae* or *Hydriomenidae*. Since that time increasing intercourse between entomologists of different nationalities has enabled workers to unite these names, *cambrica*, *crutaria*, and *nebulosaria*: and although Doubleday, in his first *Synonymic List*, in 1849 (p. 17), wrongly gave precedence to Boisduval's name, everyone, from Lederer onwards, has consented to abide by the law of priority, and to call the species *cambrica*, Curt.—amended to *cambricaria* by those pedants who thought the Linnean Geometrid termination inviolable. Lederer, in 1853 (*Die Spanner*), merges Herrich-Schäffer's *Hydrelia* in his great genus *Cidaria*, but admits irregularities in neuration, and confesses he has no first-hand knowledge of the particular species, *cambrica*. Guenée, in 1857, removes the little *Hydrelia* group back to the vicinity of *Acidalia* (*Acidalidae*, Gn.), where it had been placed by the old authors on account of the wing-pattern; but he does not give any valid reasons for this retrograde move. The neuration and the early stages are distinctly not Acidaliid. He makes three genera, as is well known to our British workers, who have long been accustomed to his system, *viz.*, *Asthena*, Hb., Stph. restr.*, *Eupisteria*, Bdv., Gn. restr.†, and *Venusia*, Curt. He admits that the last-named is difficult to locate, and has decided Larentiid affinities. Walker, in his British Museum lists, adopted Guenée's Geometrid genera, including, of course, *Venusia* for *cambrica*: but in his own inimitably bungling way, he made a New York specimen, given to the museum by Edward Doubleday, the type of a new species, *Tephrosia* (!!) *scitularia* (*List*, xxi., p. 406, 1860), and erected a near North American ally as *Tephrosia comptaria* (*loc. cit.*). Two other of his species are also cited under *Venusia* by Hulst, *viz.*, *Melanthia condensata* (*List*, xxiv. [not xxv., as given by Hulst.], p. 1273), and *Cidaria inclinataria* (*List*, xxvi., p. 1727). The former seems to be an aberration of the species known as *lucata*, Gn., and this species is, at least superficially, a *Hydrelia* (close to *testaceata*, Don.=*sylvata*, Hb., as Guenée already remarks) rather than a *Venusia*. The latter (*inclinataria*), according to the type specimen, is a synonym of *ferrugata*, Cl., Linn., and thus has nothing to do with the genus before us. Walker's description was so atrociously bad that Hulst cannot be blamed for having entirely mistaken its identity, although one learns that he discovered the truth on his subsequent visit to England. (*Ent. News*, vi., p. 70.)

The elucidation of the generic affinities of *V. cambrica* and near allies in the imaginal stage must, as I have already indicated, be sought out in the writings of Herrich-Schäffer, Guenée, Packard, Meyrick, and Hampson, though Herrich-Schäffer and Packard fail to recognise it as a genotype. Herrich-Schäffer (*Syst. Bearb*, iii., p. 110) defined his genus *Hydrelia* thus: "Small geometers, with small hindwings, angled in vein 4 (in *cambrica* and *testaceata* very indistinctly), simply ciliated ♂ antennæ, in *cambrica* pectinated, hind tibiæ in both sexes with four strong spurs, and wings marked with double or triple

* This has page-priority over *Hyaralia*, Hb., but it was a "mixed genus," and it is a pity that Herrich-Schäffer's usage was upset, especially as Hampson will make *Acidalia nemoraria* the type of *Asthena*.

† This restriction is almost certainly wrong. I believe *famula*, Esp., is the type of *Eupisteria*, Bdv.; in any case, *Euchoeca*, Hb., is the prior generic name for *obliterata*, Hfn., and is employed by Meyrick.

transverse lines (in *obliterata* only distinct beneath), in addition to which, however, they have the so-called half transverse line next the base. Frons broader than the diameter of the eyes; palpi not visible from above, weakly scaled, with moderately distinct joints; tongue strong, antennæ of ♂ with distinctly marked joints, simply ciliated. Hind tibiæ about $\frac{1}{3}$ longer than femora, with long protecting spurs, the median ones at $\frac{2}{3}$. Forewings: vein 6 arises from the angle between cell and areole, or even from the areole; 7 from the apex of areole at at a point with 8 and 11; 9 and 10 arise out of 8, sometimes also 11 (*candidata*), in *obliterata* 6 arises out of areole, 7 from its apex, 8 from ditto, 9, 10, and 11 from 7, in *testaceata* 11 separately from the areole, thus quite as in *Minoa murinata*, only that the areole is not double. Hindwings: 5 exactly between 4 and 6, 6 and 7 *on long stalk*. It will thus be seen that Herrich-Schaffer admitted *cambrica* to be an aberrant member of the genus, both in respect of the shape of the hindwing and the pectination of the ♂ antennæ. It should further be noted that he says on p. 711, under this particular species (*erutaria*, H.S., *cambrica*, Curt.), that "the simple areole of the forewing speaks against its union with *Lobophora* or *Larentia**, also the rest of the neuration fits into the present genus, namely 6 and 7 separately from the areole, 8 and 11 out of 7, the latter (11) near its origin, 9 and 10 one after the other out of 8. Neuration of hindwing quite as in *Cheimatobia*." Apparently at one time he thought of placing *cambrica* in *Lobophora*, and by an oversight he has omitted to delete the reference; for we find under that genus (p. 178), in speaking of the female antennæ, "in *cambrica* pectinated."

Guenée adds little of critical value, and his diagnosis of *Venusia* need not be quoted; he knows no other species besides *cambrica*, and his grounds for removing it from *Asthena* (*Hydrelia*, H.S.) are that "the antennæ, the form of the frons, the neuration, the pattern of the wings manifestly distinguish it." He does not say what is the neurational distinction, nor does he even indicate the neuration of his *Asthena*: but under *Venusia* he mentions that the areole is simple† and that veins 7, 8, 9, and 10 arise from a common stalk.

Packard, as we have seen, boldly unites *cambrica* with *dilutata* under Hübner's "Tentamen" name of *Epirrita*, which belongs to the latter. Apparently he is unwise enough to diagnose the genus from *cambrica*, the neuration of the forewing of which is figured at plate 1, fig. 4; and he does not notice that the areole of *dilutata* is double‡, for he gives the fact that "there is but one subcostal cell" as a generic distinction from *Glaucopteryx*. He makes much of the bulging, rounded frons, using it even in his *Synopsis of the Genera* on p. 46§;

* This a curious assertion, as Herrich-Schäffer allows *sexalata* (genus *Mysticoptera*, Meyr.) a place in the genus *Lobophora* and places several of the members of Meyrick's *Plemyria* in *Larentia*; yet these, too, have the areole simple.

† This separates it from *candidata*, which Guenée shows as the "type" of *Asthena*, but others of his *Asthenae* have the areole double (genus *Enchoeca* of Meyrick, *Hydrelia* of Hampson).

‡ A figure of the neuration of the costal part of the forewing of *Epirrita* (*Oporabia*) *dilutata* will be found in Poppius' *Finlands Phytometridae*, Tab. xiii., No. 130 (*Act. Soc. F. F. Fenn.*, viii., No. 3).

§ Snellen also alludes to this in his interesting article, "Aanteckening over *Cidaria procellata*, Wien. Verz.," in *Tijd. Ent.*, xxxii., pp. 207 *et seq.*, where he further touches on its palpi and neuration, but does not advocate a generic separation, being averse to a multiplication of genera.

he also makes a point of the feeble, slender palpi, and I think he is the first to draw attention to the oblique placing of the outer margin of the cell, a character which becomes further intensified in the (probably allied) Indian genus *Discoloxia*, Warr. The rest of the contents of Packard's genus *Epirrita* are *E. perlineata*, Pack., and *E. 12-lineata*, Pack., the former of which is wrongly sunk, in the British Museum Collection, to *lucata*, Gn. (a *Euchoeca*, on Hulst's system—Dyar, *List N. Amer. Lep.*, p. 275, No. 3,335), while Hulst sinks it, instead, to *Venusia comptaria*, Walk., which looks to me more of a true *Venusia*, and rightly supersedes both these species of Packard's and come nearer to *cambrica* than to *dilutata*, *12-lineata*: none of the three have really pectinated ♂ antennæ, nor, I think, the broad frons, and Meyrick will place them all in *Euchoeca*, not *Venusia*.

The next noteworthy contribution to the classification was that of Meyrick. In his well-known paper (*Trans. Ent. Soc. Lond.*, 1892, p. 75), he releases *cambrica* from the company of all its Holarctic allies known to him, and re-diagnoses *Venusia*, Curt., in such a way as to differentiate it definitely (by neuration, etc.) from the neighbouring genera *Asthena*, *Euchoeca*, etc. *Asthena* is reserved for species with the areole double; it is described (p. 74) as "a genus of a few scattered species," and seems a very unhappy one, its European representatives being given as *dilutata*, Schiff., *filigrammaria*, H-S., (*autumnata*, Bkh.), *murinata*, Scop., *candidata*, Schiff., *nymphulata*, Gn.; but it serves a useful purpose in correcting Packard's confusion of *dilutata* with *cambrica*, and restoring currency to Curtis's generic name for the latter. *Euchoeca* contains the rest of Herrich-Schäffer's *Hydreliae* (excepting *cambrica*), and has the areole simple, as in *Venusia*: it comes very near this latter, the only differential characters indicated being in the palpi—"porrected, slender" in *Venusia*—and in the ♂ antennæ—"shortly ciliated" in *Euchoeca*, "bipectinated, apex simple" in *Venusia*. Of the latter genus, as here restricted, Meyrick only knows four species, *cambrica*, Curt., *verriculata*, Feld., *xanthaspis*, Meyr., *undosata*, Feld.; the three last-named are New Zealand species, and were made the types of three separate genera in Meyrick's earlier works (*N. Z. Journ. Sci.*, i., pp. 526, 527; *Trans. N. Z. Inst.*, xviii., p. 184), but their author came to the same conclusion as did Snellen (*Tijd. Ent.*, xxxii., p. 207), that the minor neurational characters upon which they were mainly founded—point of origin of veins 6 and 7 of forewings, etc.—were too inconstant to be of generic worth. But I cannot help thinking that he has gone to the other extreme in uniting those New Zealand species with *cambrica*, and I suspect—though only on superficial grounds I fear—that a closer knowledge of their structure and economy will teach us that their close resemblance to *Venusia*, in the Meyrickian characters, is in part accidental, and that they are really an independant development of the *Euchoeca—Hydrelia* stock; in that case Meyrick's genus *Epiphryne*, with type *undosata*, Feld., will need resuscitating for them. Through the kindness of my old frend Mr. Ambrose Quail, who has given me a number of Geometrides which he collected during his residence in New Zealand, I am able to exhibit four specimens of this charming little species.

Meyrick's classificatory work was quickly followed up by Hampson's, and in volume iii. of his "*Moths of India*" (1895), on p. 415, we get

another good concise diagnosis of the genus *Venusia* in its imaginal stage; "Palpi slight, fringed with hair below and hardly reaching beyond the frons, which is rounded; hind tibiæ with two pairs of spurs. Forewing with vein 3 from before angle of cell; 5 from above middle of discocellular; 6 from wall above upper angle; 11 anastomosing with 7, 8, 9 and 10 to form the areole. Hindwing with vein 3 from before angle of cell; 5 from below middle of discocellulars, which are angled; 6, 7 stalked; 8 anastomosing with 7 to near end of cell." He divides the genus into two sections, the typical one, *Venusia* (unrepresented in India), in which the antennæ of the ♂ are bipectinated with short branches (= *Venusia*, Meyr.), and "Sect. 11, Antennæ of ♂ minutely serrate and fasciculate" (= *Discoloxia*, Warr.), In the latter he places four species, *sikkimensis*, Elw., and *lilacina*, Warr. (both originally described in *Proc. Zool. Soc.*, 1893, under *Hydrelia*), *obliquisigna*, Moore (described in 1888, as a "*Cidaria?*"; made the type of *Discoloxia*, Warr., in 1895), and *dharmsalae*, Butl. (*Proc. Zool., Soc.*, 1883, under *Ephyra?*). None of these four look to me very close to *cambrica*, and I should provisionally maintain the two sub-genera as genera, even if nothing can yet be added, by way of differentiation, to the secondary sexual character here adduced.

The next year (1896) brings us to Hulst's American revision in vol. xxiii. of the *Transactions of the American Entomological Society*. It was admittedly founded mainly on Meyrick, but I grieve to say that, so far as I have yet analysed it, it is a kind of mutilated Meyrick. Meyrick, in spite of the surprising results which he sometimes gets through having used too few diagnostic characters for his genera, is at least consistent, and acts up to his own principle, that every generic diagnosis shall be applicable to that which it is intended to include, and exclusive of all else. But Hulst, in abandoning this as an absolute principle, has abandoned nearly the whole of the value of such an artificed system. His manner of dealing with *Venusia* will illustrate this criticitm. His diagnosis (*loc. cit.*, p. 273) reads: "Palpi rather short, somewhat recurved scaled; tongue developed; clypeus scaled, smooth; antennæ of ♂ bipectinate, of ♀ filiform; thorax and abdomen untufted; hind tibæ with all spurs present. Wings rounded, forewings 12 veins, one accessory cell to beyond middle." It will be seen that this is virtually an adaptation of Meyrick's, with the addition of a little verbiage. Similarly we find on the next page that *Euchoeca* = *Hydrelia* has a diagnosis which, when critically examined, leaves only "Palpi short scaled, slender, porrect; antennæ filiform, ciliate" as differential characters; this, again, is after Meyrick. But when we examine the *contents* of the genera we find Hulst retaining all Packard's *Epirrita* species in *Venusia* with the exception of *dilutata*, which, as with Meyrick, is removed to *Asthena*, and also adding *inclinataria*, Walk.*; in other words, his genus is composed of *cambrica*, Curt., *duodecimlineata*, Pack., *perlineata*, Pack., and *inclinataria*, Walk., and this constitution is practically maintained in Dyar's recent list (p. 274). But, as I have already noted, none, excepting *cambrica*, conform to Hulst's generic character "antennæ of ♂ bipectinate," and I am very dubious about the palpi, though I only possess one specimen of *comptaria* = *duodecimlineata*. How little validity there is in the line which Hulst

* This is an error, "sec. specim. typ.," not as has been shown above.

draws between his *Venusia* and *Euchoeca* is still further shown by the fact that he places *lucata*, Gn., in the latter, but leaves its synonym *condensata*, Walk., and its close ally *perlineata*, Pack., in Venusia†.

Other species which have at one time or another been placed in *Venusia* are not numerous, and I can easily recount all of which I have any knowledge. *Venusia chrysocilia*, Hmpsn. (*Ill. Lep. Het.*, viii., p. 124), does not belong here, as its author has recognised in his maturer work; it is a *Chrysocraspeda*. Oberthür's four Tibetan species (*Et. Ent.*, xviii.), to which he gave the highly classical names of *tchraria* (p. 29, pl. iii., fig. 32), *naparia* (p. 30, pl. iii., fig. 36), *laria* (p. 30, pl. iii., fig. 34), and *kioudjronaria* (p. 31, pl. iii., fig. 46), all from Tâ-Tsien-Loû, look as though they might all be Venusias *in sensu Hmpsn.*, although Leech (*Ann. Mag. Nat. Hist.*, xix., p. 661, 189) transfers *naparia* to *Larentia* (*sens. Hmpsn.*), doubtless with some good reason, leaving only the other three to *Venusia* (*loc. cit.*, xx., pp. 83-84), but adding a new species, *V. undularia*, Leech (*loc. cit.*, p. 83); but in any case they will all go to Hampson's section ii., which I prefer for the present to call *Discoloxia*, Warr., bon. gen. To the same section (or genus) belong Hampson's new Tibetan species (*Journ. Bomb. Soc. Nat. Hist.*, xiv., p. 647), *viz.*, *Venusia pallidaria*, *V. conisaria*, and *V. ochrota*. I may mention also that *Cidaria semistrigata*, Christ. (*Bull. Mosc.*, lv., 2, p. 99), is spoken of by Warren in *Nov. Zool.*, vol. ii. (in erecting his new species, *Discoloxia megaspilata*), as "*V. semistrigata*, Christ.," which—if it be not a mere *lapsus*—no doubt means *Venusia semistrigata*; but, as I do not know the species, I have no idea how close it may come to *V. cambrica*.

The result of my researches, summed up, is that I cannot find a single known species which is close enough to *Venusia cambrica* to satisfy me that it is really likely to be congeneric with it according to our modern restricted ideas of genera; but that if it has any very close relatives, they are probably the rest of Hulst's American "Venusias," (which would necessitate a reconstruction of Meyrick's diagnoses), or, much less likely, Meyrick's three New Zealand Venusias; and that there is also a good deal of affinity with *Discoloxia*, Warr., and some with *Euchoeca*, Hb. (type *obliterata*, Hfn.), *Hydrelia*, Hb. (type *testaceata*, Don.), *Asthena*, Hb. (type *albulata*, Hfn., = *candidata*, Schiff.), and *Epirrita*, Hb. (type *dilutata*, Schiff.). I am inclined to view it as a specialised development of *Hydrelia* rather than as "a collateral branch from the same stock" (Meyrick), but the difference in the point of view is very slight, and the whole subject is largely speculative.

Distribution.—The range of *Venusia cambrica* is rather wide, considering how local it generally is, and how scarce in many parts. Staudinger's *Catalog* (3rd edition, p. 296), gives northern Britain, central Scandinavia, northern Russia (excepting the Polar region), central Germany and eastern central Europe (in the lower mountains), the Alps (*pro parte*), Pyrenees, Altai, Japan, North America. I fancy it may be commoner in the last-named than in the Old World; it seems to turn up freely enough in American collections, and if I remember aright, our member, Rev. C. R. N. Burrows, has told us that

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* I notice that Mr. Warren, in arranging the National Collection, placed only *cambrica* and *12-lineata* in *Venusia*, making *comptaria* a *Hydrelia* (= *Euchoeca*, Meyr., Hulst); the antennæ of *12-lineata*, even if it be not really a synonym of *comptaria*, are decidedly not "pectinated."

it was one of the only two species which he saw on a brief visit to Canada. With few reservations—at least in the Old World—it may be described as "Alpine and boreal," and I think most of the European collections are supplied from Scotland, Finland and the Swiss Alps. I believe Mr. Leech only obtained one specimen from Japan (Oiwake, ex. coll. Pryer), and I fancy it was reported as either a novelty or great rarity for Hungary at a quite recent date (*Parel, Term. Füz.*, xx., p. 75, 1897). The only specimen which Dr. Chapman has brought me from his Continental travels is one from Trondhjem in Norway. Herr August Hoffmann, to whose life-history of the species I have already several times made reference, found it in the Upper Hartz wherever its food-plant was common, and gives some notes on its habits there. The *Discoloxia* branch is mainly Indian, and evidently has its headquarters in Tibet.

Variation.—There is an appreciable sexual dimorphism in *Venusia cambrica*, the females being generally larger and paler than the males. I have not been able to discover any true geographical variation. Three even of the North American specimens at the British Museum are so like our British ones that I could not pick them out if they were mixed up therewith. The Oiwake specimen, already mentioned, is somewhat wasted; it is a tolerably large ♀, perhaps slightly paler than ordinary (? ab. *erutaria*, Bdv.), but showing no signs of being a "var." The Finland specimens seem inclined to run small on an average—though by no means always—and one small aberration, ab. *pygmaea*, Tgstr., is possibly recurrent there. But—as with so many other species—our own country has the proud distinction of possessing the only really noteworthy recurrent aberration, and this is the melanic Yorkshire form*—I might here again add, "as with so many other species," both as regards the nature of the variation and also the county producing it. I cannot find much in our literature concerning this interesting form; in fact, I can only lay my hands on Mr. Brady's note (*Ent. Rec.*, xiv., p. 305), where he says that in the Sheffield district 90 per cent. are melanic, and that nearer Doncaster, in 1902, about 50 per cent. were so; and Mr. Barrett's reference and figures (*Lep. Brit.*, viii., p. 193, pl. 349, fig. 1*b* and 1*c*). Mr. Barrett says of it that "in South Yorkshire a local recurrent form seems to have quite recently made its appearance, and he gives (*tom. cit.*, p. 195) "the Sheffield and Rotherham district" as its habitat. It has two principal phases, as is usual with these melanic Geometrids:—1st, ground-colour mostly infuscated, but with variable intensity, the markings, therefore, still traceable (Barrett, fig. 1*c*); 2nd, ground-colour wholly infuscated, leaving practically no markings—absolutely none on hindwings (Barrett, fig. 1*b*). My two examples, kindly given me by Mr. Brady, belong to this latter. I do not think either has yet been named. Staudinger (*Cat.*, 3*e*. Aufl., 1901) gives absolutely no named forms under the species, though it is curious that he should

* It was not till some months after this paper was written, and, indeed, not long before going to press, that I made acquaintance with a *second* dark form, noted by Porritt (*Naturalist*, 1904, p. 377) as the "Middlesbrough" form, and added to my collection by the kindness of Mr. T. Ashton Lofthouse. I add a description of it to my summary of the variation (*infrà*). It is recorded somewhat loosely by Mr. S. Walker as the black aberration of *Venusia cambricaria* (*Ent. Rec.*, xvi., p. 302).

have overlooked *pygmaea*, Tgstr., seeing that it is quoted by Aurivillius, whose work (*Nordens Fjärilar*) he has freely used.

The following are all the separable forms known to me :—

1. *Venusia cambrica*, Curt. (type form).—Ground-colour light bright grey, well freckled with pale brown, and with the lines, etc., on the forewings distinctly marked. This seems to be the commonest form, at any rate in Britain. In Curtis' figure the central area is not narrowed, but this narrowing often happens without any other deviation from type. Barrett (*Lep. Brit.*, iii., pl. 349, fig. 1) also figures the type form. *Nebulosaria*, Frr. (*Neu. Beitr.*, vi, pl. 528,5) is virtually synonymous with the type ; it is a ♂, figured from a worn specimen, allowing for which (and for manifestly poor execution), I do not see anything aberrant in it*. His later figures (pl. 546, 2, 3, ♂ and ♀) are of the whitish form (no. 2, *infrà*) but cannot take the name *nebulosaria*, which is preoccupied at pl. 528.

2. Ab. *erutaria*, Bdv. (*Gen. et Ind. Meth.*, p. 203), Dup. (*Hist. Nat. Supp.*, iv., pl. 54,4).—Ground-colour much whiter than in the type, markings well pronounced. Boisduval says "alæ albidæ," and Duponchel gives a very respectable figure of the whitest normal form. Herrich-Schäffer (*Syst. Bearb.*, iii., fig. 258, 259) figures a less strongly marked example, but still belonging to these pale aberrations. Whitish specimens (almost unfreckled) seem commoner in Scotland and on the continent of Europe than in England†.

3. Ab. *scitularia*, Walk. (*List*, xxi., p. 406).—Rather dirtier-looking than the type (though not actually infuscated), the lines somewhat less-strongly expressed, the normally black ones less black, so that the whole effect is less sharply contrasted and nearer to the allied American *Venusia* (or *Euchoeca*=*Hydrelia*) *comptaria*, Walk. Besides Walker's type specimen (from New York) the British Museum has a similar one from Anticosti. It may well occur also in the Old World. Both the specimens adduced are rather small, but I should not insist upon this characteristic in applying the varietal name.

4. Ab. *pygmaea*, Tgstr. (*Cat. Lep.*, in *Acta. Soc. F. F. Fenn.*, x., p. 31).—Small, with central area constricted, and hindwings almost without markings.‡ None of the Finnish specimens in the British Museum entirely agree with this, which must be a rare aberration ; but they have the "posticis subinnotatis§.

5. Ab. *latefasciata*, Strand (*Nyt. Mag. Nat.*, xxxix., p. 59).—

* It would be just possible to use the name for aberrations with the second line on the forewings unusually distinct compared with the other markings, if such occur in a state of nature ; for Freyer's figure has this line rather thick and black, while the other markings are comparatively weak.

† Some intermediates occur between the type and ab. *erutaria*, and sometimes they have quite a bright light-brown tinge ; but they do not seem to admit of being named separately.

‡ "Multo minor, strigis transversis alarum anticarum ambis approximatis et confluentibus (posteriori itaque a limbo magis distante) alisque posticis subinnotatis, albidis, ad Petrosavodsk a Günther deprehensa, vix propria efficit species" (Tgstr., *loc. cit.*).

§ I may here remark that the hind-wing varies (in more or less normal specimens) from having four to only one transverse line perceptible. Thus H.-S. 258,9 and Frr. 528,5 show only one (central) line, Frr. 546,3 only two (submarginal), Frr. 546,2 all these three, whilst Dup. 54'4, Word 1724 and Pack. viii. 27 all these four (a central *pair* and a submarginal pair). The type figure (Curtis) also has all these four, but none very strong, the inner pair the weaker and less complete.

"Median area very broad, the transverse lines being about twice as widely separated one from another as usual, they run parallel, while in other forms they approach or (in ab. *pygmaea*) join a little before the inner margin."—(Strand.)

6. Ab. *webbi*, mihi, n.ab. (Barr. *Lep. Britt.*, viii., p. 194, pl. 349, fig. 1*a*, *sine. nom.*)—Whitish, with the markings practically obliterated excepting on the costa and median nervure. This interesting aberration is in Mr. Sydney Webb's collection, and, to judge from Mr. Barrett's figure, it bears a most remarkable analogy to the French form of *Epirrita autumnata*, Blch., which I have named var. *gueneata* (=*autumnata*, Gn.), and, to a less extent, to *E. dilutata* var. *christyi*, mihi.

7. Ab. *suffusa*, mihi, n.ab. (Barr. *loc. cit.*, pl. 349, fig. 1*c*, *sine nom.*).—"Suffused with smoky clouding, through which the markings show in darker colour."—(Barrett.)*

8. Ab. *bradyi*, mihi, n.ab. (Barr. *loc. cit.*, pl. 349, fig. 1*b*, *sine nom.*).—Uniform dark smoke colour on both pairs of wings, with no traces of markings excepting a very narrowly blackened central area. I have great pleasure in dedicating this very interesting example of extreme British melanism to my kind friend Mr. L. S. Brady, of Sheffield, to whom I owe not only my two specimens of it but also the assistance already acknowledged which has enabled me to prepare this paper.

AID TO THE STUDY OF LEPIDOPTEROUS LEAF-MINERS.

(Read April 19th, 1904, by ALFRED SICH, F.E.S.)

The aim of the following notes is to provide the student of the British Lepidopterous Leaf-miners firstly with a short sketch of the various groups and genera whose larvæ mine leaves and secondly with, a set of references to those works where further or more detailed information may be obtained.

Leaf-miners are so called from their peculiar manner of feeding. An external feeding larva, such as *Sphinx ligustri*, will entirely consume a leaf, cuticles, parenchyma and all. The leaf-miner has a more delicate appetite and only consumes the parenchyma, that is the inner, usually green, portion of the leaf, the two skins of the leaf, the upper and

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* 7*a*. Ab. *lofthousei*, mihi, n.ab.—Forewings suffused with smoky, leaving practically nothing of the white ground colour excepting in the outer area, which is more or less rayed along the veins therewith, hindwings normal. This is not much less extreme than the type figure of ab. *suffusa*, but is only yet recorded from *North* Yorkshire (vide *Naturalist*, 1904, p. 377). I have much pleasure in naming in after my friend T. Ashton Lofthouse, who has been chiefly instrumental in bringing it to our notice.—L. B. Prout, Dec., 1904.

lower cuticles, remaining untouched. In order to get at this inner substance the larva must bore or mine into the leaf, and hence Réaumur's term, Mineurs des feuilles.* There is also another point of difference in the manner of feeding between the external feeders and the leaf-miners. Dr. Wood draws attention to this point (*Ent. Mo. Mag.*, vol. 26, p. 2), when speaking of mining larvæ and their well developed muscles that move the head from side to side, which, he says, "is the movement these larvæ employ in feeding instead of the usual up and down one of external feeders."

There are two chief kinds of mines, the gallery and the blotch. The gallery mine is simply the space out of which the parenchyma of the leaf has been eaten by the larva, and usually appears as a flat thread-like track, running in a more or less serpentine manner in the leaf. It gradually increases in width as the larva grows, and usually ends in an elongated ovoid space, where the larva makes its exit from the leaf. In the gallery mine the larva simply moves forward as it feeds, filling the mine behind it with its excrement. In certain species the gallery will wind round itself, and in that case will usually develope into the blotch mine. The blotch mine has two forms, the flat and the arched or domed mine. The flat blotch appears as a continuous more or less uniformly pale space in the leaf. The domed blotch has usually the upper surface arched over. The larva causes the mine to assumed this shape by making one or more puckers in the leaf cuticle opposite the surface to be arched. This it does by covering parts of the cuticle with silk. The parts so covered then wrinkle up, drawing the edges of the mine nearer together and so forcing the opposite cuticle to form a dome. This arrangement may easily be seen in the mines of *Lithocolletis messaniella* in evergreen-oak leaves. The blotch mine made by the larger leaf-miners, such as the Gelechiids, often assumes quite a bladdery appearance. The blotch miners can wander about their mines at will and occasionally we find more than one larva in the same mine, but as a general rule the leaf-miner lives alone, or, as Réaumur says (*Mem.*, vol. iii., 1st mem., p. 5) "ils vivent dans une grande solitude."

The British Lepidopterous leaf-miners at present number, in round figures, three hundred and fifty species. Though they mostly belong to the smaller moths, known as the Tineina, there are a few representatives among the larger species, the imagines of which will be found in most collections of the Macro-Lepidoptera. For the sake of convenience the leaf-miners may be divided into four sections:—

Section A.—Containing those species in which the mining habit is confined to the earlier larval stadia. (*Adscita*, *Recurvaria*, *Yponomenta*, *Buccalatrix*, *Ornix*, *Gracilaria* (*Phyllloporia?*))

Section B.—Those species of which the larvæ continue to mine leaves throughout the feeding stages, but move from one leaf to another at will (*Ragades*, *Tortrix*, *Aristotelia*, *Depressaria*, *Coleophora*, *Elachista*, *Orthotaelia*, *Bedellia*).

Section C.—Containing those species which pass all the feeding stages in the same mine, only quitting the mine when about to pupate (*Nepticula* (most), *Leucoptera*, *Lyonetia*, *Eriocrania*, *Heliozela*).

Section D.—Those species which only quit the mine as perfect insects (*Lithocolletis*, *Phyllocnistis*, *Tischeria*.)

* Memoires vol. iii, 1st mem., p. 1 (1737.)

Of course each of these sections may be sub-divided, but in a sketch like this we may content ourselves with these broad divisions. I must however point out that these sections are purely arbitrary and of no phylo-genetic significance.

The leaf-miners nearly all belong to the Microlepidoptera, but one species of the "Geometræ," *Scotosia retulata*, shows larval habits not far removed from those of a leaf-miner. The young larva bores into the shoots of the Buckthorn (*Rhamnus catharticus*), and even when the larva is more advanced it still feeds between leaves, only eating the softer parts of them. (Newman, *Entom.* vol. iv., p. 123, 1868). Many species of the genus *Eupithecia* also mine into buds. No doubt from the Macrolepidopterist's point of view, the most interesting family of leaf-miners is that known to collectors as the "Foresters."

Adscita statices, our commonest species of Forester, bores into the leaves of its food plant, the Sorrel, after quitting the egg. It appears, however, to be only a half-hearted leaf-miner, for though some of the larvæ noticed burrowed well into leaves others contented themselves with just burying the body. Whether this species continues the mining habit till hibernation does not appear to be stated, but when again feeding in the spring it eats the under side of the leaves. Its congener, *Adscita geryon*, in its early stage, mines the leaves of the rock-rose (*Helianthemum*). This species, however, appears to be less inclined towards leaf-mining than even *A. statices*, for it never appears to bury more than half its body in the leaf. For very good accounts of these species see Tutt, *Brit. Lep.*, vol. i., p. 392 and 402.

The larval habits of *Rhagades globulariae* (the scarce Forester), are very close to those of a leaf-miner of Section B. On hatching, the larva burrows into a leaf of knapweed (*Centaurea nigra*), which it partially excavates. In this way it makes large blister-like patches in the leaves. It continues to feed in this manner throughout its larval existence. It has one peculiar habit, that of leaving the mine to undergo ecdysis. Whenever it wants to moult, it leaves the mine and spins a silken platform whereon it rests. It also hibernates and pupates without the mine. There is a good account of the habits of this larva in captivity in the 2nd volume of Buckler's larvæ p. 1, *et. seq.*, and also in Tutt's *Brit. Lep.*, vol. i., p. 409, from which these remarks are gathered.

Though the *Tortricids* are nearly all concealed feeders, yet the leaf-mining habit is exceedingly rare among them. One species, however, *Olethreutes woodiana*, is an interesting exception. It mines the leaves of the mistletoe (*viscumalbum*), making at first a narrow gallery with openings for the discharge of its excrement, on the underside of a leaf, occasionally sending off a diverticulum. With the growth of the larva the mine assumes a blotch, sometimes occupying the whole of the leaf. The larva forms a kind of silken gallery in the mine, in which it rests when not feeding. It can pass from one leaf to another. To pupate it comes out of the mine and spins up on the bark of the tree which nourished its food plant. The above is condensed from an excellent paper by Dr. Wood (*Ent. Mo. Mag.*, vol. xxviii., p. 225), who was the discoverer of this insect as well as of its larval habits.

The larvæ of *Glyphipteryx equitella* mines, at least, in the later stages, the shoots and leaves of the yellow Stonecrop (*Sedum acre*). It consumes the whole of the interior, and moves freely from one shoot

to another. When fullfed it leaves the mine and spins up among the the roots.

Prays curtisellus begins active life by mining into ash leaves in autumn. Quitting the leaf before it falls, the young larva burrows into the bark and finally attacks the young shoots (*Stt. Nat. Hist.*, vol. xi., p. 8).

The larvæ of the genus *Yponomenta* live gregariously in webs, but one species, *Y. rigiutipunctatus*, begins its larval career by mining into the thick fleshy leaves of *Sedum telephium*.

Orthotaelia sparganella seems to possess a somewhat singular larva. In early life it mines the leaves of water plants, such as *Sparganium*, *Iris*, etc., Heinemann records (*Hein*, ii., 2, p. 129), finding larvæ in cases of dry leaf fragments in burrows in *Poa aquatica*. Stainton gives a figure of the larvæ (*Stt. T. B.*, pl. 10, fig. 10).

The large genus *Depressaria* is not much given to leaf-mining as far as is at present known, but *Depressaria carduella* mines in the leaves of thistles. It makes elongated blotches close to the mid-rib. It quits the mine to pupate. (*Stt. Nat. Hist* , xii, p. 148).

A few of the species belonging to the great family, *Gelechiidae* are leaf miners. *Gelechia* (*Lita*) *acuminatella* makes long brownish blotches in the lower leaves of thistles. *Xystophora arundinetella* forms long slender galleries in the leaves of one or two species of *Carex*. Both these have the power of moving from one leaf to another, and they usually spin their cocoons within the mine. (Stt. *Nat. His.* vol. ix., p. 116 and vol. x., p. 220,) *Chrysopora stipella* and *hermannella* mine the leaves of *Atriplex* and *Chenopodium*. They make rather bladdery mines and three or four larvæ often occupy the same mine. They quit the mine and spin up on the leaves to pupate. (*Stt. Nat. His.* vol. ix., p. 246 and 262.) *Recurvaria nanella*, whose life history was so long a puzzle, commences its career by mining into the leaves of apricot and other fruit trees. It leaves the mine to hybernate and attacks the newly formed buds in the spring, in there it usually pupates. A good English account of its habits will be found in the *Entomologist's Monthly Magazine* (vol. 39, p. 219), by Mr. Houghton.

Another *Gelechiid*, especially noteworthy, is *Lita costella*. It feeds on *Solanum dulcamara*. I have found it making large blotch mines in the leaves, feeding spun up in the young leaves, and also burrowing in the young stems. The books say it feeds as well on the berries. Thus combining in one species almost all the methods of feeding adopted by the concealed feeders. (*Stt. Nat. His.*, vol. x., p. 79.)

Though the genus Coleophora is a large one, containing at least 75 species in Britain, only about half its members are leaf-miners, the remainder feed on seeds. A noticeable peculiarity is their habit of making a portable case, in which they live. This case is usually distinctive for each species. The Coleophorid mine is easily recognised. If a pale mined space be noticed in a leaf, with a small round hole in the lower cuticle, it may confidently be ascribed to a *Coleophora*, unless the leaf noticed be that of a Convolvulus. In the latter case it must be attributed to *Bedellia*. The common *Coleophora fuscedinella* will serve to show the habits of the leaf miners belonging to this genus. (*Stt. Nat. Hist.*, vols. 4 and 5, Hein-Wck. 531).

COLEOPHORA FUSCEDINELLA.

The moth lays her ova on the underside of the leaves of birch, elm, etc. On hatching, the larva wanders about over the leaf, seeking a convenient place at which to bore into the interior. Having found this, it soon buries itself in the leaf and a few days later has eaten out a pear-shaped space. Here it undergoes its first ecdysis, and afterwards cuts out a tiny oval case from the mined space. It then walks off with its case and proceeds to fasten it onto another leaf. Here it cuts a minute round hole in the lower cuticle of the leaf, just large enough to admit its body. Then it eats out the parenchyma to a convenient distance around. It then loosens its case and departs to another spot, leaving behind the characteristic Coleophorid traces—a pale blotch with a small circular hole in the lower cuticle of a leaf. After making several such blotches the larva crawls off the leaves, fastens its case to a twig, and undergoes hybernation. In the spring it again attacks the leaves in a similar manner, and later makes an elongated blotch and cuts out a new case, quite of another pattern. The old case was more or less oval, but the new case is cylindrical. The larva still continues to make round holes and pale blotches in the leaves, though of much larger size than the previous ones. At length, fullfed, it fastens the case, usually on the upper side of an unmined leaf, and in a few weeks the dark brown moth emerges.

The larvæ of the genus *Elachista*, a genus containing over 40 species, are almost exclusively attached to grasses and sedges. They may be found in winter or early spring, and again as a second brood in July. Perhaps the most noteworthy point about this genus is the manner of pupation. In many species the pupa is fixed by the anal segment, and by a girth of silk round the body, very much after the manner of a Pierid pupa. The mines of this genus differ somewhat in shape and colour, according to the species, but that of the common *Elachista megerlella* may be taken as an example. (*Stt. Nat. Hist.*, vol. iii., also *Douglas, Ent. Soc. Lon., New Series*, vol. ii., p. 209, *et seq.*)

ELACHISTA MEGERELLA, STT.

The egg is laid on a blade of grass, and the young larva, mining upwards, leaves a very slender brown track, the frass collecting at the bottom of the mine. Before long, the larva comes out of the first mine and burrows into a fresh blade. Here it makes a much broader, whitish mine, which sometimes occupies the whole blade, When fullfed, the larva leaves the mine, and, finding a convenient situation, fastens itself by the tail, then passing a silken girth round its body, pupates. The pupa, thus attached, reminds one of a minute Pierid chrysalis. The dark-grey, white-banded moths appear in about three weeks. (*Stt. Nat. Hist.*, vol. ii., p. 74.)

The family of the *Gracilariidae* are all leaf-miners, though some of them only mine in the earlier larval stages. *Gracilaria stigmatella*, when quite young, mines in the leaves of willows and poplar, and afterwards leaves the mine and lives in a cone, which it makes by rolling up a portion of the leaf like a grocers apprentice twists a piece of paper to carry a pound of sugar, as Stainton suggests in the *Entomologist's Companion*, p. 60. After the larva has eaten the inner portion of the cone it leaves it to form a fresh one. To form its silken cocoon it turns up a piece of the leaf-edge.

The genus *Ornix* has similar habits, but generally turns down a corner of the leaf instead of making a cone. Perhaps the most often noticed member of this family is *Gracilaria syringella*, which often occurs in considerable numbers on lilac bushes in gardens, disfiguring the leaves with pale brown blotches, or rolling up the leaves like Tortricids. It is quite gregarious in habit. (*Stt. Nat. His.*, vol. viii., Wood, *Ent. Mo. Mag.*, vol. xxvi., p. 133.)

The exquisite insects known as *Lithocolletids* are true leaf-miners, as they pass all their larval and pupal life in the same mine, usually on the underside of the leaf of the foodplant. Most species are attached to one or two particular foodplants, but the common *Lithocolletis messaniella* mines in the leaves of oak, evergreen oak, hornbeam, sweet chestnut, and beech. The mines can be recognised by their having one, usually the upper, portion domed, and on the top of the dome there are often little quadrangular pale spaces where the larva has eaten away the parenchyma. The larva usually, if not always, spins a cocoon inside the mine, and I imagine that in the autumn brood, after the leaves have left the tree, these cocoons must frequently become detached on account of the breaking up of the leaf. Swammerdam was, I believe, the earliest writer to notice these moths, but Frisch and Réaumur also mention them. (*Stt. Nat. His.*, vol. ii.)

The *Nepticulids* are leaf-miners par excellance. They are all of small size and *Nepticula acetosae* is at present the smallest British lepidopteron. The newly laid egg may be described as a point of life in a globule of nourishment. (*Ent. Rec.*, vol. xiii., p. 362.) But the egg shell, which is usually seen at the commencement of the mine, is not so transparent, and is usually filled with black excrement. The mine is generally a gallery, but sometimes forms a blotch. The larva has no ordinary legs but is furnished, in at least the last instar, with eight pairs of fleshy discs. De Geer says (*Mem.*, vol. i., *men*, xiv., p. 449), speaking of a rose-feeding *Nepticulid* in 1737, that it has eighteen feet, and he repeats this observation nine years afterwards, remarking, "on ne peut pas assez vérifier des observations nouvelles et singululierès." The fact is, there are neither legs on the prothorax nor on the 1st abdominal segment, but the 1st abdominal segment often has the lower portion prolonged, and this under an indifferent lens or microscope, as De Geer probably had, might easily be counted for a leg. When fullfed the larva, in nearly all cases, leaves the mine and seeks a convenient situation to spin up. The summer brood soon matures and yields the imago, but the autumn brood passes the winter in the cocoon, though the common, *Nepticula aurella*, may be found feeding in its mine in a bramble leaf throughout the winter. The *Nepticulids* appear to be an ancient family, as traces of their work have been found in fossils of the Lower Miocene (Tutt, *Brit. Lep.*, vol. i., p. 181). As a help towards the future identification of the imago, the following particulars should be noted in the early stages of the *Nepticulids:* the foodplant, position in which the egg is laid, type of mine, arrangement of the excrement in the mine, and the colour of the larva. The study of the genus *Nepticula* has so recently and so marvellously been enlightened by one of our own members, Mr. Tutt, in the first volume of his *British Lepidoptera*, that little can as yet be added to our knowledge of these beautiful atoms, which will not be found incorporated in that excellent account. Nevertheless, every

student of the early stages of this genus should make a point of reading for himself Dr. Wood's paper entitled "Notes on the earlier stages of the Nepticulæ, etc." (*Ent. Mo. Mag.*, vol. xxix., p. 197, *et. seq.*, and vol. xxx., p. 1, *et. seq.*). He gives here, at length, most valuable details for distinguishing many of the species while still in the larval stage, as well as other most valuable, but more general, matter. (See also, *Stt. Nat. His.*, vol. i. and vol. vii.) The larva of *Teichobia verhuellella*, is remarkable in that it mines in the leaves and among the spores of Hart's Tongue and other ferns.

Phylloporia bistrigella makes in birch leaves a rather straight mine along the mid-rib to a certain distance, it then brings the mine nearer the edge of the leaf, where it widens it, and suddenly expands it into a large blotch, "like a river running into a lake," as Stainton remarks. When full fed the larva cuts out a case and falls to the earth. (*Stt. Nat. His.*, vol. xii., p. 32.)

Tischeria marginea is very common among brambles. It mines in the leaves. The mine is at first long and narrow, but assumes later "a cornucopia shape." (*Stt. In. Brit.*, p. 264.) The mine is carpeted with silk, and the larva is very careful to remove its excrement out of the mine through a slit cut for the purpose. The larva changes to a pupa within the mine. The other species of this genus make differently shaped mines, but their habits are similar.

Bedellia somnulentella is a most interesting species. It mines flat blotches in the leaves of Convolvulus, entering by a round hole like that of a *Coleophora*. It moves freely from one leaf to another, and often spins strands of silk under the leaves. The larva is a beautiful object, and the pupa is one of those reminding one of a Pierid pupa. (Douglas *Ent. Soc., new series*, vol. 2, p. 207, and Clemens *Tin North Ann.*, p. 189.)

The mines and larvæ of the genus *Eriocrania* are very common in birch and oak leaves in early summer. So very unlike moth caterpillars are they, however, that many entomoligists, though acquainted with them, never took the trouble to rear any until Kaltenbach discovered that they were not beetles. When reared, however, these moths are not very moth-like in appearance. The female possesses an apparatus with which she cuts out a pocket in the leaves and deposits her eggs in it. The footless larvæ make large mines in the leaves, and their excrement is deposited in a curious manner. Stainton describes this exactly when he says "it is like short lengths of black cotton, from a quarter, to one sixteenth of a inch in length." (*Ent. Ann.*, 1862, p. 122.) When fulfed, the larva leaves the mine and buries itself in the damp earth. The pupa is very singular, having moveable jaws. Until recently, the genus *Eriocrania* was mixed up with *Micropteryx*, and many references to it will be found under the latter name (*Stt. Nat. Hist.*, vol. xiii., p. 94; Wood, *Ent. Mo. Mag.*, vol. xxvi., p. 1; Wood and Chapman, *ib.*, p. 148 *et seq*).

General remarks on the Larvæ of Leaf-miners.

The larva is often remarkable for its comparative breadth and flatness, especially of the thoracic segments. The thoracic legs are sometimes so widely separated and so short that the larva cannot make them meet. They are particularly useful for crawling on the flat surface of the mine, but inadequate for grasping an object, like a Geometrid

larva does when crawling. In many cases the thoracic legs are altogether absent, and their place is taken by fleshy discs (*Nepticula*, etc.). The ventral claspers, are usually all ill-developed, and often entirely absent on the 6th abdominal segment. [*Gracilaria*, *Lithocolletis*, *Coleophora* (part)]. The anal claspers are generally better developed. In certain genera there are neither legs nor claspers, but in these cases the larva is furnished with cone-like processes on certain segments (*Eriocrania*, *Phyllocnistis*, etc.). The larva comprised in sections A and B, which do not spend all the feeding stadia in one mine, are well provided with legs, most of them are rapid in their movements. The caterpillars in section C, which only leave the mine to pupate, are often ill-provided with organs of locomotion, and therefore progress in a more leisurely manner. They spin ladders of silk, on which they crawl. For instance, if we watch a Nepticulid larva leave the mine to spin up, we shall see that its head sways from side to side, and as it does so the spinneret leaves a strand of silk behind it. On this the larva has a firm hold. In the larvæ of *Nepticula* that I have examined, and also in those of *Phyllocnistis*, there are, in the last instar, neither legs nor fleshy discs in the prothorax, while both meso- and metathorax carry fleshy discs. As the prothorax sways to a certain extent with the head, while the larva is spining, and also of course, previously, while the larva was feeding in mine (as the true leaf-miner feeds with a side to side motion), legs on the prothorax would be more of a hindrance than an advantage, the head having greater freedom of movement when the prothorax is also free. Hence, I believe the reason for the curious absence of organs of locomotion on the prothorax of these larvæ.

There is one curious phenomenon connected with the leaf-miners, and which, perhaps, lends itself to very wide suggestion. It has been noticed, more especially by Stainton and Wood, that though a leaf occupied by a miner may fall from the tree, and even turn brown, yet the area affected by the miner will remain green, and to all appearance healthy, for a very long time after the leaf has fallen. It has been suggested that the larva, even when commencing its mine, in some way impregnates the area surrounding it with some preservative or antisceptic. I would go one step further, and suggest that all those species, Macro- as well as Micro-lepidoptera, which pupate in spun or earthy cocoons (nearly always lined with silk), impregnate the atmosphere of the cocoon with some kind of preservative.

Generally speaking the leaf-miners are of very small size. De Geer says (*Mem.*, vol. i., *mén.*, xiv., p. 431), after mentioning the leaf-rollers (*Tortricids*), "other larvæ still smaller have also need to be covered in order to live at their ease," and adds, "the moths are difficult to find, 'à cause de leur peu de volume.'" Stainton says of *Nepticula microtheriella* (*In. Brit.*, p. 302), that upwards of thirty larvæ may be found in a single nut leaf, and Frey preserved a nut leaf in which he counted 22 mines of the same species. (Frey *Tin. and Pter.*, p. 386.) Being so minute these creatures would speedily perish unless protected from drought and from their living enemies. Very small larvæ would dry up if not protected in some manner, unless they always lived in damp situations, and, in that case, the area of their activity would be too much restricted. For instance, the genus *Micropteryx* (*calthella*, etc.), can never inhabit any but wet areas. But *Eriocrania* (*purpurella*, etc.), a widely separated genus, but still of old

type, solved the difficulty and prevented dessication by burrowing into the interior of a leaf, and living among its juices.

If a larva of *Phyllocnistis* be taken from its mine and exposed to the air, it will dry up in a very short time. *Buccalatrix* perhaps, in its early stages, one of the smallest exposed feeders, encloses itself in a kind of cocoon while changing its skin, in order, I would suggest, to prevent dessication. Even *Coleophora*, a very much larger larva, undergoes its first ecdysis within the mine. Small larvæ, like those of the genus *Argyresthia*, keep themselves moist by burrowing into shoots and buds, while a similar burrowing habit is prevalent among the much larger larvæ of the *Tortricids*. Although larvæ which burrow into stems, shoots, and leaf buds may be hidden, and therefore more or less protected from their enemies, I do not believe the leaf-mining habit was resorted to primarily for the purpose of protection from living enemies. No doubt this protection has had a good deal to do with the lines on which this habit has developed. The leading idea was to ensure a moist condition for these minute creatures, and, after this moist condition was attained, the secondary idea of protection began to work its modifying influences on the character of the nimes.

SUPPLEMENTARY NOTES ON CIDARIA. *

(Read November 19th, 1901. by LOUIS B. PROUT.)

When I read a paper on this genus in April last, I found it necessary to allude to various lacunæ, and I expressed the hope of being able to fill up some, at least, of these in the near future. As I have to some extent succeeded in realising this hope during last summer, I think it well to bring before you the following supplementary notes. They deal with the type-species of *Lygris*, Hb., *viz.*, *populata*, Linn., and two of the outlying species, *silaceata*, Hb., and *pyraliata*, Schiff., all of which I have had under observation from egg to pupa during the last summer.

Lygris populata, Linn.—The larvæ which were just hatching when I wrote in April, were fed chiefly on lombardy poplar (*Populus pyramidalis*), as bilberry was unfortunately not obtainable. Notwithstanding the "Habitat in *Populo*" of Linné's original description of the species, I did not find they throve very well on this food, and I only got one or two as far as the pupa stage, and these were undersized. Occasionally *Salix alba* was offered, and this seemed to give somewhat better satisfaction than the poplar. The duration of the larval period was about seven weeks—April 10th to June 2nd. I made copious

* Publication accidentally delayed.

notes on the larvæ in their different stadia, but as the generic position was already assured, and my notes did not in any way upset it, and as the adult larva has been well figured by Buckler, I need not dwell upon it just now. It is somewhat variable in both the last stadia (3rd and 4th).

Lygris pyraliata, Schiff.—I have already placed this at the foot of the genus, as a somewhat aberrant member, in consideration of its lacking the usual pencil-tuft of hairs on the underside of the male forewing; but I had not, at the time of writing, made acquaintance with the adult larva or the pupa, and as the egg and the newly-hatched larva agreed so perfectly with typical species of *Lygris*, I rather rashly assumed that it would not prove at all aberrant except in that one imaginal character, and I ventured to write that I had "no doubt it will conform to the characters here given," *i.e.*, the pupal markings characteristic of the allies. It turns out that in this I was mistaken, and I am obliged to admit a slight divergence from typical lines in *Lygris pyraliata*, though I still do not see any necessity for separating it generically from its neighbours. I have already given it a separate section (C) in the genus, and I am now ready to add a second distinction (even if somewhat superficial) of this section C from section A—pupa nearly unicolorous green, only with the dorsal line somewhat darkened; no trace of the dark wing-case markings of section A.

The larva, when left undisturbed, is excessively sluggish, often sitting day after day in the same place, feeding on the *Galium* within reach, but when removed it becomes very uneasy and restless, moving about with a fair degree of activity. It is not a very interesting larva to describe, having but few markings or characteristic features. In its first instar, after feeding a few days, it is green in colour, the orange head, therefore, now sharply differentiated from the rest. In the second there is no material change to note; the dorsal area is somewhat darkened, especially towards the anal end, and the intersegmental spaces are yellowish; the setæ are exceedingly short, whitish, knobbed at the tip, as in the allied species; in form, the larva is still very thin in proportion to its length. In the third instar there is again no striking change, but the head is now green, and altogether the shades of colour assimilate very perfectly to those of the usual foodplant, *Galium aparine*; the head perhaps a little lighter than the stems of the plant; the body exactly the colour of the stems or young leaves, with a darker dorsal stripe precisely agreeing with that of the darkest mature leaves; there is a very pale green line along the centre of the ventral area, as in allied species; dorsal tubercles fairly conspicuous, being blackish, lateral practically concolorous with ground-tone. I was interested to notice that at this stage the anal flap showed a tendency to form two extremely rudimentary anal processes corresponding in position to the "spikes" which are so much more highly developed throughout the career of the more typical section of Cidarias—*fulvata*, *truncata*, &c. On entering the fourth (and final) instar the larva continues very slender; the length, when fully extended, being 19mm. or just over, the breadth less than 2mm.; head tolerably large, rather distinctly bi-lobed, bright-green without markings; body uniform width, nearly cylindrical, but belly rather flattened; tubercles minute, setæ very short; colour bright green with very dark mediodorsal line, especially so on thoracic and 5th to 10th

abdominal segments, but interrupted on front half of 5th abdominal, and inclining to be so on the two or three segments proceeding; ventral line pale, as in 3rd instar, and other lines differing slightly in in shade from the ground-colour also run longitudinally; segment-incisions distinct, pale. The anal processes are so slight and obtuse as to be hardly worth mentioning, and even in the 3rd instar, where they were more noticed, I should probably have passed them by but that they seem to show yet a third link (absence of pencil-tuft in imago and of wing-case markings in pupa being the others) between *L. pyraliata* and the non-Lygrid Cidarians. The duration of the different stadia in one larva which I had under close observation was as follows: 1st stage, about 9+2 days; 2nd, about 5+2; 3rd, 12+3 (colder weather); 4th, 18+6; total, 49 days (April 9th to May 28th, 1901). I may explain that the number added after the *plus* sign indicate the days occupied with the ecdyses.

Eustroma silaceata (? Schiff.) Hb.—In my previous paper I pointed out that this species was, by strict laws, the type of the genus *Eustroma*, and that in case it should prove necessary to unite this genus with *Lygris*, the name *Eustroma* would have priority. But I had no personal knowledge of the early stages of *E. silaceata*, and as various authorities had various different views as to its affinities—one likening it to *Lygris prunata*, another to *Lampropteryx suffumata*, another separating it widely from both—I expressed myself very impatient to make acquaintance with them. You may guess, therefore, how pleased I was, when on the night of August 1st-2nd this year, my friend Mr. J. E. Gardner captured a good female on the North Devon coast, and how I prevailed upon his good nature to keep her alive—though he wanted the specimen for his collection—until she had laid a few eggs. Fortunately she was not long in obliging us, laying 16 the same night and early next morning, and so we were able to kill her before any material damage had been done.

Owing to my absence from home and from my microscope, I was unable to examine the egg and newly-hatched larva so minutely as I could have wished; but with the aid of a good hand-lens I could make out quite enough to satisfy myself that neither conformed to my generic characters for *Lygris*, and that the latter name (for *populata*, etc.) need not fall. The egg was (as in *Lygris*) rather large, but not (or hardly) flattened at its broader end, and of a different texture from *Lygris*, smoother and less granulated, and a good deal polished; in colour it was quite a whitish yellow (whiter than that of *Cidaria immanata*), although it must be added that its colour-change (on the 3rd or 4th day) gave some suggestion of the mottling of *Lygris populata*, and *testata*: the change commenced on about the 2nd day, with a tendency to become slightly yellower, but in another day or two the eggs become much spotted and dashed with bright carnation-colour, giving them a tolerably uniform flesh-coloured appearance to the naked eye.

The larvæ hatched in about 9 days, after a final change of the eggs on the 8th day to a deeper purplish. The newly-hatched larvæ were long and slender, apparently about the size of those of *Lygris pyraliata* and very active. Head tolerably large, somewhat inclined to be broadened, and flattened in front; body uniformly cylindrical. Tubercles not discoverable (with the hand-lens), setæ very short and

inconspicuous. Colour of body light brown, head and anal extremity somewhat yellower brown; no markings discoverable. I found they would eat indiscriminately any species of *Epilobium* which was offered them (*E. hirsutum*, *E. parriflorum*, etc.), and after my return to London a garden Fuchsia seemed to satisfy them equally well. Their growth was rapid, the duration of the four stadia being respectively 6, 4, 4 and 7 days, or thereabouts, but 4 days out of the last 7 are accounted for as the period which elapses between spinning up and pupating.

In the second instar the larva is yellow-green, with a reddish dorsal line on the thorax and again on the 7th to 10th abdominal; in the third instar, it becomes somewhat more variable, the dorsal line sometimes continues, and often almost black anteriorly and posteriorly, the ground colour at the same time varying towards dark blue-green, and even (in one or two individuals) towards flesh-colour; there is a rather conspicuous whitish medio-ventral line. In both these stadia the larva is extremely thin in proportion to the length.

In the last stage, it seems slightly less elongated proportionally, but is still a very slender larva. The segmented form is not quite perfectly cylindrical, the elongate abdominal segments being slightly, though not conspicuously, of what Mr. Bacot describes as the "taper-form," the intersegmental spaces yellowish. Head flattened, face with a large lunular, or almost horse-shoe-shaped black mark, the enclosed space green excepting black sutural lines; mouth-parts pinkish. Metathoracic legs much blackened, mesothoracic somewhat so. Body showing the same colour-variation as in 3rd instar, the pink (or blackish) medio-dorsal line generally interrupted. It becomes darker and thicker at the anal end, and throws out an equally dark and thick branch which runs obliquely along the anal clasper, where it is margined anteriorly with white; these darkened anal markings bear some minute white spots which give this portion of the larva a rather ornamental appearance; anterior claspers dull blackish on outer side. It struck me that the larva was not altogether remote from that of *Lygris prunata*, though decidedly not congeneric therewith.

The pupa, which is enclosed in a flimsy web among leaves on the ground, is very variegated in appearance, and perhaps shows more decided affinity with the Lygrids than either ova or larva. As I do not feel competent to describe it in a way that would be of any scientific value, although I have some rough notes at home for my own use, I think I must bring this communication to an abrupt conclusion, merely remarking that I am still far from having completed my studies of this interesting group of moths, and that I shall hope ere long to have an opportunity of studying some of the life-histories of which I am still almost entirely ignorant, and of forming some more definite views on their affinities.

LIST OF DESIDERATA FOR THE SOCIETY'S CABINET.

LEPIDOPTERA.

P. Daplidice
A. Lathonia
P. C-album
E. Antiopa
P. Iris
N. Semiargus
L. Arion
D. Galii
D. Lineata
C. Celerio
D. Nerii
H. Tityus (Bombyliformis)
Æ. Myopæformis
Æ. Formiciformis
Æ. Asiliformis
Æ. Ichneumoniformis
Æ. Cynipiformis
Æ. Allantiformis
Æ. Spheciformis
Æ. Scoliæformis
Æ. Chrysidiformis
T. Bembeciformis
M. Castaneæ
H. Asellus
Z. Exulans
L. Pygmæola
E. Striata (Grammica)
E. Cribrum
D. Pulchella
O. Fascelina
L. Cœnosa
T. Cratægi
M. Castrensis
G. Ilicifolia
P. Harpagula
C. Bifida
G. Crenata
N. Trilophus
N. Bicolora
D. Dodonea
B. Fluctuosa
B. Duplaris
B. Ocularis
J. Algæ
T. Tridens
A. Strigosa
A. Auricoma
A. Menyanthidis
S. Musculosa
H. Vitellina
H. Obsoleta
H. L-album
S. Maritima
N. Neurica
N. Concolor
N. Cannæ
X. Conspicillaris
L. Exigua
P. Leucophæa
A. Corticea
A. Cinerea
A. Aquilina
A. Præcox
A. Obscura
T. Subsequa
A. Depuncta
A. Subrosea
A. Sobrina
P. Hyperborea
P. Leucographa
G. Populeti
G. Erythrocephala
D. Rubiginea
J. Croceago
I. Retusa
C. Pyralina
V. Oleaginâ
M. Satura
M. Exulis
M. Perigrina
T. Atriplicis
C. Polyodon (Perspicillaris)
L. Semibrunnea
L. Socia
C. Scrophulariae
C. Lychnitis
C. Asteris
C. Gnaphalii
C. Absinthii
C. Chamomillæ
H. Armigera
A. Cordigera
E. Ostrina
B. Notha
P. Chryson
P. Moneta
P. Interrogationis
P. Bractea
S. Anomala
C. Fraxini
N. Lunaris
E. Erosaria
D. Obfuscata
M. Cineraria
P. Fuliginaria
T. Papilionaria
C. Orbicularia
L. Contiguaria
A. Circellata
P. Straminata
R. Sacraria
E. Filigrammaria
P. Affinitata
P. Alchemillata
P. Tæniata
C. Sparsata
L. Halterata
T. Cognata (Simulata)
H. Ruberata
A. Cuculata
A. Derivata
P. Fluviata
C. Lapidata
C. Polygrammata.
E. Silaceata
L. Prunata

W. ILSTON COX,
Hon. Curator