

THE
LEPIDOPTERA
OF THE
BRITISH ISLANDS
VOL. II.



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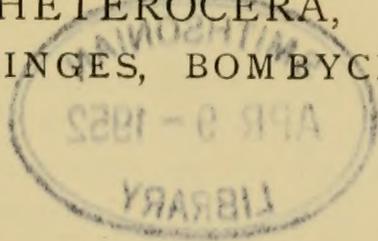
THE
LEPIDOPTERA
OF THE
BRITISH ISLANDS

A DESCRIPTIVE ACCOUNT OF THE FAMILIES, GENERA, AND
SPECIES INDIGENOUS TO GREAT BRITAIN AND
IRELAND, THEIR PREPARATORY STATES,
HABITS, AND LOCALITIES

BY
olding
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ONE OF THE EDITORS OF THE "ENTOMOLOGIST'S MONTHLY MAGAZINE"

VOL. II.

HETEROCERA,
SPHINGES, BOMBYCES



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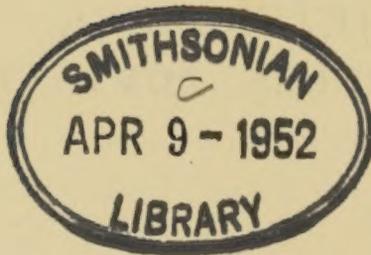
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LEPIDOPTERA.

DIVISION II.—HETEROCERA.

*Antennæ terminated with a point, never with a distinct club;
in other respects of very various structures.*

Group 1. SPHINGINA.

Antennæ distinctly thickened beyond the middle, slender at the base, attenuated at the apex.

In other respects divided into three widely divergent families.

Family 1. SPHINGIDÆ.

Imago with antennæ robust, strongly thickened beyond the middle, frequently with a recurved bristle or jointed spike at the apex. Fore wings stout and strong, elongated, pointed, with the hind margin waved, indented, or gracefully curved. Hind wings thinner in texture, rather short and broad.

Larvæ naked, solid, smooth, or shagreened with minute raised dots, generally with either bright coloured stripes or ocellated spots on the sides, and in most cases with a horn on the twelfth segment.

Pupæ rounded, usually smooth and without angles or external limbs, but in some cases with a projecting sheath in which the long tongue or sucking trunk is developed.

The larvæ in this group are so handsome, so striking in appearance, and in most cases so much more readily met

with than the moths, that a table of their characteristics, as used by Mr. Stainton, will be useful :

- A. Larva with the anterior segments attenuated and retractile.
- B. With eye-like spots on the fourth segment. *C. neri*.
- BB. With eye-like spots on the fifth and sixth segments.
- C. With no horn. *C. Porcellus*.
- CC. With a very short horn. *C. Elpenor*.
- CCC. With a longer horn, slender and straight. *C. celerio*.
- AA. Larvæ with the anterior segments not especially attenuated nor retractile.
- D. Head pointed above, sides dotted with white or yellow.
- E. A scutcheon on the anal segment behind the horn. *S. tiliæ*.
- EE. No such scutcheon.
- F. Horn sky-blue. *S. ocellatus*.
- FF. Horn yellowish above, reddish beneath. *S. populi*.
- DD. Head rounded above, sides not dotted.
- G. Horn curved back and then upwards. *A. Atropos*.
- GG. Horn with a simple curve backwards.
- H. Horn smooth.
- I. Spiracles black. No distinct lateral stripes. *S. convolvuli*.
- II. Spiracles orange. Distinct lateral stripes. *S. ligustri*.
- HH. Horn rough and black. *S. pinastri*.
- HHH. Horn rough and red.
- K. Dorsal line pale grey. *D. galii*.
- KK. Dorsal line red. *D. euphorbiæ*.
- KKK. Dorsal line black. *D. Livornica*.

The male moths of this family have, in addition to the thickening in the outer portion of the antennæ, a double row

of teeth or pectinations (*pecten*, a comb) on those organs. These pectinations, which look like solid teeth, are really composed of tufts of short bristles arranged in the form of a horseshoe, and incurved at the tips, so that the bristles touch at the point of the tooth and give the appearance of solidity.

Genus 1. **SMERINTHUS.**

Antennæ thickening gradually from the base to considerably beyond the middle, then tapering to the apex, but without a recurved bristle; in the male regularly pectinated on the lower side with a double row of tufts of bristles. Fore wings with the hind margin broad, scalloped, or bluntly angulated. Thorax and abdomen stout. Proboscis or sucking trunk very short, or even absent.

LARVÆ green, roughened with minute raised dots, head triangular, sides with oblique stripes, twelfth segment with a prominent horn.

PUPÆ thick, blunt, rounded. Subterranean, but usually close to the surface.

1. **S. ocellatus**, *L.*—Expanse 3 to 3½ inches. Rosy brown clouded with darker brown; hind wings pink, with a blue and black ocellus.

Shaft of the antennæ whitish, pectinations yellowish or reddish, prominent in the male; thorax very stout, pale brown, upper or dorsal portion occupied by a sharply defined blotch of rich dark brown; abdomen stout, pale brown; legs blackish brown. Fore wings thick and strong, with the costal margin nearly straight for three-fourths of its length, thence strongly rounded to the apex, which is pointed; hind margin rounded, except below the apex and above the anal angle, where in each case it is rather hollowed; dorsal margin

deeply concave before the anal angle. Hind wings short, rounded, except that the hind margin is hollowed before the anal angle.

Fore wings pale grey brown, with a rosy or purplish bloom; near the base is a rather indistinct, angulated, indented, greyish-brown transverse line, shaded outwards; beyond it an oblique brown stripe arises on the costal margin, passes below the middle of the wing, and turns towards the anal angle, spreading into a broad central brownish cloud, from which undulating parallel olive-brown lines are thrown back towards the costal margin so as to enclose a large triangular space, in which, at the end of the discal cell, is a rather lunate whitish spot, edged with brown; on the middle of the dorsal margin is a large semicircular brown blotch which reaches almost to the central cloud; beyond the undulating olive-brown lines is a rather obscure, complete, transverse, brown double line, parallel with the hind margin, touching in the middle a dark-brown triangular spot or blotch; hind margin mainly occupied by a broad brown cloud, which is sharply terminated above by a pale line from the apex of the wing. Hind wings bright rosy red, shading into paler towards the hind margin, and having a broad straight stripe of greyish brown, waved with paler brown, along the costal margin; near the anal angle is a large pale blue spot or ocellus, centred with a blackish cloud, and surrounded by a broad black ring which throws off a black cloud to the anal angle. Cilia of all the wings very short, darker brown.

Female similar, larger and stouter, often more richly coloured, and having, in place of the pectinations of the male, a pair of bristles on each joint of the antennæ.

Underside of the fore wings brilliant rose-red from the base to beyond the middle, thence pale purplish-grey or brownish-grey, with the costa pale brown, the hind margin clouded with dark brown, a chestnut patch towards the anal angle, and three or four waved transverse brown lines outside the

rosy portion; hind wings pale brownish or purplish grey with a whitish central lunate spot towards the costa, and a succession of dark-brown or reddish-brown lines throughout.

Slightly variable in the darkness of the brown shades and lines of the fore wings, and in the presence or absence of rosy or purplish bloom, but otherwise very constant. Specimens however occur, rarely, in which the hind wings are almost or entirely destitute of rosy colour, being of a dull yellowish instead. Mr. Sydney Webb has specimens with the fore wings of a putty colour, with the usual markings, and Mr. Charles Briggs one in which the shades and marbling of the fore wings are nearly absent, but the lost colour seems concentrated in the triangular spot which lies against the outer line. Another curious aberration is recorded, in which the ocellus of the hind wings is replaced by a triangular dark spot.

Double brooded, appearing in May and June, and again in August, or even September, though the second emergence is probably but partial, and rarely occurs in the more northern portion of its range, while the individuals of the first emergence sometimes remain in pupa more than a month beyond their usual date.

LARVA stout, rather tapering in front, head triangular, pointed above, face flattened; skin of the body rough with minute raised dots, wrinkled transversely; having on the twelfth segment a long, slightly curved, sharply pointed horn inclined backwards. Bright apple green, whitish green, or bluish green, with the raised dots white; on each side of each segment, from the fifth to the eleventh, is an oblique white stripe edged above with dark green, each extending beyond its segment both in front and behind, and the seventh passing across the eleventh and twelfth segments and reaching the horn upon the latter; another similar stripe, less oblique, lies along the side of the second to the fourth segments; spiracles yellowish-white or pale pink, surrounded with pinkish-brown

or violet; head green; its lobes edged with yellow; legs pinkish-brown; pro-legs green, edged below with pink; horn blue. Mr. Buckler has figured a beautiful variety of the larva, having a subdorsal row of red spots on each side. When very young the head is rounder, the horn pink, and there are faint traces of dorsal and subdorsal lines, while the oblique stripes are scarcely visible, and the body has numerous rather long slender hairs or bristles. When young it eats away the leaf of its food plant on both sides of the midrib, using the latter as a resting-place. At all ages, when at rest, the fore part of the body with the head is raised and rather drawn back in a curve. When well grown it rests on the stem or on a leaf of the food plant, but clears off every leaf from the tip of the spray which it has chosen.

On willow, sallow, apple, crab, white Ontario poplar, and even wild plum and many Rosaceous plants, but probably the various species of *Salix* and the apple are the most favoured. June, July, August, September.

PUPA stout, smooth, glossy, dark purple-brown, with slight projections at the anal extremity. Subterranean, but only just beneath the surface, in a large cocoon of earth, very slightly held together with silk.

The moth flies rather slowly and heavily at dusk, and again, and more swiftly, later in the night, and is not uncommonly attracted by a strong light. In the daytime it sits among bushes or on the side of a hedge with its fore wings falling back and hind wings forward, so as to show a broad edge in front, and bears a striking resemblance to a spray of two or three dead leaves hanging down.

Moderately common in the south and east of England, and westward as far as Devon, though scarcer in Cornwall; locally common in other parts of England as far as Cheshire, Lancashire and Yorkshire, and found more rarely northward to the districts of the Tweed and Solway in the south of Scotland.

In Ireland generally very scarce but widely distributed, and said to have been found as far north as Belfast.

Common throughout Europe, and often much more richly coloured than with us; also widely distributed through Northern Asia, and, under the name of *S. planus*, in China and Japan; also in some parts of North America, a slight variety, found in California, being called *S. pallidulus*.

2. **S. populi.** L.—Expanse 3 to $3\frac{3}{4}$ inches.

Pale brown or grey, fore wings with scalloped hind margin; hind wings with a brick-red blotch.

Antennæ of the male pectinated with strong tufts of yellowish bristles, with the shaft white; of the female pale brown or whitish, with a double row of minute bristles. Thorax, abdomen, and legs pale-brown or greyish-brown, the former very stout. Fore wings strong and thick; in the male with the costa nearly straight to beyond the middle, then much rounded to the apex, which is pointed; in the female more regularly rounded throughout: hind margin waved, and regularly scalloped in hollows between the nervures; anal angle rendered prominent by a deep concavity in the dorsal margin. Hind wings short, costal margin much rounded, hind margin scalloped.

Fore wings of the male pale grey or pale brown-grey; near the base is an indistinct, oblique, curved, darker grey transverse line; the whole central portion of the wing is occupied by a broad band of darker grey or grey-brown, the inner edge of which is oblique and slightly concave, the outer edge much more oblique and scalloped throughout in regular crescents between the nervures; beyond and parallel with this is a complete dark-grey transverse line similarly scalloped, beyond which the hind marginal space, except near the apex, is clouded with brown. Within the central band and at the end of the discal cell is an ovate, or lunate, white spot. Nervures rather sharply pale. Hind wings of the colour of the fore wings, with three or four rippled trans-

verse darker brown lines or shades, and near the anal angle a large, ill-defined, roundish brick-red blotch.

Female pale brownish-grey, yellowish-grey, yellowish-brown, or even pale buff, in many individuals having a rosy or purplish flush; with markings as in the male, but far paler and less distinct, except in the case of the red patch on the hind wings, which is large and bright.

Underside extremely plain, greyish, yellowish-grey or yellowish-brown, with the nervures paler, and faint indications of the transverse markings of the upper side. In the hind wings these sometimes become more distinct than above, but there is no indication of the brick-red blotch.

Variation in this species is usually in the lines already indicated—to darker grey markings in the male, and to paler general colour, or excess of rosy bloom, in the female—but in Mr. Sydney Webb's collection is a male having three large pink blotches on the fore wings, one at the base, one near the apex, and the third at the anal angle; while Mr. C. A. Briggs has a male of the extremely pale buff colour sometimes seen in the female, but with faint indications of grey transverse lines and shadings. At Armagh, in the north of Ireland, the Rev. W. F. Johnson has reared the male having the pink suffusion, and females of an extraordinarily pale yellowish. There is, in addition, a record of the rearing of a specimen wholly of a chocolate colour, and one has been found in Derbyshire devoid of the red blotch of the hind wings.

Regularly double brooded, appearing in May and June, and again at the end of July and in August.

LARVA stout, firm, rather tapering towards the head, rough with minute raised dots; head large, green dotted with yellow, triangular, the point upwards, face flattened; horn on the twelfth segment rough, curved back, yellow, sometimes tipped with pink; body yellow-green, raised dots yellow, extremely abundant; on the sides commencing with the fifth segment is a series of seven oblique lemon-yellow stripes, the

last of which extends from the eleventh segment on to the twelfth as far as the dorsal horn; the second to the fourth segments have yellow subdorsal and spiracular lines, and the anal pro-legs and flap are edged with a yellow line; spiracles whitish, edged with pink or crimson. Sometimes a crimson spot lies before or on each side of the spiracles, and even the subdorsal region is enlivened by a row of larger crimson spots. This variety is frequent in the north. Mr. Adam Elliott has repeatedly noticed it in Roxburghshire.

When very young the larva has an extremely long caudal horn, which however does not grow in the same proportion; the larva is then of a delicate green, but the lateral stripes and raised points soon begin to appear, though both are whitish rather than yellow, and the brighter colour does not show itself until it is somewhat advanced in growth.

In June and July, and again in September, on all kinds of poplar, including aspen, also on willow, and, in the fen-districts, commonly on the broad-leaved sallow (*Salix caprea*). It has also been found on birch, laurustinus, and rose. Rests on the under-side of leaves on the tree.

PUPA dull and coarse-looking, with a rough surface, stout, blunt at the tail with a short spike, colour dark purplish-brown. At the roots of trees, just below the surface, sometimes hardly underground, and in the slightest possible earthen cocoon. Readily dug up from loose earth at the foot of a poplar tree in the autumn or winter.

The moth flies at dusk, and again late at night. Its flight is heavy and rather clumsy, and in its attempt to alight on the smooth, slender-stalked leaves of a poplar tree it sometimes achieves a very undignified tumble, fluttering and slipping from leaf to leaf. Late at night it is attracted by any strong light, and may often be seen hanging to the lower part of a gas-lamp. In the daytime it commonly sits on the lower part of the trunk of a poplar tree, or on a hedgebank, or even on the knocker of a front door, or any

other convenient projection, where, its fore wings hanging back with the front margin of the hind wings thrust forward, it has much the appearance of a pair of withered poplar leaves.

It appears to occur in all parts of the United Kingdom except in the extreme north of Scotland, but is scarce in the extreme west of England and of Wales. In Ireland it seems to be more frequent, occurring wherever poplar is common. Formerly it was very abundant in the south of England, and even in London, occurring commonly in the squares and gardens; in the Surrey Zoological Gardens, for instance, when they existed, it was plentiful. Now however it is rarely seen in the suburbs of London, and seems to be generally less common throughout the country.

Abroad it is abundant throughout the greater part of Europe and large portions of Asia.

This species and the preceding, being of about the same size and emerging from the pupa at the same period, have long been recognised as suitable subjects for experiments in hybridization. These experiments have to some extent been successful, the offspring of such ill-assorted pairs having repeatedly been reared, though with difficulty, from the delicacy of constitution of the larvæ. Such specimens however have not proved to be capable of reproduction, and indeed are said to be, very often, gynandrous. In markings and colour they vary greatly, but are usually inferior in brightness of colour and distinctness of markings to both parent species; the antennæ are usually smaller than those of either parent, and in those which show male characters the pectinations are shorter. In the majority, if not in all the successful cases, the male parent seems to have been *ocellatus*, the female *populi*. The earliest recorded case of rearing such hybrids which I can find, took place in 1857, when twelve specimens of one brood were reared, all of which are stated to have been much alike, almost exactly intermediate in appearance between the species, as well as intermediate in sex. Another batch was much more variable;

some had one fore wing *ocellatus*, the other *populi*; others having *ocellatus* bodies with *populi* wings, and the converse. Mr. Porritt states that of several broods which have come under his notice, reared in Yorkshire, every specimen has male antennæ, yet specimens with female antennæ are certainly occasionally reared. The admixture of markings is most strikingly shown in the coloured spot near the anal angle of the hind wings, which sometimes exhibits the ocellated blotch of *ocellatus* surrounded by the red of *populi*, but usually consists of the large red blotch inclosing a blue, or black, ill-defined cloud.

The LARVÆ, though like those of *populi* when young, appear also to become intermediate, or even to resemble those of *ocellatus* when full grown; and the pupæ are described as differing from both parent forms.

S. tiliæ, L.—Expanse $2\frac{1}{2}$ to 3 inches. Pale olive-green, or reddish-brown, with hind margin deeply scalloped, and a dark olive-green, usually broken, central band.

Antennæ rather short and slender, whitish, with short brownish pectinations in the male. Thorax moderately stout, pale grey or pale brown, with a greenish tinge; the collar, a broad stripe down each shoulder, and a narrow line on the back, deep olive-green; abdomen pale brown, sometimes tinged with smoky or greenish. Fore wings with the costa tolerably straight to near the apex, then rounded; apex squared; hind margin deeply concave in the middle, and again near the anal angle, having a projecting point between; dorsal margin gracefully curved, and hollowed out before the projecting anal angle. Hind wings very short with rounded apex, and the hind margin sinuous but hollowed towards the anal angle.

Fore wings whitish-grey, tinged with olive-green or with pale reddish-brown, and having the base faintly, and the hind margin deeply, and broadly, clouded with dark olive-green; there is also a faint waved, olive-green, transverse

line near the base, and another, more oblique, beyond the middle; between these is usually a broad, sharply defined, deep olive-green central band, sometimes entire, more frequently broken into two blotches, the upper or costal blotch large, square, or pear-shaped, or shaped like a broad ivy leaf with the point outwards; the lower, or dorsal blotch, rhomboidal or obliquely conical. When entire, this band is always sharply constricted below a central projection, but this constriction commonly becomes the division, and then the variations in shape of the separated halves or blotches are remarkable, both becoming contracted, narrowed, detached from the margins of the wing, the smaller occasionally reduced to a mere streak or faint brown cloud, or even disappearing altogether, and the larger taking almost every possible form from a square to a wedge, though usually preserving the curious resemblance to an ivy leaf. Towards the apex the dark olive clouding of the hind margin is sharply cut off by a straight horizontal white line from the tip, which bounds an indented whitish blotch. Cilia short, reddish. Hind wings brownish, pale grey, or grey tinged with reddish, often with a brown or dark grey cloud near the base; the excavated portion of the wing near the anal angle dark green, merging into a dark grey cloud which extends transversely across the wing, and outside which the marginal space is greenish, reddish, or smoky blackish.

Underside delicate pale olive-green tinged with reddish, with the costa whitish, straight whitish bands across the middle of the fore and hind wings, and a whitish patch at the apex.

Besides the extreme irregularity in shape of the central band, or divided band, already described, there is great variation in colour, especially in the female, from olive-green or greyish-green to paler, or deeper, red-brown. In many specimens this is merely an effect of fading or alteration of colour, the greenish colour of the pale portion of the fore wings from the base to the clouded line beyond the middle changing

gradually to reddish, and this colour becoming slowly intensified from year to year, until in old specimens the influence sometimes, though rarely, attacks the central band and changes it also to dull red. Along with the paler portion of the fore wings a similar gradual change takes place to some extent in the lighter portions of the hind wings. But this change of colour—chemical or otherwise—is not solely the effect of fading in the dead insect; it occurs also in the living moth, and even in some cases is the original colour in which the specimen emerges from the pupa. Mr. Frohawk has even reared a specimen having the central band dull red. Very rarely a specimen occurs which is totally devoid of any trace of the central fascia or spots, and in other instances, hardly so rare, one fore wing is destitute, while the other has a small spot or cloudy indications. From these forms every possible grade of variation, to the complete band, exists.

On the wing at the end of May and through June. No second brood.

LARVA elongate, rounded, narrower in front; head large, triangular, with the apex upwards; skin not polished; twelfth segment with a long horn, curved backwards; anal flap with several raised points or incrustations. Back brilliant apple green; sides and belly paler green; whole surface covered with raised yellow dots; seven oblique lateral yellow stripes, sometimes edged above with violet or purplish, the first commencing on the fourth segment, and the last, and most conspicuous, ending at the base of the dorsal horn, which is blue above, purplish or violet beneath, with the tip yellowish. The incrustation or scutcheon on the anal flap is orange, edged externally with yellow, and encloses a dark purplish blotch. Spiracles yellowish edged with carmine; legs tipped with pink; face edged with a yellow line.

Or with the back dull dusky purple dotted with pale emerald green; sides and belly dull pale purplish flesh colour, with seven pale green lateral lines, the first entirely on the

fifth segment; horn rough, blue above, paler or yellowish beneath, tip pale greenish; spiracles yellow edged with red; head purple, the face edged with a yellow line; anal flap with the encrustation orange.

Or with the back dull olive green tinged with purple and profusely dotted with greenish-yellow or pale emerald-green; the dots disposed in transverse rows or bands; the seven oblique lateral stripes very pale lilac, edged above with dull purple; horn bright blue above, lilac beneath, tip yellow; anal scutcheon light orange-yellow, enclosing a ferruginous patch; spiracles deep red, centred with yellow; head olive-green, with the usual yellow line round the face; belly and sides below the spiracles very pale dull greenish; legs tipped with pink. (Fenn.)

When very young the larva is yellowish-green, very slender, with the horn black, bristly, and bifid at the tip, but very soon the horn becomes single and yellowish and the lateral stripes begin to appear. At the second moult the yellow raised points are developed, and after the third, the scutcheon upon the anal flap. The adult colours are gradually assumed as it grows, and sometimes a larva changes from green to purple before pupation. This is a graceful and very handsome larva.

July and August. On elm and lime, and, very rarely, on birch.

PUPA not very stout, rather rough, tail blunt with a stout spike. Dull dark purplish-brown. Subterranean, usually at the foot of a tree, in a large cocoon of earth and silk. May often be dug up in the autumn and winter at the foot of an elm or lime tree.

This beautiful moth may sometimes be seen at rest on the lower part of the trunk of a lime tree in the London suburbs, with fore wings hanging back and hind wings projecting a little forward; in shape and colour resembling in a most curious

manner a pair of green leaves pointing obliquely downwards, such as the lime trees throw out, here and there, upon their trunks; the resemblance being sufficiently close to deceive the careless eye, so that the moth, attractive as it would be to children, sometimes sits all day unnoticed within reach of their hands. Its flight is rather late in the dusk, so that it is seldom seen on the wing, and it is very little attracted by light.

Perhaps more common in the outer suburbs of London than in any part of the country—having a special liking for the limes—but moderately common throughout the south and south-east of England from Suffolk to Devonshire; scarcer in Norfolk and the Midlands, and in many parts quite absent. The most northern record upon which reliance can be placed appears to be of a single specimen in Yorkshire. A statement that one has been taken in Scotland is believed to have originated in a mistake, and I know of no record in Wales or Ireland.

It is common in the more central portions of Europe, is said to be found in some parts of Siberia, and has even been brought from Sierra Leone, but its range appears to be far more curtailed than that of its congeners. No very closely allied species seems to be known.

Genus 2. **ACHERONTIA.**

Antennæ rather short, straight, thick, terminated by a distinctly recurved bristle-like point; fore wings bluntly pointed, with the hind margin slightly rounded, densely clothed with scales; thorax and abdomen very massive.

LARVA very large, smooth, with rounded head, and broad oblique lateral stripes; horn of twelfth segment rough, bent down backward, and recurved at the tip.

PUPA very large, delicate, thin skinned, shining, rounded. Subterranean.

1. **A. Atropos**, *L.*—Expanse, $4\frac{1}{2}$ to 5 inches. Extremely stout, fore wings blackish-grey mottled with yellow and red; hind wings yellow, barred with black; a death's-head on the back of the thorax.

Antennæ rather short, straight, stout, and hardly tapering, but having a bent hairy jointed bristle at the apex; colour black, except that the upper side is white towards the tip; pectinated with short broad tufts of bristles in the male. Thorax and abdomen very broad and thick; head large, rounded in front, with large, thick, heavily scaled palpi, between which is coiled the short, thick proboscis or tongue. Head and the front and sides of the thorax blackish-grey, with a bluish gloss; upper portion of the thorax blackish-brown, with a large well-defined yellowish blotch, containing two round black spots and some dark grey clouds, so arranged as to produce a striking resemblance to the face of a human skull. Abdomen not tapering, densely scaled, deep yellow, with a cross-bar of black along the edge of each segment, and a broad bluish-black stripe down the middle, broadest at the anal segment. Fore wings very thick and strong, with the costal and hind margins gently and regularly rounded; apex pointed, but not acutely so; dorsal margin straight. Hind wings rather broad, with the apex sharply rounded or almost angulated; hind margin in part rounded, but hollowed before the anal angle, which is broad, with the dorsal margin much rounded towards the abdomen. Fore wings deep dark bluish-grey, mottled with reddish-brown and yellow; at a short distance from the base is an indented, double, transverse yellowish-white stripe, edged, within and without, with black; beyond this is a black indented transverse line before the middle of the wing, a second much more curved and indented beyond the middle, and a third, scalloped and indented, lying much nearer to the hind margin; in the middle of the wing at the end of the discal cell is a white spot ringed with black; and between this and the following transverse line

the space of the costal half of the wing is occupied by reddish and yellowish clouds, broken up by irregular indented blackish stripes; towards the hind margin are usually indications of several dusky-whitish, double, curved lines or even circles; and on the hind margin the terminations of the nervures are marked by rusty dashes. Hind wings rich yellow with a narrow black transverse band in the middle, and near the hind margin another, much broader, which throws off black streaks along the nervures inwards, towards the first band, and outwards, more broadly, to the hind margin. Sexes similar.

Under side deep rich ochreous yellow, having on both fore and hind wings a rather narrow central black transverse stripe, and towards the hind margin another of a more dusky black, throwing off broad dusky rays towards the hind margin, or even clouding the large space of the outer half of the fore wings with smoky-black. Legs brownish-black with the large tufts of scales yellow; under parts of body also yellow.

Usually not variable except in a small degree in the amount of pale mottling or clouding in the fore wings, but when striking aberrations take place, they seem to be in connection with the hind wings. Mr. S. J. Capper has a male in which the hind wings are of a straw colour, and another specimen in which the outer black band is obliterated, but the inner is so suffused as to spread in a cloudy manner over its space and towards the hind margin. One in Mr. Sydney Webb's collection is devoid of the inner black band, and another has it almost obsolete, while in a third the intermediate space between the bands is filled up with smoky colour, and the black of the outer band is suffused to the hind margin. There is also considerable variation in the width of the black bands.

Rather unreliable in times of appearance, usually either emerging in September or October, and, probably, hibernating; or else lying in pupa through the winter and

emerging in May or June, but occasionally appearing in July, August, or November, and, indoors, in December. Only one generation in the year. It is a curious circumstance that those females which appear in the autumn are usually without developed eggs, but it is not clearly established whether these are actually barren, or whether the eggs are gradually developed during hibernation.

LARVA very large and handsome, about five inches in length, solid and thick, when at rest fond of raising its anterior segments and drawing them back into the curious sphinx-like posture so frequent in the group. When in this position it is a very striking object. Usually of a soft green, bright green, dull yellow, greenish-yellow, or pale orange yellow, profusely sprinkled with minute black or purplish dots which are rather larger in the dorsal region; segments five to twelve with oblique lateral stripes, seven in number, of a dull blue or violet colour edged beneath with yellow or whitish, extending also to the back and meeting so as to form a dorsal series of **V** marks; spiracles purple or black, margined with white; horn on the twelfth segment of the colour of the body, very rough with points, curiously curved down and then recurved at the tip; head dull orange.

But specimens are occasionally found of a dark brown, dull purplish-brown, or even blackish-brown, with the stripes much less distinct, purplish-brown, or in other cases white; while some of these have the first four segments white clouded with grey; or brown with broad white stripes and patches, and instead of the usual lateral stripes a broad chain of diamond-shaped, purple-brown cross-bars. Altogether a most singularly coloured and variable larva.

In July and August, usually in potato fields, devouring the leaves of the potato, and completely stripping one portion of the plant. Feeding usually at night and remaining concealed low down on the stem in the daytime, so that it is not so readily found as would seem probable from its large size. When the potatoes are destroyed by disease it will attack

other plants, and has been known to take so kindly to nettle as to refuse to leave it for potato, when supplied. Also found feeding, naturally, on *Lycium barbarum* (tee-tree), jasmine, *Solanum dulcamara* (woody nightshade), and even on snow-berry, dogwood, spindle, and various other plants.

PUPA of large size, smooth, thin skinned, dark purple brown, rounded and without excrescences, but with the spiracles very distinct; anal segment terminated by a spike. Subterranean, preferring to bury itself to a considerable depth (eight or ten inches), forming a large chamber of the soil and a gummy secretion, and smoothing it very carefully inside. Frequently found in the potato fields when the tubers are dug up in the autumn, but from its delicacy of skin, very frequently injured, and, after such disturbance, rather difficult to rear. This difficulty is so great in the case of those which do not produce the moth in the autumn, that it is usual to force them out in the winter, by keeping them in a warm room, or even near a fire, always covered with moss or other porous material which is kept constantly wet. Without these precautions dug-up pupæ almost invariably die.

This moth is in several respects a most remarkable species—from its large size and bulk of body, and from the singular figure of a human skull which it bears on the back of its thorax, but still more from the fact that it has a voice, a curious shrill squeak resembling the cry of a mouse, which sound is readily produced by some individuals whenever touched or disturbed, though others cannot be induced to make it at all. The origin of this sound does not seem to have ever been satisfactorily ascertained. It has been attributed to friction of the thorax against the first segment of the abdomen, in the manner of the longicorn beetles; and to the forcing of air, by constriction of the abdominal segments, through the the thorax and head, and through minute apertures in the tongue or trunk; and it is said that bubbles have been seen upon the tongue when the moth had been

induced to produce the sound under water. But it has been satisfactorily proved that the *pupa* has the power of producing the same sound, and it is difficult to understand how either of the suggested methods could operate in the case of the pupa. Strange to say, the larva has also a power of producing sound, which however is of a totally different quality, being a curious grating or crackling noise, which appears to result from a lateral action of the maxillæ or jaws over one another, whereby one jaw passes over some minute prominences on the other, as though the larva might be *grating its teeth*.

The moth is said to be seen, very rarely, hovering at flowers, but I know of no case in which it has been captured while so occupied, and as its sucking tongue is short, I am doubtful of this habit. It is strongly attracted by honey, but prefers to take it in larger quantities than flowers supply, and is well known to enter beehives for this purpose. It has even been caught while hovering about the hives, and instances are well known in which it has been securely fastened down inside the hive, and completely covered with wax by the indignant bees. This, however, is a rare circumstance, and possibly only occurs when the moth has happened to die within the hive; indeed this could not well occur to a living moth, unless it were completely stupefied by greedy feeding on the honey; and as the stridulous voice of the moth has been observed to arrest and control bees in a manner similar to that produced by the voice of their queen, the former conjecture seems the more probable. It is not surprising that an insect with so many startling peculiarities, should be an object of alarm to the ignorant and superstitious, and it is on record that in eastern Europe, where it is extremely plentiful—so much so, indeed, as in some years to fly into houses and extinguish the lights—it is regarded with the greatest terror, and looked upon as the harbinger of disease and death. As a moth, it is excessively sluggish, and can hardly be induced in the daytime, even by squeezing

and throwing it into the air, to flutter even the smallest distance, but when aroused at night it has probably immense power and endurance, and has very often been found upon ships at sea, which it must have flown hundreds of miles to gain. A note has just reached me from Mr. J. Ross, Anstruther, Fifeshire: "I have now brought me a very good female specimen, by one of our fishermen. It was found at rest on one of the blocks of his boat, in the North Sea, about 100 miles east of May Island." When it happens to fly at night, in, at an open window, to a bedroom, there is no more sleep for the occupants until the noisy powerful creature is caught and in some way silenced.

Irregular in its times of appearance; in some years, as in 1865, 1869, and 1877 very common, especially in the larva state; but usually scarce. Appears to have been taken in every part of the United Kingdom, including the Orkney and Shetland Islands. In the south of Ireland sufficiently common to be known under the local name of the "bee-robber." Everywhere uncertain, and in many parts occurring only casually and at long intervals, but found almost every year in the warmer portions of the southern and eastern counties of England.

One or two observers have noticed that the moth when squeezed is able to exude a peculiar odour, which has been compared to that of musk, and of jasmine.

Abroad it is found over the whole of Europe and large portions of Africa and Western Asia, and has even been brought from Sumatra, though, in the last case, the capture seems to have been made at sea.

Genus 3. SPHINX.

Antennæ long and moderately stout, terminated by a thin, sharp, slightly curved bristle; tongue of great length; fore wings long, pointed, stout and strong, with the hind margin slightly rounded; hind wings short and broad, rounded and

sometimes delicately scalloped at the hind margin; thorax stout and very powerful; abdomen rather long, stout, but tapering rapidly, and smoothly, to a rather blunt point.

LARVÆ naked, smooth, very handsome; horn on the twelfth segment smooth and sharp, raised and curved back.

PUPÆ usually with a prominent case in front, containing the tongue, otherwise smooth and rounded.

1. **S. Convolvuli**, *L.*—Expanse, $4\frac{1}{2}$ to 5 inches. Large and stout; fore wings grey mottled with darker grey, hind wings paler with blackish bars; abdomen with interrupted bands of black and red.

Antennæ long, whitish-grey, in the male pectinated with broad blunt tufts of incurved bristles; in the female shorter and almost simple; tipped with a sharp point which usually bends back. Head grey, large and prominent, furnished with a sucking-trunk or tongue of great length—fully three inches—which coils up like a watch-spring between two robust palpi. Thorax very stout and powerful, grey dusted with whitish, whiter at the sides so as to form a pale stripe above the insertion of the wings, and having, in the male, an ill-defined blackish stripe on each side, just above; at the back and infringing on the first abdominal segment is a deep black forked streak on each side, enclosing a bluish spot. Abdomen long and stout, but tapering to a blunt point, barred on each segment with deep pink and black with a narrow white edging, each bar interrupted by a broad stripe of hoary grey down the middle of the back.

Fore wings very long, stout, pointed, with the costal margin regularly curved in a long sweep; hind margin oblique, slightly rounded and faintly undulating; dorsal margin most gracefully curved inwards to form a hollow before the anal angle. Hind wings short, rounded at the

apex, hind margin flatly, but regularly, curved, and edged by faint scallopings; anal angle rounded.

Fore wings hoary grey; in the male having the central portion much clouded with blackish, this blackish portion edged on the side next the base by an indistinctly blackish line, which, arising on the costa at about one-third the length of the wing, makes a considerable bend, and then returns so as to reach the dorsal margin at the base of the wing. Outwardly this dark central clouding is ill-defined, and often it is divided by the ground colour; but in it are two or more long black streaks lying upon nervures, and often it is spread beyond the middle of the wing in irregular rippled dark grey clouds, while a blackish cloud lies along the apical portion of the wing, and another near the hind margin, both containing deep black streaks. The female has none, or very little, of the blackish clouding, but has the long black streaks on the nervures and near the apex and hind margin stronger and more distinct. Hind wings, in both sexes, very pale grey, paler at the base, near which lies transversely a large, ill-defined black stripe; a dark grey transverse band, often divided in the middle portion, crosses the centre of the wing, and beyond it is another near the hind margin. Cilia grey spotted with white.

Underside dull grey; fore wings with a faintly indicated, darker, transverse fascia, pale-margined on each side, lying beyond the middle; hind wings banded with dark and pale grey as above, but more faintly; legs and body grey.

Apparently not variable.

On the wing in August and September, but on one or two occasions has been taken in June. Such specimens are believed to result from late larvæ, of which the pupæ have remained unchanged through the winter.

LARVA four inches long and stout in proportion, rather tapering in front; each segment of the body divided into rings by parallel wrinkles; skin smooth, but not glossy; horn

of the twelfth segment smooth, curved back over the anal segment. Colour of the body blackish brown; head yellow, edged with black, second to fourth segments with a bright ochreous subdorsal stripe, continued in a more indistinct and interrupted manner to the twelfth segment; dorsal stripe double, with a blackish central line and composed of similar interrupted ochreous streaks, with which moreover the whole dorsal region is profusely sprinkled; from head to tail, along the sides, just below the spiracles, is a broad pale grey or whitish stripe, often shaded off upwards or spreading so as to form large triangular patches on the segments, or else indications of oblique stripes, but very obscure and much dotted with grey; spiracles large, black; horn black, or sometimes ferruginous, or fawn colour above, black beneath; legs shining black; pro-legs brown, ringed with orange red or yellow. Very variable in shade of brown, and in the degree of yellow dorsal colouring and white clouding at the sides. Strangely enough this larva does not appear to assume the sphinx-like posture common to so many of its allies.

In June and July, and sometimes August, on *Convolvulus arvensis* in fields. Occasionally also on *C. sepium* (common bindweed) and there is a record of the finding of half a dozen larvæ in Wales upon the wild balsam (*Impatiens noli-me-tangere*) but there seems to be no record that they were reared, and from the extreme rarity of the larva in this country it seems possible that a mistake was made. From the same cause very little is known of the habits of the larva here; it has been supposed to hide underground in the daytime, but this seems to be mere conjecture, and is not confirmed by the result of Mr. Buckler's experiments with one of his larvæ. He found that it showed no desire to enter the earth, or even to remain upon it in bright sunshine, but crawled back to the *Convolvulus* plant. He also says that its whole demeanour was so sluggish that it would remain day and night in the same position on the same trailing stem, and merely move a little to the right or

left in order to devour the next leaf; so that it moved about three or four inches in a day. On the Continent it is said to feed, in addition, on *Convolvulus tricolor* and *Ipomea coccinea* (called by gardeners *Convolvulus major*).

PUPA very large, $2\frac{3}{4}$ inches long, smooth, with leg- and wing-cases rather prominent, and a very large projecting loop in front, which contains the tongue; abdominal segments rather distinctly divided; rich mahogany brown, with the head, thorax, proboscis and tail darker; the tail having a short blunt spike.

Subterranean, occasionally dug up in potato fields where *Convolvulus arvensis* is common.

This noble moth appears to be constructed especially for bold, rapid, and sustained flight. From the great size and muscular strength of its thorax, and the firmness of its long and sharply cut fore wings, to the fish-like shape of its taper body, all is arranged for the greatest power of movement with the smallest resistance to the air. When flying, as it loves to do, about tubular flowers in a garden, in the twilight, it exhibits a perfection of motion lovely to behold. Backwards and forwards from one flower-bed to another, or hovering an instant in front of a blossom, then moving to another like a shadow; but, if a sudden movement is made by the spectator, gone, lost to view, not seen to go; it has simply vanished. One of my sons, whose quick eyes on one occasion enabled him to see it dart away, testifies to the flash-like rapidity with which a specimen disappeared at a great height in the air! But, if no sudden movement is made to alarm it, the creature seems by no means timid, and even at times familiar and inquisitive. I have repeatedly seen it when nearly approached hover up and seem to look in my face, so that its gleaming lustrous eyes were distinctly visible looking into my own, then flash past over my shoulder, and return to the flowers. It has even been seen to approach and inspect a brilliant

scarlet striped jacket on one of the lads and apparently touch the bright colour with its tongue, as though desirous of ascertaining what new kind of brilliant flower had entered the garden. While flying in this manner the humming sound produced by the rapid motion of the wings is distinctly audible, indeed it is so loud that persons of quick hearing know that a specimen has entered the garden even before they see it. Although its favourite time of flight is the twilight, it by no means restricts itself to that period. Specimens may be seen, when the insect is common, at intervals for hours, and certainly up to midnight; at such a time a lantern is necessary, and it evidently excites their curiosity greatly. Altogether I look upon this species as the highest, in the scale of intelligence, of the Lepidoptera of these islands.

It frequents tubular flowers for the sake of their honey, which it readily extracts, by means of its long tongue, while hovering in front of them. Not, apparently, the blossoms of *Convolvulus*, but *Petunia*, *Verbena*, Marvel of Peru, Scarlet Geranium, *Pentstemon*, even the long tubed *Datura*; but far beyond all others it prefers the richly scented, evening flowering *Nicotiana affinis* (white tobacco).

In the daytime it loves to sit on posts or among garden plants close to the ground with wings pressed down to the sides forming a steep roof, when it looks like a bit of wood; and has also a curious trick of reposing itself upon linen hung out all night to dry, to the no small disturbance, and even alarm, of the women when taking it in next day. The male has been noticed by several observers to exhale a scent of musk when disturbed.

Usually scarce in this country, and, unless in a favoured southern locality, many years may pass without seeing it, but occasionally it is abundant, and then it occurs in all parts of the United Kingdom, even to Orkney and Shetland. Such apparently was the case in 1846, and to some extent in 1858-9, 1868, 1875, 1885, and especially in 1887. Yet in none of

these years was the larva found in any numbers, indeed it is doubtful whether there are records of the finding of twenty larvæ, in all, in these islands ; so that, although no doubt exists that a few undergo their transformations here, there can be no question that the vast majority arrive here from abroad, a conclusion which is greatly supported by the fact that the appearance of the species, in numbers, in this country, is immediately preceded—as in 1887—by that of multitudes in the neighbouring countries of the continent of Europe. To give localities seems therefore useless, especially as it appears to have occurred in all parts of England, Wales, Scotland and Ireland. It is widely distributed and plentiful throughout Europe, Asia, and Africa, except in the extreme north, though in South Africa it attains to but about two-thirds of its size with us, while in Tahiti Lieutenant J. J. Walker found it of only three inches in expanse of wings. As far as its powers are concerned there is no reason why it should not be found in any part of the habitable globe.

2. **S. Pinastri.** *L.*—Expanse 3 to $3\frac{1}{2}$ inches. Pale brownish grey, with three black streaks on the middle of the fore wings ; hind wings, and body, grey.

Antennæ rather slender, white above, brownish beneath ; in the male with short brownish pectinations. Head and thorax grey or brownish grey, with the tips of the abundant scales hoary, giving a powdered appearance, except in a broad stripe from the head along each side of the upper part of the thorax, which is blackish brown. Abdomen grey or brownish grey, with a black line down the middle of the back, and bars of dark brown and whitish on the sides. Fore wings with the costa hardly curved except near the pointed apex, hind margin rounded and very oblique ; dorsal margin very gently curved. Hind wings short, rounded, except a slight hollow in the hind margin before the anal angle. Fore wings grey or grey brown, much dusted with

ashy or whitish ; a dark brown irregular stripe runs from the base of the dorsal margin, parallel with the costa, one-third the length of the wing, when it turns with a short curve to the costa ; a second brown stripe, broader and less defined, arising on the costa at nearly two-thirds of its length, half crosses the wing, then makes a bend inward, and turns to the dorsal margin ; the space enclosed between these stripes forms a central band, more or less clouded, from the margins, with brown, but especially so on the dorsal margin. In it at the end of the discal cell is a small white spot, below which are three thick, longitudinal, straight black streaks, the middle one extending far beyond the other two ; another black, or brown, streak runs from the tip of the wing to the second line, marking off an ovoid apical space of a slightly paler grey. Cilia white, broadly spotted with dark brown. Hind wings dark grey or dark brown-grey faintly dusted with ashy scales ; cilia white with narrow brown dashes.

Underside greyish brown, with a darker brown transverse band beyond the middle, indistinct in the fore wings, distinct, and followed by a pale band in the hind wings ; cilia white, spotted regularly with black brown. Thorax whitish-brown beneath with a black stripe from the head passing below each wing ; abdomen whitish.

Not very variable, but English specimens are frequently plain in appearance, portions only of the transverse lines being indicated by ill-defined brown shades, and their general colour is exceptionally brown ; the straight black streaks are very constant.

On the wing in June, July, and August.

LARVA three inches long, not stout, smooth ; head, dorsal plate, anal flap, horn, legs, and pro-legs, all glossy as though highly varnished, and sprinkled with raised black dots ; segments transversely wrinkled. Dark green with a dark red dorsal stripe edged with yellow ; sub-dorsal stripe yellow or whitish, no oblique stripes ; spiracular stripe yellow, interrupted at every segment ; spiracles dark purple, ringed with

black, with an interrupted line of yellowish flat crescents below them. Head reddish brown, horn on the twelfth segment black. When young, however, green with slender longitudinal yellow stripes, head dark green, spiracles dark red, head and legs bright red. This description is condensed from that of Buckler, and represents the produce of eggs received from Saxony. Larvæ found in Suffolk by the Hon. Mrs. Carpenter, sister to Lord Walsingham, and figured by her, are much less bright in colour, the dorsal region broadly light brown, with darker brown clouds on each segment, and the sides mixed brown and greenish or yellowish, with head, spiracles, and horn as already described, and two striking black spots on the second segment; indeed the larva appears to be subject to considerable variation.

September and October, on *Pinus sylvestris* (Scotch fir).

PUPA dark red, with a short thick brown projecting sheath for the tongue; tail with three short points. Subterranean.

This species was recorded as British by Donovan and Harworth, and Stephens gave as localities Esher, Colney Hatch Wood, and Rivelston Wood near Edinburgh. A specimen still exists in the Norwich Museum Collection, formerly in that of Mr. Sparshall, which was evidently believed by him to be British; besides which, in 1841, Mr. Thomas Marshall, of London, stated that in 1827 or 1828 he saw a living specimen in Cumberland. "It was hanging in the position peculiar to the family when recently escaped from the pupa state, to a portion of the root of a fir-tree which protruded through the projecting edge overhanging a perpendicular bank of ten or twelve feet high at the side of a fir plantation on Lattrigg, a low mountain near the foot of Skiddaw." After this date the insect was lost sight of for many years, so that doubt was thrown on the early records, and the species expunged from the British list. But in 1860 a specimen was taken near Romsey, Hants, and exhibited at a meeting of the Entomological Society of London. In 1863 another was met with, by a lady, at Hinton St. George, Somerset. In 1876 one was

taken at Waldingfield, near Ipswich, and in the following year another, when also a specimen occurred in the garden at Tuddenham St. Martin Vicarage, in the same district; and at about the same time a larva seems to have been found at Wimbledon and a pupa at Wickham Market, both of which were safely reared. In 1878-9 and 1880 larvæ were found near Leiston, Suffolk, by the Hon. Mrs. Carpenter, as already mentioned. At the same time the late Dr. Hele, of Aldeburgh, began to find the insect in his own neighbourhood. He says, "The first specimen captured was in 1879 in the vicinity of Saxmundham. In 1881 a few were taken in some pine woods in this locality (Aldeburgh). In the following year in July and August we captured about forty specimens in this neighbourhood. We found them at rest on the trunks of the common Scotch firs from about four to fourteen feet above the ground, in every aspect, apparently without any regard to wind or weather. In one case we discovered a deformed female in the act of laying eggs on the trunk of the tree. Some of these eggs we gathered; nine larvæ were hatched on August 9, and took to Scotch pine freely; six fed up and buried themselves in October; from May to July 1883 they emerged." In 1885, and doubtless in subsequent years, more were taken in this locality, and in the meantime others had been found near Ipswich, and one in Herefordshire. In 1892 Lord Rendlesham and his sons captured eleven specimens in the neighbourhood of Woodbridge, Suffolk, and also obtained eggs from which larvæ were fed up. Several of these have been preserved and placed in the cabinet which has been established in the National Collection at South Kensington, by Lord Walsingham. From others the perfect insects have been reared this year, and I now hear that two more moths were found, one of them just emerged, in the fir woods at Woodbridge, by Lord Rendlesham on the sixth of the present month—June 1893. The only other records with which I am acquainted are of two larvæ in the Island of Mull in

1860-1. These appear to have been of the browner colour of the Leiston larvæ, and not green.

It thus appears that the insect is mainly confined to Suffolk so far as this country is concerned, but that it still exists elsewhere both in England and Scotland, though in great rarity. It is common throughout the greater part of Europe and apparently in India and the United States of America.

3. **S. Ligustri**, *L.*—Expanse $3\frac{1}{2}$ to $4\frac{1}{2}$ inches. Fore wings dark brown, shaded with darker; hind wings pink, with black bands; abdomen purplish pink, barred with black.

Antennæ rather long, whitish above, pectinations, in the male, brownish. Palpi and lower part of the head blackish, upper part greyish-white, often with a rosy tinge; a broad whitish or pinkish-white stripe passes from the head along each side of the thorax, covering the insertion of the wings; above this the front and each side of the thorax are broadly deep black, shaded off above into the central space, which is grey mottled with brown and black, while nearer the abdomen on the upper surface are two blue-grey spots surrounded with black. Abdomen bright purplish pink, broadly barred, on each segment, with black, except down the middle of the back, where is a broad pinkish-grey longitudinal stripe divided by a black central line. Fore wings long, pointed, costal margin very slightly curved in the male, more arched in the female, hind margin very oblique, slightly rounded, dorsal margin gently curved and hollowed before the anal angle. Hind wings not very short, bluntly pointed at the apex, with the hind margin slightly rounded. Fore wings very pale greyish-brown or pinkish-brown, shaded with darker brown; costa brown; a broad, ill-defined, blackish-brown longitudinal stripe extends along the dorsal margin for two-thirds of its length, occupying half the breadth of the wing, thence gradually narrowing off through the remainder of the wing to the apex. Outwardly this is in part bounded by a darker black-brown double line,

which arising on the dorsal margin proceeds in a series of slight curves and indentations to the apex of the wing, where it is merged in a sharp, elbowed, black blotch, above which the tip is often hoary. Between, and outside, these blackish lines are parallel whitish shades or stripes, and beyond them the hind margin is brown with the cilia much darker. At the apex of the discal cell is a black spot, through which, longitudinally, and sometimes transversely, run long black lines. Other, thicker, black lines lie along the nervures beyond the middle of the wing, and at the base is a tuft of long scales, some of which are rosy. Hind wings pale pink, brightest at the base, and having three transverse black bars, one short, near the base, the other two long, one completely crossing the middle of the wing, the other near the hind margin; outside the latter the margin is tinged with brownish; cilia reddish-brown. Female similar, but with broader fore wings.

Underside pale grey-brown, with a rosy tinge, much dusted with white scales. At the apex of the fore wings these are dense enough to form a silvery white blotch which is edged below with a black line; the latter being continued as a dark brown indented stripe to the dorsal margin, and there uniting with a blackish shade which crosses the wing near the middle; these two join and are continued, as a broader blackish stripe, across the hind wings. Outside these stripes, on all the wings, are broad ill-defined whitish parallel bands. Body greyish-white beneath, tinged with pink and brownish; legs black.

Variation in this species is mainly in the degree of dark colour on the one hand, or of rosy shading on the other, in the fore wings; in the hind there is a tendency in the first and second black bands to coalesce near the dorsal margin. Mr. Sydney Webb possesses beautiful specimens in which the pale portions of the fore wings are rosy red. In another they are very nearly of a fawn colour. A female reared by Mr. C. A. Briggs, a year or two since, is a magnificent variety,

the usually darker portion of the fore wings deeply and broadly black; the black transverse bands of the hind wings double their usual width and intensely black; the narrow marginal band also clouded with blackish; the back of the thorax unusually dark, and a broad black stripe down the middle of the abdomen, tapering towards the tail. Two specimens reared by Mr. W. Holland at Reading have the hind wings yellowish white.

On the wing in June and July.

LARVA three inches in length; stout, smooth, segments with slight transverse wrinkles; incisions of segments compressed; head rough, with minute depressions; twelfth segment with a large curved horn pointing backwards. Body bright apple-green, segments five to eleven each with a broad oblique white stripe, edged above with lilac, and continued below in the form of white dots upon each preceding segment; spiracles dull yellow; head dull emerald green, each lobe internally margined with a broad brown line; mouth and tips of legs and prolegs brown; horn yellowish beneath, tip and upper surface black; anal flap edged with yellowish. (Fenn.)

When extremely young the larva is green, with minute bristles and yellowish dots, the horn at first bristly and slightly forked, afterwards merely covered with small tubercles. The yellow dots and hairs disappear as it grows, the stripes first appear pale greenish, later yellowish, and the lilac and white colour is not shown until the larva is well advanced in growth.

Mr. Buckler has figured a magnificent variety of the larva, found at Colchester, in which the body is purplish-red, the stripes white edged with black and shading off to faintly greenish on the back; head and second segment green above, edged with black.

July and August on privet (*Ligustrum vulgare*), feeding in the evening and at night, eating off the leaves in regular

order from the topmost shoots, which it strips; hiding in the thicker parts of the bush in the day. Also found occasionally on lilac, holly, laurustinus, dog-wood, ash, Gueldre-rose—wild and cultivated varieties—mealy-Gueldre-rose, hop, snowberry, mountain ash, evergreen oak, *Phyllirea*, and even once on teazle.

When at rest it raises the front segments high, in the sphinx-position, with head and legs drawn close in, and is a very striking as well as handsome object, and in this country the most familiarly known and noticed of the group.

PUPA very large and stout, elongated, with deep segmental divisions, and a blunt, rounded, closely-joined tongue-case in front of the thorax; reddish or purplish-brown. Subterranean, enclosed in an earthen chamber.

The moth flies at late dusk, but is seldom seen on the wing. It comes occasionally to tubular flowers—jasmine, rhododendron and honeysuckle, but rarely while there is light enough to see it. In all probability its principal time of activity is after midnight and in the morning twilight, indeed there is a record of a dozen specimens being secured at three o'clock in the morning, drawn together by the presence of a reared female. It is also seen sometimes in the night at lighthouses far at sea, when, possibly, migrating. In the daytime it sits on posts, palings, or walls near the ground, and, with its wings closely shut obliquely to its sides, looks as much like a discoloured chip of wood as a moth.

Common in the southern half of England, but becoming rare in the northern Midlands, recorded only once in Lancashire, and very rare in Yorkshire. It has been taken in Scotland, but only in the southern portion. In Ireland larvæ are said to have been formerly taken by Mr. Haliday, and there appears no reason whatever why it should not occur there, but I know of no other record. It is common through the greater part of Europe, in North Africa, and

Northern and Western Asia. In North America a form is found having little or no trace of the rosy colour on the hind wings, which has been named *S. drupiferarum*, but it seems to be no more than a local variety of this species.

[**S. quinquemaculatus**, *Haw.*; **Carolina**, *L.*—Of this species, Haworth stated that he possessed a specimen taken at Chelsea by his friend D. Drury. This specimen still exists in the collection of Dr. P. B. Mason, at Burton-on-Trent, and shows the ancient label "Taken near Chelsea." The late Mr. J. C. Dale wrote: "I saw a specimen actually bred at Leeds, another taken at Hull, one at Chelsea, and have heard of two or three others," and Stephens mentions seven or eight specimens which he believed to have been taken in this country, also mentioning the name of the gentleman by whom a specimen was reared at Leeds, but he adds, with great truth, "Its true locality is North America. I have no doubt all were imported," and goes on to protest against the inclusion of accidentally imported species, such as this, in the British fauna. "If this be admitted, as well might the 'noble monarch of the forest' because a captive lioness, which had escaped from her prison, was re-taken upon Salisbury Plain." This opinion has met with general acceptance, and the moth, a noble-looking species, has long ceased to vex the souls of entomologists by its visits.]

[**S. Druræi**, *Don.*; **Cingulata**, *Fab.*—Another North American species, of which the late Mr. E. Newman wrote: "I possessed for many years a specimen which bore a first-rate pedigree as a true Briton, and have seen others," and Stephens mentions the capture of a specimen about 1778, near London, which was carried alive to the late Mr. Drury; also another taken in September 1826 in a nursery ground near the Kent Road, and a third in his own cabinet, taken near London, but as with the last species, is satisfied that all

were imported. Some change in the conditions of trade between this country and America—possibly in the timber trade—seems long ago to have put an end to these perplexing arrivals.]

Genus 4. **DEILEPHILA.**

Antennæ straight, of moderate length, and with a slightly recurved point; fore wings moderately elongated, pointed, with oblique hind margin and slightly hollowed dorsal margin. Hind wings short, brightly coloured, with a slight projection at the anal angle. Thorax stout and rounded, abdomen also stout and round, tapering off gracefully and smoothly to a point.

LARVÆ elongated, smooth, with a prominent horn on the twelfth segment and large conspicuous sharply defined pale spots along the sides.

PUPÆ thin-skinned and very delicate, without protuberances. Subterranean, or among refuse on the surface of the ground.

A little group of our most beautiful as well as rarest species of Hawk-moths, remarkable for the graceful shape of their smooth, clean-cut bodies and wings, and for their splendid larvæ.

A table may be useful—two species being very similar.

A. Nervures of fore wings whitish. *D. Livornica.*

AA. Nervures of fore wings not whitish.

B. Central pale stripe of fore wings broad, rosy-grey.

D. euphorbiæ.

BB. Central pale stripe of fore wings narrow, whitish.

D. Galii.

1. **D. Euphorbiæ, L.** Expanse $2\frac{1}{4}$ to 3 inches.

Fore wings broadly pale rosy-grey, with olive-brown stripe and spots; hind wings pink with black base and submarginal stripe.

Antennæ rather long, moderately stout throughout, white, with the lower side, and pectinations in the male, faintly brownish; head bluntly pointed, olive-brown, with a white stripe over each eye; thorax very broad, olive-brown, with a broad white stripe continued from that over the eyes along each side of the thorax, above the insertions of the wings, to the abdomen, where it turns up a little towards the back at the tip of the shoulder lappets, thence shading off to light reddish brown at the back of the thorax. Abdomen round, stout, tapering from the middle to a point at the tail; olive-brown with a broad black bar on each side of the first segment, a large black spot on each side of the second, a white bar between them, and a large white spot on the third, beyond which are white lines at the edges of the remaining segments except the last. Legs all white. Fore wings rather short and broad, but pointed, with the costal margin hardly curved except towards the tip; hind margin oblique, nearly straight; dorsal margin waved. Hind wings rather broad with the apex nearly rectangular, hind margin slightly curved and with a hollow before the anal angle, which is broad and rounded off. Fore wings very pale rosy-grey, or rosy-white, faintly sprinkled with grey atoms, having at the base a large blotch of olive-brown, the edge of which, arising on the costa a short distance from the base and curving broadly, attains the base of the dorsal margin. At this spot the olive-brown blotch shades into black, and touching it is a large tuft of long white scales covering the base of the wing. Dorsal margin narrowly white. Beyond the discal cell is a pear-shaped olive-brown blotch usually united with a cloud of the same colour along the costa, which in some cases forms also a second, smaller, blotch beyond. Upon the dorsal margin from the middle to near the anal angle, as from a wide base, arises a broad olive-brown stripe which, narrowing rapidly as it crosses the wing, attains the apex as a mere point. Outside this oblique stripe the hind margin is pale rosy-grey, a little darker than the ground colour. Hind wings rosy pink, with

the basal portion broadly deep black, a slender black transverse band parallel with the hind margin, a large white space above the anal angle, and the hind margin beyond the black band, yellowish or pinkish; cilia white. Female similar, slightly larger and stouter. Underside dull rosy with the pear-shaped blotch of the fore wings blackish and the remaining markings indicated by brownish clouds; thorax rosy; abdomen faintly rosy with white bars.

Hardly variable except in the presence or absence of olive-brown clouding along the costal margin and of the second blotch; but in warm climates the ground colour is deeper rosy-grey, or the dark atoms are larger, and the dark markings of a deeper olive.

On the wing in June and July, and has been taken in September.

LARVA, when full grown, 3 to $3\frac{1}{4}$ inches long. Plump, cylindrical, but tapering considerably from the fourth segment to the head, which is rather small, and rounded. Each segment, from the fifth to the twelfth, is so deeply cut by transverse wrinkles as to appear divided into seven rings, that in front being much the broadest. On the twelfth segment is a rough, blunt-tipped horn, curving a little backwards. Skin smooth and shining; anal prolegs larger than the ventral and rather squared. Head crimson, with the mouth yellow edged with black. General colour of the body bronzy-green or blackish-bronze, varying in tone with every individual, but consisting of rows of minute bronze dots with the interstices paler. Dorsal stripe crimson, widening on the second segment, thence narrow throughout to the anal flap which is also brilliant crimson; dorsal horn glistening, red, with the tip black; subspiracular stripe variable, bright crimson, purplish-red, or yellowish,—broad, sometimes interrupted, at others spreading down over the whole subspiracular surface to the sides of the prolegs; between the dorsal stripe and this broad subspiracular stripe is, on the front sub-

division of each segment, a black, or green-black bar containing two large white, greenish, or pale yellow spots, the upper spot round or oval, the lower ovate, squared or elongated, these pale spots with their black surrounding bars being the most striking markings upon the larva. Behind these, upon each segment, is usually a broadly wedge-shaped reddish or yellowish bar. Feet red.

But in some cases all the usual crimson markings are green, except that the broad subspiracular stripe is pale yellow; or the head, horn, dorsal line, and feet, only, are crimson, the side markings yellow and the spots white. The variations in colour are great, but the markings appear to be sufficiently constant and reliable, and to be assumed very early in the larval life. (Mainly from Buckler—description and figures.)

July, August, and September on *Euphorbia paralias*, *E. Portlandica*, and *E. cyparissias*; extremely fond of the acrid juice which flows from the wounded plant, also devouring the whole plant—flowers, seed-vessels, leaves, and even stalks where sufficiently tender, biting them off to the level of the sand. Mr. Stainton says, on the authority of Mr. Melhuish, that when a larva has finished a plant it rambles about until it finds another to its taste, then commences at the lower leaves, although old and covered with sand, devours them all before proceeding to climb the stem, and so clears all before it. He also says that the seed-vessels are taken between its front legs and held close to its mouth, “like a monkey with an apple,” until devoured.

PUPA thin-skinned, stout, rounded, but with the head bluntly angulated in front, and the thoracic portion depressed in that part. Colour brown, segments and wing-cases faintly striped with darker brown.

In a cocoon of silk and sand beneath the surface of the sandy places at the sea-side, in which its usual food-plant grows. In pupa through the winter, and sometimes remaining in that condition through a second winter, while in other rare cases

the moth emerges in September. In confinement most difficult to rear at the proper season, as pupæ kept through the winter almost invariably die, and the plan found most successful is that of forcing them out, in the late autumn or early winter, by moist heat.

This species is hardly to be considered more than a casual and fitful inhabitant of these islands. The first reliable record seems to be that by Mr. W. Raddon, who obtained larvæ in the year 1806 on the coast opposite Instow, North Devon. In this district, lying along the right-hand coast of the arm of the sea which receives the Taw and the Torridge, is an extensive range of sandhills extending from near Barnstaple to within a few miles of Ilfracombe. Upon these sandhills, known as Braunton Burrows, the larvæ were found in abundance, upon *Euphorbia paralias*, by Mr. Raddon, the greatest plenty being reached in the year 1814. The vast majority appear to have died in the larva or pupa state, and comparatively few were reared. These few form the majority of the British specimens now in collections. From some unascertained cause the species seems to have disappeared from North Devon after 1814. This cannot have arisen from over-collecting, since Mr. Raddon distinctly stated that the larvæ were so plentiful that he took only those which were full grown, except in one instance, when gathering an armful of the plant, at dusk, for food for his larvæ, he found afterwards that he had inadvertently also taken *more than a hundred* young larvæ!

The Rev. E. N. Bloomfield has seen a specimen, and the skin of its pupa, which was reared, many years ago, from a larva found on *Euphorbia* at Landguard, Suffolk. The plant was known to grow on that coast formerly, though it has now become extinct.

In September 1889 thirteen larvæ were found by a young collector upon *Euphorbia* on the north coast of Cornwall. Of these, four died in the larva or pupa state, eight were reared in 1890, emerging from May 9th to July 24th, and the remaining

specimen made its appearance on June 21st, 1891. These are vouched for by the Rev. J. Seymour St. John, in whose cabinet are three of the moths.

Mr. J. H. A. Jenner, of Lewes, has furnished the following information, obtained from Mr. J. Cosmo Melville: "I obtained the two specimens exhibited from a working man, not a scientific entomologist, and one who knew nothing of importations. I found them in his collection among a great variety of common *Lepidoptera*, set English fashion; one perfect, the other without antennæ. He said that he found the larvæ at Ecclesbourn in 1871, and bred them; and I believed him."

Captures of the insect in the perfect state appear to be of extraordinary rarity in this country, of the few recorded the majority being really *D. galii*. One, however, was taken in 1871, at rest, in a garden near Southampton, by the late Mr. W. Weston. The only other such capture of which I am aware was of a male specimen, by myself, on September 7th, 1887, in my garden at King's Lynn, Norfolk. It was flying very quietly and gently, at early dusk, about a large bed of *Verbena*, leisurely sipping as it hovered at blossom after blossom, and was captured with the greatest ease. A suggestion was afterwards hazarded that the specimen might have been accidentally conveyed by one of the steamers which carry iron ore from the Bilbao River in the north of Spain to the north of England, and might have escaped while off the Norfolk coast. This explanation seems by no means unreasonable, especially when the time of year, and the absence of *Euphorbia paralias* from that part of the Norfolk coast is taken into account; but it remains no more than a suggestion. In all probability every case in which the larvæ have been found has resulted from some accidental introduction or partial immigration of the perfect insects, and, on the other hand, their disappearance, from the inability of the species to withstand the variations of our climate.

Abroad it is widely distributed, and often abundant in Central and Southern Europe, Armenia, Asia Minor, and North America.

2. *D. galii*, *W.V.*—Expanse $2\frac{3}{4}$ to $3\frac{1}{4}$ inches.

Fore wings olive-brown, with a toothed whitish longitudinal stripe; hind wings pink and whitish, with black base and a black stripe.

Antennæ olive-brown, whitish towards the tip. Head and thorax olive-brown, with a bright white stripe commencing on the palpi, passing over the eyes and over the base of the wings, to the hinder part of the thorax on each side—the thoracic portion being broad and edged above with black. Abdomen olive-brown, with a faint line of whitish dashes down the middle of the back, and, at the sides of the basal segments, two broad black and two white bars on each side; hinder abdominal segments also barred at the sides, narrowly, with white. Fore wings with the costal margin nearly straight till near the apex, to which it is gently curved, apex pointed, hind margin slightly curved and very oblique, dorsal margin curved so as to form a hollow before the anal angle. Hind wings rather short, with the apex rounded; hind margin gently rounded but hollowed before the anal angle; dorsal margin dilated. Fore wings broadly olive brown along the costal margin, with sharp indentations of the pale central colour, and having also an olive-brown longitudinal stripe, in the form of a very long triangle, based upon the whole central portion of the dorsal margin and tapering thence through the middle of the wing to a sharp point at its apex. Between these olive-brown stripes is a broad longitudinal yellowish-white or pinkish-white stripe extending from near the base of the dorsal margin to the apex of the wing, where it also tapers to a sharp point, on its way giving off two tooth-shaped branches pointing back obliquely towards the costa. Along the hind margin is a rather broad bluish grey stripe edged internally by a darker sinuous line. At the

base of the wings is a rather dense tuft of long white, deep black, and pale blue scales; and the base of the whitish longitudinal stripe is tinged with glossy blue.

Hind wings yellowish white or pinkish white, with the basal portion broadly deep black, and a narrow black transverse band just within the hind margin. In the intermediate pale space is a large cloud of bright pink, shaded off so as to tinge a great part of this space, except towards the dorsal margin, where it remains white; hind margin tinged with brownish grey; cilia whitish.

Underside of the fore wings broadly olive-brown along the costal and dorsal margins, pale bluish grey along the hind margin, and having the long middle space yellowish white, tinged with olive. At the end of the discal cell is an elongated black spot, not visible above. Hind wings with the basal half pale olive followed by a broad band of pinkish white; hind margin broadly bluish grey, and having a brown blotch near the white anal angle. Body beneath pale olive-brown with white transverse lines; legs olive-brown and white. Sexes very similar in all respects.

A very constant species in colour and markings, but the pink colouring on the hind wings is occasionally much reduced in area, and, more rarely, specimens occur insufficiently covered with scales, and having the dark markings obscure and the pale spaces smoky.

On the wing in May, June, July, and August, and occasionally in October.

LARVA nearly three inches long. Moderately plump and cylindrical, except that the thoracic segments taper considerably to the rather small head; caudal horn rough with minute bristly points, curved back over the anal flap. Hinder portions of the segments divided by wrinkles; prolegs fringed by a few bristles. Head pinkish or purplish pink, with a black band over the mouth. Colour of the back and sides olive-green, sometimes varying towards olive-brown,

with an indistinctly paler dorsal line, sometimes broad and cloudy, at others narrow and partially interrupted. Body, below the spiracles, dull pinkish tinged with smoky. On the front portion of each segment of the body is a large, round, pale yellow, subdorsal spot, ringed with black which shades off outwardly. Sometimes these spots are ovate, and that at the base of the horn is always elongated. Horn pinkish red, spiracles ringed with blackish; legs black; prolegs dark red. In markings this larva is rather constant, but there is much diversity in the ground colour. One striking and not very rare variety has the colour of a black-olive, even the spots being small and dull in colour; and of this form a modification takes place, where the blackish ground colour is broken by close lines of minute yellowish or olive-green dots, or where the general colour is bluish black. In these the round spots, the head, and the legs are often dark or suffused with darker shades.

The young larva is quite different, being of a bright full green, with dorsal, subdorsal, and subspiracular lines pale ochreous yellow. As it grows spots begin to appear on the subdorsal line, and at the last moult—which occurs when the larva is still not half of its ultimate size—the subdorsal line disappears, and the spots become bright and conspicuous.

August and September, on *Galium verum* and *G. mollugo*. Said also to have been found on *Fuchsia* and on *Epilobium angustifolium*, and will eat *Galium aparine*, though not always with satisfactory results. Usually met with, however, upon *Galium verum* (ladies' yellow bedstraw), on seaside sandhills or hillsides on the chalk. Extremely sensitive to cold, retiring to the roots of the plant, or even burying itself in the sand, when the temperature falls, and should the fall be considerable the effect seems usually to be fatal. But in warm weather it loves to sun itself on the sand or on its food-plants, feeding in the evening and at night when warm.

PUPA thin-skinned and delicate, regularly rounded, except

that the wing-cases are rather full and prominent; anal spike slightly curved. Colour greyish brown or reddish brown, dusted with blackish; antenna sheaths outlined with pinkish.

In a large cocoon or silk-lined cavity in the sand beneath the surface; sometimes buried at some depth. Passing the winter—usually—in this stage. More easily reared than the previous species, yet delicate, and most successfully perfected in moist heat.

Of this species the moths reared in this country are always, or nearly always, found to be smaller in expanse of wing than those from the Continent; and Mr. W. H. Tugwell has furnished very curious tabulated accounts of specimens captured in the perfect state on our own coasts or inland, as compared with our reared examples—fortified by his own experience in rearing upwards of one hundred—by which he shows that, while captured specimens in the great majority of cases range from three inches to very nearly three and a half in expanse, those reared in this country range from two and a half to about three inches—the captured specimens agreeing in size with those brought from the Continent.

Although far more frequently found with us in both the winged and the larva state than the other species of the genus, it is very far from common, and in some years is not recorded at all, though it is difficult to believe that it is not present every year on some portions of our southern coast. Occasionally, though at long intervals, it becomes locally common, and when this occurs it, singularly enough, always visits certain localities which are by no means all in the south. Such a favoured spot is the range of sandhills at Wallasey, on the coast of Cheshire, and here larvæ were taken in 1859, when the insect was widely distributed in England; in plenty in 1870, when it was found in all parts of England and the southern half of Scotland; and again in 1888, when the abundance of its larvæ and the extent of its range were greater than on any previously recorded occasion. This locality, so

favourable for obtaining the larva, is by no means distinguished for captures of the imago, and there is great cause to fear that the migrating moths may have deposited eggs too far from a suitable climate to allow many of the larvæ—if left out of doors—to attain to maturity. The moth flies in the evening and morning twilight, and is strongly attracted by flowers such as *Verbena*, *Petunæa*, Honeysuckle, Scarlet geranium, *Centranthus ruber*, and even Red carnation; and occasionally, when on the wing later into the night, has been found attracted by a strong light. In hot weather it is probably long upon the wing, and has even been found sipping honey from flowers at midday.

No fixed localities can be given; probably the most prolific spot for this species is the sandy coast about Deal and St. Margaret's Bay, Kent, and, so far as is known, the Cheshire locality already mentioned stands next, but captures of moths or larvæ, or both, are on record in Kent, Sussex, Devonshire, Cornwall, Somerset, Norfolk, Suffolk, Essex, Cambridgeshire, Hunts, Middlesex, Bucks, Gloucestershire, Herefordshire, Derbyshire, Notts, Lancashire, Yorkshire, Cumberland, and Northumberland. Stephens even mentions the capture of two specimens, from seventy to eighty years ago, in North London. In Scotland the records are few, but these include Perth (with Moncrieff Hill), Dundee, Selkirk, and Aberdeen; while in Ireland the only one appears to be that of a moth captured at Howth, in 1888, by Mr. G. V. Hart.

Abroad its range extends over great part of the central, northern and eastern portions of Europe; Siberia, with the Amur; portions of Asia Minor; and even North America—where (with a slightly different shade of colour) it appears to be known under the name of *D. Chamænerii*.

3. *D. livornica*, *Esp.* Expanse $3\frac{1}{4}$ inches.

Fore wings olive-brown with yellowish-white longitudinal stripe and white nervures; hind wings pale pink, with black base and stripe.

Antennæ rather slender, olive brown with the apex whitish, but the recurved bristle light brown. Head and thorax olive brown, with a white stripe commencing over the eyes and passing above the insertion of the wings the full length of the thorax on each side, joining there another pair of white stripes which, arising at one point in the front of the thorax, separate obliquely so as to seem to divide it into three tolerably equal portions. Abdomen, pale olive brown, the hinder part of each segment barred with a stripe of alternate black and white spots, extending into black bars at the sides of the first two segments, and into white stripes on the remainder.

Fore wings long, pointed; costa very straight, except near the apex; hind margin oblique and slightly rounded; dorsal margin nearly straight. Hind wings short, rounded at the apex, hind margin slightly rounded, but with a faint hollow before the anal angle, beyond which the dorsal portion is much dilated. Fore wings dark olive brown. From the base of the dorsal margin, through the middle of the wing to the apex, is a long, nearly straight, yellowish-white stripe of even width, except near the apex, where it narrows to a mere line. Below the discal cells the nervures are all marked by slender white lines, which, crossing the pale central stripe, reach to near the hind margin, along which is a broad stripe of paler olive brown or greyish brown. At the base of the wing, and for a short distance along the dorsal margin, are tufts of long loose white scales. Hind wings bright pink with the base black, and a black stripe round the apex and along the hind margin, where it forms a rather broad sinuous band; outside this the margin is softly shaded with pale brown; a round patch above the anal angle is white, as also are the cilia.

Underside, dingy dull brown, with a brownish-white longitudinal stripe, broadened and scalloped, passing obliquely through the fore wings; and another occupying that portion of the hind wings which is pink on the upper side.

Thorax and legs, beneath, whitish ; abdomen, golden-brown. Sexes similar.

On the wing in August and September, and also in April and May. It is stated that those appearing in the spring are from pupæ which have remained unchanged through the winter ; but most probably some of the imagines also hibernate.

LARVA about $3\frac{1}{4}$ inches in length. Body cylindrical, but tapering regularly from the fifth segment to the head, which is small. Segments not deeply divided, and the whole body smooth and solid looking. Horn long, blunt at the tip, rather upright, and but slightly curved back. Anal prolegs broad and square. Head black, with a yellow streak across the mouth. Dorsal-plate black, conspicuous. Back, and sides of the body down to the spiracles, deep dark green ; dorsal line rather narrow, pinkish yellow, very distinct, and sharply edged by the ground colour. In the anterior portion of each segment on each side, from the fourth to the eleventh, is a large, roundish, yellow subdorsal spot, tinged with pink in the upper portion, and enclosed in a deep black ring, to which, on its upper edge, are attached two black spots. On the twelfth segment is a similar large yellow spot, but pear-shaped, and on the second segment a smaller paler spot. The broad area of each segment behind these large spots is profusely covered with yellowish green dots arranged in lines. Below the spiracles, which are yellowish, the skin is puckered, and along this portion runs a broad white or yellowish-white subspiracular line, broken by roundish spots of pale pink which shade off into the pinkish under-surface. Legs black ; prolegs pale pink with a black spot in front, except that the broad anal prolegs are black. Horn reddish, tipped with black.

The dark colour is sometimes still more dotted with yellow, and the head, dorsal line, and lower parts of the body seem to vary between pink and yellow. In other cases the dorsal

line is blackened, or the black rings are extended into a black bar, the spots cramped, and the head and second segment black, while in another form these last are entirely pink. (Compiled, Buckler and others.)

June and July, on various plants,—Vine, *Fuschia*, *Galium*, *Rumex*—said to be polyphagous.

PUPA rather long, regularly rounded, pale brown in colour, and having a sharp anal spike. In a slight cocoon of bits of vegetable refuse and earth held together by silk. July, but probably in some cases lying unchanged through the winter.

A swift and active species, erratic in its mode of flight, and producing a humming noise. Exceedingly fond of the nectar of flowers, particularly those of the Lilac, Scarlet geranium, Marvel of Peru, Petunia, Rhododendron, and even visiting those of *Lychnis*, *Centranthus*, *Narcissus*, and *Pedicularis*. Flying in the early twilight, and even at times by daylight. Not very rare in this country in the imago state—though the larva is very seldom observed—indeed, it is probable that a large proportion of our specimens are immigrants, since the species passes freely over wide extents of sea, and is often taken on shipboard. One, now in the possession of Mr. R. McLachlan, was actually seen to fly in from the sea to the shore near Folkestone, and to drop fatigued upon the sand, where it was promptly secured. By our earlier writers this species was looked upon as a great rarity, but in the year 1860 about twenty were taken in various parts of the country in the month of May; in 1862 others occurred; in 1868 about twenty, very widely distributed, and mostly in the month of August; in 1870, fifty at least must have been secured, and their range included the three kingdoms; others occurred in 1891 and 1892, and there is little reason to think that it is now at any time totally absent. It seems to have no especially favoured localities. Cornwall was its ancient home, and there it is still occasionally found as well as in Devon, and from these counties larvæ have been obtained. But records of the moth exist for almost

every county in the south of England to Bucks, Cambridgeshire, and Gloucestershire, also for Norfolk, Derbyshire, Cheshire, Lancashire, and Yorkshire. The Isle of Man appears to be rather a favoured spot, and several have been found in Wales—in Carmarthenshire. In Scotland, Perthshire seems to be the limit northward, and there larvæ also have been found. Other records of the imago exist for Fifeshire and other parts of the south of Scotland. In Ireland, two were taken near Killarney in 1864, and two others are recorded without date at Youghal. One was obtained at Derriquin Castle, Kenmare, in 1867, one at Kildare in 1868, one at Kilkenny in 1870, and more recently two specimens, which I have seen, were taken by Mr. C. W. Watts in Belfast Park.

Abroad its range is very wide, through the greater part of Europe, the whole of Africa to the Cape Colony, where it is very common, India and a large portion of Asia. Through this wide extent of territory it scarcely varies at all except in size, but in North America it presents a pretty modification in markings, the white lines on the thorax being duplicated. This variety is known under the name of *lineata* and is found in California and many other parts of the United States, in Jamaica and other of the West India Islands, Canada, and Nova Scotia.

(**D. Daucus**, *Cramer*.—This species was recorded by Stephens, with the statement that one was understood to have been taken near Lynn in Norfolk; and also that he had seen about eight specimens in various English collections, but believed them to have been introduced in lieu of *D. lineata*. He furnished the true habitat of the species—North America. A specimen, formerly in Haworth's collection, is now in that of Dr. P. B. Mason, of Burton-on-Trent; but there is no reason to believe the species to be truly native.)

The occurrence of unexpected species in old collections is unfortunately no satisfactory proof of their British origin. Dr. Mason possesses, also from Haworth's collection, a speci-

men of *D. dahlia*, Hub., an inhabitant of Sardinia and Corsica ; and from that of the late Mr. E. Brown, a specimen of *D. hippophaes*, Esp., a local species in Southern and Eastern Europe, labelled "Devonshire." There is no reason to suppose that either species has voluntarily made its appearance in these islands.

Genus 5. CHÆROCAMPA.

Antennæ straight, of moderate length and rather slender, terminal bristle slightly recurved ; in the male furnished with short pectinations. Fore wings long and pointed, sharply cut, with the hind margin rather rounded and often slightly concave below the apex, and the dorsal margin hollowed before the anal angle. Hind wings short and having a projection at the anal angle. Thorax stout and rounded ; abdomen stout, smooth, either short and tapering suddenly to a point, or long and regularly tapering.

LARVÆ smooth, with strongly retractile anterior segments, which are narrowed rapidly towards the head ; conspicuous ocellated spots on the fourth, or fifth and sixth, segments ; horn of the twelfth segment usually present, but sometimes short or even absent.

PUPÆ thin-skinned and delicate, not stout. Either subterranean or in a loose cocoon, among rubbish, on the surface of the ground.

1. *C. celerio*, L. Expanse 3 to $3\frac{1}{4}$ inches.

Fore wings light brown with a longitudinal silvery stripe and silvery dashes ; hind wings pink with black nervures and a black stripe ; abdomen slenderly white-striped.

Antennæ whitish above, light brown beneath. Head and thorax olive-brown, with a dusky white stripe above the eyes, continued along each side of the thorax, where it broadens, but at the base of the fore wings becomes narrow and silvery-white to the base of the abdomen ; above it on the thorax is a slender pale-golden stripe on each side ; and in the middle

of the back of the thorax is a narrow grey stripe. Abdomen very long, tapering regularly from the base to the point, and having down the centre of its back a slender, interrupted, and partially divided, white line faintly edged on each side with a blackish or dark brown stripe; down the sides is a series of silvery-white streaks or dashes. Fore wings long and narrow, sharply pointed; costa unusually straight; hind margin oblique and rather sinuous; dorsal margin waved and so deeply hollowed before the anal angle as to cause the latter to form a conspicuous elbow. Hind wings rather long, bluntly pointed, with hind margin hollowed before the anal angle, which forms a distinct projection; dorsal margin dilated. Fore wings pale olive-brown, varied along the central area with dashes of dark brown and short black lines, and having a longitudinal silvery stripe, which, arising on the dorsal margin at some distance from the base, passes below the middle of the wing, then curves gently upwards, and proceeds to the tip; this stripe is compound, consisting of a clear slender silvery-white line, edged with black above, and below by a broader creamy white line, shading along its lower edge into olive-green, but much tinged with silvery, especially in its basal portion. Outside this, and near the hind margin, is a slender silvery-white line, edged externally with brown, from the apex to the anal angle; the margin outside this being faintly clouded with whitish, olive, and grey. At the middle of the base of the wing is a broad silvery longitudinal dash; and slender silvery lines indicate several of the nervures. The extreme edge of the dorsal margin is also sharply silvery-white, and there is a round black dot, sometimes set in a pale space, at the apex of the discal cell. Cilia light brown.

Hind wings bright rosy-red at the base, and broadly so to the anal angle. A broad black band lies across the middle of the wing, and extends round the apex, returning as a narrow black stripe near the hind margin to the anal angle. The enclosed space is of a very pale rosy colour,

divided by a black line down every nervure. Hind margin pale greyish brown, dusted with darker atoms; cilia silvery-white. Sexes alike, but female slightly the larger and stouter.

Underside of the fore wings dingy pale brown to the middle, beyond which is a broad oblique band of dull orange dusted with black atoms, extending to the apex; hind marginal space broadly tinged with a bluish bloom and margined inwardly with brown; central spot whitish. Hind wings dusky dull orange or reddish, dusted with black or brown atoms, with the margins broadly brown, and across the middle, three parallel, indented and curved, grey transverse lines. Body and legs, beneath, whitish brown.

Apparently not at all variable except in size.

On the wing in September and October, and, very rarely, in the spring, probably after hybernation in the imago state.

LARVA, three inches in length, moderately stout and cylindrical from the fourth segment to the tail, but tapering very much to the head, which with the next two segments is drawn in during repose. The head is small, roundish in outline, but flattened in front, dark brown, lobes edged with blackish. Twelfth segment with a short, thick, pointed, dark brown horn on the back, pointing obliquely backwards but slightly curved up. Body of a pale umbreous brown closely covered with dark brown dots arranged in lines, except in the cases of the first three body-segments, which are paler and the lines of dots few. Anal flap light yellowish-brown. On each side of the fifth and sixth segments is a conspicuous black ring-spot, with the centre white, and outside it a ring of yellow. The white centre is not always round or quite central, and is sometimes somewhat divided. Beyond these spots a yellowish subdorsal line extends to the twelfth segment, and on the thirteenth spreads into a broad yellowish-brown blotch which attains the anal flap. Spiracles bluish, ringed with black, and having above each an orange spot. Legs and pro-legs dark brown.

August and September, on Vine, and Virginia-creeper (*Ampelopsis hederacea*); and also occasionally on *Galium*, *Epilobium*, and *Fuchsia*.

PUPA red-brown with wing-cases and head-sheath dark grey. Usually but a very short time in this state—perhaps a fortnight—in September or October, but it seems possible that some remain in this stage during the winter, the moths emerging in the spring.

An active species, of extremely swift and powerful flight. Occasionally attracted by flowers such as those of the *Verbena* in gardens, and has even been found at Ivy-bloom, but much more strongly attracted by light and must therefore have the habit of flying late at night. Rarely seen on the wing, the large majority of the specimens obtained in this country having been found in the daytime sitting on windows or other places to which they appear to have been tempted by a strong light. Probably not so rare as is usually supposed, since the capture of a large number of specimens is on record; and almost certainly existing with us every year. Haworth considered it very rare, but recorded a specimen at Bunhill Fields, which he called *near* London—the term would hardly be appropriate now—and he also knew of a larva found at Wisbech. Larvæ have also been found at Ely, at Newmarket, at Epping, and in Sussex. Of imagines several were recorded in 1861, in each year from 1866 to 1870, in 1879, 1881, and a considerable number in 1885, while in most of the intermediate and subsequent years one or more were met with. As with the last species there appears to be no specially favoured locality. Possibly Devon may lay some claim to such a title, but the records seem to embrace every district, and probably every county, in the south, east, and west of England; there have been several captures in the Midlands, rather a large proportion in Yorkshire, several in Lancashire, and three in Cumberland. In Scotland, besides Roxburghshire and other places in the south, there are

records from Aberdeen, Peterhead, Fyvie and Banff. In Ireland I know of but a single instance, at Mullaghmore, Co. Sligo, in September 1881. Abroad, though not always plentiful, it is one of the most cosmopolitan of insects. Scarce in Central Europe, common in Spain and other parts of the South, abundant in South Africa, where it almost equals *Macroglossa Hylas* in numbers about the flowering shrubs in the gardens. Common also in the Canaries, Northern Africa, Abyssinia, Northern India, Australia, Java, Borneo, Labuan and the Fiji Isles. The freedom with which it passes from continent to continent, island to island, is illustrated by the frequency with which it is found at rest upon ships in mid-ocean.

2. **C. porcellus**, *L.* Expanse 2 to 2¼ inches.

Fore wings pale brown with rosy costal and hind margins ; hind wings yellowish with the base black.

Antennæ white, with the underside and pectinations (in the male) light brown. Thorax broad and robust ; abdomen thick in the basal half, but tapering off rather suddenly to a long point. Head and thorax rosy-red, sometimes with a patch of olive-brown upon each shoulder ; base of the wings covered by a whitish tuft. Abdomen rosy-red with a broad bar of rosy-brown on the back of each segment. Fore wings with the costa straight to near the apex, which is sharply pointed ; hind margin sinuous, slightly hollowed below the apex, then rounded, and very faintly scalloped between the nervures ; dorsal margin hollowed before the anal angle, which is rather strongly elbowed. Hind wings short, blunt at the apex, with the hind margin sinuous, faintly scalloped and hollowed before the anal angle. Fore wings dull ochreous brown with a faint clouding of olive-brown ; along the costal margin, commencing near the base, is an irregular longitudinal stripe of rosy pink, broken twice by the ground colour and narrowing off to a point at the apex of the wing ; hind margin also rosy pink, broadly

so in the middle, edged on the inner side by an irregular indented brownish line extending from the apex to the anal angle. Across the middle of the wing are, sometimes visible, two oblique, parallel, faintly brownish shades indicating an oblique central transverse band. Cilia pink shaded with brown at the nervures. The base of the dorsal margin is tufted with long white scales. Hind wings black at the base shading off to dull yellow in the middle of the wing, and sometimes to blackish brown at the apex. Along the hind margin is a broad purplish-pink stripe tapering off to a point at the anal angle. Cilia white, interrupted with purplish-red at the nervures. Sexes similar.

Underside more brilliantly coloured than the upper. Fore wings purplish-red along the costal and hind margins, blackish from the base to the middle, the remainder light ochreous. Hind wings ochreous, with the base and margins purple-red and the cilia white. Under surface of head, thorax, abdomen, and leg tufts, bright rosy red; legs white.

Variable in the tone of yellowish brown in the middle area of the fore wings, and also in the depth of the rosy and purplish-red of the margins. One taken in Perthshire by the late Sir Thomas Moncrieffe has the rosy and purplish colouring replaced by yellow and yellowish-grey, and the body and thorax grey. One reared in London by Mr. W. H. Tugwell has the fore wings olive-green, with the costal margin rosy, and a faint shade of grey on the dorsal margin; hind wings greenish, with faint grey-brown shades along the dorsal margin.

On the wing in May and June, extending into July in its more northern and north-western range.

LARVA over two inches in length; smooth and plump, rounded but thickest in the fifth and sixth segments, tapering rapidly to the head, which is very small. When this with the following segments is retracted it gives the front part of the body a curious puffed appearance. The

twelfth segment is devoid of a horn, the place usually so occupied is indicated by a minute double tubercle. Head pale grey, second to fourth segments pale buff, with brown dorsal line, remainder of the body ashy brown freckled with black, the front of each segment paler and bearing larger freckles, which seem to form a transverse band. On each side of the fifth and sixth segments is a round eye-like spot of a lilac colour, centred with brown, the second having also a yellow dot; both spots bordered with black and very conspicuous. Under parts pale bluish-grey tinged with pink, spiracles white ringed with black; legs and pro-legs of the colour of the body. Varying in colour, sometimes green, abundantly dusted with black-brown, and the ocellated spots pink and vivid; or very dark umbreous, with the upper part of the anterior segments pale brown, creamy, or yellow-brown. Below the tubercle on the twelfth segment is often a pale brownish or yellowish stripe; sometimes there is a subdorsal row of yellowish dots, or the spiracular region is dotted with white.

Buckler, from whose description and figures much of the above is adapted, says that the larva, when very young, is pale greyish green, with blackish bristles, yellowish head and under surface, but no caudal horn at any stage, only the indistinct double wart. As it becomes older the green surface is abundantly dotted in transverse lines with white. At the third moult the ocellated spot on the fifth segment appears, lilac and white, edged below with brown, and a white dot on the sixth segment; the ground colour in some cases changed to brown; and at the fourth moult the adult colouring is assumed.

In August and September, in dry places, on *Galium verum*, *G. mollugo*, *G. palustre*, *G. saxatile*, and occasionally even on *G. aparine*, hiding by day close to the ground, and feeding at night. Has also been found to feed on *Epilobium angustifolium*, *E. hirsutum*, and *Lythrum salicaria*.

PUPA cylindrical, but rather thickest in the middle; eye-cases prominent; tongue-case keeled; anal spike rough, triangular, flattened. Colour dusky ochreous, freckled with black; dorsal line and wing-cases smoky black; abdominal segments ringed with black. In an open network cocoon on the surface of the ground, with bits of moss worked in (Buckler). In the pupa stage through the winter. A larva in the possession of Mr. R. Adkin, and fed up by him in a gauze bag, spun up in the gauze, forming a cocoon like a film of gelatine, apparently a curious modification of the silk lining usually employed to bind together the rougher materials. The moth in this case was duly reared.

An active and lively species at early dusk, frequenting flowers of Honeysuckle, Rhododendron, *Lilium martagon*, *Centranthus*, *Silene inflata*, Sage, Pink, and other flowers. I have even obtained it by cutting bunches of honeysuckle blossoms and placing them in the open fields where *Galium* was abundant. It is also occasionally taken at the "sugar" used to attract *Noctua*. In the daytime it sits among the low herbage close to the ground, or on an open bank, or hangs to a thistle. After its evening flight it may sometimes be again found sitting on a bank or hedge. Its eggs are said to be laid while hovering over its food plant.

Widely distributed in chalk and limestone districts, and, in the south, rather common—even plentiful in Devonshire and Gloucestershire—fairly common in Norfolk and Suffolk, and in all suitable localities south of these counties. At Oxford and in Cambridgeshire it is scarce, and rare in the Midlands. Rather common in Herefordshire, Worcestershire, Lancashire, and Cheshire, and found in several localities in Yorkshire; at Witherslack, Cumberland; and at Tynemouth. In Scotland it is common in Perthshire, more especially at Moncrieff Hill, and is found in Roxburghshire and along the east coast to Aberdeenshire. In Ireland very widely distributed, and in the western districts is said to be the commonest species of the whole group. Abroad it is found over the

greater portion of Europe, as well as in Siberia, Armenia, and Asia Minor.

3. **C. Elpenor**, *L.* Expanse $2\frac{1}{4}$ to $2\frac{3}{4}$ inches.

Fore wings olive-brown striped with pink; hind wings pink with the base black.

Antennæ with the shaft pink shading into white towards the tip; pectinations, in the male, light brown. Head olive-brown with a pink stripe on each side from the base of the antennæ down the palpi. Thorax broad and robust, olive-brown, with a white stripe passing above the bases of the wings, a pink stripe above it over each shoulder, and the central portion of the back having a broad divided stripe, gradually widening to the hinder edge of the thorax, where the two halves coalesce, so as to form a broad pink triangle with its base towards the abdomen. Abdomen stout, tapering very smoothly, and then suddenly more rounded towards the apex; olive-brown, with the sides, the terminal segment, and a stripe down the middle of the back, pink.

Fore wings moderately long, pointed; costa rather straight except towards the apex, where it is gently rounded; hind margin sharply defined, straight below the apex but rounded below the middle; dorsal margin nearly straight; anal angle not protuberant. Hind wings short, very bluntly pointed; hind margin faintly undulating, with a slightly projecting anal angle. Fore wings rich bright olive-brown, with a purple-pink oblique stripe from near the base of the dorsal margin, tapering off to a point beyond the middle of the wing; a second stripe, rather more purple, running parallel from the middle of the dorsal margin straight to the apex; and a broader purple-pink stripe occupying the whole of the hind margin. Dorsal margin white, with a large tuft of long white scales near the base, at which is a black spot; cilia deep pink. Hind wings with the basal half black, and the remainder purplish-pink; cilia white. Sexes alike.

Underside of all the wings olive-green towards the costa,

broadly pink towards the hind margins, and with a broad red stripe in the middle; dorsal margin of the fore wings clouded with blackish. Under surface of thorax and abdomen rosy pink; legs pinkish white.

Usually not variable, but in the collection of the late Mr. F. Bond is a bred specimen having the middle portion of the fore wings devoid of scales and diaphanous, while the margins—more especially the hind margin—are clouded with smoky black.

On the wing in June, and, very rarely, as a second emergence, in August.

LARVA three inches in length. Rather stout, especially in the fifth and sixth segments, which, when the anterior are retracted, become extremely puffy and thick; anterior segments tapering rapidly to the small head; beyond the sixth segment rather cylindrical and less thick. Horn short, rough, thick at the base, and curved slightly back. Head dark grey or dark brown. Body dull umbreous or greyish brown, from the fourth segment much dotted with black, especially on the back; second to sixth segments with a yellowish spiracular line which sometimes spreads into a broad lateral blotch extending almost to the feet. Just above this the fifth and sixth segments have on each side a large and conspicuous round eye-like spot, the lower portion of which is deep black, the upper edged with black and enclosing a lunate or kidney-shaped spot of a lilac or yellowish colour which has a black centre. From the hinder of these ocellated spots proceeds a broad, lateral, cloudy yellow or yellow-brown stripe, extending to the anal segment. Horn and legs of the dark colour of the body; spiracles yellowish or brownish ringed with darker. Sometimes the upper portion of the segments just behind the head is blackish.

Another and much handsomer variety has the head and body entirely dull green mottled with irregular ragged black

patches on the back and sides, and the ocellated spots reddish orange.

This larva is at all times of an extremely striking appearance when stretched out, from its long tapering anterior segments, like the snout of a hog (whence its name), and the great eye-like spots; but when the anterior segments are drawn in, the segments receiving them puffed out, swollen and wrinkled, and the great eye-spots upon them even more glaring and conspicuous, it becomes a truly formidable object, and a cause of terror to the rustic mind. Few creatures can look so truculent while so utterly harmless.

July and August on *Epilobium hirsutum*, also occasionally on *Galium verum*, *G. saxatile*, *G. palustre*, *G. uliginosum*, *Circea lutetiana*, *Menyanthes trifoliata*, *Impatiens noli-me-tangere*, and, in gardens, on *Fuchsia*. It seems to feed mainly at night, concealing itself low down among the food plant in the day, but is said to crawl up for the purpose of sunning itself at about four o'clock P.M.

PUPA regularly and smoothly rounded, but with the abdominal segments rather deeply divided, and tapering to a point, which is somewhat broadly spiked. Colour pale brown, rather tinged with buff and with smoky clouding; anal tip black. On the back of some of the abdominal segments is a row of sharp points. In a large open cocoon of dirt and rubbish, held together with rather strong silk, on or under the surface of the ground. Passing the winter in this condition.

The moth flies swiftly and actively at dusk, and is very partial to the blossoms of the Common Yellow flag (*Iris pseud-acorus*), against the brilliant yellow petals of which its bright pink colouring shows in a charming manner. Also said to frequent the flowers of Honeysuckle and Monkshood (*Aconitum*), and well known for its fondness for the "sugar" spread on trees to attract *noctua*. Up and down this it will

hover for a considerable time, taking a sip here and there, and little disturbed even by the collector's lantern.

Common through the southern portion of England, to Cambridgeshire, and in Wales, though scarce in the midland districts; fairly common in Herefordshire, Cheshire, and Lancashire, and occurring, though more sparingly, in various parts of Yorkshire. In Scotland it is found in the Clyde district and on the east coast further north towards Aberdeen. In Ireland it has been found commonly in the County Wicklow, and is plentiful in Galway and Kerry; has been taken at Cavan, and appears to be pretty generally distributed. In Europe it is very widely spread, though apparently not in the extreme north or south; and is found in Armenia, Siberia, and other parts of northern and western Asia. Also apparently in India, though the names of *macromera* and *fraterna* have been given to the hardly differing specimens brought from that country; and in Japan, though the larva of the form, named *Lewisii*, found there, is said to be somewhat different.

4. *C. nerii*, L. Expanse $4\frac{1}{4}$ inches.

Fore wings richly blotched and shaded with velvety green, with a broad pink band and a whitish triangle; hind wings grey-brown with a whitish line; body marbled with green.

Antennæ pale brown, the pectinations, in the male, consisting of tufts of *very short* bristles. Head green, with extremely large brown eyes. Thorax very robust, rich green, with a whitish bar across the front, and a whitish stripe down each side, meeting a slender oblique whitish line from the middle of the back of the thorax, thus dividing its area into three triangles. Abdomen very stout at the base, gently rounded to past the middle, then tapering rapidly off to a blunt point; greyish green, with a black bar edged with white at the base of the dorsal surface, and a white line edging several of the segments, on the sides of which are also oblique whitish stripes, and, on the two last,

three large dark green spots placed in a triangular form. Fore wings stout and strong, elongated and pointed; costa slightly but regularly curved throughout; hind margin slightly rounded; dorsal margin gracefully rounded and then hollowed so as to render the anal angle extremely prominent. Hind wings short, bluntly pointed, with the hind margin nearly straight, except towards the anal angle which projects in a broad point. Fore wings richly marbled with deeper and paler green, pink, white, and grey. At the extreme base is a round dark green spot, broadly ringed with whitish, then a large blotch of dark velvety green edged with whitish and followed by a broad ill-defined oblique band of pink or pinkish white slightly striped with green; beyond this the colour is again velvety green, and in the middle of the dorsal margin arises a slender pinkish white line, which, after making a long indentation, curves indistinctly outward through the centre of the wing towards the hind margin, near which it makes a wide bend upwards and proceeds to the costal margin, becoming, in this portion, broader and more distinct. Between the longitudinal portion of this line and the dorsal margin is a broad black and fuscous glistening blotch of a sort of curved triangular shape, the basal portion approaching the hind margin of the wing. From the broad bend upward of the pinkish white line another line or stripe, of the same colour but broader, runs back obliquely to the costa, inclosing a somewhat triangular space, shaded with pale green and pinkish white. A white line runs inward from the apex, and under it is a semicircular dark green patch edged with a whitish shading. The nervures beyond the middle of the wing are lined with pinkish white. Cilia green tinged with pink or brown. Hind wings dark smoky grey tinged with brown, with an undulating transverse white line from the costal margin to the anal angle, outside which is a broad stripe of faintly greenish-brown or yellowish-brown, almost yellow at the anal angle, and faintly edged outwardly with black. Marginal area broadly tinged or clouded with

glistening green; cilia white. A large patch of whitish scales lies in the dark grey area near the dorsal margin. Sexes similar.

Underside of all the wings dull greenish-grey, greener towards the hind margins, with a white line from the apex of the fore wings obliquely to the dorsal margin, and continued on the hind wings to near the anal angle. At the apex of the fore wings is an orange cloud; near it, but inside the white line, are two more, large and elongated; at the anal angle two more, all dusted and clouded with brown. Hind wings clouded with orange near the base, and having in this orange cloud a white, black-edged dot. Between this and the white stripe is a curved indistinct double stripe, whitish and brownish; and outside the white transverse line there is an indistinct interrupted brownish-orange band, most distinct towards the anal angle. Under part of thorax green; of abdomen greenish, tinged and blotched with faint orange, and with a white central longitudinal line. Legs pale greenish-grey.

On the wing in August, September, and October.

LARVA four inches long, very stout and of nearly equal thickness from the fifth segment. Anterior segments tapering rapidly; head small; horn short and rough, pointing backward and depressed at the tip. Head green or brown; three next segments yellow tinged or shaded with either green or brown; body, from the fourth segment, with the dorsal surface broadly deep green or olive green, or more rarely ochreous or brownish, yellow, dotted with black or white. This dark dorsal portion is edged by a broad lateral whitish or yellowish white stripe which extends to the twelfth segment, there bending up to the base of the horn and cutting off the dark colouring from the thirteenth segment, which in the green larva is reddish-ochreous or yellow-green, in the brown larvæ yellow. Body below the lateral stripe of a paler hue than the dorsal portion. On each side of the fourth segment is a

large blue spot, surrounded by an irregular black ring, and containing two white spots. Kirby says that it feeds from July to September, gregariously, upon the *Oleander*, preferring the flowers, but in this country it is understood that the only larvæ found have fed upon the common small Periwinkle (*Vinca minor*).

PUPA, as figured by Kirby and Hoffmann, very large and elongated, thickest in the middle and rather tapering to the head; abdominal segments deeply divided; apex with a strong spike. Light bright brown, with the wing cases paler, or tinged with pale grey, spiracles indicated by large brown spots. The moth usually emerges in the same autumn, but it is stated that pupæ sometimes continue through the winter, producing the perfect insects in June.

Quite the most rare of our hawk moths, only about a score of captures in these islands being upon record. Indeed, it is doubtless only a casual immigrant, and, although the larva has been observed here, there is no reason to suppose that it passes through its transformations successfully in this country. Its extraordinary strength and power of flight render its passage across wide extents of land and sea a matter of no difficulty. It is in some degree attracted by flowers, and has been captured at those of the honeysuckle and passion-flower; also in several instances attracted to lights in houses. The records are so very few that they may be given in detail. The first appears to be of a larva in a garden at Teignmouth in 1832, followed by the capture of a moth at Dover in 1833; and one was seen about the same date by Mrs. Raddon in Devonshire. In the year 1847 one appears to have been taken at Prestwich; in 1852, one at Brighton, and another in 1857; in 1859 two larvæ, which subsequently died, were recorded as taken at Eastbourne: a moth at St. Leonards in 1862; one at Sheffield in 1867; again at St. Leonards in 1868, which specimen is now in the British Museum; one in a garden at Birmingham in 1869; one at Southtown, Great

Yarmouth, in 1872; two in 1873, one of them at Ascot, Berks, the other at Crieff, Scotland; one at Lewes, Sussex, in a garden, in 1874; one at Hemel-Hempstead in 1876 (now in the collection of Mr. G. T. Porritt, and obligingly lent for the purposes of this work); one each at Eastbourne, Sussex, Blandford, Dorset, and Tottenham, Middlesex, in 1884; one at Hartlepool in 1885; another at Brighton in 1886; one settled upon a railway at Poplar, London, in 1888; and one, which had been seen for several successive evenings, was captured flying about honeysuckle at Dartmouth, Devon, in 1890.

Stated by Kirby to be a rare species in Central Europe, and only a casual visitor north of the Alps. More common in Southern Europe, and throughout Africa, with Mauritius and the Canary Isles; also in India and other parts of Southern Asia.

Genus 6. **MACROGLOSSA.**

Antennæ long; straight, robust, and very stout beyond the middle; apex with a distinctly recurved point; pectinations in the male very indistinct or confined to two widely separated rows of extremely short bristles. Fore wings broad and short, with oblique rounded hind margin; hind wings short, with a slight projection at the anal angle. Thorax and abdomen very broad and stout, the latter with broad apical and lateral tufts of scales.

LARVÆ smooth, with lateral stripes and a distinct horn.

PUPÆ usually subterranean.

1. **M. stellatarum**, *L.* Expanse, 2 inches.

Fore wings dark grey, with black lines; hind wings tawny; abdomen with black and white lateral tufts.

Antennæ, dark grey, very thick towards the apex, narrowing off rapidly, and provided with a short recurved point. Head large and prominent, with densely tufted palpi, dark

grey. Tongue extremely long and flexible, black and shining. Thorax remarkably broad and robust, dark grey. Abdomen broad, short and rounded, grey above, shading into blackish behind, blotched at the sides with black and pale yellow, and having on the sides of the last four segments large spreading tufts of black scales edged with white, those upon the final segment extremely broad, squared, and massed together.

Fore wings stout and strong, rather short, bluntly pointed, having the costa straight to near the apex; hind margin slightly rounded and very oblique; dorsal margin short, slightly hollowed. Hind wings short, with the apex and hind margin rounded, and the slightest possible hollowing out before the anal angle. Fore wings dark grey, with a distinct, black, slender, sinuous, transverse stripe before the middle, and a less distinct, rather elbowed, similar stripe beyond the middle, each having on the inner side a faint parallel duplicate line; another, very slender, faintly dark line crosses the wing at some distance outside the second black stripe; and immediately following, with its margin exactly parallel, is a darker grey shade which occupies the entire hind margin. At the end of the discal cell is a round black dot; cilia dark grey. Hind wings pale tawny, darker towards the hind margin, which is edged and shaded with blackish brown; base blackish, shading into the tawny colour; cilia pale brown.

Under side of fore wings golden brown; of hind wings, pale golden brown, shading into yellow at the anal angle. Face, legs, and thorax beneath, whitish; abdomen yellowish-white mixed with blackish, and having the lateral tufts of long scales black and white.

Very little subject to variation, but occasionally the hind wings have the tawny colour replaced by dark brown, faintly streaked with golden brown, especially towards the anal angle.

On the wing from August to November, but most commonly in September; and, after hybernation, less commonly

from April to June, or even July. The imago state in this species seems sometimes to last for nine or ten months.

LARVA, two inches in length. Cylindrical, except that the anterior segments taper slightly to the head, which is rather small and rounded; segments smooth, not swollen, puckered, nor retractile. On the twelfth segment is a rather short straight rough horn, pointing obliquely backward and tapering to a sharp point. The skin of the segments is faintly divided, as in other species, by slight parallel transverse wrinkles. Colour either greyish green or dull brown, usually the former, darkest along the middle of the back, and profusely set with minute white dots. Sub-dorsal line whitish, dark-edged above; spiracular line yellowish; spiracles black; horn bluish at the base, yellow at the tip.

July, August, and sometimes September, on *Galium verum* and *G. mollugo*, occasionally also upon *Rubia peregrina*, and in confinement has been known to eat *Galium aparine* (Common goose-grass).

PUPA rounded, rather slender, but thickest in the middle, with a blunt, flattened, slightly projecting tongue case; last segment with a short sharp anal spike. Skin thin and delicate, dull yellowish-grey or drab, with dark brown spiracles, and the wing cases and lower surface veined with the same colour. In an open loose silken cocoon among rubbish, or amidst the stems and roots of the food-plant, near the surface of the ground. In this stage only a few weeks.

The moth flies in the daytime, usually in the sunshine, and especially late on a bright afternoon. Its swiftness and power of flight are extraordinary. It appears, suddenly, poised in front of a flower, and glides round from flower to flower, extracting honey with its long flexible tongue, but is never known to settle upon a blossom. If disturbed it is instantly gone, high into the air, and passing over the trees with a speed which the eye can scarcely follow. From these peculiarities it is known as the Humming-bird moth, and has

actually been at times mistaken for a genuine humming-bird, by persons accustomed to those exquisite creatures in their native lands, and but little acquainted with natural history. It is much attracted by the blossoms of Larkspur, Scarlet Geranium, Jasmine, Red Valerian (*Centranthus*), Verbena, Marvel of Peru, Sweet William, and Honeysuckle, and does not entirely restrict its attentions to them to the sunshine, but will continue on the wing quite into the dusk on warm evenings, and has even been taken at flowers by moonlight. Its habits in other respects are erratic and curious; it is fond of flying along stone walls at the sides of fields, and the walls of houses, examining the holes and interstices as though searching for a place to hide in, and will even settle and run into such places. Coal seems to have a peculiar attraction for it, and it has often been seen examining the large heaps, or resting for a short time on the lumps. The fronts of perpendicular cliffs are equally frequented; and the reason does not seem to be clearly ascertained—indeed, the moth has been known to carefully examine, and settle upon, a glaring advertisement poster. The most obvious suggestion is that it is seeking a suitable place for hybernation, but if so, the habit outlives the necessity, since the moth is quite as fond of investigating walls in the spring as in the autumn. Possibly its habit may be to take its ordinary repose in such places of shelter, and this may account for the fact that we rarely, if ever, find it at rest. For hybernation it enters houses, outhouses, barns, and other buildings. Mr. Stainton saw it after hybernation, in the early spring, at Rome, in such numbers and under such circumstances that two or three were buzzing in nearly every window of the Villa Borghese.

It is said by some writers to be double-brooded, but all the evidence seems to point the other way. The eggs are laid after hybernation (the moth hovering over the plant while she deposits them), and there is strong reason to believe that this does not take place very early in the season; while, on

the other hand, no record seems to be obtainable of their being laid at any time before hybernation.

A generally distributed and rather common species, and in certain seasons—as in 1865—everywhere abundant; while in other years it is comparatively scarce. In England most plentiful in the southern counties, and along the eastern and western coasts. Much less common in the Midlands and scarce in hill districts. In Scotland less common, but found occasionally from the southern border to the Orkneys and Shetlands. Common and widely distributed in Ireland. It is also found occasionally at midnight at lighthouses, possibly passing from one country to another. It is found all over Europe, Northern Asia, Northern Africa with the Canaries, and in India, China, Japan, and the Corea.

2. *M. fuciformis*, *L.*; *bombyliformis*, *Ochs., Staud. Cat.*—Expanse, $1\frac{3}{4}$ to 2 inches. Wings transparent, with a rather broad reddish hind-marginal band; back of the abdomen yellow with a red bar.

Antennæ long, very stout beyond the middle; tipped with a bent-back bristle formed of several tapering joints; black; in the male with hardly perceptible pectinations, but larger and thicker than in the female. Head large and thorax very broad and robust, both blackish, but densely covered with dull golden-yellow or greenish-yellow hairs. Abdomen broad, short and rounded, dull olive-yellow, brighter at the sides, crossed by a broad central transverse band of dark red, beyond which the hinder segments are dull yellow, with pale yellow lateral tufts, and a broad yellow and black anal tuft.

Fore wings short, blunt at the tip, with the costa nearly straight, the hind margin rounded and very oblique, and the dorsal margin slightly hollowed. Hind wings very short with rounded apex and hind margin, but the anal angle produced into a projecting point. Fore wings with the whole middle area transparent and devoid of scales, except upon the

nervures, which are reddish-black and distinct; hind margin broadly banded with dark red-brown, or glistening dark red scales on a blackish ground, the band broadest at the apex of the wing and tapering very slightly, yet extending past the anal angle; costal margin blackish brown, dusted with yellow towards the base: touching it is an oblique elongated reddish-black spot at the end of the discal cell; base of the wings reddish-black densely covered with long yellowish scales; from this a rapidly tapering stripe of the same runs along the dorsal margin. Hind wings transparent, with reddish-black nervures, a dark red-brown stripe along the hind margin; base and dorsal margin broadly reddish-black, densely covered with long, dull yellow scales. Cilia all very short, dark red. But when freshly emerged from the pupa, and before flight, every specimen has the whole surface of the wings covered with large loose dark red scales, which in the broad central portions of the wings are so loosely attached that they are shaken off at the first flutter. These scales give the specimens which have been killed before flight a dusky, semi-transparent appearance.

Under side of all the wings broadly yellow at the base and along the costa, with the hind margin broadly banded with dark red, and the transparent surface brilliantly shot with iridescent red. Face, legs, and underpart of the thorax pale yellow; of the abdomen reddish, mixed with yellow and black towards the tail.

Sexes similar and apparently not variable.

On the wing in May and June.

LARVA one inch and two-thirds in length. Cylindrical, except that the anterior segments taper a little to the head, which is small; body smooth, though the usual wrinkles on the segments are visible; horn on the twelfth segment rather rough, but sharply pointed and curved back. Head dark green; body a beautiful clear green, rather whiter on the back, with darker green dorsal line, which is only visible at

the incisions of the segments; spiracular lines broadly yellow, enclosing the spiracles, which are rust-red and have a white spot above and below them; horn lilac at the base, shading through reddish to brown at the tip. Before changing to pupa the larva often becomes of a reddish-brown dusted with whitish, and the broad spiracular line light brown. When young it is not so smooth, but shagreened with minute rough points. Occasionally the larva, although green, has the legs and under-surface dull red. (Adapted from Buckler.)

July and August, on Honeysuckle, and in confinement will eat Snowberry (*Symphoricarpos racemosus*).

PUPA rather slender, rounded, tapering towards the head, and sharply so at the tail. Rich brown, shaded with purplish or blackish on each segment and on the wing and antenna cases. In a loose open network cocoon, among moss or grass roots at the surface of the ground. In pupa through the winter.

A swift and lively species, flying in the sunshine, and, so far as is known, never at night. It is usually found in open places in and near woods, hovering at the blossoms of *Lychnis flos-cuculi* (Ragged robin), *Rhinanthus crista-galli* (Yellow rattle), *Rhododendron*, *Betonica officinalis*, and especially *Ajuga reptans* (Common bugle), sucking nectar as it hovers, and never alighting upon the flowers; in this respect differing from the large humble bees which it so closely resembles in appearance. Its eggs are deposited while hovering over honeysuckle sprays, upon the leaves, and are easily found.

Generally distributed in woods in the south of England, and common in Surrey, Sussex, Kent, and Hants. Rather common also in Devon, but apparently less so in Somerset, Dorset, and Gloucestershire. Not scarce in Berks, rare in Suffolk and Norfolk, though widely distributed in the latter county. In Northamptonshire locally common, once recorded in Cambridgeshire, and found in some parts of Lincolnshire and Yorkshire. In Scotland it is said to have been taken in the Solway and Clyde districts, but there may be confusion

with the following species; if not, it is certainly rare. Abroad it ranges through Europe except the extreme north and part of the extreme south; also over portions of Northern and Western Asia and Northern Africa.

It may be well to point out that the present species is known as the *Broad-bordered* Bee-hawkmoth; but that German authors (following Ochsenheimer) transpose the names of this and the following species, which is known, with us, as the *Narrow-bordered* Bee-hawkmoth.

3. **M. bombyliformis**, *Esp. fuciformis*, *Ochs., Steph., Staud. Cat.*—Expanse $1\frac{3}{4}$ inch. Wings transparent, with a narrow brown marginal band; abdomen yellow, with two slender black bars.

Antennæ long, thick beyond the middle, black, without pectinations; having a recurved point or bristle at the tip. Head rather prominent; thorax very broad and robust; both black, but completely covered with long dull yellow hairs, palest above the insertion of the wings. Abdomen broad, short, rounded, densely covered with long yellow scales, except upon two central narrow black transverse bands, which are sometimes partially united or suffused; hinder segments with whitish-yellow lateral tufts and a broad anal tuft, or brush, of dull yellow and black. Fore wings very slightly broader and shorter than in the preceding species, hind wings also a little shorter, and rounder. Fore and hind wings transparent, with the nervures slender and distinctly reddish-black. Costa of the fore wings narrowly purplish-black; hind margin having a purplish-brown stripe, which is broad at the apex of the wing, but narrows rapidly, becomes very slender below the middle, and terminates in a point at the anal angle; dorsal margin blackish, broadly so at the base, thinly covered with yellowish-brown scales. At the end of the discal cell is an oblique line, hardly thicker than the other nervures. Hind wings with an extremely narrow brown stripe along the hind margin, broader at the anal angle and

on the dorsal margin, where it is clothed with long yellowish scales. When freshly emerged from the pupa the wings are thinly covered with silvery-grey scales, having a purplish iridescence. These are shaken off at the first movement. Under side of all the wings brilliantly iridescent, with purple reflections; basal portion—of the hind wings especially—bright yellow; nervures yellow; margins dull reddish-grey. Face and under-part of the thorax whitish-yellow, of the abdomen yellowish mixed with black.

Sexes similar, and not variable.

On the wing in the latter part of May and in June.

LARVA $1\frac{2}{3}$ inch in length. Cylindrical, but tapering a little to the head, which is small and rounded; horn on the twelfth segment slender, and sharply pointed, bent obliquely back, Head green. Body rather full green; each segment with a few whitish dots; subdorsal line pale green, and having immediately above it, from the fifth to the twelfth segments, a row of elongated claret-red spots or short lines; a similar, but larger, row of spots or streaks of claret colour lies along the spiracular region of the same segment and is continued to the thirteenth. Horn green at the base, dark red to the apex; legs, pro-legs, and sometimes the under surface, claret-red.

July and August on *Scabiosa succisa*, and probably *S. arvensis*; biting holes in the leaves, and resting on their undersides.

PUPA dark brown, in a slight loose cocoon, among rubbish in some sheltered nook on or just under the surface of the ground. In the pupa state through the winter.

This, the Narrow-bordered Bee-hawkmoth, is like the preceding, a day-flying species, extremely swift and sudden in its motions, appearing, in a moment, poised on quivering wings (something like a great bee) at a flower, and trying blossom after blossom, but if disturbed disappearing like a flash. It loves to extract the honey from blossoms of *Lotus*

corniculatus, *Lychnis flos-cuculi*, *Pedicularis sylvatica* and *P. palustris*, *Menyanthes trifoliata*, and other marsh and hill-side plants. It is found in open meadows near woods and in the woodland glades, also in marshy spots in the hollows of hills and of woody heaths, and about the adjoining gullies and hill-slopes; but is shy and difficult of approach in the hot sunshine.

Its range is more northern than that of the last species. In Yorkshire, Lincolnshire, and Northamptonshire it used to be abundant, and is still to be found in certain localities. In the Cambridgeshire fen-lands, where Mr. Doubleday found it abundantly in 1841, it appears to have become very scarce, and this seems to be the case also in Norfolk. In Devon it has been taken at Bickleigh Vale and near Barnstaple, but is very rare; more common in Herefordshire, Gloucestershire, and Berkshire; scarce in Surrey, Sussex, Hants, and Suffolk; but is apparently spreading southward, and most likely may be found in some secluded marshy meadow in every southern county. It is also recorded from Lancashire, Carlisle, and the Lake District; but records from the Midland and mid-western districts seem to be wanting. In Wales it has been found plentifully near Swansea, more rarely near Penarth, and very uncommonly in Pembrokeshire. Much more generally distributed in Scotland, where it has been taken in Roxburghshire, near Glasgow, at Dunoon, and various parts of Argyleshire, commonly near Oban; also at Kerrera in Sutherlandshire, Perthshire, and at Inverurie, Aberdeenshire. In Ireland also widely distributed, having been found near Cork, at Athenry, Killarney, Glandore, New Glendalough in the county Wicklow, Connemara, Galway, Sligo, Down, and Antrim. Abroad it ranges through Eastern, Central, and Western Europe, Asia Minor, Persia, and parts of Siberia.

Family 2. **SESIIDÆ.**

ANTENNÆ thickened in the middle, gracefully curved, tapering to a long point. Fore wings long and very narrow, broadest towards the apex, and with a very short rounded hind margin. Hind wings long and narrow, rounded behind. Abdomen long, usually banded with bright colours.

LARVÆ smooth, soft, maggot-like, and without bright colours or definite markings. Burrowing in the bark of trees, in twigs or shoots of trees or bushes, or in root-stocks of herbaceous plants.

PUPÆ long and slender, with numerous short strong spines on the abdominal segments. In a cocoon in the burrow made by the larva.

The structure of the fore wings in this group is somewhat peculiar; the costal nervure is strong and doubled and the sub-costal lies closely parallel to it, forming together a very firmly ribbed margin which is usually covered by a costal stripe of coloured scales. The median nervure is relatively distant from the sub-costal, lying rather near to the dorsal margin; it is continued unbroken two-thirds the length of the wing, where it is united by a cross-bar with the sub-costal; from this cross-bar the usual smaller nervures, or nervules as they are sometimes called, are thrown off to the hind margin. The usual sub-dorsal nervure becomes dorsal—that is to say, it runs along the dorsal margin instead of within it.

The structure, appearance, and habits of the perfect insects and of the larvæ of this group bear little or no resemblance to those of the preceding, so far as the species found in this country are concerned, but the connection by means of numerous and various intermediate forms, in exotic groups, is very close, and seems fully to justify the present position of this family. It also appears to be closely allied to a group

of small and very beautiful exotic species—*Eretmocera*, &c., which have hitherto been placed among the *Tineina*. In another direction the present family is more distantly connected by means of the brilliant genera *Euchromia* and *Syntomis*, and many other lovely and wonderful forms, with the *Zygænidæ*.

The resemblance of the species of the present group to various species of Hymenoptera and Diptera and particularly to the Ichneumon-flies, is most extraordinary; and has, in many instances, suggested the specific names.

Genus 1. **SESIA.**

Antennæ very gracefully curved, thickened in the middle, tapering to a long point; furnished in the male with short tufts of bristles in pairs on the under side of the shaft; these tufts, though in some species extremely short, being thick and regular; apex of the antennæ with a tuft of longer bristles. Fore and hind wings very narrow; abdomen long and slender, with a broad anal tuft.

LARVÆ soft and fleshy, with short pro-legs. In the bark, shoots, or twigs of trees and shrubs, and the roots of low plants.

PUPÆ very slender and active, moving by means of abdominal and anal spines.

A table of the species may be useful.

- A. Fore wings with only a slender streak transparent.
- B. Fore wings brown. *Asiliformis*.
- BB. Fore wings bright red. *Chrysidiformis*.
- AA. Fore wings bronzy-brown with two small transparent spaces. *Philanthiformis*.
- AAA. Fore wings mainly transparent.
- C. Abdominal belts yellow or whitish.

- D. Abdomen with six or seven belts; anal tuft slender. *Ichneumoniformis*.
- DD. Abdomen with four or five bright yellow belts; anal tuft large, black in the male, yellow in the female. *Cynipiformis*.
- DDD. Abdomen with three or four slender belts, anal tuft black. *Tipuliformis*.
- DDDD. Abdomen with two belts; anal tuft reddish-yellow. *Androniformis*.
- DDDDD. Abdomen with two belts; anal tuft chesnut. *Scoliaformis*.
- DDDDDD. Abdomen with one belt; anal tuft black. *Sphaciformis*.
- CC. Abdominal belts red or orange.
- E. Tip of fore wings reddish-bronze. *Formiciformis*.
- EE. Base of fore wings red. *Culiciformis*.
- EEE. Fore wings without red colour. *Myopæformis*.

1. **S. asiliformis**, *Schiff.*; **vespiformis**, *Westw., Stn.*; **tabaniforme**; *Staud. Cat.*—Expanse $1\frac{1}{4}$ to $1\frac{1}{2}$ inch. Fore wings bronzy-brown, opaque; hind wings transparent; abdomen black with yellow belts; palpi bright yellow.

Antennæ of moderate length, black, strongly pectinated in the male, simple and rather short in the female. Palpi black above, bright yellow in front. Head black; collar yellow; thorax black; abdomen blue-black, with three equidistant yellow belts, the first and second narrow, the third broad and placed close to the anal tuft. This belt in the male is very broad or even divided into two. Anal tuft black, narrow in the female. Legs yellow, blotched with black, the tibiæ being of a bright orange-yellow. Fore wings very narrow but broadest near the apex, opaque, of a dark purplish-brown, devoid of markings except that in the male two slender transparent streaks lie between nervures, from the base one-

third the length of the wing; in the female these are very slightly indicated. Hind wings transparent with brown nervures and the margins narrowly purple-brown. Cilia all purple-brown.

Under side of the fore wings pale purple-brown, suffused, especially upon the margins and nervures, with glossy golden scales; hind wings iridescent blue with the margins, nervures, and cilia, golden purple. Thorax black beneath, with a yellow streak on each side; abdomen also black, with a broad central yellow belt. Antennæ towards the base, beneath, yellowish.

On the wing in June and the beginning of July.

LARVA whitish yellow with a darker dorsal line and with scattered solitary bristles; head and dorsal plate black-brown. Lives in the trunks of poplars—*Populus nigra* and *P. tremula*—making a gallery under the bark, in which it passes the winter, becoming full fed at the end of May; changing to the pupa state within the burrow, but having previously gnawed the bark so thin that the pupa is able to break through it. (Hoffmann.)

PUPA yellow brown. In a cocoon in the larva-burrow, in the bark of the poplar.

Always a very rare species in this country. Haworth (1803) says "very rare near London." Samouelle (1832) furnishes an accurate figure and description, giving the same locality, and mentioning willow, as well as poplar, as its food. Mr. H. Doubleday (1858) mentions that he has taken three specimens in his own garden at Epping, Essex, all of them near a trunk of aspen, which had been brought in from the woods, and used as a support; he also mentions the capture of others in the neighbourhood, and of the discovery of empty pupa skins protruding from an aspen trunk in a wood. Stephens records it from Birch Wood and Bexley, Kent, and from Colney Hatch Wood, Middlesex. Besides these a few specimens have been obtained at

Ashford, Kent, and Mr. S. Webb has seen two believed to have been taken near Chiswick. I know of no recent capture.

It is found not uncommonly in France and other portions of Central and Southern Europe, and occurs also in Scandinavia and Finland.

2. *S. scoliæformis*, *Hüb.*—Expanse, $1\frac{1}{4}$ inch. Wings transparent with the cross-bar and tip black. Abdominal belts yellowish; anal tuft chestnut.

Antennæ, in the male, black and distinctly pectinated; in the female simple, black also, but with a large space from the middle to just below the apex silvery yellowish-white. Head black; collar reddish at the sides; thorax black, with a long slender yellow stripe on each shoulder; abdomen black with two clear yellow rings or slender belts; anal tuft large, chestnut or yellowish-red, mixed with black at the base, and with chestnut side-sections; legs yellowish, clouded with black, tarsi brownish. Wings transparent, with the nervures black; costal margin of the fore wings broadly deep black; dorsal margin very narrowly black; hind margin dull black and having its area, more especially towards the costa, filled with a large smoky-black blotch, in which the deep black nervures are visible; transverse spot deep black, ovate, and not reaching the dorsal margin. Hind wings margined with black; all the cilia smoky-brown.

Under side of the wings like the upper, except that the costal margins of both fore and hind wings are yellow; the transparent surface shining, but not iridescent. Palpi and front of the thorax orange-yellow; remainder of the under surface of the thorax black; of the abdomen black, with a broad yellow belt, and the anal tuft orange-red, with the centre yellow; legs yellow with blackish spots.

On the wing in June or in late seasons in July.

LARVA slightly flattened, of tolerably even thickness, with segments deeply divided; furnished with short, scattered,

fine hairs. Head pale brown, dorsal plate whitish with two brown spots; body pinkish white tinged with yellowish behind, with a slender dark brown dorsal line, and with faint transverse brownish lines or wrinkles on each segment. Legs black; prolegs very short, whitish; spiracles black; anal segment bristly.

August to May in a burrow under the bark of large, old, rough-barked birch trees, feeding on the inner bark.

PUPA elongated, of rather even thickness, with prominent antenna and wing-cases, and a horizontal ridge just in front of the eye-cases. Abdominal segments with rows of short spines. General colour dark shining brown, with the ridge and eye-cases darker, the wing-cases edged with chestnut, and the abdomen banded with paler brown. In a thick ovate reddish cocoon of silk and raspings of wood, placed at the end of the burrow, and immediately under the surface of the thick bark, the skin of which is gnawed to a mere pellicle, through which the pupa forces the front part of its body when ready to produce the moth. There is scarcely a trace externally of the presence of the pupa, and when discovered it is hard work to cut it out safely from the old rough bark. The cocoon is usually about four or five feet from the ground, always in the trunk of the tree.

The moth is said to emerge in the early morning sunshine. It is timid, and on being disturbed throws itself off backwards and falls to the ground, hiding among the herbage or undergrowth. First found about the year 1854 at Llangollen, North Wales, where there appears to have been a considerable colony in some very large old birch trees. Here in the course of three seasons at least fifty specimens seem to have been secured. At the death of the captor, Mr. Ashworth, the locality was lost, but was re-discovered by the late Messrs. E. Birchall and N. Cooke in 1862, and other specimens taken; then the trees were cut down and the insect was again lost, though from the capture of a single specimen

sitting on a stone in the same wood in 1864 it became evident that the species was not exterminated; and it was again taken in 1881, though only singly. On July 15th, 1867, a specimen was taken by Mr. N. Cooke in the Black Wood at Rannoch, and there the larva has since been found commonly, but with little result, nearly all being infested with ichneumons. Of the very few reared, some are considerably smaller than Welsh examples. One such was reared by Mr. R. Adkin in 1892. But Mr. W. H. B. Fletcher possesses a Rannoch specimen of fully the ordinary size, and several, obtained from Sutherlandshire, which are larger than any of those from North Wales. The species is also said to have been found in Argyleshire, and appears to be confined to northern and hilly districts with us. In the present year (1893) a good many have been reared from pupæ obtained in these Scottish localities, and I have myself, through Mr. Fletcher's kindness, reared full-sized examples. In 1857 the capture of a specimen near Ramsbury, Wilts, was recorded by the late Mr. E. C. Rye. If correct, this is the only known instance in the south of England; but Dr. Chapman states that it has been taken near Hereford. Mr. E. Birchall was of opinion that he found traces of the larva and pupa in birch trunks at Killarney, Ireland, but this observation does not seem to have been confirmed.

Abroad it is found in Northern and Central Europe, Piedmont, and Southern Russia.

3. *S. spheciformis*, *Schiff.* Expanse, $1\frac{1}{8}$ to $1\frac{1}{4}$ inch. Wings transparent; bar and tip black; antennæ black and white; abdominal belt yellow; anal tuft black.

Antennæ rather strongly pectinated in the male, simple in the female, strongly curved outward at the tips; black, except that the shaft from beyond the middle to near the apex is pale yellow. Head and thorax deep black, the latter with a slender yellow stripe on each side and a small yellow spot at the back. Abdomen blue-black with a single narrow

pale yellow belt near the base and two or three yellow spots on each side; anal tuft black; legs blackish, tarsi shaded with yellow.

Wings transparent with the nervures purplish black; fore wings with the costal margin broadly, and the dorsal margin narrowly, purplish black; apex and hind margin black, and containing a large, rather crescent shaped, apical blotch, which extends along the hind margin, purple black tinged with bronzy; transverse spot large, but not quite reaching the dorsal margin, purple black. Hind wings with the margins and a central spot near the costa purplish black. All the cilia smoky brown.

Under side of all the wings iridescent. Fore wings with the costal and dorsal margins bright yellow; apical blotch and transverse spot purple, but tinged in the male with orange; hind wings with bronzy margin and nervures; cilia all of a lovely bronzy purple. Palpi yellow. Under part of thorax black with a yellow spot on each side, of abdomen black with a yellowish spot on each side at the base, an imperfect yellow belt, and a faint yellow spot under the black anal tuft. Legs blackish beneath, with the spines and tarsi pale yellow. On the wing in June and the beginning of July.

LARVA one inch in length. Head flattened, purplish red-brown; second segment larger than the rest, having on the back a shining plate, outlined with brown; body pale yellowish flesh colour with the dorsal vessel indistinctly seen through the semi-transparent skin; spiracles brown, indistinct; anal plate shining ochreous; a few short fine hairs on the body. Burrowing in the stem of an alder tree. (Buckler.)

Mr. W. H. Tugwell says: "Eggs are laid in June, hatched in July, and the young larvæ commence to feed under the bark of alder (*Alnus glutinosa*). Through the next year and the following they tunnel in the solid wood; but, when full-grown in May of the third year, each larva eats its way to the

surface, and there spins up, covered only by the thin skin of the bark. It inhabits branches and stems of all sizes from one-third of an inch to the thickness of a man's leg, but keeps generally near the ground. It forms no cocoon, the upper end of the feeding tunnel for three or four inches is merely made large enough to change in and also to allow the pupa to work up and down by means of the spines on its abdomen, which it does with the utmost facility, the bottom of this portion of the tunnel being closed by a plug of wood raspings. It will even force out the head portion of the pupa through the bark when ready to emerge, and then if the weather is dull, withdraw again, perhaps even for a day or two. It is found in trees and isolated bushes outside woods."

PUPA rather slender with the back of the thorax and head smoothly rounded off to the front, where is a sharp projection, like a beak, pointing a little forwards, and apparently used for piercing the bark when ready to emerge. Antenna and wing cases prominent. Each segment of the abdomen furnished at its front edge with a row of broad, closely set points, those on the hinder segments much the most prominent, while the anal segment has a series of large strong raised points, and is bent forward so as most effectively to use them in moving up and down its tunnel. Colour shining dark pitchy brown with the edges of the limb cases and incisions of the segments reddish brown. (The living pupa was furnished by Mr. A. F. Griffiths.)

The moth emerges in the early morning sunshine, sits on the leaves of the alder trees and neighbouring plants, and flies about them in bright warm sunshine, but is very rarely seen. Many have been captured by Messrs. Tugwell and Robinson by taking freshly reared females to their haunts and thereby attracting the males. These are described as coming up with a straight booming flight that is unmistakable, but if alarmed dashing off with such rapidity that the eye cannot follow their motions. Found most frequently in Tilgate

Forest, Sussex, but has been taken in Burnt Wood, Bishops Wood, and other places in North Staffordshire, in Herefordshire, at Chat Moss, Lancashire, and in Yorkshire, Essex, and possibly in Norfolk; also formerly in the Isle of Wight, and near London. In the present year it has been taken near Basingstoke, Hants, by Mr. Hamm, and Sir John Llewellyn's gardener has found it at Neath, South Wales. It does not seem to have been met with in the other portions of the United Kingdom, but abroad is widely distributed in Northern and Central Europe, with Northern Italy, Southern Russia and Siberia.

4. **S. andræiformis**, *Laspeyres*; **allantiformis**, *Newman*.—Expanse 1 inch. Wings transparent, nervures black, thickened, apex broadly black, antennæ black, abdomen with two yellow belts and an orange tuft.

Antennæ rather slender, thickening very gradually from the base to near the apex, then suddenly tapering to the point, black. Head and thorax deep black; abdomen blue-black with two slender yellow rings or belts, the second slightly the broader; between and beyond these the edges of the segments are slightly tinged with yellow; anal tuft blue-black at the base, then reddish-yellow; legs with the tarsi shining blue-black, tibiæ yellow and black, spurs yellow. Wings transparent.

Costal margin of the fore wings black, most broadly so at the base and beyond the middle; dorsal margin black, broadly so at the base; apical and hind marginal space filled by a broad purple-black blotch, from the perpendicular inner edge of which the nervures are distinctly thickened with black scales; transverse bar broad, black, touching the black margin on each side; transparent portion of the wings rather narrow. Hind wings with nervures black, and a purple black border to the hind margin, broadest at the apex. Cilia all black.

Under side of the wings brilliant with a purplish golden gloss; nervures black; margins black, thinly covered with

golden-yellow scales; transverse bar purplish black; apical blotch black, with the nervures in it covered with glistening golden scales. Palpi bright yellow; thorax blue-black, with a yellow patch on each side; abdomen blue-black, with a broad yellow belt, and the anal tuft as on the upper side.

When alive the insect spreads out its anal tuft, like a fan, and it then appears black at each side, pale yellow at the base, and the larger middle portion fulvous.

On the wing at the end of June and in July.

The LARVA appears to be unknown, though suspected of feeding in the stems of *Cornus sanguinea* (Dogwood).

Excessively rare in this country. The first specimen seems to have been taken at Darenth Wood, Kent, in the year 1829; and several more are recorded from the same wood, and from Greenhithe, though at long intervals. One of these was beaten out of dogwood (*Cornus sanguinea*). The Rev. A. W. Wratishaw took one flying about a hedge of the same plant between Folkstone and Dover about 1858, and Mr. R. C. L. Perkins another in the same manner at Wotton-under-Edge, Gloucestershire, in 1886. One was taken basking in the sunshine, upon a laurel leaf, in a garden near Tring, Hertfordshire, in 1876; Mr. C. A. Briggs has one taken at Gravesend, and Mr. S. Webb one from near Dover, where three were seen and two captured in 1889. There is also a record of a single specimen taken near Bristol. Abroad it is found in Austria, Hungary, and Southern Russia, but does not appear to be found commonly anywhere.

5. *S. tipuliformis*, L.—Expanse, $\frac{5}{8}$ to $\frac{3}{4}$ inch. Wings transparent, tip bronzy, cross bar black; abdominal belts slender, yellow; anal tuft spreading, black.

Antennæ slender, black; head and thorax black, the latter with a slender yellow stripe on each side; abdomen slender, deep black, with three very narrow, equidistant, yellow rings or belts; anal tuft large and spreading, blue black; legs

purple black with orange dashes. Wings transparent with black nervures. Fore wings with the costal margin blackish; dorsal margin narrowly black; apical and hind marginal space filled with a blotch consisting of narrow lines of reddish orange separated by broad black lines on the nervures; transverse bar broad, black. Hind wings with the hind margin bronzy black. Cilia all dark bronzy grey.

Under side of fore wings iridescent light blue; costal and dorsal margins yellow; apical blotch orange divided by black nervures; cross-bar dark purple; of hind wings iridescent purple with the margin bronzy orange; cilia all dark grey with a golden gloss. Palpi bright yellow; thorax black; abdomen black with yellow lateral spots indicating the belts of the upper side; legs yellow with blackish dashes.

June, and, in its northern range, in July.

LARVA slender, smooth, shining, with a few scattered bristles; usual spots slightly raised; divisions of segments rather deep. Head reddish brown, with the mouth darker, and the lobes outlined with whitish; second segment with a pale yellowish-brown horny plate; body whitish-ochreous, unicolorous, with very faint indications of a darker dorsal line. In the pith of the stems of currant trees (*Ribes rubrum* and *R. nigrum*) feeding downwards. (C. Fenn.)

August to May, but possibly feeding two years.

PUPA red brown; placed head upwards, within the stem, at the junction of two or more branches, close to a small aperture prepared by the larva. (C. Fenn.)

A common species in gardens about the currant bushes, sunning itself upon the leaves, and hovering about around them, but so little timid that it may be touched with the hand, and has been known to be attracted by the blossoms of aromatic plants such as thyme and marjoram.

Very common in most parts of England; abundant in the south; found in Yorkshire and South-west Lancashire, but

apparently very scarce, or absent, farther north, and in Scotland has only been noticed, rarely, in the south. Scarce or absent in some parts of Wales. In Ireland it was found commonly near Dublin by Mr. E. Birchall, and has recently been reared by Mr. J. N. Milne at Londonderry.

Abroad it is widely distributed in Northern and Central Europe, Piedmont, Southern Russia, Bulgaria, Dalmatia, and Armenia. It has been imported into North America with currant bushes, and has there effected a settlement, and is supposed to have arrived by the same means in New Zealand, where it has been found by Mr. R. W. Fereday.

6. *S. cynipiformis*, *Esp.*; *asiliformis*, *Staud. Cat.*—
Expanse $\frac{3}{4}$ to 1 inch. Wings transparent, cross-bar red, tip purplish; abdominal belts yellow; anal tuft yellow or black.

Antennæ blue-black; head black; collar yellow; thorax black, with a yellow stripe on each side above the insertion of the wings; abdomen slender in the male, stouter in the female, black, with two yellow spots at the base, and three brilliantly yellow belts placed at regular intervals, the last of which, placed immediately before the anal tuft, is double in the male, with the tuft black; single in the female, with the tuft golden yellow. Legs bright yellow, with a black bar, and the tarsi orange.

Wings transparent, with the nervures purplish black. Fore wings with all the margins purplish black, and having a dusky purplish or bronzy-purple apical blotch which is divided by the black nervures; transverse spot rich orange-red, edged inwardly with black. Hind wings edged with purplish black. Cilia all dusky purplish grey.

Under side of the transparent portions of the wings iridescent blue; fore wings with the base and costal margin glistening yellow, dorsal margin narrowly reddish, apex yellow with the nervures dark, transverse spot orange red, cilia bronzy grey; margin of hind wings bronzy purple. Palpi and front of the thorax yellow; remainder of the under side of the thorax

black ; of abdomen black with two yellow belts ; anal tuft of the male beneath black and yellow, of the female light yellow.

There is occasional variation in the markings of the abdomen on the upper side, the belts in the female being at times broader, and the two yellow basal spots larger or united into a crescent, while in other specimens in both sexes faint yellow lines appear between, and parallel with the belts. Mr. R. Adkin has, this year, reared a specimen having the right fore wing normal, but in the left the transverse spot yellow, and yellow scales replacing the purple at the apex and inside the costal stripe.

July and the beginning of August.

LARVA nearly an inch long. Head small and flattened ; body cylindrical, but tapering a little at the tail, plump, with segments rather deeply divided. Head dark purplish brown, mouth blackish, above it a flesh-coloured spot ; plate on the second segment shining brown ; body of a rather opaque yellowish flesh-colour, with the dorsal vessel faintly indicated in the last segments ; plate on the anal segment pale yellowish brown ; body set with the usual tubercular spots, each with a short brown bristle ; spiracles minute, flesh-coloured, edged with dark brown. (Buckler.)

Full fed in May or June, in the trunks of oak trees, feeding on the inner bark. Dr. T. A. Chapman says that the insect also takes advantage of felled oak trees, the larva feeding within the open edge of the stump where it was cut across. He believes that the larval stage continues through nearly two years.

PUPA half an inch long, slender, tapering behind, with deeply divided segments, tips of the antenna and wing-cases long, and projecting a little from the body and sides ; abdominal segments with two rows each, or in the last three segments one row each, of small, sharp hooks pointing backward ; anal segment with a circlet of hooks. Colour shining brown, hooks blackish. (Buckler.) In a small, rough chamber

in the oak bark, through the thin covering of which it partly forces itself before the emergence of the moth.

The moth emerges in the morning, and is fond of sunning itself upon oak trunks. It is said to fly mostly from 10 A.M. to noon, and has been found on flowers of the nettle. It has long been known as a denizen of Hyde Park, London, and in some years, as in 1856 and 1867, has been very common there; indeed the vast majority of the specimens in British collections have been obtained from this favoured and readily accessible spot. Elsewhere it appears to frequent woods, or the scattered trees in open parks, and has been found in Kent, Sussex, Devonshire (near both Plymouth and Exeter), Herefordshire, Staffordshire, Leicestershire, Oxfordshire, Essex, and more rarely in Suffolk, Gloucestershire, Somerset, and near Doncaster, Yorks. But it is, like its congeners, readily overlooked, and doubtless may be found, where oak is plentiful, in some part of most of the more southern English counties.

Abroad it ranges through Central and Southern Europe and Asia Minor.

7. *S. myopæformis*, *Bork.* Expanse, $\frac{3}{4}$ to 1 inch. Wings transparent, tips purplish black, belt of abdomen red.

Antennæ rather long, serrated, black; head, thorax, and legs blue-black; abdomen long and slender in the male, stouter in the female, black, with a broad central vermilion belt; anal tuft long and dense, blue-black. Wings transparent, with black nervures; fore wings with a black stripe along the costal margin, a narrow black line along the dorsal margin, hind margin broadly black with a faint coppery or purplish tinge, and the cross-bar, or transverse spot, black. Hind wings with the hind margin rather broadly black with a coppery tinge, and having, near the costa, an oblique black central streak. Cilia all smoky-black.

Under side of the wings having all the transparent membranes of a brilliant iridescent blue, the margins brilliant

orange-yellow, nervures blackish, cross-bar and apical blotch orange-yellow, but with the nervures visibly black and dividing them, in the female broadly so; cilia coppery-black. Palpi silvery, thorax black beneath, tinged in front with silvery, and with a brilliant orange blotch on each side; abdomen beneath blackish, with a long yellow patch in the male, but with no indication of the red belt of the upper side; in the female blue-black, and showing the red belt; anal tuft, beneath, yellowish in the male, blue-black in the female; legs black, except the tarsi, which are yellowish-white, clouded with black.

This species is liable to considerable variation in the colour of the abdominal belt, from vermilion to orange-red, orange, and even yellow.

On the wing in June, July, and August.

LARVA three-fourths of an inch long, of even thickness, rather flattened; head rounded; second segment slightly broad; skin wrinkled, with the horny spots slightly raised, and each bearing a bristle; segments rather inclined to overlap. Head red-brown, dorsal plate large, partly covering the third segment, tinged with bright brown; body dirty white, with pinkish pulsating dorsal vessel, and the fifth to eighth segments tinged with purplish-pink; pro-legs hardly visible. (Hellins.)

August to June, in trunks and branches of apple trees, feeding on the inner bark; but it may feed during two years.

PUPA long, slender, cylindrical, but tapering at the tail, which is blunt, and has a circlet of small spines. Abdominal segments with two rows, or, in case of the hinder, with one row of dorsal points. Glossy light brown, with darker brown wing-cases; head and rows of points still darker brown. In a chamber in the rough bark of apple trees, forcing its way partly through the skin of the bark when ready to produce the perfect insect.

The moth sits on the apple trees, either on the trunk or on leaves; also upon shrubs and low plants growing beneath, and occasionally comes to flowers in the gardens. It is common in the gardens of the London suburbs wherever old apple trees exist, and has been found in gardens in Norwich. Elsewhere it mainly frequents orchards, and is sometimes abundant in Surrey, Kent, and various parts of Cambridgeshire. Scarce in Sussex, Devon, Somerset, Gloucestershire, and Herefordshire; found in several localities in Suffolk, Essex, and Middlesex. It has also been found near Sheffield, and a single specimen, "sitting on a road close to some old apple trees," at Grange, Lancashire. But it is most easily overlooked, and probably will be found in suitable places in almost every county south of Yorkshire and Lancashire.

In Ireland it was recorded by Mr. E. Birchall from Dublin and Cork, but does not appear to have been noticed recently. Abroad it is found in Silesia, and many other parts of Central Europe, Livonia, Dalmatia, Greece, and Southern and Eastern Russia.

8. **S. culiciformis**, *L.* Expanse 1 to $1\frac{1}{8}$ inch. Wings transparent; fore wings reddish or orange at the base, purplish black at the tip; abdominal belt red.

Antennæ in the male with short, dense pectinations, in the female simple, but long, stout, and gracefully curved, blue-black. Head and thorax black; abdomen black, with a broad central orange-red belt; anal tuft large, black; legs black, with yellow dashes, except the tarsi, which are yellowish. Wings transparent, with black nervures; fore wings with the base of the costal margin and of the nervures, tinged with bright orange-red; costal stripe rather broad, bluish black; apex and hind margin broadly bronzy black; dorsal margin narrowly black; transverse spot rather oblique, deep black. Hind wings with the costal margin orange; hind margin narrowly blue black, central streak black. Cilia of all the wings dark purplish grey.

Under side of the transparent portions of the wings brilliantly iridescent, blue and purple. In the male all the dark portions of the fore wings, except the transverse spot, are thickly dusted with golden yellow, but in the female the costal and dorsal margins only are golden yellow, the apical blotch being dark purple; transverse spot in both sexes black. Hind wings with all the margins dark purple-grey, as also are all the cilia beneath. Palpi brilliant orange-red, thorax and abdomen black, except that the latter is embellished with a belt of orange-red of the same breadth as above.

The abdominal belt is liable, on the upper side, to great variation in colour, from orange-red to deeper red, also to orange, and yellow, and even occasionally, though rarely, to white. This white variety is very remarkable, and seems with us to be confined to the district round Dover. It is very conspicuous when flying, and the usual red or orange colouring at the base of the wings is, in it, changed to creamy white.

On the wing at the end of May and in June.

LARVA of tolerably even width, but a little broader in the middle, hardly tapering until very near the extremities. Head of rather a bright, light brown, dorsal plate whitish, with the middle portion light brown; body of a smooth clear white, faintly tinged with grey; anal segment with a light brown plate. In the bark of birch, feeding on the alburnum or inner layer. In the trunks of trees, and the larger stems of birch bushes, but especially preferring the stump or stub whence the birch stem or trunk has been cut. Here it feeds sometimes in numbers, and may readily be dug out.

Full fed in May, but probably feeding for the greater part of two years.

PUPA moderately slender, with prominent antenna and wing-cases, the latter slightly projecting at the points, a projecting ridge in front of the head, and the plate at the back

of the thorax rather elevated at its hinder edge. Pale reddish brown, with the eyes black, limbs outlined with dark brown, and the abdomen ringed with pale yellowish brown, the usual rows of raised points being dark brown. In a cavity under the bark of the birch trunk, or, when in a stump, the cocoon is formed just within the upper surface under the bark where cut through.

The moth emerges about 10 A.M. and flies in a lively manner about birch trees and bushes early in the afternoon, but is hardly distinguishable upon the wing except by its belt of bright colour. Even then its resemblance to a large ichneumon fly is extraordinary, so that there is constant likelihood of its being overlooked. It may occasionally be seen upon blossoms of *Euphorbia amygdaloides* (Wood-spurge) but does not seem to frequent other flowers, and when seen is usually at rest on a leaf of a birch bush or some adjacent shrub. It is common in Tilgate Forest and in other birch woods in Sussex and Kent, found also in Surrey, Essex, Suffolk, Norfolk, Somerset, Glamorganshire and other parts of Wales, Staffordshire, Herefordshire, Yorkshire, and very rarely in Lancashire; doubtless in other districts, but overlooked or not recorded. In Scotland it is found in the Clyde district; also in Perthshire, at Bræmar; and in the Aberdeen district. I have a memorandum of its capture many years ago at Killarney, Ireland, by the late Mr. E. Birchall, of the correctness of which I have no doubt, but it does not appear in the list which he published in 1868. Abroad it is widely distributed throughout Northern and Central Europe, Piedmont, Hungary, Dalmatia, Southern Russia, Siberia, and Armenia.

9. **S. formicæformis**, *Esp.* Expanse $\frac{3}{4}$ to 1 inch. Wings transparent; tip of fore wings red; abdominal belt red.

Antennæ blue-black, head and thorax black, abdomen black, bronzy towards the base, with a broad central belt of rich vermilion; anal tuft broad, black, edged with white at the sides; legs blue-black, with white tufts at the joints; wings

transparent with blackish nervures; costal margin of the fore wings of a brilliant red shading into glistening mixed blue and red; dorsal margin similar; hind marginal space filled by a large blotch of rich deep vermilion divided by the black nervures, and with the extreme margin black; transverse spot black with glistening blue suffusion; hind wings narrowly edged with black. Cilia all coppery grey.

Under side with the transparent portions of the wings iridescent purple-blue; costal margin of the fore wings broadly glistening golden yellow; crossbar black, edged with yellow; tip vermilion divided by black nervures and edged outwardly with black; other margins of both wings, with the cilia, bronzy-purplish black. Palpi brilliant red; under surface of thorax and abdomen black, except a large vermilion blotch covering three segments of the latter; legs black, tarsi shining yellow. Sexes similar.

Variation in this species seems to be rare, but Mr. Sydney Webb has a specimen in which the red belt extends over three segments on the upper side of the abdomen; and one reared by Mr. F. W. Frohawk has the belt and the apex of the fore wings of a bronzy gold colour without any trace of red.

June, July, and August.

LARVA rather plump and of equal thickness; head rounded with the lobes rather prominent, brown edged with blackish; dorsal plate large and broad, light brown, with two oblique lines; body white faintly tinged with yellow; dorsal line faintly grey; anal segment with an indistinct pale brownish plate.

In stumps of Osier (*Salix viminalis*) burrowing in the solid wood and pith. September to June.

PUPA slender, reddish brown.

Usually in a chamber at the top of the stump of osier, where it has been cut.

A very local species, and seldom noticed. It sits upon

leaves of willow and osier in the sunshine, but is remarkably like a small ichneumon fly, and may for this reason be overlooked. Probably it also is timid and darts down among the thick herbage which always grows about the osier stumps. It was at one time common close to London, at Hammersmith, and in the Hackney Marshes, as well as at Wormwood Scrubs, but seems to have disappeared or to have been exterminated by building operations. Also found in Kent; in the Forest of Bere, Hants; in various parts of Cambridgeshire; at Epping Forest, Essex; in Somerset rarely; in Herefordshire; and in Suffolk, where it is said to have been found commonly at Stoke-by-Nayland. A specimen was taken by Mr. J. B. Bridgman upon the blossom of one of the smaller thistles, when he was collecting *Hymenoptera* in a marsh near Norwich, close to some willows on the banks of the Yare. It is also recorded from Gloucestershire, Derbyshire and near York, and probably exists in suitable places in many of the southern and midland counties. Abroad it is extremely local, and not very plentiful, but found in many parts of Northern and Central Europe, Piedmont, Dalmatia, Greece, and Southern Russia.

10. *S. ichneumoniformis*, *Schiff.* Expanse $\frac{5}{8}$ to $\frac{7}{8}$ inch. Fore wings semi-transparent, yellowish; hind wings transparent; abdomen with several slender yellow belts.

Antennæ black, rather slender; head blackish with tufts of pale hairs; thorax blackish with a yellow stripe on each side, passing over the insertion of the wings; abdomen blackish with six narrow yellow belts; anal tuft yellow in the middle, blackish on each side; legs orange-yellow clouded with blackish. Fore wings partially transparent, with the nervures broadly dark brown, the costal margin dark brown edged with yellow; dorsal margin narrowly orange-red, hind marginal space filled in with a dark orange blotch, divided and obscured by dusky nervures; and the transverse spot black-brown with a bright orange-red spot on its outer edge. Hind wings transparent, with the margins dark brown and

an oblique tooth-like black spot in the middle of the costal margin; cilia of all the wings long, bronzy brown. Female considerably larger and stouter than the male, otherwise similar.

Under side of the wings iridescent blue; fore wings with the margins and nervures glistening yellow, apical blotch orange-red, divided by the nervures, which here are black; transverse spot rich red; hind wings with margins and nervures yellow, and central spot red; cilia all brown with a yellowish gloss. Face yellow, palpi yellow above, black below; under part of thorax blackish with yellow tufts of scales in front; of abdomen dark brown barred with yellow; anal tuft yellow, mixed with black; legs yellow, spotted with orange and black.

On the wing in July and the beginning of August.

LARVA half an inch long, rather thick, plump and rounded; head slightly flattened, third and fourth segments rather the thickest, looking puffed and swollen; tapering towards the tail; the middle segments seeming rather to overlap. Head pale brownish-pink, with three broad brown stripes down each lobe, and a triangular brown patch between them; mouth blackish brown; dorsal plate polished, semi-transparent, pink; body rather opaque, pale yellowish-pink; dorsal vessel faintly darker; hairs few, delicate, pale brown; spiracles ringed with brown; legs pale brown, prolegs pink. Burrowing down the side of a strong thick root of *Lotus corniculatus* or *Anthyllis vulneraria*, eating the solid root and covering its burrow with silk and frass; by the time that it is full fed it commonly eats out the whole substance of the root and kills the plant.

September to June. It is not known whether it feeds through more than one season.

PUPA rounded on the back, rather flattened in front; head with a beak-like projection; wing and antenna-cases remarkably long, extending nearly to the end of the abdomen;

abdominal segments edged with minute hooks; tail blunt. Shining bronzy brown; eye cases black.

In a cocoon in the middle of the root-stock of the food plant.

This species, unlike some of its congeners, usually emerges from the pupa in the afternoon or evening. The moth may be swept up from among its food plant from 6 to after 8 o'clock P.M., and has been taken flying at 7.30 P.M. It appears to be mainly confined to dry flowery slopes on the coast, and to chalk hills in the South of England. It is found along the whole sweep of the south coast, Kent, Sussex, Hants with the Isle of Wight, Dorset, Devon, and Cornwall. In the latter two counties it is found also on the north coast, and in some of these localities is plentiful. On the east coast it has been found in the Isle of Sheppey and at Southend, Essex; inland at Whittlesford, Fulborne, and elsewhere on chalk hills in Cambridgeshire; Wolverton, Bucks; on hills in Herefordshire, Gloucestershire, and Somersetshire; rarely at Lewes, Sussex; formerly plentifully at Charlton, Kent. Has been taken, very rarely, near Brandon, Suffolk; and one of the earliest notices of the species in this country was of a specimen taken at South Creake, near Fakenham, Norfolk. North of this the only records are from Flamborough Head and near Scarborough on the coast of Yorkshire. In Wales it is abundant in Pembrokeshire, and doubtless occurs in suitable places on the remainder of the South Wales coast. Very widely distributed over Europe, the north of Africa, Asia Minor, and Siberia.

11. *S. philanthiformis*. *Laspeyres*; *musciiformis*, *Staud. Cat.*—Expanse, $\frac{5}{8}$ to $\frac{3}{4}$ inch. Fore wings with very narrow transparent spaces; margins and apex dark brown; abdominal belts slender, yellowish-white.

Antennæ blackish-brown in the male, in the female with a long whitish central blotch on the upper side; head blackish; collar pale yellow; thorax black-brown, with a white or pale yellow stripe on each side; abdomen bronzy black-brown,

with two or three very slender pale yellow or whitish belts, and a slender faint yellow line down the middle of the back; anal tuft in the male black-brown, in the female with two yellow stripes. Fore wings blackish-brown at the base, and with the costal and dorsal margins and median nervure broadly dark bronzy-brown; hind margin narrowly the same; apical space yellowish or whitish, edged internally with bronzy-brown, and divided by the dark nervures; transverse bar broad and complete, bronzy-black, faintly edged outside with reddish; before it is a narrow triangular semi-transparent longitudinal space, and between it and the apical blotch another semi-transparent space, rather rounded and divided by dark nervures, both these semi-transparent spaces being slightly obscured by yellowish-white scales; extreme margin of the costa beyond the middle whitish. Hind wings transparent with purple iridescence; nervures blackish; central spot black; margins bronzy-brown. Cilia of all the wings bronzy-brown, whitish at the tips. Under side of the fore wings like the upper, except that the costal margin is whitish; hind wings iridescent purple, with dark margins; palpi and front of the thorax white; remainder of the under parts silvery-brown or bronzy-brown.

On the wing in June and July.

LARVA plump but rather flattened, tapering from the fourth segment to the tail; rounded behind. Head rather small, pale brown; dorsal plate horn-colour; body yellowish-white, with the dorsal line faintly darker from the greyish dorsal vessel showing through; legs whitish; prolegs extremely minute, yellowish; spiracles black; anal segment furnished with a few bristles. In the root-stocks of *Statice armeria* (otherwise *Armeria maritima*) (Thrift), more especially in the small plants which grow on coast rocks close to high-tide mark, feeding down into the long root-stem which penetrates a deep chink of the rock.

August to June.

PUPA half an inch long, slender, tapering to the tail; thorax arched; antenna- and leg-cases long, the latter projecting; abdominal segments with ridges of hooks. Light reddish-brown; thorax, eye-cases, and parts of the wing-cases dark brown; hooks black. In the upper part of the hollowed root-stock, and readily found by examining the small dead plants of thrift on the rocks, though sometimes placed too deeply down in the rock-fissure to be readily extricated. Beginning of June. Mr. Buckler found that in some instances the larva fed up through the tuft of thrift, and made a tube of silk and stony particles, which projected upwards above the plant. I can only suppose that in these instances the root-stock was too short to shelter it, as I have never observed any such projecting tube in the numerous plants found containing larvæ and pupæ collected on the coast of South Wales.

The moth is not often seen in its very restricted localities, or if seen for a moment, at rest on the bare rock, is so like a small slender fly that it becomes practically invisible the moment it moves, the eye quite failing to follow its swift flight. On one occasion, however, Mr. E. A. Atmore saw it in abundance on the Cornish coast, frequenting a high bank covered with thyme, about and upon the flowers of which this little clearwing was flying and settling freely.

The first record of the species in this country was of a specimen taken near Torquay, more than sixty years ago, but it was not again met with until 1860, when specimens were taken at the same place, settling, it was stated, upon wild thyme. It has since been found on many rocky portions of the Devon and Cornwall coasts, and on those of Carmarthen-shire, Pembrokeshire, Cardiganshire, and the Isle of Man. In Scotland it has been found on the coast of the Solway Firth on the west, and also at Aberdeen and Muchalls on the east; and there is little doubt that it occurs in suitable places all round the Scottish coast, as well as on that of

North Wales and the North-west of England. The same may be suggested with regard to Ireland, though hitherto the insect appears only to have been met with in the Saltee Islands, Co. Wexford, and once at Howth, near Dublin. Found in various parts of the continent of Europe, but its exact range is doubtful, some of the recorded localities possibly belonging to closely allied species in this obscure group.

12. **S. chrysidiformis**, *Esp.*—Expanse, $\frac{3}{4}$ to $\frac{7}{8}$ inch. Fore wings bright red, hind wings transparent; abdominal belts yellow; anal tuft red.

Antennæ blue-black; face white; palpi yellowish; top of the head reddish-brown; thorax blue-black; abdomen brilliant greenish-black, with a narrow yellow belt in the middle, and another, still more slender, before the anal segment; anal tuft of a brilliant orange-red; legs orange-red, tarsi greyer, spines white. Fore wings deep rich orange-red, with the base and costal margin broadly black; hind margin narrowly smoky-black, with the nervures blacker; beyond the middle a broad kidney-shaped black spot takes the place of the usual transverse bar, but does not reach the margins; before it is a long, wedge-shaped, glistening yellow, transparent space, and sometimes a narrow line of the same between the dorsal and median nervures; beyond it, in the orange-red area, are three or four short transparent streaks between nervures. Hind wings transparent, with black nervures and purple-black margin, and having, close to the middle of the costal margin, a black spot edged outside with orange-red. Cilia of all the wings long, dense, shining, smoky-grey with a purple gloss. Female rather larger and much stouter than the male. Underside of all the wings similar to the upper, except that the costal margin of the fore wings is glistening yellowish, and the red colour is paler toward the base of the wings; transparent portion of the hind wings of a brilliantly iridescent purple and red. Under parts of the head, palpi, thorax, and abdomen blue-black, the central

yellow belt being faintly visible, but broken ; antennæ faintly yellowish beneath.

A variety has been found, though rarely, in which the yellow belts are absent. On the wing in June and the beginning of July.

LARVA five-eighths to three-quarters of an inch long. Head broad, slightly flattened ; body pellucid, plump, smooth, and shining, tapering a little to the tail. Head and narrow dorsal plate reddish-brown ; body dirty brownish-white, with the dark grey internal vessel showing, as a dorsal line, to the tenth segment ; anal plate yellow ; some minute black dots above the spiracles (Buckler). Burrowing in the thickest part of the root-stock of sorrel and dock (*Rumex acetosa*, *R. acetosella*, *R. crispus*, *R. obtusifolius*). Full fed in May, but probably feeds during two years.

PUPA long, and rather even in thickness, antenna-cases prominent and but slightly attached, glossy chestnut, with the hinder segments rather darker. In the upper part of the burrow of the larva, in the root, in a cocoon of silk and gnawed material, the top of which is sometimes raised above the top of the root, forming a sort of dome on the surface of the ground.

The moth emerges from the pupa in the forenoon, and flies in the midday sunshine, when, from its brilliant colour, it is far more conspicuous than most of its allies. It also frequents the flowers of *Umbelliferae* occasionally, and has been taken over those of *Echium vulgare*, and about plants of sorrel and dock.

It appears to have been noticed in this country as early as 1802, but the records are not very clear, and that of the capture of a specimen "in a thick grove" seems too glaringly contrary to the known habits of the moth to be at all probable. The capture of a specimen near Haslar Hospital was recorded in 1851, and in 1856 one was taken between Dover

and Folkestone, on the Undercliff, by a Coleopterist, and was handed by him to Mr. J. W. Douglas, by whom it was recognised. Guided by this fortunate capture, the haunts of the insect on this part of the coast of Kent soon became well known, and specimens have been taken there nearly every season since. It may probably extend some few miles along the coast, and indeed is said to have been taken near Eastbourne; but the only reliable locality in this country is on the slopes of the open banks and hill sides of the Warren between Folkestone and Dover. Abroad it is rather widely distributed in Southern France, Spain, Italy, Belgium, and Central and South-Eastern Germany.

Genus 2. SPHÆCIA.

Antennæ rather short, thickened in the middle; apex curved back, and having a tuft of bristles; pectinations in the male short, blunt, solid, and appearing as though caused by a series of cuts half through the antennæ. From these solid tubercles arise minute bristles. Wings long and narrow, transparent, or nearly so, with dark nervures. Thorax robust; abdomen thick, rounded, banded with bright colours, and devoid of a distinct anal tuft.

The moths of this group bear an extraordinary resemblance to hornets or wasps.

LARVÆ soft, with horny head and jaws, feeding in the solid wood and bark of the trunks of trees and large bushes.

PUPÆ elongated, with the abdominal segments thickly set with short spines.

The two species are readily separated:

A. Collar yellow (*S. bembeciformis*).

A. A. Collar black, shoulders yellow (*S. apiformis*).

1. *S. bembeciformis*, *Hüb.*; *crabroniforme*, *Haw.*, *Staud. Cat.*—Expanse, $1\frac{3}{8}$ to $1\frac{5}{8}$ inch. Wings transparent,

slenderly margined with pale brown; thorax black; collar yellow; abdomen yellow, belted with purple and black.

Antennæ rather short and stout, pectinated (or rather laminated), in the male, black. Head dark brown with a bar of paler brown across the forehead; collar bright yellow; thorax blackish brown, with some long yellow scales at the back; first two segments of the abdomen black-brown, the third bright yellow edged with black, the fourth dark purple, or else yellow edged with purple-black, or even partially shaded with purplish; the remaining segments bright yellow edged with black, except the last, which is tipped with orange and purplish, and ends in a blunt point. Legs brilliant orange-red shaded with yellow. Wings transparent, with the nervures orange-brown, but when freshly emerged covered with loose, yellowish-brown, scattered scales; costal margin of the fore wings narrowly orange-brown, slightly broadened towards the apex; dorsal and hind margins also narrowly orange-brown; discal streak sinuous, reddish orange; margins of hind wings, and all the cilia, orange-brown. Sexes similar except that the female is larger and considerably stouter than the male. Underside of the wings similar to the upper, but yellower; palpi bright yellow; face and under part of thorax purplish-brown; abdomen purplish-brown banded with yellow, especially towards the anal segment.

End of June to August.

LARVA one inch in length. Head rounded, dark-brown; body tapering considerably behind, yellowish-white; dorsal plate pale yellowish, edged with blackish behind; legs brown, prolegs extremely small and inconspicuous. In the bark and solid wood of willows (*Salix caprea*), osiers (*S. viminalis*), weeping willow (*S. Babylonica*), and black poplar (*Populus nigra*); feeding about two years. Full fed in May or June. In the woods of the southern portions of England the willows only are commonly attacked, a large

burrow thicker than a goose-quill being visible in many of the larger sallow-poles when cut down. In these the larvæ or pupæ may often be found, but are not easily reared. In its more northern and western localities the poplar seems to be selected, and the larva, after feeding at first in the bark, eats deeply into the solid wood, leaving a hole in the surface through which the excrement is cast, so that it lies like little heaps of sawdust on the lower projections. In the north of Ireland larvæ have been found, by the Rev. J. Bristowe, in colonies, in the trunks of willow trees (*Salix viminalis*), feeding in all respects as in the poplars, and by Mr. J. N. Milne in the usual manner in sallow-poles.

PUPA long and of tolerably even width, with a small projecting point in front, the wing-cases short, the antenna and leg-cases rather long and free at their extremities, and the abdominal segments with double or single rows of minute hooks. Colour bright chestnut with the rows of hooks blackish. In a strong cocoon of white silk and gnawings of wood, in a cavity formed at the extremity of the burrow and just inside the bark, which is gnawed very thin. By means of its strong abdominal hooks the pupa thrusts itself through this covering and projects far out of the hole when ready for the emergence of the moth. This takes place on sunny mornings between seven and ten o'clock: if the weather is dull, sometimes later.

The moth sits on the trunk of the tree or on the leaves of the sallow bush, and sometimes on plants growing below, and looks most deceptively like a hornet. It also flies in the sunshine, but is rather sluggish.

Common in Kent, Surrey, Sussex, Hants; scarce, though widely distributed, in Devonshire; common in Essex, Norfolk, Suffolk, Cambridgeshire, Leicestershire, Derbyshire, Herefordshire, Cheshire, Lancashire, and Yorkshire; also in Pembrokeshire, and most likely to be found, where its food grows plentifully, in almost every English and Welsh

county. In Scotland it is found in Perthshire and Roxburghshire, and apparently throughout the southern districts, as well as in Aberdeenshire. Widely distributed in Ireland; common in the Dublin, Belfast, and Londonderry districts, and throughout the south and west. Abroad its range appears to be restricted, but it is recorded from Holland and Central Germany.

2. *S. apiformis*, *L.*—Expanse $1\frac{1}{2}$ to $1\frac{3}{4}$ inches. Wings transparent, with yellow-brown margins and nervures; thorax brown, with a large yellow patch on each shoulder; abdomen thick, yellow, belted with purple and black.

Antennæ short, stout, and strongly laminated in the male; blackish brown, with the laminae or teeth purple-brown; head bright yellow; collar dark-brown; thorax dark-brown, with four large yellow blotches, two in front on the shoulders, and one at the back on each side, though these last vary considerably, being sometimes quite narrow, while in other instances they coalesce and form a band across the back; abdomen bright yellow, each segment edged with black, the basal segment purplish-black, and three other segments shaded with purple and black; legs deep yellow, the third pair very long, robust, and thickly clothed with orange scales.

Fore wings narrow, transparent, though, when the moth has just emerged, having a thin covering of coarse, loose, yellow-brown scales; costal margin with a broad yellow-brown stripe increasing in breadth towards the apex; nervures and the dorsal and hind margins narrowly yellow-brown; no apical blotch nor transverse spot, but at the end of the discal cell a broad reddish perpendicular streak from which the small nervures arise. Hind wings transparent or, when just emerged, clothed very thinly with fine yellow scales; margins and nervures narrowly yellowish-brown. All the cilia very dense, brown mixed with dull yellow.

Under side of all the wings similar to the upper, except that the margins and nervures are much more yellow, and the

transparent portion brilliant irridescent blue; palpi yellow; thorax brown; abdomen blackish brown beneath, with three broad yellow belts, and the apex yellow.

On the wing in the latter part of May and in June.

LARVA nearly one and a half inches long. Rather broad and slightly flattened in front, broadest at the third segment and tapering slightly to the tail, skin much wrinkled. Head flattened, hard, and horny, smaller than the second segment, into which it is retractile; shield of the second segment strong, wide in front, narrowed behind; prolegs extremely small and ill-developed, with small disks of points in place of the usual hooks. Head rich chestnut-brown, with the mouth paler, but outlined with black; second segment more yellow than the remainder; body soft, glossy yellowish white; spiracles ringed with red-brown; hairs few and scattered, short, brown. Much like a large soft maggot, yet from the strength of its jaws well fitted for eating through solid wood. Lives in the basal portions of the trunks, and the upper parts of the large spreading roots, of poplar, especially *Populus nigra* and *P. tremula*; sometimes following the root to some distance from the trunk, but feeding principally in the bark. (Hellins.) Lewin reared larvæ feeding under bark of lime trees (*Tilia Europæa*).

Full fed in April, after feeding, probably, nearly two years.

PUPA elongate, cylindrical, rounded at the back, flatter in front, having in the front of the head a keeled projection; eye-covers prominent; tongue and wing-cases very distinct and slightly detached at their ends; leg- and antenna-cases also prominent, but closely attached; abdominal segments with double or single rows of sharp strong points; tail rounded off. Glossy rich brown. (Hellins.) In a cocoon of wood gnawings and silk, in the burrow, and immediately beneath the bark. The projection in front of the head has been observed to be used for scratching and partially cutting the cocoon from the inside, so that it bursts open at the marks produced.

For this purpose the strong rows of spines or points on the abdomen are useful in enabling the pupa to exert sufficient pressure.

The moth emerges from the pupa in the early morning sunshine, and sits upon the trunks of the poplars, bearing, from its colour, transparent wings, shape and appearance, an extraordinary resemblance to a hornet; and, strange to say, it also has a trick of raising its abdomen in a distinctly threatening manner when approached, as though ready to sting on the smallest provocation. It is hardly necessary to say that this habit is merely part of the protective mimicry natural to the species. It is perfectly harmless, and rather sluggish, when disturbed dropping or jumping off the tree to the ground, and shuffling away among grass or dead leaves. The male flies at midday about the trees, and the female either later in the afternoon or in the early morning.

Very common in Cambridgeshire, Huntingdonshire, Suffolk, Norfolk, Essex, and Northamptonshire; less so in North Staffordshire, Leicestershire, Buckinghamshire, Herefordshire, and Shropshire; scarce in Kent, Sussex, Devon, Gloucestershire, and near Scarborough in Yorkshire. In Scotland it is only recorded near Glasgow and in the Tweed and Solway districts. In Ireland it was stated by Mr. E. Birchall to occur near Cork and Waterford, and specimens have, more recently, been reared from larvæ found in young poplars near the latter city. Abroad it is widely distributed in Europe and North-western Asia.

Family 3. ZYGÆNIDÆ.

Antennæ stout and solid in the middle, tapering to the base and very often to the apex, which then is usually gracefully curved. Fore wings long and narrow, rounded at the apex and anal angle, usually of rich and lustrous colours. Hind wings rather narrow, short and rounded.

LARVÆ short, thick, soft and sluggish, usually slightly hairy; bearing no resemblance to those of the two preceding families.

PUPÆ elongated, usually with the leg-cases and wing-sheaths more or less free at the tips; in a tough silken cocoon on the stems of plants or close to the ground, or even upon rocks or stones.

Genus 1. PROCRIS.

Antennæ rather short and stout; in the male with short pectinations, partially so, or slightly toothed, in the female; wings elongated and rounded, without markings; thorax and abdomen of moderate thickness, smooth and glossy.

LARVÆ short, plump, almost ovate, slightly downy; mining in the leaves of plants.

PUPÆ in a thin semi-transparent cocoon, concealed close to the ground.

We have three very similar species, but their distinctions hardly admit of tabulation.

1. *P. globulariæ*, *Hüb.*—Expanse $1\frac{1}{8}$ to $1\frac{1}{4}$ inch; fore wings rather broad, bright golden green; antennæ somewhat pointed.

Antennæ of the male rather slender, pectinated regularly to the tips, all the pectinations oblique and pointing forward; of the female much stouter, pectinated equally to, or beyond the middle, then becoming solid, round and thick, with crowded joints; shaft shining blue-green, pectinations blackish. Head and thorax bronzy green; abdomen similar, but with a bright golden gloss. Fore wings rather narrow at the base, broader toward the hind margin, with the costal and dorsal margins nearly straight, apex blunt, and hind margin very little rounded; thinly scaled; unicolorous, glistening bronzy-green or golden-green, with the principal nervures thickened and raised, and longitudinal hollows

between them ; costâ narrowly darker ; cilia mixed green and grey. Hind wings short, with the costal margin long, the apex much rounded, and the hind margin moderately so ; smoky-grey, nervures and cilia slightly darker.

Underside pale smoky-grey, tinged with bronzy-green towards the costa of both fore and hind wings. Thorax, abdomen, and legs of a brilliant green.

Very little liable to variation, but in preserved specimens the abdomen frequently becomes of a glossy red—probably from some chemical action or from slight damp—indeed the entire insect becomes dark-red if placed in a relaxing vessel, usually recovering its green colour as it dries. In Mr. C. A. Briggs' collection is a specimen having extraordinarily short antennæ, in which nevertheless the pectinations are well shown. It was taken at Folkestone.

On the wing from the middle of June to the middle of July.

LARVA hardly more than half an inch long ; very broad, almost ovate. Head small and flattened, retractile ; segments of the body plump and deeply divided, the second with a smooth, glossy dorsal plate ; raised spots very broad and ovate, occupying much of the surface ; under-surface rather flat ; legs small, placed well underneath. Head and dorsal plate black, the latter tapering in front ; body green with the raised spots or plates light bluish-green ; an indistinct creamy-white or yellowish-white subdorsal line, below which is a broad dark-green stripe ; legs and spiracles black ; prolegs green ; the surface of the body dotted minutely with black, and furnished with short fine blackish bristles.

When very young it is similarly short and thick, with a retractile black head and a brownish dorsal plate ; body tinted with greenish drab and covered with a short whitish pubescence. As it grows it becomes more green in colour, especially after each moult, fading, before the next, to flesh colour or ochreous-green. After hybernation it is, at first, extremely dark, but after feeding soon becomes of a greener

colour; the bristles then appear, and the adult colouring is gradually assumed. Its habits are most curious. The young larva, as soon as hatched, mines into the substance of a leaf and eats the parenchyma. When ready to cast a skin it leaves the mine and places itself quietly upon the surface of the leaf until the moult is accomplished—which is not for nine or ten days—then, after a further rest, it enters another leaf, eating out the parenchyma as before, and leaving a blister-like space. This continues, with several rests for change of skin, until October, when a silken mat is made on the midrib of a leaf for hybernation. Here it remains, although the leaves die down, until February or March, when the same habit of feeding is recommenced and continued to full growth, except that, occasionally, a full grown larva may be seen to eat through the entire leaf including the surface skins. (Buckler.)

July to June on *Centaurea nigra*, *C. scabiosa* and *C. jacea*.

PUPA half an inch long; rounded, with the thorax prominent, the tips of the wing-cases free from the body, and the long leg- and antenna-sheaths all free; abdominal segments deeply divided, and having dorsal rows of hooks, pointing back, by means of which it ultimately works out of its cocoon. Head, thorax, and wing-cases dark shining olive-green; body and leg-cases lighter shining green; hooklets black. Just below the surface of the ground, in an oval cocoon of earth and silk, and an inner cocoon of soft opaque greenish-white silk. (Buckler.) But Zeller found that his larvæ made their brownish-grey cocoons *on* the surface of the earth, deeply concealed, close to the roots of the plant. Probably both mean the same, as Buckler says that the cocoons were visible as slight elevations of the surface. His account of this species is long and most interesting, and could only be condensed here.

An exceedingly local species, of quiet habits, yet fairly active in the sunshine, and is said not to sham death when

alarmed. It was discovered in this country about the year 1845 by Mr. J. Jenner Weir, who found it in numbers upon the South Downs near Lewes, Sussex, but keeping itself to extremely restricted spots, and Mr. Weir says always about *Poterium sanguisorba*, probably attracted by the flowers. It is still to be found in Hollingbury Vale, the Coombe, and other suitable spots near Lewes and Brighton; on the hills at the back of Shorncliffe Camp and of Folkestone, on the sunny slopes; and near Abbots Wood, Sussex; but does not appear to have been taken, in these islands, outside the counties of Sussex and Kent.

Abroad it seems to be found in France, Belgium, Central and Southern Germany, Switzerland, Northern Italy, Southern Russia, Armenia, and large portions of Western Asia.

2. *P. statices*, L.—Expanse 1 to $1\frac{1}{8}$ inch.

Fore wings rather narrow; bronzy blue-green. Antennæ moderately long, solid at the tip.

Antennæ of moderate length, in the male strongly pectinated for three-fourths of their extent, the pectinations consisting of flat laminae pointing forward; the remaining fourth solid, quite equally thick, with numerous tumid joints; in the female solid throughout, the joints towards the apex tumid; shaft burnished green; lower side and pectinations blackish. Head, thorax, and abdomen bronzy green, generally brightly burnished. Fore-wings rather long and not so broad behind as in the last species; margins moderately straight; apex blunt; hind margin rather oblique; thinly scaled, and having the larger nervures rather raised into longitudinal ridges from the base; dark bronzy green, without markings; costal margin and cilia rather darker. Hind wings rather sharply rounded at the apex, with rounded hind margin; smoky grey, with nervures and cilia darker. Female less in expanse than the male, with the hind wings broader at the apex; otherwise similar.

Underside of all the wings smoky, with the costal margins bronzy green; body and legs brilliantly green. As in the preceding species the abdomen frequently, and the whole insect occasionally—or under the influence of moisture—turns dark red after death. Professor Zeller states that this also occurs during life, the moth being quite red when taken off the dewy grass in the early morning, but changing to green even as it dries upon the hand. Otherwise it varies but little, except occasionally to a blue-green.

On the wing in June, and, in its more northern range, in July.

LARVA three-fourths of an inch long, very broad and almost ovate. Head small, retractile, shining black; second segment much broader, having a dorsal plate rounded off behind; body pale green, pale yellow, pinkish, or even dirty white; dorsal line pink, brownish, or composed of short brown dashes; there is also a broad pink, or greenish, lateral stripe, usually contrasting in colour with the upper part of the body; the raised spots are very broad, forming flat plates, six on each segment, each with a thin radiating fascicle of short stiff bristle-like hairs tipped with brown, among which are a few longer, more silky, whitish hairs; the raised spots themselves being pink, pinkish-brown, or pale brown; legs shining black, prolegs and under-surface dingy yellowish white. When very young it is thick and stumpy, with the spots large and diamond shaped, and the colour yellowish; later the colour becomes more brown and the bristles appear; then after further growth the dorsal line becomes orange-coloured and the lateral stripe yellow, the hairs increase in number, the colour becomes again browner, and the mature appearance is gradually assumed.

July to the end of April or even May. On *Rumex acetosa* (common sorrel) burrowing into the leaf and eating out the parenchyma; hybernating when very small at the roots of plants; feeding more rapidly in the spring, and often con-

suming one surface of the leaf, as well as the substance, leaving the transparent skin of the other surface; or, in the case of very young leaves, eating them through.

PUPA stout, blunt behind, rather pointed in front, having long, well defined wing-cases, and the leg-cases so long as to extend rather beyond the hinder extremity; colour brown. In a thin, white, tough but filmy cocoon, attached to stems of plants, close to the ground.

An exceedingly local species, frequenting meadows, and often to be found in hundreds in one corner of a pasture while hardly a specimen can be found in other parts of the field or in those adjoining. Generally sluggish, though the males fly freely enough, a few yards at a time, in the bright sunshine; but usually found sitting on flowers and grass-blades.

Common in suitable places in the southern and south-midland counties to Gloucestershire, Cambridgeshire, and Northamptonshire; scarce in Norfolk and Suffolk, though found in some years commonly in one spot near King's Lynn; uncommon in Devon and Somerset; also to be found in Herefordshire, Staffordshire, Derbyshire, Cheshire, and Lancashire; and in East Yorkshire rather commonly. Probably there are few English counties in which it has not a secluded home, but there is a singular absence of records in Wales. It is found in Dumfries-shire and some other parts of the south of Scotland; in the neighbourhood of Oban, and in several other localities in Moray and Argyleshire, the latter district producing specimens of large size and singularly blue-green colour. In Ireland it was found in abundance some years ago in the county Wicklow by the Rev. J. Bristowe, and has also been met with in Clare and Westmeath.

Abroad it is common in the South of France, Northern Italy, generally in Central and Northern Europe, Spain, South Russia, and Armenia.

3. **P. Geryon**, *Hüb.*—Expanse $\frac{7}{8}$ to 1 inch. Antennæ short and thick; fore wings short, rather dark bronzy-green.

Antennæ rather short, in the male pectinated for two-thirds of their length with distinct flat laminæ lying obliquely forward, then thickened and solid to the apex; in the female with a few pectinations near the base, thence solid and thicker than in the male; in both sexes very blunt; shaft glossy green, pectinations and lower side blackish. Head, thorax, and abdomen bronzy green, very glossy. Fore wings shorter and more blunt than in *P. statices*, with fairly straight margins; apex rounded; hind margin oblique; dark bronzy green, golden green, or bluish-green, rather thinly scaled and with nervures slightly ridged at the base; cilia green mixed with grey. Hind wings dark smoky grey with darker nervures and cilia. Sexes very similar.

Underside of the wings smoky grey, with a few longitudinal streaks of bronzy green; legs and body of a brilliant green.

Not, apparently, very variable, but like its allies, apt to turn dark red under the influence of damp, and the abdomen very liable to remain of a rich bright purple-red.

On the wing in June and July.

LARVA nearly half an inch long; plump, rounded, somewhat fusiform. Head very small, glossy black, retractile; dorsal plate blackish edged with yellowish in front; back and tubercles dingy white or pale yellow, the latter large and those of the back elongated, all set with short fine bristles; skin between them studded with minute star-like dots; dorsal line purplish brown, divided down the middle with whitish; subdorsal lines waved and claret colour; below is a broad lateral band of reddish brown extending to the spiracles, which are ringed with black, and below which are longitudinal stripes of flesh colour and pale brown; legs ringed with black; prolegs yellowish. The very young larva is yellow, but its tubercles with hairs soon appear; then the

back becomes whitish, the dorsal line claret, the subdorsal deep purple, with following whitish and claret lines and brownish spiracles. After hibernation the adult colour is soon assumed.

July to May on *Helianthemum vulgare* (Rock-rose or Common Sun-cistus); when very young making a hole into the substance of a leaf and eating out the parenchyma, but it seems never to completely enter the leaf which it is mining. When older it eats away the lower surface, leaving patches of clear skin-like blisters. When full grown it eats the whole substance of the leaves and the tender shoots, feeding usually in the sunshine. (Hellins.)

PUPA fusiform, with small head-covering and plump abdomen; wing-cases long and free at their edges; tongue-case and leg-cases long, free at the tips and extending beyond the wing-cases; abdominal segments with a transverse row of small points; anal segment rounded. Head and wing-cases deep shining olive-brown, abdomen more bronzy. In a small, tough, slightly fusiform, silken cocoon low down among the stems of the food plant. (Hellins.)

Very similar to *P. statices*, but smaller and darker, with shorter wings, and the sexes are much more equal in size. Far more sluggish than either of its allies, and has the habit of feigning death when alarmed. The males fly rather briskly sometimes, for very short distances, in hot sunshine, but they keep pretty near to the patch of *Helianthemum*, from which the more sluggish females hardly stir. Mr. J. J. Weir says that all the three species of this genus may be found within the space of a mile upon the Cliff Hill at Lewes, occupying their respective and restricted spots in abundance, but scarcely straying away. As a rule, they only move in the sunshine, but there is a record of the capture of the present species at a lamp at midnight. It is confined almost entirely to hills of chalk or limestone, and is by no means to be found wherever its food

plant is plentiful. It appears to have been first noticed on limestone hills in Worcestershire, about 1857 or 1858, and in 1859 was recorded, as British, under the name of *Ino tenuicornis*. In addition to the Lewes locality already mentioned, it has since been found in plenty in other places on the slopes of the chalk downs of Sussex and Kent, near Brighton, Canterbury, Shorncliffe, Abbots Wood, &c.; in Oxfordshire in glades of beech-woods on the hills sides; on the slopes of the Cotswolds in Gloucestershire as well as Worcestershire; near Barmouth, North Wales; on the Malvern Hills; at Grange and Silverdale in Lancashire; near Beverley in Yorkshire; at Bakewell, Derbyshire; and near Hartlepool, as well as at various places along the Durham coast. Abroad it is abundant in the Pyrenees and other parts of Spain; in Switzerland; in various localities in Germany; Vienna and other parts of Austria, including Carinthia; and in Asia Minor.

Genus 2. ZYGÆNA.

Antennæ much thickened beyond the middle, distinctly jointed but not pectinated; forewings elongated, much rounded at the apex; usually with red spots or blotches; hind wings short; abdomen rather long.

LARVÆ very plump, cylindrical, usually black-spotted, and rather downy.

PUPÆ with the wing- and leg-cases partially free, in a tough, spindle-shaped, silken cocoon.

1. **Z. Minos**, *Schiff.*; **pilosellæ**, *Staud. Cat.*; **nubigena**, *Lederer.*—Expanse $1\frac{1}{8}$ to $1\frac{1}{4}$ inch.

Fore wings semi-transparent, grey, with long red blotches; hind wings red; body hairy, black.

Antennæ black, thickened towards the apex, with a

slightly recurved blunt point. Head, thorax, and abdomen velvety black, shaggy with long dense soft hairs. Forewings elongated, rather narrow at the base; costal and dorsal margins nearly straight, apex rounded, hind margin slightly rounded and oblique. Thinly scaled and somewhat diaphanous; pale shining slate-grey, with the nervures slightly darker, and with three narrow longitudinal streaks or blotches of pale scarlet, one along the basal third of the costa, another from the base to beyond the middle but nearer to the dorsal margin, and the third arising between them like a wedge, but, extending considerably towards the apex, throws off a broad extension toward the anal angle. These three blotches are separated by the dark nervures. Cilia shining, pale gray. Hind wings rather short with rounded apex and hind margin; very pale scarlet with an extremely narrow dark grey stripe round the hind margin; cilia pale grey. Female similar, except that the fore wings are paler and more transparent, the antennæ rather more slender, and the body less hairy. Underside similar to the upper, except that the nervures are not dark, and the elongate markings on the fore wings appear as one large irregular blotch; body and legs black.

Usually not variable, but Dr. Mason possesses a specimen in which the red elongated blotches are lighter in colour than usual, but the entire fore wings, except the nervures, are suffused with the same colour, and the hind wings have a rather broad marginal grey stripe. Occasionally the dark colour of the dividing nervures is so spread out that the red blotches are separated in a sensible degree, the sharp wedge-point of the middle one being shortened, so that the latter seems to lie further from the base than usual. This variation was at one time introduced to our lists as a distinct species, under the name of *Achillea*, but was very soon ascertained to be rather the typical form of the present species in Switzerland. It was also found that our more frequent type had received the name of *nubigena*. *Minos* and *nubigena* were then placed as

distinct species in lists and collections, and as an additional distinction it was stated that in the form called *Minos* the scales or hairs of the body were shorter and smoother than in *Nubigena* and of a greenish tint. This, however, was soon shown to be fallacious, the smoother appearance being only caused by the lying down of the hairs, and it was readily demonstrated that one form varied perfectly into the other, leaving no distinctive characters, and that all were to be found living together, without indication of anything but the most absolute identity of habit and species. Nevertheless the name *nubigena* is still in not uncommon use in this country.

The semi-transparent appearance of the wings of this and the allied species is caused by the fact that the scales do not overlap as in other species, but lie separate. Under a strong lens they appear, in the present species, like great shoals of the fry of fish in the act of swimming.

LARVA three-fourths of an inch long. Soft, plump, cylindrical; head black, retractile; collar whitish; body rich dark olive-green, with the dorsal line dirty white, expanding at the front of each segment; on each side of it a row of eleven round, velvety, black spots, placed on the third to the thirteenth segments; below these a row of eight yellow spots on the fourth to eleventh segments, placed nearly alternately; each segment with a transverse row of eight fascicles of stiff white hairs; spiracles black; legs and prolegs grey.

When very young brownish, hibernating when quite small, at which time it is of the size and shape of a dry leaf of thyme, so that when stationary upon the plant, it is perfectly concealed. In March, after moulting, blackish-green with the black and yellow spots visible, but becoming paler with growth, yet again darker at each moult.

July to April or May, on *Thymus serpyllum*, eating the leaves; feeding most freely in the sunshine. (Buckler.)

Other and very various food plants—*Polygala vulgaris*, *Pimpinella saxifraga*, *Veronica officinalis*, *Genista tinctoria*, *Trifolium*, and even grasses—are recorded by various authors, but as the larvæ described by them are not always found to agree very closely, it is probable that, in some cases, there have been errors.

PUPA rather short and thick, with head, wing-sheaths, leg-sheaths, and back black-brown; abdominal segments yellowish. In a short truncate cocoon, of a glistening brownish-yellow or dirty-white colour; attached to a rock, stone, or some other object on the ground.

The moth flies actively, with a direct buzzing motion, in the sunshine, through the earlier part of the day, frequenting flowers, but from four o'clock P.M. it becomes quiet, and may readily be found asleep on flowers and plants. It frequents rocky limestone pastures and hill-sides, and where it occurs is usually abundant.

It appears to have been first taken in these Islands in 1853, when it was found in plenty in limestone pastures in the county Galway, in the West of Ireland, principally near the coast. From the neighbourhood of Ardrahan, Kilcolgan, Oranmore, and other places in that county, multitudes were procured then and since, and no diminution seems to occur in its abundance. More recently it has been found commonly on the Burren Mountains in Clare, and on the coast of that county in thousands. In Scotland, it has been taken commonly in the neighbourhood of Loch Etive, Argyleshire, as well as on the coast of Forfarshire; and in Wales near Abersoch, on the shores of Cardigan Bay, where it was abundant in 1887 and 1889. No locality is known for it in England. Abroad it is plentiful in Switzerland, Germany, France, Sweden, Livonia, Siberia, Armenia, and Asia Minor, and in mountainous districts varies in a perplexing manner.

2. **Z. exulans**, *Hochenwarth*.—Expanse 1 to $1\frac{1}{4}$ inch.

Fore wings semi-transparent, grey, with five faint red spots; hind wings faintly reddish; body hairy, black.

Antennæ black, curved forward, very thick toward the apex, where they are curved gently back; apex blunt. Head, thorax, and abdomen black, densely and roughly clothed with long, black, soft hair-scales. Fore wings rather narrow at the base; costal and dorsal margins nearly straight; apex and hind margin much rounded; semi-transparent, smoky bluish-grey or greenish-grey, with five pale crimson spots; the first three elongated, the longest being that from the base along the costa, the other two shorter and placed in the angles of the nervures; the remaining two larger, more or less round, one in the middle of the wing, the other beyond and nearer the costa; nervures distinctly darker, separating the basal spots and faintly dividing the fifth; cilia short, yellowish-brown. Hind wings rather short, bluntly pointed, rounded behind, pale reddish, dull crimson, reddish ochreous, or even pale grey shaded with pink or ochreous; sometimes nearly transparent, with the hind margin narrowly or broadly shaded with bluish-grey; cilia yellowish brown, inconspicuous.

Female similar, but paler and more transparent; having the portion of the collar in front of each shoulder white or yellowish; the nervures of the fore wings very pale; the spots and hind wings sometimes whitish-red, and the cilia whitish. Legs yellowish-white.

Underside shining and almost destitute of scales, showing a faint repetition of the colours and markings of the upper side.

Variable in intensity of colour of the fore wings, as blue, grey, or greenish predominate, and in the colour of the spots, which often are crimson only in the centre, otherwise dull ochreous, whitish or pale pink; also in the colour of the hind wings, from crimson to pale pinkish-grey or ochreous-

grey, the darker grey border shading inwards in these paler specimens. Rarely the spots and hind wings are almost white, with a floury appearance, arising from a dusting of whitish ochreous scales.

The scales lying separately upon the surface of the fore wings, bear the queerest possible resemblance, under a good magnifier, to immense shoals of tadpoles.

On the wing in July.

LARVA two-thirds of an inch in length; broad and fat; head very small, glossy black, retractile; body enlarging rapidly, with segments rather deeply divided; upper part of second segment naked, green, somewhat retractile; body very dark green; subdorsal stripes velvety black, interrupted by bright yellow transverse spots; each segment with a series of ovate tubercles thickly studded with short black bristles, and each having one long black hair; spiracles black; under surface smooth, paler green; legs shining, green and black; prolegs light green. When very young pale green, and continuing so until hibernation. In the spring, when approaching full growth, intensely black with bright yellow lateral spots. (Buckler.)

August to June on *Azalea procumbens*, *Cherleria sedoides*, *Silene acaulis*, *Trifolium alpinum*, *T. repens*, *T. pratense*, *Lotus corniculatus*, *Geum montanum*, *Sibbaldia procumbens*, *Alchemilla alpina*, feeding in the sunshine. Dr. White says *Erica* and *Vaccinium*, and that he reared larvæ upon *Polygonum aviculare* and *Triticum repens*—plants which do not grow in their native localities.

PUPA half an inch long, tapering behind, the backs of the abdominal segments with rows of minute hooks; leg and antenna-sheaths free at the ends; wing-cases with the margins prominent: black, with the abdomen greenish-black, not glossy. In a rather fusiform cocoon attached to a stone, rock, or other object; colour pearly-grey with a silvery lustre. (Buckler.) Mr. W. H. Tugwell found a cocoon attached to

a trailing stem of the Crowberry (*Empetrum nigrum*), and another was subsequently found attached to the same plant, but there is no evidence that the larvæ had fed on this plant. Dr. Buchanan White found cocoons attached to stems of *Erica* and to grasses.

A mountain species, excessively local here. Originally taken by Dr. F. Buchanan White and Professor Traill on the mountains at Braemar, Aberdeenshire, in 1871, on an elevated spot from 2000 to 3000 feet above the sea level. Dr. White says: "The locality is an ancient shore of the glacial sea, and the same agencies which deposited there various boulders and arctic plants, probably, at the same time, brought the *Zygana*. The insect is extremely local in its habits, for not a specimen was to be found except in one grassy and rushy place about 200 yards long and 50 broad; in this spot the moths were not uncommon, flying about in the sunshine, sitting on flowers of *Gnaphalium dioicum*, or hanging on the stems of grasses." Mr. W. H. Tugwell has found it on ground which is not grassy, but upon "crisp heath and dwarf *Azalea*, a few inches high and grey with lichen." He says that it utilises every gleam of sunshine, flying as soon as the sun comes out, even after a cold hard rain, though there may be only a gleam for a few minutes. Its colour fades rapidly during life. The insect is still taken at Braemar year by year by those who have access to this remote district, but no other locality has yet been recorded in these islands. The varietal names *Vanadis* and *subochracea* have been applied to it, but the forms pass quite insensibly one into the other, the females showing the yellower variations. A slight deterioration seems to have taken place in our examples, in that the fore wings are rather narrower than in continental specimens. Abroad it is a plentiful mountain species, found in the higher Alps, the Pyrenees, the mountains of Sweden and Norway, and in Lapland.

3. *Z. meliloti*, *Esp.*—Expanse 1 to $1\frac{1}{8}$ inch.

Fore wings rather opaque; dull dark grey, with five red spots; hind wings red with grey margin; body blue-black.

Antennæ blue-black, slender at the base, curved forward and recurved in the thicker portion beyond the middle; apex rather blunt. Head, thorax, and abdomen deep black, or greenish black, with smooth surface, except that in the male there is a row of tufts of slightly longer black scales down each side of the abdomen. Fore wings narrow throughout, more than usually rounded off at the apex and anal angle, which last, in fact, disappears. Thinly scaled, hardly opaque, smoky blackish-grey, or glistening purplish blue, according to the direction in which the light falls; but usually appearing of a dull smoky grey, with five light, bright, scarlet spots, two at the base rather equally elongated, two, rounder in shape, in the middle, of which the upper is small, lying in the angle of two nervures, and a fifth, also nearly round, beyond the middle. Hind wings rather short and narrow, rounded at the apex, and having the hind margin nearly straight; bright crimson-scarlet, with the marginal band rather narrow, blackish grey shot with intense blue. Cilia of all the wings dark grey, shot with purple and golden. Sexes alike, except that the fore wings of the female are slightly the broader.

Underside thinly scaled, similar to the upper, but with the dark portions fainter in colour.

Very constant in colour and markings; but in Mr. B. G. Rye's collection is a specimen in which the spots are united into elongated blotches separated by the nervures (as in *Z. Minos*). Mr. J. J. F. X. King has one with all united into a single long red blotch, and Mr. W. H. B. Fletcher another. He has also this year (1893) reared a specimen having indistinct sixth spots.

On the wing in July.

LARVA nearly one inch long, plump; head very small and retractile, black spotted with white; dorsal plate small, green

with two black dots; body of even thickness, except that it tapers suddenly to the very small head, and the hinder part of each body segment is slightly raised into a ridge. Colour dull pale green with abundant minute black points; dorsal line broadly whitish green, shaded off on each side; subdorsal line whitish, interrupted on each segment by a distinct yellow spot, immediately above and behind which is a distinct round black dot at the incision of each segment; spiracular line very indistinct, whitish green; ordinary raised spots green, bearing tufts of short downy white hairs; spiracles black with white rings; legs and prolegs greenish with a blackish ring. Before full growth the colour is rather darker, and the subdorsal lines are interrupted by a very bright yellow spot on each segment. Fairly active in its movements when hungry, but usually so sluggish that another may walk over without disturbing it.

August to May or June, hybernating when small and growing very slowly. On *Lotus corniculatus* and other low-growing leguminous plants.

Mr. W. H. B. Fletcher finds that the larva of this species is not, in all cases, satisfied with hybernating only once, but that some individuals, after waking up in the spring, cast a skin, eat a little, and then settle down again to wait for another winter. This, moreover, is not caused by low temperature, since several larvæ settled down again in this manner and remained torpid during the unusual heat of the early part of the present summer (1893). Even when feeding up its growth is slow as compared with that of the larvæ of the allied species.

PUPA with the head, and sheaths of the wings, legs, and antennæ, glossy black; the whole of the abdomen and the back clear spotless pale yellow, the skin of the latter portion so thin that after the moth has emerged there remains only a filmy transparent white pellicle. (The contrast shown in this species between the two colours is most remarkable and

unusual in the case of a pupa). In a fusiform, pale yellow or whitish, silken cocoon; attached to a grass stalk, or any other convenient object, near the ground.

Only recognised as an inhabitant of this country in 1872, when it was found that what had been looked upon as small specimens of *Z. trifolii*, occurring with that species in its normal forms in the New Forest, truly belonged to the present species. A belief that it is only a stunted variety of *Z. trifolii* has been freely maintained, and strong confirmation appeared to be furnished by the rearing of ten unmistakable *Z. trifolii* from, it was believed, eggs of the present species, by a most careful observer. This extraordinary result remains unexplained, except upon the hypothesis of an accidental substitution of larvæ or eggs; but the production of genuine *Z. meliloti*, without fail, from the eggs of that species, has been abundantly demonstrated by Mr. W. H. B. Fletcher, and, through his kindness, by myself, and the distinctive characters in the imago, larva, and pupa appear to be striking, and far more constant and reliable than in the two following species. These characters are, moreover, those of the insect as described by Esper, and as found on the Continent; and a comparison of long series of British with Continental specimens fully confirms their identity. Further evidence has been furnished by Mr. F. N. Pierce, in the discovery that the structure of the organs at the apex of the abdomen is quite different from that observable in *Z. trifolii* and its allies.

It inhabits marshy spots in the New Forest, Hants, and is said to have been taken, many years ago, in Tilgate Forest, Sussex; I know of no other British locality.

Abroad it is a common and well known species, found in France, Switzerland, Germany, Northern Italy, Sweden, Hungary, Dalmatia, Bulgaria, Southern Russia, Siberia, Armenia, and parts of Asia Minor.

4. *Z. trifolii*, *Esp.*—Expanse 1 to 1 $\frac{3}{8}$ inch.

Fore wings opaque, glossy, dark blue-green with five red spots; hind wings red, with rather broad blue margin; antennæ short and stout.

Antennæ black, rather thick from the base, very so beyond the middle, rather short, strongly curved forward, and then recurved in the thick portion, so that the rather blunt apex bends back. Head and thorax black; abdomen deep blue-black. Fore wings rather long, narrow at the base, broader towards the hind margin, which, with the apex, is much rounded, but having a slight anal angle; costal and dorsal margins slightly arched at the base, then straight; opaque, very glossy, dark blue-green or blue-grey with greenish reflections; with five rich crimson-scarlet spots; two, close together and rather elongated, at the base, two, rounded, in the middle of the wing, of which the lower is usually double the size of the upper, and one beyond, rounded or slightly ovate; cilia blackish-blue. Hind wings moderately long, broader than in the preceding species, bluntly pointed, with the hind margin straight or even a little hollowed before the anal angle; crimson-scarlet or pale scarlet, with a somewhat broad irregular rich purple-blue stripe along the hind margin; cilia of the same colour. Sexes alike, except that the female is stouter with rather broader fore wings; there is also a tendency to blue in the colour of the fore wings of the male, to green in that of the female. Underside like the upper, except that the blue-grey is more smoky.

Variable in the size of the spots of the fore wings, and also in their liability to coalesce, so that very often there are only three rather large spots in a line, the first two pairs each completely uniting; less commonly the united middle pair is joined to the outer spot by a slender line, or more completely into a long constricted blotch, and in the latter case there is frequently an approach to or union between the basal and middle united pairs in different degrees until all

become one broad irregular longitudinal stripe. Another and quite independent phase of variation is in the breadth and shape of the marginal blue stripe of the hind wings. This, in some cases, especially in small dark specimens, is extremely broad round the apex and along the hind margin, sometimes extending into the wing in a broad indentation in the middle or near to the anal angle. A third direction of variation is in colour; occasionally, though rarely, a specimen is taken in which the spots and hind wings are of a reddish-yellow—one such is before me, taken by Mr. W. Holland near Reading—or the hind wings are shaded with orange. In other cases, also hitherto very rare, the spots and hind wings are clear yellow. A startling instance of this has occurred in the present summer, an isolated colony having been found by Mr. W. M. Christy in West Sussex, of which very many specimens were of a clear pale yellow, some having also the spots united in pairs, and one in which all were joined into a blotch running three-fourths the length of the fore wings. With these were found some red specimens with the spots abnormally small; and others in which the wings were incomplete, as though irregularly cut back, so that some had but half wings, and a few were nearly apterous. Mr. S. Stevens has two specimens in which the fore wings are entirely suffused with red except along the dorsal and hind margins. Dr. Mason has beautiful yellow specimens with and without confluent spots similar to those just mentioned. A much more perplexing variation occurs now and then in a specimen showing a more or less distinct sixth spot. I have taken one such in Pembrokeshire in a secluded locality in which the present species abounded, but in which I never saw any allied species.

On the wing in June, and, in its more northern range, in July.

LARVA one inch long, very plump, with segments deeply divided. Head small, black; body rich yellow-green or

bluish-green; subdorsal line represented by a row of black markings of an X shape, or else divided into pairs of elongated blotches; spiracular line irregular and undulating, being composed also of black streak-like spots set obliquely and meeting each other; incisions of segments broadly yellowish; the usual raised spots or tubercles abundantly set with short fine hairs; legs black; prolegs greenish. Very similar when young, but before hibernation the body becomes paler and more transparent and the black spots browner, so that it is far less conspicuous. It hibernates in little companies on the stems of the food plant.

On *Lotus corniculatus* and *L. major*, *Trifolium pratense*, and probably other soft leguminous plants; from the end of July to September, then hibernating and feeding again from March to the end of May. Mr. T. H. Briggs has ascertained that some individuals scarcely feed at all in the spring, but settle down again and pass a second winter as small larvæ. This has since been confirmed by other observers.

PUPA with the cases of the wings, antennæ, and legs, and also the head, black-brown; abdominal segments dark-green ringed with darker. In a yellow, or whitish, fusiform silken cocoon attached to the stems of grasses or rushes, usually close to the ground or in the thickest tufts, but sometimes, and especially in a very wet season, may be found conspicuously on the higher portions of the plants. In pupa about a fortnight.

A lively and fairly active species in the sunshine, frequenting thistle blossoms and other flowers; but usually confining itself to the limits of some favourite marshy place, or hill-side where herbage is tolerably dense, and particularly attached to damp meadows. Always local and gregarious, even though in a drier locality. Very plentiful in suitable places throughout the South of England and of Wales; apparently absent from many parts of the Midland Counties; not at all common in Norfolk and Suffolk nor in Yorkshire,

but found in Herefordshire, Cheshire and Lancashire. In Scotland very local in Ayrshire, Forfarshire, Kincardineshire and Ross-shire, usually near the coast. In Ireland the Rev. W. F. Johnson has found it plentifully in some marshy meadows near Armagh, and it is recorded from Galway, and from Blackrock near Dublin. It is plentiful throughout the greater part of the Continent of Europe, and in Northern Africa, Siberia, and portions of Asia Minor.

5. *Z. loniceræ*, *Esp.*—Expanse 1 to $1\frac{1}{2}$ inch. Forewings opaque, lustrous, dark blue-grey or green-grey with five light red spots; hind wings red, with a narrow blue margin; antennæ long and rather slender.

Antennæ blue-black, long, rather slender, curved forwards, and, where thickened beyond the middle, curved gracefully back in a long slender point. Head and thorax deep velvety black; abdomen blue-black. Forewings shaped very nearly as in the last species, but with the rounded apex a little longer, and the hind margin slightly more oblique; opaque, brilliantly glossy: deep rich blue-grey or green-grey, with five rich scarlet spots placed as in the last species, but usually more widely separated, the lower middle spot being often but little larger than the upper; cilia blue-black or green-black. Hind wings also shaped as in *Z. trifolii*; rich scarlet, with a slender deep blue irregular stripe along the hind margin; cilia deep purple, or greenish purple. Female similar, but with broader forewings, and often much larger than the male, which varies greatly in size. Underside a faint copy of the upper, being thinly scaled so that the dark portions are poorly represented.

Decidedly less variable than the preceding species, but liable occasionally to coalition of the pairs of spots, and also rarely to the union of the whole into a long blotch, more or less constricted or indented. Occasionally also, though very rarely, specimens are found with the spots and hind wings yellow, the spots separate or confluent; others occur in which

the fore-wings are pale, or semi-transparent, or of a golden hue as though the blue colouring had been discharged—especially towards the margins; and from near York a local strain was obtained some years ago, more thinly scaled and greyer than usual with the lower central spot unusually large. Mr. G. T. Porritt has one which has the dark portion of the forewings of a rich blue shot with purple, and Dr. Mason a specimen in which the same portions are wholly bronzy without a trace of blue, the blue colour at the margins of the hind wings also being absent. In Mr. C. A. Briggs' collection is one, taken at Croydon, having the hind wings and the spots pink.

On the wing at the end of June and in July.

LARVA nearly an inch long; head small and retractile, black and shining; mouth yellow; body plump with rather deeply divided segments, green, with subdorsal and spiracular rows of velvety black blotches, divided by transverse pale yellow bars, by which each black blotch is separated into two, one oval, the other reniform; the usual tubercular spots green with short whitish bristles (Buckler).

From August to October and after hybernation to June on *Lathyrus pratensis*, *Lotus corniculatus* and clover; but not unfrequently refusing to feed in the spring and remaining quiescent through the summer and a second winter. This has been noticed by more than one observer.

PUPA with the coverings of the head, antennæ, legs and wings blackish brown, the back and abdominal portion dark green or blackish green. In a fusiform, yellow or whitish, silken cocoon, attached to culms of grass or the stems of plants, often quite conspicuously visible. In pupa two or three weeks.

Like the preceding in its habits. Abounding in its favourite localities, which are rather various, comprising high limestone pastures, damp woods, and even fens. Mr. H. Doubleday records that he received from time to time hundreds of larvæ from Holme Fen, where they fed on *Lathyrus pratensis*, and

that they all emerged typical. On the other hand, I have seen the moths—also all typical—in hundreds on the top of a ridge of limestone hills in Shropshire, crowding upon the patches of blooming thyme. The blossoms of thistle, knapweed and various other plants are also frequented, and it flies about among them in a sufficiently lively manner during the sunshine. Widely distributed though always local, and known to occur in Kent, Sussex, Dorset, Hants, Bedfordshire, Devon, Somerset, Gloucestershire, Oxfordshire, Herefordshire, Derbyshire and Shropshire, also rarely in Cheshire, Norfolk and Suffolk, and rather plentifully on the eastern side of Yorkshire. In Scotland the only record seems to be from near Oban, Argyleshire. In Ireland the Rev. W. F. Johnson has found it commonly near Armagh in company with *Z. trifolii*, a companionship which seems hardly to have been noticed elsewhere; and Lieut. J. J. Walker found it in Galway.

Abroad it is common over the greater part of Europe, and in Siberia, Armenia, and Asia Minor.

I have described these last two species—*Z. lonicerae* and *Z. trifolii* as distinct, in deference to the universal admission of them as separate species, both at home and abroad, but they are exceedingly difficult to separate in the perfect state, since all their distinguishing characters, even to the form of the antennæ, and of the marginal stripe on the hind wings, vary so as almost to merge one into the other. The larvæ also are alike, so that no reliably distinctive character seems to exist, and their pupæ and cocoons are similar—though a difference of habit seems apparent in the situation of the latter. But the difficulty has recently been very seriously enhanced by the discovery by Mr. W. H. B. Fletcher, that they not only pair together with perfect freedom, but produce fertile eggs from which emerge healthy larvæ producing in due course moths having intermediate characters, or the characters in part of both parent races. And further, these (so-called)

hybrids pair freely together, or with either parent race, with similar results. From the year 1889 until the present time (1893) Mr. Fletcher has continued the race—or rather several races—from generation to generation; and even by selection of parents, has brought out a very blue variety with most of the characters of *Z. loniceræ*, and another, somewhat different, form with most of the characters of *Z. trifolii*. These experiments render it difficult to believe that what we call by those two names are more than local races of the same species, very rarely found intermingled.

It may be well here to notice that a similar experiment between *Z. loniceræ* and *Z. filipendulæ* resulted in the production of about a dozen of the largest Burnet-moths that Mr. Fletcher has ever bred, having characters intermediate between those of the two parent species; but that no fertile eggs were obtained from these hybrids, since of those deposited after two pairings, none hatched. Mr. Fletcher does not yet consider, however, that the experiment is conclusive, and will doubtless try again. He is better satisfied with respect to *Z. Meliloti*, from which it appears to be impossible to obtain fertile hybridised eggs by crossing with either of the other three.

6. *Z. filipendulæ*, L.—Expanse 1 to 1 $\frac{3}{8}$ inch.

Forewings opaque, brilliant dark blue-green or grey-green, with six red spots; hind wings red.

Antennæ black, rather stout, long, and very gracefully curved and recurved, tapering to a sharp point. Head and thorax greenish black; abdomen blue-black or green-black, densely clothed with scales. Forewings rather long and narrow, but broader towards the hind margin, with nearly straight costa, rounded apex, and oblique rounded hind margin; opaque, brilliantly glossy, rich blue-green or grey-green with six bright vermilion spots, five placed as in the previous species, the sixth rounded and placed beyond and

lower down than the fifth, and much nearer to the hind margin. The four *rounded* spots—the second and third pairs—have usually the centres of a brighter vermilion than their margins, the scales appearing there to be crowded and slightly raised; and the third and sixth are commonly divided by dark nervures. Hind wings shaped as in the previous species, or slightly more pointed at the apex, bright vermilion with a narrow, somewhat irregular, dark blue edging or stripe along the hind margin. Cilia of the colour of the wing-margins. Female similar, but with broader and often greener forewings, and of slightly larger size.

Underside of the forewings paler bluish-grey, with the spots bright red, usually of larger size than on the upper side, or confluent, and very often suffused into a pale red cloud which then occupies a considerable portion of the wing; hind wings as above, body black. Variable in the size of the red spots which in the male often become small, and in the female large; occasionally the second pair is confluent, more frequently the third, indeed the latter pair sometimes forms one large spot while those of the former are separated. More often, however, both are joined, and more rarely the confluent pairs extend towards each other, or unite, forming a longitudinal blotch. Sometimes the sixth spot is obscured, diminished, or almost absent, but it seems to be always present on the underside. In a curious aberration which I took on the bank of the Thames the lower spot of the middle pair is absent, both above and below. In colour the variation is very great and is also somewhat local. In Essex many specimens have been taken by Mr. W. H. Harwood of which the spots and hind wings are of some paler shade of red or orange-red, or else of a more dull brick-red; in chalk pits, and on chalk hills in Cambridgeshire a form having these portions yellow is not very rare, and it has also been found near Winchester, Maidstone, Colchester and in other localities in the South of England. A far more rare and extraordinary variety (which has been named *chrysanthemii*) has the fore-

wings entirely deep dark steel-blue, with the spots only visible by their more dull reflection of light; and hind wings purplish black. Of this aberration there is a specimen in a collection made forty years ago, by Mr. Robertson, and still preserved at Liverpool by his family; another was taken, just emerged from the pupa, in the New Forest by Mr. Herbert Goss, a third has been secured by Mr. B. G. Rye in Sussex, and Dr. Mason has a fourth. Mr. C. A. Briggs has one in which the usually dark portions of the forewings are very pale and nearly transparent and the hind wings pinkish white. This was taken near Folkestone. Others in Mr. Webb's collection are light blue with hind wings white except the base which is pink; and the gradations, and intermediate variations, of most of these forms, in some of our larger collections, almost defy enumeration. There are even local races in form of the wings, one with narrow wings is said to be common in the Isle of Man; and from the north of Ireland specimens are obtained with fore and hind wings short and more rounded than usual. One such, with very short broad round wings, has no trace of the lower middle spot on the right forewing; all the spots are small, and the outermost strongly divided by the nervure. It is sent from Londonderry by Mr. D. C. Campbell. The most extraordinary specimen known however, and perhaps the most remarkable malformation or aberration extant of any recorded Lepidopterous insect, is a specimen which was reared a few years ago by Mr. N. M. Richardson from a pupa collected in Cambridgeshire. This specimen has five wings, the fifth being *substituted for the left hind leg*, which is absent, and is attached to the underpart of the thorax at the spot at which the first joint of the leg would have arisen had it been present. This fifth is a hind wing in structure though paler in colour, and has the usual dark border. It is fully half the size of a normal hind wing.

On the wing in July and August—in some seasons in June.

LARVA one inch in length; very soft, plump, and thick; with deeply divided segments and a small retractile head, which is black with the front portion yellow or white; body dull greenish; dorsal line yellowish green with a yellow spot at the hinder edge of each segment; a subdorsal row of black spots each shaped somewhat like a dumb-bell, two on each segment, and below them a row of nine yellow spots placed on the hinder edge of segments three to eleven. Each segment has a transverse row of oval tubercles bearing numerous bristles, the lower ones half-edged with black; spiracles black. In the intervals of the spots and tubercles the skin is studded with minute raised black points. Legs black; prolegs greenish, with triangular black tubercles on their sides (Hellins). A variable larva, the black spots becoming sometimes much larger and almost coalescing, and the whole surface of the body blackened.

August to October, then hibernating small and feeding again from March to June on *Lotus corniculatus*, *Trifolium pratense*, *Onobrychis sativa*, *Anthyllis vulneraria*, and other Leguminous plants.

On one occasion the Rev. J. Hellins found larvæ in *July* in a warm spot on the Devon coast and reared the moths in August; these he suspected to be of an exceptional second generation.

PUPA with the head-case prominent; antenna- leg- and wing-cases free at the tips; abdomen tapering off suddenly at the last three segments; dorsal portions of abdominal segments having rows of points. Glossy black with the abdominal segments dull black; greenish in the incisions. In a yellow fusiform cocoon of close tough silk fixed conspicuously to a stalk of grass, or stem of a plant, some inches from the ground. In pupa about a fortnight or three weeks, sometimes longer. Mr. S. Webb tells me that it occasionally lies over in that state until the following year.

The most abundant species of the group, tolerably active

in the sunshine, flying with a straight heavy booming motion like a red bee, and much attracted by flowers of thyme, clover, knapweed, and other low-growing plants. Most abundant on the coast, where it may be found in thousands on cliffs and sandhills; but also plentiful in chalky districts inland, on the hillsides and in the valleys and pastures; otherwise rather local, and in some districts absent. Sometimes it is found associating with the other species of the group—as in the west of Ireland, where it occurs along with *Z. minos*, though far less abundantly—in other cases in the damp meadows frequented by *Z. trifolii*. In such a situation Mr. J. J. Weir has found it paired with the last-named species, and has also captured specimens which he believes to be hybrids between the two. There is, however, an element of doubt upon that point, since it is certain that the variety of this species in which the sixth spot is nearly obsolete, is found in places in which *Z. trifolii* is not known to occur. Most plentiful through the southern half of England to Cambridgeshire; scarce or excessively local in Norfolk; local also in Pembrokeshire; common in Herefordshire and on the Lancashire and Cheshire coasts; also in some parts of Lincolnshire and Yorkshire, though in others it appears to have died out; and probably to be found *somewhere* in most of the counties of England and Wales. In Scotland still more local; found in Fife and Aberdeenshire and other parts of the east coast; also in Argyleshire and West Ross. In Ireland widely distributed on the coast, even extending northward as far as the County Derry, but very local inland. Abroad it is plentiful nearly all over the Continent of Europe, except in the coldest portions, as well as in Armenia and Asia Minor.

(*Syntomis Phegea*, L.—A beautiful species, in structure somewhat similar to the *Zygænæ*, but blue-black, with six transparent spots on each forewing, two on the hind, and two yellow belts across the abdomen. A specimen was taken on

24th June 1872, near Dover, flying in the sunshine, and is now in the collection of Mr. W. H. Tugwell. Besides this, a worn specimen is said to have once been taken in Yorkshire. These appear to be the only cases in which this species has been found at large in this country, and they furnish but a very slight claim to naturalisation. There appears, however, nothing in its habits to forbid its occurrence here, since it is found in Central and Southern France, Holland, Belgium, North and South Germany, as well as in Northern and Western Asia and North and South Africa. Probably it requires more and hotter sunshine than these Islands usually afford.)

(*Naclia ancilla*, L.—A neat, rather plain species with narrow forewings, brown with a row of three white spots beyond the middle, hind wings yellow with brown base and border. A specimen, said to have been captured near Worthing, Sussex, was exhibited at the Entomological Society in 1867 by the late Mr. E. Newman. No other British specimen is known. This species is said to be found, locally, in dry flowery woods in France, Germany, Belgium, Italy and in other parts of Southern, and also Eastern Europe.)

The two last mentioned (casual) species are allied to the *Zygenidæ*, though in the case of *Naclia* the thickening of the antennæ is extremely slight, and it appears to lead towards the *Lithosidæ*, one of the families of the *Bombyces*. Another family of very large extent—the *Agaristidæ*—with sphingiform antennæ, shows a wonderful series of relationships with *Zygenidæ*, *Lithosidæ*, and *Arctidæ*, and the habits of its species are mainly diurnal; while another—*Castnia*—seems to imitate some of the broader winged *Noctuæ*. Indeed the relationships—if any—in these groups appear often to run in parallel rather than in direct lines, and there is very small apparent affinity, except in the narrowness of the wings, between the species just described and those next to be dealt with.

Group 2. *BOMBYCINA*.

A very convenient, yet not very homogeneous group, used indeed to include families which, but for their paucity of species, might themselves well lay claim to form separate groups. By no means largely represented with us, in consequence of which the passage from one family to another is, apparently, even more abrupt than where some of the gaps are filled in by the multitude of exotic forms. Yet with these additions, the isolation of certain families is extraordinary, while others extend and diverge until they almost interlock with families in what are usually considered to be the most distant groups.

Distinctive and reliable characters can hardly be furnished, but the forewings are usually blunt and hardly triangular, the bodies are also generally blunt at the end. The antennæ in certain families reach the utmost development of pectination, in others they are simple and threadlike. The forewings are usually broad, but in one large family quite narrow, yet still with the apex obtuse. In many families the hind wings are ample and densely clothed with scales, and as brightly coloured as the forewings; in others they are thinly scaled and without ornamentation.

Family 1. **ZEUZERIDÆ.**

Antennæ rather short; forewings elongated, hind wings shorter, rather distant at the base; abdomen much elongated or very stout.

LARVÆ naked, with strong jaws, and a horny plate on the second segment; feeding in the wood or pith of trees or plants.

PUPÆ elongated, with segments deeply divided, and having rows of stiff spines.

Genus 1. **MACROGASTER.**

Antennæ short, pectinated to the middle in the male; wings narrow; abdomen very long.

1. **M. arundinis**, *Hüb.*; **castaneæ**, *Staud. Cat.*—
Expanse $1\frac{1}{4}$ to 2 inches. Forewings drab-brown with a darker longitudinal shade; hind wings paler; abdomen drab, long, very so in the female.

Antennæ rather short, in the male with long pectinations at the base, rounding off regularly shorter to just beyond the middle, from which point they disappear, and the remainder is almost threadlike; in the female slightly dentated. Thorax narrow, brownish drab; abdomen of nearly the same thickness, long in the male, extremely so in the female, whitey-brown; anal segment tipped with a long tuft of scales. Forewings long and narrow, with rounded apex and blunt hind margin; colour pale ashy or greyish white, regularly dusted with dark grey in lines of obscure cloudy dots; nervures light brown; costal margin broadly, and dorsal margin still more broadly pale brown with a yellowish gloss; cilia pale brown dotted with dark grey. Hind wings narrow, shorter than the forewings; white, faintly dusted with brownish; cilia whitish brown. Female similar but larger.

Underside of the forewings smoky, with the margins and nervures pale brown, hind wings whitish, with pale brown nervures; body and legs whitey-brown.

Apparently not variable, except in size.

On the wing in June and July and in some seasons even in August.

LARVA $1\frac{1}{2}$ to 2 inches long, rather slender, slightly flattened, of nearly uniform thickness but with the thirteenth segment long and tapering. Head horny, rounded, flattened; yellowish brown; dorsal shield pale brown, broad and deep, rounded behind and there furnished with rows of projections; body

wrinkled but shining, dirty creamy white; raised spots similar in colour, each furnished with a bristle; subdorsal stripe broad, pale purplish; spiracles small, indistinctly pale brown, except in segments two three and four, where each is protected by a large oval, or round, plate; anal plate horny, translucent; prolegs undeveloped, having mere transverse rows of small points; anal prolegs aborted. When young tapering from near the head to the tail; yellow, and with the subdorsal stripes more purple. As it reaches full growth these stripes partially disappear. (Hellins).

Full fed in April and May, probably feeding two years; the eggs hatching about August, and the larvæ becoming full fed in the second following spring. In the underground—or under-water—stems of the Common Reed (*Arundo phragmites*), burrowing in and feeding upon the pith.

PUPA very slender, cylindrical, of even bulk throughout; front of the headpiece with a small projection like a beak; wing-cases short; back of the abdominal segments furnished with rows of short points, and anal segment with strong spines. Colour brown, paler on the wing-cases, darker on the abdomen (Hellins). In the hollow upright stem of the reed, in a space cut off by a diaphragm at the top and lined by the larva with silk; a place for emergence being prepared by gnawing the substance at one side almost through. In this cut-off portion of the reed stem the pupa moves freely and rapidly up and down. June or July.

Always an exceedingly local and obscure species, clinging to the reed-stems in the daytime, and from its colour and slenderness, closely resembling the dead sheaths and leaves, so as to be scarcely perceptible. Flying only at night and usually captured by means of a powerful light. Dr. F. D. Wheeler says, "It is so strong on the wing that it can fly in a hurricane. I have taken it at light on a bitterly cold night, when a high north-west wind was blowing." He also says

that it flies straight at the lamp, banging itself against the glass, and dropping down to struggle about among the herbage. The female rarely comes to the lamps, but may occasionally be caught flying within the verge of the ring of light, conspicuous by her long drooping abdomen. The earliest capture in this country seems to have been by the late Mr. H. Doubleday, at Holme Fen, Cambs., of a male floating in a drain about the year 1841. He obtained two more in 1848, and in 1850 found it in profusion at Whittlesea Mere, also discovering its larva and pupa. But it seems to have been totally exterminated from these two localities by the draining and destruction of the fens. In 1869 Lord Walsingham took a specimen at Wicken Fen, Cambridgeshire, and it has been obtained there in almost every year since that date. Within the last few years it has also been found in some numbers in Chippenham Fen in the same county. Those taken in the more recent years are not by any means so large as the earlier Whittlesea specimens. This Dr. Wheeler attributes to the stunted size of the reeds arising from the gradual drying of the Cambridgeshire fens. In the year 1873 he sent eggs, obtained from a female captured at Wicken, to me at Norwich. These I inserted into the sheaths of reeds at Ranworth Fen, Norfolk, where the species had never been known to occur. Five years later—August 1878—two male specimens were captured within a hundred yards of the spot where the eggs were planted, by Mr. W. H. B. Fletcher. It is therefore possible that the species may maintain itself in the far more extensive, and more secure, fens which border the Norfolk rivers, even if the Cambridge fens should become dried up or cultivated. I know of no locality outside these counties. Abroad, it is found in Holland, Germany, Northern France, Corsica, Hungary, and Central and Southern Russia, in fens and marshes, but is always very local. It has also (apparently) been obtained from India, Ceylon, Japan, Formosa, a small variety from China, a very small one from Northern India,

a large form from Central Africa, and others from the Niger district and from Madagascar.

Genus 2. **ZEUZERA.**

Antennæ pectinated to the middle in the male, woolly at the base in the female; forewings long, spotted; abdomen elongated.

1. **Z. æsculi**, *L.*; **pyrina**, *Staud. Cat.*—Expanse, male 2 inches, female $2\frac{3}{4}$. Thorax and wings white, with numerous blue-black spots.

Antennæ black, in the male with long pectinations at the base and to the middle, thence decreasing in length rapidly so as to round off beyond the middle, from which point the remainder is threadlike and curled up. Face black; top of the head white, downy; thorax densely covered with white downy scales, and having on its dorsal surface six large oblong black spots arranged in pairs; abdomen elongated, rather narrow, dark grey, with thick, soft, whitish scales. Forewings long and rather narrow, having the nervures stout and prominent, margins nearly straight, or very gently rounded, apex and hind margin much rounded; semi-transparent, white with the extreme costal and dorsal margins faintly tinged with brown, the whole surface between the nervures irregularly covered with small indistinct blue-black spots, a larger, and more distinct, similar spot at the termination of each nervure along the hind margin, and a row of the same along the costal and dorsal margins. A small patch only, near the costa and beyond the middle of the wings, is devoid of spots. Cilia white, so short as to be scarcely perceptible. Hind wings rather short, semi-transparent, white with faintly brownish nervures, black spots along the hind margin at the tips of the nervures, and the surface between them sprinkled with small faintly blackish spots. Female much larger, often more than double the size of the male, and with the wings

far broader, the spots on the forewings similarly placed, but distinctly blue-black, larger, more elongated, and more striking; and the nervures very thick and conspicuous. Hind wings also a little more distinctly spotted between the nervures. Antennæ slender and threadlike, but with a large tuft of downy white scales at the base, and clothed with the same to the middle; abdomen stout and tapering to a long point, where is a conspicuous ovipositor, blackish, thinly scattered with whitish scales. Underside of all the wings in both sexes similar to the upper; body grey with whitish scales; legs black; slightly variable in the size and intensity of the blue-black spots, and, in the female, in the size of the immaculate space near the costa—which is sometimes supplemented with a similar space before it—also, occasionally, in the female, by the spots in the middle area of the forewings coalescing and running into long blotches. In a specimen in the collection of the late Mr. F. Bond is a beautiful instance of this in which the spots have united into *long* blue-black stripes.

On the wing from the end of June to the beginning of August.

LARVA 2 inches long, rather stout and slightly flattened, with segments deeply divided; head prominent, rounded, rather small, blackish brown; second segment with a broad rectangular dorsal plate of the same colour; anal segment with a similar, but smaller, lunate plate; body tapering slightly to the tail, brownish white or yellowish white, whiter upon the back; with the usual raised spots large, conspicuous, black, each bearing a thin bristle. When younger the dorsal plate is more bell-shaped, and toothed at the back, the anal segment blackish, and the general colour pale yellow; spots always conspicuously black. In the trunks, branches, and even shoots and twigs of trees and shrubs—Poplar, Aspen, Horse-chestnut, Ash, Elm, Sycamore, Birch, Willow, Sallow, Hawthorn, Lilac, Privet, Holly, Alder, Pear, Apple, Quince,

probably on all the "sweet-wood" trees, feeding in the solid wood. Commencing to feed in August or September, remaining very small till after the winter, and feeding up in two, or possibly three years. Full fed in May.

PUPA flattened beneath, having in front of the head a beak-like projection, back rounded and rather curved, the segments of the abdomen with rows of strong spines. Reddish-brown, with the antenna and wing-cases edged with paler, and the sides of the body shaded with pale brown. In the burrow formed by the larva, but close to the bark, which has been gnawed so thin that the pupa easily forces itself through, and partly out, before the emergence of the moth.

An exceedingly sluggish species in the day-time, so much so that the females are frequently picked to pieces on the trees, by sparrows, and make no effort to escape. Flying late at night with considerable swiftness; and the male (probably just out of the pupa) has been observed to fly up into a tree in the sunshine. It has also been taken flying round gas-lamps. The female is far more frequently found than the male, but this doubtless arises from the habit of the latter of frequenting the higher branches of trees. Especially a metropolitan insect; it seems to be met with, from time to time, in every planted square and park in London, and probably every garden in the suburbs, and occasionally, as in 1871, becomes abundant. At Blackheath the destruction of good-sized elm-trees has been attributed to the abundance of its larvæ, and it is said that in some of the suburban nurseries many young trees are pulled up and burned on account of its ravages. Yet from its sluggishness and fondness for the branches of trees the moth is rarely seen in any numbers, and it may take years to secure a series even in London. In the country it is almost everywhere scarce. Some light was thrown upon the cause of this a few years ago, by an observation of Dr. C. B. Plowright. A specimen of the larger spotted woodpecker (*Picus major*) was shot in the

neighbourhood of King's Lynn, and was handed to him. On examining its stomach he found two fresh and undigested larvæ of good size, which proved to be those of the present species. Doubtless the commoner green woodpecker knows how to find such a succulent morsel, and this may help to account for the comparative scarcity of the insect in the country districts.

It seems to be found occasionally in all the southern counties, though recorded as rare in Devon and Somerset and even in Sussex. Also found in Norfolk and Suffolk, Staffordshire, Leicestershire and Herefordshire; more commonly in Cambridgeshire; uncommon in Gloucestershire, scarce in Yorkshire and recorded but once in Cheshire. I have no record in Wales or Scotland, but in Ireland a single specimen which seems to have been correctly determined, was seen some years ago by Mr. D. C. Campbell in a local collection made in the northern provinces. The owner is now dead, and the specimen cannot be traced, but the insect is one which might readily be transplanted with trees from a nursery, and it is difficult to understand why it should not be far more widely distributed, with us, than seems to be the case.

It is found throughout Central and Southern Europe, in Northern Africa, and the Western parts of Asia Minor. Specimens which appear to be identical have been brought even from Australia.

Genus 3. **COSSUS.**

Antennæ of the male pectinated throughout, of the female more shortly toothed. Fore wings elongated and uniformly broad; thorax and abdomen very stout.

1. **C. ligniperda**, *Fab.*, **cossus**, *Staud. Cat.*—Expanse $2\frac{3}{4}$ to $3\frac{1}{2}$ inches. Very stout; fore wings ample, grey-brown mottled with white and rippled with black; hind wings and body dark grey.

Antennæ pectinated throughout in both sexes, the pectina-

tions being solid distinct teeth—not tufts of hairs—not long in either sex, quite short in the female, blackish-brown, the shaft being whitish. Head reddish-brown, whitey-brown at the back, collar broad, double, the front portion brown or grey-brown, the hinder forming an edging of whitey-brown; thorax rusty brown to the middle, then having upon the back a broad ashy-grey blotch, followed by a transverse blackish bar, edged behind with rusty brown; abdomen very stout, dark grey, with the segments edged with long loose ashy-white scales, forming pale slender transverse bars. Fore wings oblong, broad and ample, with the costal margin nearly straight in the male, gently curved in the female; apex rounded; hind margin regularly rounded, not very oblique; ashy-grey clouded with whitish and shaded with brownish, especially near the base and dorsal margin, and through the middle; and having over the whole surface multitudes of delicate, irregular wavy brown or blackish lines, mainly lying in short lengths in a transverse direction, but also forming a delicate network all over the fore wings. Costa barred with numerous short black streaks; a long and distinct black line arises upon the costa at two-thirds of its length and crosses to the anal angle, beyond it is another of half the length, and sometimes another, more broken, shows itself much nearer the base. Hind wings ample, dark smoky grey, paler towards the hind margin, much reticulated with very delicate brown and blackish cross lines. Cilia of all the wings whitish-grey, faintly dashed with brown. Sexes similar, but the female the larger, stouter, and often darker in colour. Underside of the fore wings very smoky, but with the black costal bars and the black lines beyond the middle broader and more clouded; of the hind wings ashy-grey, abundantly reticulated with irregular dark grey lines, except towards the dorsal margin, which is smoky-brown; under-surface of the body ashy-grey mixed with smoky-brown; legs blackish spotted with brown.

June and July.

LARVA 3 to 3½ inches in length, naked, rather flattened, smooth, shining, transversely wrinkled, and puckered at the sides; incisions of segments deep. Body with a few scattered slender hairs. Head small, shining black, slightly retractile, mandibles very large and strong; second segment with a large horny plate, having upon it a broad triangular black mark divided by a yellowish line; dorsal region broadly dark red, incisions lighter red; sides and ventral region reddish ochreous or yellowish flesh colour; spiracles and tips of legs and pro-legs brownish. (Fenn.) Very similar in appearance when young and throughout its long life. Feeding under the bark and in the solid wood of Willow, Ash, Elm, Oak, Birch, Alder, Apple, Pear, Chestnut, and other trees, feeding between three and four years and hybernating three winters; when young in companies of various sizes under bark; when full grown in a large cocoon of silk mixed with plenty of wood raspings or earth. It is a peculiarly livid and objectionable looking larva, and having a habit, when full grown in the autumn, of wandering away from the tree in which it has fed, is then frequently observed, sometimes to the great alarm of timid people. But in any case, from the strength of its jaws, as well as from an unpleasant odour which attends it (on account of which the moth produced from it is called the Goat-moth) it is far from being a pleasant object or desirable inmate. There is even a record—perfectly reliable, I believe—of a larva, found wandering, shut up in a wooden cigar box, and placed inadvertently upon a piano-forte, that it gnawed its way through the bottom of the box, and through the polished wood of the instrument, in its determination to escape. But if placed in an earthen pot without holes, or even in a large tin, and supplied with plenty of fresh sweet sawdust—not pine nor deal sawdust—it may readily be reared. Where plentiful it is most destructive to trees, eating the solid wood until the trunk can no longer support the weight of the branches. Mr. Newman attributes the destruction of thousands of willows in the Thames Valley

to the agency of this species; and in many places there is plentiful evidence, in the open visible holes large enough to put the tip of a finger in, or in the bleeding bark, to show the mischief that is in progress. It was formerly believed that this larva was eaten as a delicacy by the Romans—hence the name *Cossus*—but the claims of certain large *Coleopterous* larvæ to this distinction have been strongly urged, and it is difficult to believe that the present species, with its rank ligneous odour, can have been so estimated.

PUPA very stout, flattened beneath, and with the dorsal region rounded and much curved; head with a sharp projecting beak; wing-cases rather prominent; abdominal segments strongly divided and furnished with rows of stiff short points, anal segment blunt. Colour dark red-brown, abdominal segments lighter brown with incisions paler; spiracles dark-brown. In a tough oval cocoon of silk and raspings of wood or earthy particles, being usually the hibernaculum within which the full-grown larva has passed the winter and which it does not voluntarily leave, though the pupa state is not assumed until June or even July, and lasts but a week or two. When ready to produce the moth the pupa thrusts itself through the bark of the tree, or out of the cocoon at the surface of the earth, whichever position has been chosen, and its skin remains sticking two-thirds out of the hole.

In comparison to the abundance of the larva the moth is rarely seen. It may occasionally be found on the trunk of a tree, or on a paling, placed on a projection and holding itself stiffly erect, with wings closely wrapped round its body and fore legs stiff and straight, so that the whole moth seems to be a half-detached chip of wood or bark with a splinter or two in front. It flies soon after dark, but is rarely, or never, seen on the wing, except that it has a strange fondness for the "sugar" which is spread, by collectors, upon the trunks of trees to attract *Noctua*. The extraordinary circumstance

is that the sucking trunk in this, as in very many of the *Bombycina*, is almost, or totally, absent, and there is no reason to believe that it has any power of partaking of the attractive mixture. Yet of this attraction there is no sort of doubt. It has been recorded in numerous instances; in some the moth was hovering up and down the patch of sugar, in others, settled upon it; and this I have myself witnessed. The probable explanation is that the moth mistakes the sugar for flowing sap, and that this is accepted by it as an indication of a suitable tree for deposition of eggs. Yet this explanation is not fully borne out by the facts, since the male moth is attracted in the same manner.

Tolerably common throughout the South of England, abundant in the Eastern counties, including Cambridge-shire; less common through the rest of England and Wales, and scarce in the north; commoner in some parts of Scotland, even abundant and destructive in Morayshire. In Ireland it was recorded by Mr. E. Birchall in the County Wicklow, and the larva is said to have been found in plenty at Leixlip. Abroad it is found nearly all over the continent of Europe, Western Asia, and Northern Africa.

In a paper read before the Entomological Society of London in the present year (1893), Dr. T. A. Chapman points out that in the structure of the pupa this species agrees most closely with the Tortricina, so that in an arrangement based upon *pupal* characters, it would necessarily be placed in that group of otherwise small species. He further points out the remarkable circumstances that the neuration of the wings of the moth is almost identical with that of *Carpocapsa pomonana* (the Codlin moth), that the palpi and spurs on the legs are similar to those of many Tortrices, and that in markings it closely resembles those of the genus *Retinia*. This is certainly the case; and clearly we have here another of the perplexing instances of the inter-locking of, in many respects, distinct groups.

Family 2. **HEPIALIDÆ.**

Antennæ extremely short, minutely pectinated; fore and hind wings long and narrow, set widely apart at the base; abdomen long, of even thickness, blunt, thinly covered with scales.

LARVÆ smooth and naked; second segment protected by a horny plate; feeding under ground on roots of plants.

PUPÆ elongated, with deeply divided abdominal segments and furnished with rows of stiff spines.

The character of *extreme* shortness of the antennæ of the moth is modified in a few exotic species, they being provided with pectinated antennæ of more conspicuous length, though still short. This family is but distantly connected with the preceding, and apparently not more closely with any other of our native *Bombycina*. Dr. Chapman considers it, from the characters of the pupæ, to be allied to the *Adelidæ* among the *Tineina*.

Genus 1. **HEPIALUS.**

This being the only genus, the characters already given apply, but a table of the species may be useful.

- A. Fore wings with oblique parallel bands.
- B. The bands silvery, *H. hectus*, male.
- BB. The bands pale purplish-brown. *H. hectus*, female.
- AA. Fore wings with oblique divergent pale stripes.
- C. Pale stripes straight, meeting on the dorsal margin. *H. sylvinus*.
- CC. Pale stripes sinuous, meeting near the dorsal margin, cilia plain. *H. lupulinus*.
- CCC. Pale stripes irregular, meeting in a curve, cilia spotted. *H. vellela*.

AAA. Fore wings yellow, with long irregular dull red stripes. *H. humuli*, female.

AAAA. Fore and hind wings silvery white.

H. humuli, male.

These characters indicate the typical forms; some of the species vary greatly.

1. **H. hectus**, *Ochs.*; **hecta**, *Staud. Cat.*—Expanse $1\frac{1}{4}$ inch.

Male, fore wings orange-brown striped with silvery; female, pale brown striped with purplish-brown; hind wings, in both, purplish brown.

Antennæ of the male very short and inconspicuous, slightly serrated; head and thorax covered with long reddish-brown or yellowish-brown hair-scales. Abdomen rather long and of even thickness, thinly sprinkled with light brown scales. Fore wings with costal and dorsal margins slightly rounded, apex and hind margin in one complete curve, colour bright orange-brown, faintly marbled with darker brown; costa with two or three cloudy orange spots; a rather broad, slightly curved, silvery-white, or yellowish-silvery stripe, from the dorsal margin near the base, extends obliquely two-thirds across the wing; a second stripe of similar colour arises broadly on the middle of the dorsal margin, but rapidly narrows, and proceeds obliquely to nearly the apex of the wing, being very commonly more or less broken on the way; outside this are usually some similar spots or dashes at the apex, and along the hind margin; cilia pale purplish-brown dusted with darker brown. Hind wings dull purplish-brown with large tufts of reddish-brown hairs at the base; cilia purplish.

Female similar in size and shape; antennæ equally short, thread-like; head and thorax light brown; abdomen purplish-brown. Fore wings pale reddish-brown with oblique transverse stripes of very pale purplish-brown in the positions of the silvery stripes in the male, but far broader and unbroken;

and several large faintly pale brown spots on the costa, the intervals being reddish-brown; cilia pale yellowish-brown with darker dashes. Hind wings purplish-brown with the cilia paler.

Underside of the male, forewings dull pale brown with the markings of the upper side very faintly visible; hind wings smoky-brown; body reddish-yellow; legs short and slender, reddish-yellow; the third pair aborted, terminating at the ends of the tarsi, which are swollen and clubbed. In the female the legs are all complete, the underside of the body yellowish, and of all the wings purplish-brown.

Variation in the male is mainly in the silvery stripes, which often are broken up into spots, or in other cases are broadened, or of a more golden colour, and, in rare instances, supplemented by rows of golden dashes in the apical area of the *hind* wings. This last variation has been obtained by Mr. S. Webb near Dover, but is usually a more northern form having been obtained in Derbyshire and the North of England and West of Scotland. The late Mr. Sang found a female having ill-defined silvery fasciæ, in Leicestershire, and one somewhat similar has been met with in the West of Scotland. Mr. F. J. Hanbury has a male taken at Blackdown Hill, Somerset, with broad squared silvery blotches in succession from the base to the apex of the fore wings, obliterating the usual lines of markings; and in Dr. Mason's collection are specimens having the central portions of the fore wings occupied by a large irregular silvery blotch formed by the junction of the first stripe with portions of the second; others in which the fore wings are richly marbled with brown lines, and some having a regular row of silvery streaks along the hind margin. On the wing in June.

LARVA $1\frac{1}{8}$ inch long; slender, cylindrical, tapering a little towards the head, and also very shortly at the tail; head broad in front, rather flattened, with the sides rounded; body so regularly divided by incised wrinkles that the divisions of

the segments are obscured, each segment being divided into four rings, of which the second is the broadest. Head lustrous dark brown; body opaque, drab or pale brown; the second, third, and fourth segments more transparent and shining, and furnished with brilliantly polished dorsal plates, the two latter also with side plates placed just above the legs, all dark brown or blackish; the usual raised dots minute, black, each furnished with a fine hair; spiracles small, black. Very similar throughout its growth. Excessively averse to light, making violent efforts to hide itself. Its hairs are extraordinarily sensitive, if touched causing it to twist and wriggle with the utmost violence, and to run backwards and forwards with equal, and wonderful, agility.

In the rhizomes of *Pteris aquilina* (common Brake-fern) from July to May or June of the second year; at first burrowing in the root, growing very slowly, hibernating when small, feeding again in April and becoming of full size before the next winter, leaving the root and hibernating for the second time in the earth; the following spring biting out oval excavations from the young shoots of the fern and apparently drinking the fast-flowing sap. (Buckler.)

PUPA slender, uniform in thickness; head and back of the thorax a little prominent; abdomen long and hardly tapering, blunt and curved back, the segments with rows of minute curved points; wing-cases very short; colour dark brown; but very soon the silvery blotches begin to appear golden, through the skin. In an oblong silken cocoon, lightly covered with earth, on the surface of the ground, among dead leaves or moss. Only a few days in the pupa state. When ready for emergence the pupa thrusts itself out of the cocoon. (Buckler.)

The moth flies in woody places at early dusk, the male oscillating backwards and forwards over a space of a few inches in length, usually close to the fronds of ferns or the twigs of bushes; and so plentifully that often two or three

may be seen swinging in a space of a foot or two square. The female flies in a tolerably swift and direct manner, and has been repeatedly observed to fly against, and past, a male, which, so challenged, instantly follows, and both settle on a leaf or twig close by. The male is provided with a moderately strong perfume, something like that of pine-apple, and not disagreeable; when several fresh specimens are shut up in a box this scent is very perceptible, and it appears to be associated with the peculiar sexual habits of the species. The eggs are dropped by the female loosely on the ground as she flies swiftly a few inches above the surface.

A very abundant species in woods, and on woody heaths, especially among scattered undergrowth, in almost all parts of England where suitable localities exist; yet said not to be common in Devon nor in the fen and moss districts of Cambridgeshire, Lancashire, and Cheshire. Common in Wales, and in woods in the west of Scotland; in Aberdeenshire; and in Perthshire, on the wooded hill-sides, as high as 500 feet above the sea-level. In Ireland it is abundant in the wooded portions of the Counties of Wicklow, Cork, Kerry, Down, and Londonderry. Found throughout Central and Northern Europe, except the high northern districts; also in Eastern Asia.

2. *H. lupulinus*, L.—Expanse, 1 to $1\frac{1}{2}$ inch.

Fore wings dull brown, with a long irregular angulated white stripe; hind wings brown.

Antennæ very short, reddish-brown with minute but regular pectinations. Head and front of the thorax, in the male, light brown; hinder portion of the thorax and the abdomen yellowish-brown; legs rather short, but all complete.

Fore wings narrow, dull pale-brown, or brownish-ochreous, shaded and mottled with darker brown, and with the nervures slightly darker; an irregular white stripe edged with dark brown arises at the middle of the base, proceeds somewhat

parallel with the dorsal margin to near the anal angle, towards which it throws off a point, thence turns with a broad bend and passes obliquely across the wing to near the apex, being broken in the latter portion by the brown nervures, and also shading into yellowish. Before the middle of the wings is an elongated white spot, or streak, parallel with the costal margin; and several triangular white dots lie along the anal angle and adjacent portion of the hind margin. Cilia pale-brown faintly dappled with darker. Hind wings dull purplish-brown, edged with pale-brownish, and with light brown cilia.

Female rather larger than the male, and with similar antennæ; thorax dull pale brown; abdomen rather elongated, darker brown. Fore wings dull pale brown, shaded with darker brown or with whitish, having the nervures darker brown, and the longitudinal white stripe, when present, placed as in the male, but formed of broader, and more indistinct, whitish clouds; often however it is absent, the wings being then merely shaded with paler brown. Hind wings purplish-brown. Cilia of all the wings pale brown, sometimes faintly dappled with whitish.

Underside of the wings, in the male, purplish-brown, with pale brown margins and cilia; body and legs light brown. Underside of the female very dull brown, similar to the upper but without markings.

There is considerable variation in the colour of the male from dark-brown to yellow-brown or whitish-brown, and the markings are often broken, incomplete, or partially or totally absent, while in other cases the white colour of the stripe is spread broadly over the whole middle of the fore wings, giving them a peculiarly chalky aspect. In the female, variation is, as already stated, towards obliteration of the markings. In the late Mr. F. Bond's collection is a male with fore wings entirely white, and in that of the late Mr. H. Doubleday, a male entirely of a buff colour, without markings.

On the wing in June, or even at the end of May. In rare

instances, casual specimens, apparently of a second generation, have been found in September.

LARVA four-fifths of an inch long; plump, with the skin white and shining; head and dorsal plate bright brown; the raised dots pale yellowish-brown, each with a short stiff black hair; spiracles black. (Hellins.) Feeding under ground on the roots of plants, probably grasses, and certainly on those of ordinary meadow plants, burrowing from one to another. July or August to April.

PUPA cylindrical, of even thickness; head-case sloping to the mouth, with a small wedge-shaped projection above; antenna-cases short, prominent; wing-cases short; abdominal segments deeply cleft, very movable, five of them having transverse dorsal ridges of sharp projections, and four of them similar ventral teeth. Glossy pale reddish-brown, or brownish-ochreous, darkest on the head and wing-cases; spiracles and toothed ridges dark brown. In a long narrow cocoon or tunnel, placed vertically or obliquely in the earth, up and down which it travels freely, and rapidly when alarmed. (Hellins.) Before emergence the pupa pushes itself out of the cocoon, or tunnel, and projects above the surface of the ground, and Mr. Fenn records that he has seen the pupæ sticking out, in hundreds, from turf, when cut and piled up.

An exceedingly swift and active species, flying at early dusk, or very often before dusk, in meadows. The appearance of the males is sometimes bewildering, as they thread their way between the tallest grasses and plants at headlong speed. Their time of flight, however, is very short, often not more than a quarter of an hour. The female is much less active, remaining, at first, hanging to a grass stem, afterwards flying steadily over the grass and dropping her eggs—which are like tiny globular seeds—as she flies. Both sexes when captured, or frightened, immediately drop down and feign death.

Extraordinarily abundant in many parts of the South of England, and so plentiful in the outskirts of London that it is, in some years, quite usual to see specimens sitting about in the day-time on tree trunks, or in the corners of walls, in the thickly populated streets, where they have quite evidently lost their way. Plentiful in suitable places throughout England as far north as Yorkshire and Lancashire, but less common further north, and scarce, or very local, in Scotland, where, however, it is known to occur in the Glasgow district; in Perthshire, not commonly; in Aberdeenshire; and has even been taken in the Orkneys. There seems to be a scarcity of records in Ireland. Mr. E. Birchall stated that it was common everywhere there, but this was evidently a mistake, as it seems to be unknown in the north of Ireland. I have myself taken it in the County Galway, and have no doubt that it is existent, if not plentiful, in many more southern districts. Abroad it is found in the Alps and in various other parts of Central Europe, in Southern Sweden, and Dalmatia.

3. *H. sylvinus*, *L.*—Expanse, male 1 to $1\frac{1}{4}$ inch, female $1\frac{1}{4}$ to 2 inches. Fore wings orange-brown or dark chestnut, with two whitish transverse stripes meeting on the dorsal margin; hind wings brown, edged with orange-red.

Antennæ very short, yet with distinct pectinations; head and thorax of some shade of orange-brown in accordance with the colour of the fore wings; abdomen pale brown. Fore wings slightly broader than in the preceding species, with the hind margin rather more oblique, and the anal angle even more rounded off. Colour, in the male, orange-brown, or orange-ochreous, marbled with pale fulvous; a slightly paler basal space is edged by an oblique, partially transverse, silvery-white stripe, edged with purplish-grey, which proceeds from the median nervure, near the base, to the middle of the dorsal margin, where it almost meets another white stripe, also edged with purplish-grey, which crosses the wing

obliquely, in the opposite direction, toward the apex, before reaching which it divides into two. (These two opposite oblique stripes are straighter and more even than in either of the allied species). Outside the second is a straight row of faintly greyish spots, and others, still more faint, lie upon the costal margin. Beneath the sub-costal nervure in the middle of the wing is a broadly triangular grey spot, edged beneath with white. Cilia ochreous or reddish preceded by a series of faint grey marginal crescents. Hind wings grey, tinged with reddish toward the apex, with a reddish marginal line and pale reddish cilia. Female with antennæ short, as in the male, but more slender, and with extremely short pectinations. Fore wings orange-red, orange-brown, chestnut-brown, or even pale umbreous, with the oblique white stripes broader and whiter than in the male, but the marbling and cloudy spots indistinct or absent.

Undersides of the wings in both sexes dull orange-brown, redder at the tips; without markings, but varying in shade in accordance with the colour of the upper side. Legs rather short, but all perfect, coloured in accordance with the shade of colour of the fore wings.

Extremely variable in size, especially in the female, of which some individuals are nearly double of others *in expanse* of wings. Varying also, as already indicated, in intensity of colour, all the shades mentioned being united by imperceptible gradations; also variable in the marbling, which sometimes is distinct; in other cases, where the colour is intensified, it is obliterated. In the collection of Mr. A. J. Hodges is a male of the precise shade of brownish of *H. lupulinus*, and only distinguishable from it by the straighter oblique stripes.

On the wing in the latter half of July and through August.

LARVA $1\frac{1}{4}$ inch long; whitish and shining like ivory, with deeply divided segments and deep wrinkles. Head orange-brown with the mouth black; dorsal plate on the second

segment, brownish-orange; similar plates on the third and fourth segments, and on the legs; spiracles dark brown; body otherwise spotless; hairs very fine, few and scattered. When young whitish-flesh-colour, with the thoracic segments tinged with brown and a dark brown dorsal vessel. (Buckler.)

Feeding underground, usually in the rhizomes of *Pteris aquilina* (Brake-fern), but also in fleshy-rooted plants, such as dock. Mr. W. Purdey of Folkestone, records that on one occasion, finding a sickly-looking plant of *Echium vulgare*, he pulled it up and observed a small hole in the soil close to the partially devoured root; digging, and following the hole for nearly a foot, he found the larva. Following up this clue he found similar holes close to roots, and so obtained other larvæ of this species, some of which he reared. Mr. Buckler says that each larvæ excavated a mine or trench from the outside of the root and in a spiral direction, closing it with gnawings, spun together with silk. September to July, but it is not yet ascertained whether full growth is attained in that period or whether the larva lives through two winters.

PUPA shaped as in the preceding species and with similar abdominal hooks; bright chestnut brown or darker brown. In a cocoon in a tunnel similar to the larval habitation. Before producing the moth it forces itself out of the cocoon, and projects above the surface of the ground.

The moth flies swiftly at early dusk, especially among the common Brake-fern (*Pteris aquilina*), on open commons and rough places, but also along road sides and in waste places generally. Its flight is short, and at other times, like its congeners, it is extremely sluggish—indeed, it is scarcely possible to induce any member of this genus to use its wings except at its own favoured time. At night, after the flight is over, it may sometimes be found, more especially when paired, hanging to a frond of fern, or to a leaf or twig. In the daytime it is effectually concealed among the herbage.

Very widely distributed, and, in the South and East of

England, often common in suitable places; in the south-west less common, and scarce in Devonshire; scarce in the hill districts of the Midlands; but common in South Wales, and, locally, so as far north as Yorkshire and Lancashire. In Scotland it is found occasionally round Glasgow, and in Ayrshire, Perthshire, Argyleshire, Aberdeenshire, Moray, and West Ross. In Ireland Mr. E. Birchall recorded it as having been taken in the county Wicklow by Mr. Bristowe, but of this I can obtain no confirmation. Abroad it is common in the temperate parts of Northern Europe, in Central Europe, Dalmatia, Southern Russia, and the North-east of Asia Minor.

4. **H. vellela**, *Esp.*—Expanse, $1\frac{1}{4}$ to $2\frac{1}{4}$ inches. Fore wings pale brown, much marbled with dark brown and white; hind wings brownish; cilia all spotted.

Antennæ short, reddish, rather thick, serrated in both sexes. Head and front portion of thorax reddish-brown or chocolate; hinder part of thorax yellowish-brown; abdomen thinly scaled, pale brown. Fore wings with the apex much rounded, pale greyish-brown, orange-brown, or chocolate-brown, marbled with darker brown, chocolate, and white. A broad whitish or white stripe, margined with dark brown, arises in the middle of the base, and runs parallel with the dorsal margin to the middle of the wing, thence often throwing off a broad squared blotch to the dorsal margin; this blotch is sometimes connected by a slender line with a broader pale reddish-brown, or whitish-brown, stripe, which proceeds from near the dorsal margin, in an undulating manner, to the apex of the wing, being twice toothed and then branched on the inner side, and margined on the outer with dark brown. Touching it on the inner side is a white spot or dot; near the base another, which is elongated, or shaped like an arrow-head, or even a straight line, and sometimes these two are almost connected by an intermediate white spot or streak. Outside the second stripe, and parallel with it, is a row of white dots near the hind margin, but these

are sometimes fused together into a slender indented white stripe. Costal margin orange-red, varied with square chocolate spots; cilia white, spotted with brown. Hind wings grey-brown, with a straight whitish-grey stripe in the discal cell; the apical portion redder brown, sometimes with indistinct chocolate or pale grey shades, or faint markings somewhat imitating the pattern of the fore wings; cilia reddish-brown or yellowish-brown, spotted with whitish. Female similar, sometimes larger, and with the pale markings more suffused.

Under side entirely smoky brown, except the cilia, which are paler and spotted with dark brown, but sometimes the pale markings of the upper side show faintly through. Body brown, legs moderately short, but all complete, brown.

Extremely variable in colour—from pale grey, pale brown, whitish and pale reddish, to the various shades of redder and darker brown; also in the markings, which have a marbled appearance, and are dark brown, chocolate, grey-brown, reddish, blackish, or have the white colour spread and suffused, or the white dots, spots and stripes altered or confluent, increased or decreased in size. There is also a somewhat permanent and constantly recurrent phase of variation in which the fore wings are of a uniform yellowish-brown or reddish-brown, with the markings totally suppressed, except that the central white dot, or spot, is usually visible and surrounded by darker brown, and sometimes a faint marbling indicates the other markings. In the female of this variety a further divergence occasionally takes place, the fore wings becoming unicolorous dull brown without a trace of central spot or other markings. But always the cilia remain spotted. This phase of variation has here usually been called by the varietal name of *carnus*, but this name is now used to indicate a scarce alpine (possibly distinct) species, and the form under consideration has received the varietal name of *Gallicus*. Connecting forms between it and the type are rare. A specimen taken at Sheffield by Mr. A. E. Hall has the

marblings rich chestnut, without white stripes or spots. In the north of Ireland specimens have been taken by Mr. C. W. Watts having longitudinal patches of silvery-white on the hind wings.

On the wing in June and July, and I once found a specimen in a wood near Sheffield in the middle of September.

LARVA $1\frac{1}{4}$ to $1\frac{1}{2}$ inches long, rather thick, cylindrical, but the segmental divisions and the wrinkles deeply cut; the jaws large and prominent. Head, in the male reddish-brown, in the female purplish-red; body creamy-white or pale-green with the dorsal plate pale brownish-orange; similar plates, divided into three parts, and shielding the sides, on the third and fourth segments; and on the tail an undivided plate of the same colour. Dorsal vessel visible as a blackish, pulsating, tortuous line; tubercular spots on the back raised and of an orange colour, on the sides small and dusky, each with a very sensitive brown hair; spiracles large and black. When young of a drab colour with reddish-brown head, plates and spots; when half grown the body is yellowish, greenish, or greyish-white, with three blackish, translucent, transverse lines on each segment, and the dorsal vessel visible.

In the stems and rhizomes of *Pteris aquilina* (common brake-fern) beneath the surface of the ground; at first gnawing the skin, later penetrating the substance of the rhizome, which is excavated and channelled out for a space of about ten inches in length, in some instances nothing but the outer rind being left. Two years in the larva state, the eggs hatching in July or August, larvæ hybernating in the earth when small, feeding through the following season, hybernating a second time at some depth in the earth, but in April or May coming to the surface, and then spinning a slight cocoon among light vegetable refuse. (Buckler.)

PUPA rather slender throughout, with the head slightly beaked, abdominal segments deeply divided, and having upon

them rows of sharp hooks pointing backward, that on the twelfth segment on a raised prominent ridge; anal segment blunt with a few short spikes. Colour reddish brown. (Buckler.)

In a cocoon among rubbish, as already described, or under a stone, or piece of timber in a wood path. Bursting the cocoon and working partly out by means of its abdominal hooks before the moth emerges.

An exceedingly swift and active species—more so even than the two previous—flying, like them, at early twilight, about woods, heaths, roads, hill sides and wild spots generally; but having a more northern range, and being decidedly scarce in the South of England. There are records of captures, generally of single specimens, in various parts of Kent, Surrey, Sussex, Suffolk, and South Devon; but in the Exmoor district of Devon, and on the Quantocks in Somerset, it is abundant. It is also common in one spot near Maidenhead, and is found occasionally in the beech woods of Bucks, Berks and Oxfordshire. I have found it, though rarely, in Pembrokeshire and Carmarthenshire, but have little doubt that it is common in the hill districts throughout Wales, as it certainly is in those of the English Midlands, being plentiful in Staffordshire and Derbyshire, as well as in Herefordshire, Lancashire, and Cheshire. In Leicestershire rather local, but producing curious pale grey forms. In Yorkshire it is most abundant, and thence throughout the North of England and all Scotland, very large and strongly marked specimens being obtained in Arran and the Shetland Isles. In Ireland it also seems to be generally distributed and often common, having been recorded from Dublin, Galway, Kerry, Down, Donegal, Antrim, and Londonderry. From the Belfast district come very pretty red varieties; others somewhat similar have been taken by Mr. Morton in Lanarkshire in the South of Scotland; and, curiously enough, Mr. S. Webb reports a similar form at Dover. Wherever the species occurs the variety *Gallicus*

seems to be found, and Sir John Llewellyn reports the latter to be the only form which he has met with near Neath, Glamorganshire. This also was my experience in Surrey.

It inhabits the greater portion of Northern, and much of Central Europe, the Pyrenees, and the Piedmontese Alps.

5. *H. humuli*, *L.*—Expanse, $1\frac{1}{2}$ to $2\frac{3}{4}$ inches. Wings of the male bright silvery-white; fore wings of the female yellow, with dull red markings; hind wings grey.

Antennæ very small and slender in both sexes. Face of the male red, top of the head yellowish; thorax clothed with very long scales varying in colour, pale drab, whitish, yellowish, or reddish, in front, shading off usually to greyish-white at the back; abdomen yellowish-brown, or brown, with scattered whitish scales. Fore wings more pointed than in the previous species, with the costa rather arched near the base, and gracefully curved, inside which the subcostal nervure is strongly ridged; hind wings somewhat bluntly pointed and rather broad; fore and hind wings of a brilliant, glistening, silvery-white, without markings, but with the extreme edge of the margins, and the cilia, yellowish-brown or pale reddish. Antennæ and face of the female red; head and thorax yellow; abdomen long, shining brown with scattered yellow scales. Fore wings shaped as in the male, but broader; yellow, with dull pale red markings, consisting of a narrow stripe along the subcostal nervure from the base to the top of the wing, joined at the base to another of variable breadth which proceeds two-thirds of the distance to the anal angle, then bends and passes almost straight to the apex, thus forming the sides of a long triangle of varying width; through the middle, lengthwise, of this triangle, lies a series of three or four irregular angulated spots or blotches of the same colour, often connected with each other or with the sides of the triangle by slight lines; hind margin edged with reddish, often with similar dashes on the tips of the nervures;

cilia yellow. Hind wings pale grey, shading into pale reddish at the apex and the costal and dorsal margins; cilia light red.

Under side of the male with all the wings dark smoky, their margins red; cilia paler or whitish; body smoky brown; legs red, the third pair being rather short, though complete, but with the tibiæ thickened and bearing great tufts or fascicles of long yellow hair-like scales which spread out like a hollow fan. Under side of the female similar, except that the legs are devoid of any extraneous ornament; the thorax is yellow, and the abdomen testaceous, and hardly furnished with any scales.

Usually the male is very constant in colour, except in the front of the thorax, which varies as already stated, and occasionally becomes dark brown or red, while in rare instances the whole of the back of the thorax is reddish. There is also a tendency in very fresh specimens to redness of the cilia and edges, and in one which I took in Pembrokeshire, almost one-third of the fore wings from the apex was tinged with delicate pink, but this rapidly faded and soon disappeared, as also does the pink of the cilia in time. The female, while always preserving the general pattern of markings as described, varies, in almost every individual, in their extent of development or of suppression. Sometimes they almost totally disappear, and, very rarely, the dull red is exchanged for brown.

From the Shetland Isles, however, are obtained aberrant forms of a character hitherto observed nowhere else. Along with perfectly normal specimens are others—of the male sex—in which the female colouring of the fore wings and, to some extent, the female markings are assumed; or the white male colouring is retained, with the addition of some of these markings in grey, reddish-grey, or reddish-brown; or colour and markings are partially obscured by an extensive clouding of dull smoky. Almost every possible intermediate gradation in the form and extent of the markings and in shades of

colour is there found, the most constant characteristics being, apparently, that where the ground colour of the fore wings is of the usual silvery-white the hind wings have more or less of the same whiteness, especially toward the costal margin, the remainder being dark grey; but in those which have the fore wings of any shade of yellow, the hind wings are wholly dark grey. No correspondingly remarkable aberrations of the female are met with.

On the wing in June and July, and occasionally in August.

LARVA $1\frac{1}{2}$ inches long, plump, with wrinkled and deeply divided segments. Head oval, reddish-brown; dorsal plate also reddish-brown; body dirty whitish or pinkish white, with the spiracles black; pairs of black dots down the dorsal region, and a transverse row of round black dots on the twelfth segment; legs whitish. When younger a brown internal dorsal vessel is visible, and the raised spots are distinctly brownish.

Feeding underground on the roots of various plants—dock, dandelion, dead-nettle, burdock, asparagus, Jerusalem artichoke, and probably almost any succulent root, root-stock, or tuber which grows in meadows, or even in gardens when neglected. Feeding from July or August to the following May, at least. Mr. Hellins was of opinion that the whole growth was attained in one year.

PUPA elongated and of rather equal thickness throughout; a projecting ridge in front of the head; wing-cases short and small; leg-cases small and inconspicuous; anal segment extremely blunt, rather retracted, and furnished with several thick black points; abdominal segments distinctly ridged with rows of small blackish brown points on the back, and more distinctly ridged with pairs of broad black teeth on the ventral surface, the ridge on the eleventh segment being very conspicuous, with abundant black teeth. General colour dark

chestnut, darker in front of the head. In a slight cocoon just beneath the surface of the ground.

The moth flies, like its congeners, at early dusk and till nearly dark, but not swiftly. The male has a habit very similar to that of *H. hectus*, of swaying like a pendulum over a space of about a yard of ground, backwards and forwards; and not unfrequently two or three males swing to and fro over the same spot, now and then two, or even three, coming into contact and swinging off again, just like the flies when at play in a room. They are extremely conspicuous from their white appearance, and sometimes dozens may be seen at a time swinging, either singly or in little companies, over different parts of a field. The female never flies in this manner, but takes a tolerably straight course with rather heavy flight, and, evidently with intention, strikes, in her course, against one of the swaying males, which instantly leaves its station and follows her to where she alights at a short distance off. This has been repeatedly observed, and is open to no doubt. The male has a slight scent somewhat resembling that of the larva of the Goat-moth, but very much more faint and not disagreeable; it is only noticeable in the freshest specimens. The female, after pairing, flies rapidly over the grass, shooting her eggs down among it, loosely, with a distinct projecting action. The eggs are small, perfectly round, greenish at first, but quickly turn black; they are not in the least adhesive, but resemble tiny globular seeds. It is a very abundant species, found apparently throughout the United Kingdom, in meadows, marshy valleys, on hill sides, and in rough places wherever there is a luxuriant growth of wild plants; very frequently in graveyards, whence, and from the peculiar flight and whiteness of the male, the popular name of Ghost-moth undoubtedly arises. Abroad it is found throughout Central and Northern Europe and in Armenia, but its range appears to be less extensive than that of our other species in the genus.

Family 3. COCHLIOPODIDÆ.

Antennæ simple or slightly toothed or ridged, rather short; wings short and broad, with rather long cilia; abdomen short, blunt.

LARVÆ smooth, onisciform, without perceptible legs, or without prolegs.

This family does not seem to be in any way allied to the preceding, and is one of the isolated groups already alluded to, of which the connecting links are apparently wanting. In some respects it leans towards the *Tortricina*. Its larvæ are especially anomalous, perhaps more resembling those of the *Lycænidæ* than any other group, but are deprived of the ordinary means of locomotion. There are many exotic species, but only two European.

Genus 1. LIMACODES.

Fore wings broad and rather squared; thorax and abdomen moderately stout.

1. *L. testudo*, *Schiff.*; *Heterogenea limacodes*, *Staud.*
Cat.—Expanse, 1 to $1\frac{1}{8}$ inch. Fore wings yellowish brown, with two darker cross lines, the outer curving to the hind margin; hind wings darker.

Antennæ in the male slightly annulated, with raised ridges; simple in the female; light brown. Head ochreous or brown. Thorax rather robust; abdomen short and blunt; both ochreous or brown. Legs rather short, similar in colour. Fore wings broad and somewhat obtuse, with straight costa, rather squared apex, and hind margin but slightly oblique; in the male ochreous brown shaded with darker brown from the base, and with a dark-brown transverse line from near the base of the dorsal margin to the middle of the costa; beyond

this on the costa commences another dark-brown line which proceeds obliquely to the hind margin near the anal angle, cutting off a large paler apical space; another shorter brown line from the dorsal margin runs parallel with the first for a short distance, then turns to the hind margin and cuts off a pale space at the anal angle; the central portion between these three lines forms a broad hatchet-shaped central band, usually of a darker brown than the rest of the wing; cilia dark brown, dashed with paler. Hind wings dark purplish-brown or blackish-brown, with the dorsal margin ochreous, and the cilia dark brown faintly dashed with paler. Female similar in size, shape, and markings, but pale brownish ochreous, with the lines brownish and without the brown clouding and central band; margins rather browner; cilia brown, tipped with whitish.

Under side yellowish ochreous, with a golden tinge, the middle portion of the fore wings in the male occupied by a large ill-defined dark-brown cloud.

Not very variable, but the male is sometimes almost entirely suffused with rich dark brown. Decidedly smaller here than is usual in specimens from the Continent.

On the wing in the last week of June and to the middle of July.

LARVA with six legs only; prolegs replaced by a formation of the under surface which allows it to cling closely to a leaf, on which it leaves a shining track like that of a snail. Oval, onisciform, sides deeply indented and hollowed below the subdorsal and dorsal region, which forms a broad raised belt in the middle of the back; head small, shining, retractile, concealed under the second segment, which is also retractile. Bright emerald-green or pea-green; subdorsal lines waved, conspicuous, primrose-yellow, edged above with a deep violet spot at each incision; a row of small diamond-shaped yellowish dorsal spots placed at the incisions, and almost united; between them and the subdorsal line is a row of yellow spots, not at

the incisions; the sides, where most deeply hollowed out, have a series of yellowish spots with rather shining darker centres; a yellow lateral line passes completely round the larva and is extended across the third segment, which is ornamented in front with a red spot followed by two shining greenish dots; projecting under surface of the third segment edged with red. Head, pale greenish; mouth, and a spot on each side of it, dark brown; under surface glistening, whitish, like that of a slug or snail; legs whitish. (C. Fenn.)

August to October, on Oak, feeding on the leaves.

PUPA short, thick, and stumpy: broadest about the middle of the abdomen; thorax large, rounded, extended in front above the head; wing-cases long, well marked, with the neuration plainly traceable; leg-cases almost free, those of the third pair extending beyond the wing-cases to the anal extremity; creamy-white, with head and thorax tinged with brown; eyes visibly blackish; on the dorsal surface of each segment from the sixth to the twelfth is a broad transverse yellowish band; the whole surface roughened with minute spines pointing backward, these spines being yellow at the base, dark brown at the tip. In a broad, ovate-cylindrical cocoon, which becomes flattened on each side when attached to others on a leaf, and when upon an oak leaf fits so closely to it as to take the impression of the smallest veins; texture firm and rather hard, formed of reddish-brown silk lined inside with glistening white silk, and surrounded on the outside with a quantity of loose web. In this cocoon the larva remains unchanged through the winter and until the middle of June, the pupal stage lasting little more than a fortnight. (W. H. B. Fletcher.)

The eggs of this species are curiously broad and flat, almost scale-like as in the *Tortrices*. The larva is exceedingly difficult to rear in confinement. The moth frequents oak-woods, and doubtless flies at night. In the daytime it is rather sluggish, sitting in oak trees—young ones especially—

among the leaves, and readily disturbed by jarring the tree, when it usually darts to the ground, and there shams death, but if touched becomes excessively restless. Like very many other *Bombyces* it must not be imprisoned in a pill-box, as it will flutter and beat its wings to pieces. The female sometimes flies in the afternoon sunshine for short distances about the oak trees. It appears to be nowhere very common with us, but is found in the New Forest, Woolmer Forest, and other woods in Hants, also in most parts of Sussex, Kent, Berkshire, Oxfordshire, Essex, and Suffolk, wherever there is any extent of oak woods. Abroad it is found in the South of Sweden, widely distributed and rather common in Central and Southern Europe, Livonia, and Bithynia, also in other parts of Asia Minor.

Genus 2. **HETEROGENEA.**

Fore wings broad, rather triangular, unicolorous; thorax and abdomen slender.

1. **H. asella**, *Schiff.*—Expanse $\frac{5}{8}$ to $\frac{7}{8}$ of an inch. Fore wings triangular, shining, unicolorous, yellow-brown or dark brown; hind wings darker.

Antennæ short, simple in both sexes, thorax small; abdomen short and rather thick in proportion; fore wings somewhat triangular, with the costal margin much arched, the apex pointed, the hind margin oblique and rather rounded, and the dorsal margin short and straight. Antennæ, head, thorax, abdomen, and fore wings, in the male, glossy dark purple-brown or dark liver-brown, without markings but with the tips of the cilia slightly paler; hind wings still darker brown, with pale brown cilia. In the female the head, body, and forewings are of a rather light ochreous-brown without markings; the hind wings darker brown, with ochreous-brown cilia. Legs short, brown.

Under side, in the male, extremely glossy, dark brown,

with the margins and cilia ochreous; in the female yellow-brown, the fore wings clouded with darker brown.

On the wing at the end of June and in July.

LARVA half an inch long by one quarter broad. Onisciform, slightly tapering behind; head smooth, shining, pale yellowish-green, head and second segment retractile; dorsal surface raised into a ridge; sides slightly indented; under surface much flattened; no apparent legs. Colour yellowish-green on the sides; the whole of the back occupied by a large diamond-shaped red marking the lateral angles of which reach to the spiracles; this large diamond-shaped mark is prolonged in front as a broad red-brown band towards the head. These dorsal markings combined form a spear-head mark with the apex or point behind, the edges darker red. Under surface whitish, much tinged with greenish at the sides and towards the head. (C. Fenn.) Mr. W. Buckler says that on the margin of the under surface is a soft projecting ridge of flexible skin, which appears to serve the purpose of legs, and propels it forward with an undulating motion.

August to October, on Beech and Oak, feeding on the leaves.

PUPA short, thick, soft but polished, rather lively, squared in front, the head not extending beyond the thorax, but with a short broad projecting ridge between the eyes, in a good position for cutting off the cap-like end of the cocoon; cases of the antennæ, legs and wings stout, free from the abdominal segments, those of the wings falcate and reaching the twelfth segment; those of the third pair of legs extending to the anal segment, which is bent under, slightly forked and without spines. Colour dark brown, with the hinder edges of the abdominal segments transparent-whitish; spiracles pale, round, and projecting, all but the last two pairs covered by the detached wing-cases, under which they can be seen when the abdomen moves. In an oval cocoon, sometimes placed in the fold of a dried beech leaf, but more frequently spun very

tightly into the forks of beech twigs. The cocoon is firm, of a dull dark brown, often mottled with dirty white upon the outside, accurately matching the beech bark. Inside it is lined with pale yellow silk. In this cocoon the larva remains unchanged from October till late in May, or even into June, the pupa state lasting only a short time, perhaps a fortnight or three weeks. (W. H. B. Fletcher.)

The moth flies in the afternoon sunshine, looking much like a *Tortrix*, for which it may readily be mistaken. Doubtless it flies also at night. Exceedingly local in this country, and confined to the south. Rather common in the beech woods of Buckinghamshire, where, at Marlow, numbers have been reared by the Rev. Bernard Smith; also not uncommon in the New Forest, Hants. Found more sparingly in Woolmer Forest, Hants; at Wakehurst and Abbots Wood, Sussex; and in Epping Forest, Essex. Abroad it is found locally in Central Europe, Sweden, Livonia, Corsica, and Piedmont; also in Eastern Tartary.

Family 4. CHLOEPHORIDÆ.

Antennæ thread-like, palpi short, thorax broadly oval, abdomen short and rather blunt; fore-wings broad, somewhat bell-shaped, with costa much arched at the base; hind-wings short.

LARVÆ cylindrical, smooth, with sixteen legs.

PUPÆ in a tough, boat-shaped cocoon.

A family not closely connected with the previous, nor at all with the following; but of singular structure and uncertain location. It was formerly placed with the *Tortrices*, with which group the form of the fore wings closely associates it, but in almost all other respects it disagrees with that group. It was placed by Mr. Stainton, as a separate family, immediately before the *Tortrices*; by some other authors among the

Noctuæ; and more recently is usually included in the present group. There are only seven or eight European species in the family, the majority of which, including our own, are of a bright green colour. Exotic species are more numerous, and include many pink and green, pink, and crimson species, but the family so extended remains very isolated and of doubtful position.

Genus 1. **HALIAS.**

Antennæ simple; fore wings broad and bell-shaped but somewhat pointed; thorax and abdomen stout.

1. **H. prasinana**, *L.*—Expanse $1\frac{1}{4}$ to $1\frac{1}{2}$ inch. Fore wings rather bell-shaped, bright green with three oblique silvery cross-lines; hind wings yellowish or white.

Antennæ rather thick, cylindrical, thread-like, rather downy, bright red; palpi and legs bright red; head green, whitish at the back; thorax broad, pea-green, with a silvery white longitudinal stripe down each shoulder, and one down the centre; abdomen of the male yellowish green, of the female greenish white. Fore wings with the costa arched at the base, thence straight; dorsal margin similarly formed, apex pointed, hind margin straight to near the anal angle where it is rounded off; bright pea-green, with three oblique, parallel, silvery-white transverse stripes edged with deeper green, the third of which runs into the apex; between the first and second of these is usually a broad whitish shade; costal and dorsal margins narrowly white, edged, in the case of the male, with crimson; cilia silvery-white edged with crimson, most broadly and brightly so in the male; hind wings short and rather small, rounded, in the male pale yellowish with a greenish tinge and the cilia reddish-yellow, in the female clear shining white.

Under side of the fore wings in the male pale green, with the dorsal margin broadly white and the cilia red; hind wings pale-greenish or yellowish; of the female, fore wings very

pale greenish, with longitudinal whitish stripes, and the oblique silvery lines visible; hind wings white.

Not very variable, but in some specimens the first oblique silvery stripe bends back close to the costa, forming an angle; in other cases these stripes are broader or narrower. In Dr. Mason's collection is a specimen in which the crimson edging of the fore wings is brilliantly suffused along the costal margin towards the apex and along the hind margin, also broadly along the dorsal margin, invading the silvery stripes.

On the wing in June and July.

LARVA stout, tapering posteriorly, and with anal prolegs extended behind; head large, rounded, prolegs flattened out, or clubbed. Pale pea-green dotted with yellow; head dull green; subdorsal lines and front edge of second segment pale lemon yellow; upper surface of anal prolegs with a red line; belly whitish. (C. Fenn.)

August and September, on Oak, Beech, Hazel, Birch; feeding on the leaves during both the day and the night.

PUPA dull, elongate, incisions much compressed, tail very blunt and rounded. Very lively. Bright purple or plum colour on the back, shading into reddish-orange beneath; wing and leg cases much tinged with pale grass-green; tail reddish-brown. In a compact, brown, wrinkled, shell-like, boat-shaped cocoon, placed keel upwards, and with a ridge at the top; lined inside with silk, and placed either in a slightly drawn-together leaf, in an angle of bark, or among moss. It has the habit of making a rustling noise in the cocoon. (C. Fenn.)

In pupa through the winter.

The moth sits in the daytime on the leaves of trees and large bushes, and is readily beaten out into an umbrella, into which it falls, feigning death. Most plentiful in woods, but common among the trees in hedges in a well wooded district. It

flies just before dusk rather wildly about the trees, and has, while so engaged, the extraordinary habit of making a sharp, shrill, squeaking noise. This has been repeatedly observed and fully established, but some doubt exists as to whether it is made by both sexes, or only by the male. Mr. A. H. Swinton says: "On the skirts of a newly-leaved oak shaw I was suddenly arrested by a novel and loud succession of twitters in the dusk air, and on looking up saw a male and female silver-lines moth which came fluttering down from the foliage and were toying just in front of me." Dr. Buchanan-White states: "On the evening of the 28th May, when mothing in the oak wood surrounding my house, I noticed what I thought was a beetle flying round a small oak, and giving vent, all the time, to a sharp, quick sound very similar to that produced by the longicorn beetle *Astinomus*, when held between the fingers. Though I failed to catch this individual, I was more successful with another which was behaving in just the same manner. When in the net the sound ceased, and I saw to my astonishment that the insect was a male silver-lines. I found that a good imitation of the sound may be made by rubbing the point of a knitting-needle on the closed blade of a clasp-knife." The words of the late Rev. F. O. Morris are: "I was out hunting one evening very early, before dusk, on a rising ground near Stoke Court, when I saw many of these moths flying up and down, very fast, near or above the top of an old-fashioned high hedge on the side of a wide grassy lane. I could not help being struck by the stridulous noise they made as they flew." Another observer writes: "I was rather startled at dusk by the sudden appearance of a couple of insects whirling frantically around each other, just above my head, and both uttering a shrill and peculiar sound at quick intervals. By a fortunate stroke of the net I secured one of them, when it continued to utter its peculiar note until I boxed it. It proved to be a male of *Halias prasinana*." Again a very old collector says: "I had just pinned my first insects taken at sugar when I heard a strange sound behind me,

and on looking round, observed what I thought was a beetle flying round a sallow bush ; when in my net it again repeated the sound, but what was my surprise at finding that it was a lepidopterous insect. I got it between my finger and thumb, when it again produced the sound, and with the aid of my lantern I found it was the common *Halias prasinana*. The sound was as if you passed a pin sharply along three or four teeth of a comb. I suppose it was a love-song to charm his lady." No satisfactory explanation of this singular habit, or rather power, seems as yet to have been furnished. Mr. Swinton attributes it to friction between the sub-costal nervure of the hind wing, and a finely-striated callosity upon the thorax. A young collector at Carlisle tells me that when beaten out of a bush it opens the wings on one side only, and as it falls spins rapidly round like a falling leaf. By noticing this curious trick he took a number of specimens in rapid succession.

This species is common in suitable places almost throughout the South and East of England, though less so in Devonshire and the Western portions of Wales ; also fairly common in Herefordshire, Leicestershire, Staffordshire and Derbyshire, and found, more locally, in Yorkshire and Cumberland. In Scotland it is not uncommon in the Western districts ; also in Perthshire and Ross-shire, Aberdeenshire, Kincardineshire, and elsewhere as far north as Moray. In Ireland it was recorded in the county Wicklow by Mr. E. Birchall, and has been taken near Lough Gilly in the county Armagh. Abroad it is widely distributed, being found in France and Italy ; most parts of Central Europe, and all the temperate portions of Northern Europe ; in Southern Russia, Siberia, and apparently in Eastern Asia ; indeed specimens from Japan, although named *Sylpha*, agree accurately in both sexes with our own.

The green colour, in this group, is extremely liable to fade towards yellowish under the influence of damp, and in the present species to be changed to a bright yellow by the fumes of ammonia.

2. **H. quercana**, *Schiff.*; **bicolorana**, *Staud. Cat.*—
Expanse, $1\frac{1}{2}$ to $1\frac{3}{4}$ inch. Fore wings very broad, bell-shaped;
bright pea-green, with two oblique slender transverse white
lines; hind wings white.

Antennæ simple, cylindrical, but stouter at the base, downy,
pink at the base, shading off to whitish at the apex; palpi
short, bright pink; head pale reddish, with the upper portion
green; thorax broad, bright pea-green, with a slender yellow
stripe across the front extending to the costa of the fore wings;
abdomen tapering, thinly covered with closely appressed
white scales. Fore wings very broad, with the costa arched
throughout; the dorsal margin broadly arched at the base,
thence straight; apex bluntly angulated; hind margin not
very oblique, slightly rounded, with a faint bend or elbow in
the middle; bright pea-green, with two slender, oblique
parallel white transverse lines, the first from the dorsal
margin near the base to the middle of the costa, the second
from the middle of the dorsal margin to the costa a little
before the apex; costal margin edged with yellowish, tinged
faintly with red at the base, almost white towards the tip;
cilia silvery-white. Hind wings short and rather small,
rounded behind; pure silky-white, with the cilia white.
Sexes alike, except that there is, in the female, a faint tinge
of yellowish-grey upon the hind wings, especially towards the
hind margin. Under side of the fore wings greenish-white;
of the hind wings pure white in the male, greenish-white in
the female; body white; legs red. Apparently not variable.

On the wing in July.

LARVA smooth, soft, the third segment raised into a pro-
minent hump, from which the body tapers to the tail; the
anal prolegs sprawl backwards, the remaining prolegs are
clubbed; head retractile. Pale green or yellowish-green, the
dorsal line pulsating, slightly darker, especially towards the
tail, and edged on each side with whitish or yellowish. Sub-
dorsal lines only visible on the anterior segments, being super-
seded behind these by a series of oblique yellowish lateral

lines. Spiracular line pale yellow or whitish, raised, and very prominent on the second and third segments. Head and legs dull whitish. Dorsal projection on the third segment tipped with orange. (Fenn.)

September to May or June, on Oak.

The young larvæ, from September to November, are green, they then hibernate, and when they reappear in the early spring are quite brown, and seem to gnaw the bark of the young twigs. When the foliage appears they again become green, and so continue to full growth.

PUPA apparently undescribed; in a boat-shaped cocoon on oak.

Mr. A. H. Swinton, in the *Entomologist's Monthly Magazine*, states that the pupa makes a rustling noise in its cocoon, and also that the moth, after emergence, "makes a membranous sound: first, when it expands its wings; secondly, when it flirts its partially-expanded wings; and, thirdly, on a still, sultry afternoon, a continuous rustling is produced during flight. The spot whence proceeds the first noise I am certain about When expanding the wings I found that the inner margin of the fore wing caught a little horny thoracic plate and left it with a jerk, which most obviously produced the click."

This species appears to be almost confined to oak woods and oak trees near to woods. It flies at dusk, probably about the trees, since it is seldom observed in flight; but it is as fond of "sugar" as a *Noctua*, and is most frequently captured by this means. Although certainly very local it is found in oak woods in Kent, Sussex, Surrey, Hants, Berks, Hunts, Herts, Middlesex; more commonly in Norfolk and Suffolk, especially in the singular district of ancient sea-sand bordering those counties and Cambridgeshire; also not scarce in Essex. Very uncommon in Devon, Somerset and Gloucestershire; rare in Herefordshire and Worcestershire, and apparently not recorded further north. In Ireland it

has been taken in Galway and the Queen's county, but is rare. Abroad it is found throughout Central, and parts of Southern Europe, in Southern Sweden, and also in Asia Minor.

Genus 2. **EARIAS.**

Antennæ simple, downy; fore wings tortriciform, blunt; thorax narrow; abdomen slender, but short and blunt.

1. **E. chlorana**, *Hüb.*—Expanse, $\frac{7}{8}$ inch. Fore wings short and broad, pale green; costa arched, whitish; hind wings white.

Antennæ slender, round, not toothed nor bristly, reddish; head and front of thorax white; remainder of thorax pale green; abdomen short and blunt, brownish, thinly covered with white scales; legs whitish, tinged with reddish in front. Fore wings short and broad, with the costa regularly arched; dorsal margin rounded at the base, thence straight; hind margin rather straight, or almost retuse before the pointed apex; deep pea-green, with the costa broadly white, especially so at the base; dorsal margin narrowly white at the base, and sometimes there are whitish shades on the basal portion of the disk; cilia white. Hind wings broad, rounded behind, pure white, or sometimes with a faint tinge of green at the apex; cilia pure white. Under side entirely silvery-white, except a tinge of greenish on the fore wings, especially at the hind margin. Not very variable.

On the wing at the end of May and through June. In rare instances a partial second generation has occurred in August.

LARVA stout, rather flattened beneath, tapering to each extremity; seventh and succeeding segments swollen on the back, in a diminishing ratio towards the tail; on the seventh and twelfth segments are pairs of dorsal tubercles. Green or greenish at the sides, whitish-green on the back, edged later-

ally with brown, especially between the second and seventh and the eleventh and twelfth segments inclusive, the dark edging being vandyked. Head black and white; dorsal line greenish-grey; spots whitish, emitting very short pale hairs; tubercles brown. (Fenn.)

On sallow, willow, and osier, feeding, generally exposed, on the tips of twigs of which the leaves are a little drawn together, in July and August.

PUPA thick and rather short, with rather long wing- and antenna-cases, dull dark brown, tinged on the back with purplish; under surface and wing-cases light brown. In a short broad boat-shaped or keeled cocoon, very hard and tough, pale brown, with the keel darker brown, and covered with minute roughnesses, which cause a close resemblance to the bark or other substance on which it is placed. In pupa through the winter.

The moth ordinarily sits upon the terminal shoots of the willow tree or sallow bush, or among its higher leaves, in the day-time, and is very partial to osier beds and to sallow bushes in marshes. Sometimes it may be seen very conspicuously sitting upon the trunk of a willow just below the branches, but it greatly prefers the leaves, with which its light green colour, shaded with white, beautifully harmonises. It flies quietly at dusk, and occasionally comes to sugar.

It was formerly common at Hammersmith, Fulham, and other places in the outskirts of London, and probably is still existent where the willows are undisturbed. Also found occasionally in woods, marshy places, and especially osier beds, in Kent, Surrey, Sussex, Dorset, Berks, Essex, Suffolk, and probably throughout the southern and eastern counties, though easily overlooked. Common in the fens of Norfolk and Cambridgeshire, and at Cambridge, Wisbech, Chatteris, and Monkswood, Hants. Beyond this somewhat limited range it does not seem to be recorded in these islands; but it is found throughout Central Europe and the temperate portions of Northern Europe; also in Siberia.

Family 5. **NOLIDÆ.**

ANTENNÆ in the male with rows of bristles, or sometimes shortly pectinated; palpi long, drooping, pointed forward; fore wings ovate, usually with tufts of raised scales on the disk; thorax narrow, abdomen slender, short, rather blunt.

LARVÆ with fourteen legs (the usual pair on the seventh segment absent); short, thick, densely covered with long hairs.

PUPÆ rather slender, with long wing-cases; in a spindle-shaped or boat-shaped cocoon.

Another group of doubtful position and relationship. Formerly placed among the *Pyralites*, but certainly connected by intermediate species with the genus *Nudaria* in the next family. The species are all small.

Genus 1. **NOLA.**

This being the only genus, the characters already given apply.

1. **N. cucullatella**, *L.*—Expanse, $\frac{3}{4}$ inch. Fore wings pale grey, with two transverse lines and the base blackish; hind wings pale grey.

Antennæ thickened at the base, and furnished with a tuft of long grey scales; otherwise slender, but provided (in the male) with rows of tufts of bristles, some of them longer than the rest, furcate and branched, whitish; head greyish; palpi whitish, long, rather drooping, and projecting forwards; thorax grey; abdomen whitish-grey; fore wings rather ovate, all the margins gently rounded; apex blunt, pale grey or whitish, with a broad dark grey or greyish-black basal blotch extending to the first transverse line, which is deep black, slightly oblique and rather curved. Outside this is, usually, a broad band of the white or whitish ground colour. The second transverse line is much less distinct than the first:

slender, sinuous, much indented, edged with white, but arising from a black costal blotch. Outside it the whole hind-marginal area is clouded with grey, through which passes an irregular and indented, indistinct, whitish sub-marginal line. In the middle of the costa, and between the first and second transverse lines, a cloudy grey costal blotch encloses a black central spot. At the base of the dorsal margin is a whitish shade, and above it a prominent tuft of raised dark grey and whitish scales, standing erect; besides this, shorter raised tufts lie transversely on the central spot and transverse lines; cilia pale grey, intersected and dashed with darker grey. Hind wings rounded, pale grey, paler at the base; cilia grey, with a white line at their base. Female similar, with simple antennæ. Under side of fore wings dark grey; the costa beyond the middle freckled with paler; hind wings whitish, with large grey flecks; body and legs grey.

Variable in the colour of the fore wings, and especially of the basal blotch, which is sometimes very pale grey, at others almost black. Individuals also occur in which the central whitish band is obliterated by a suffusion of smoky black.

On the wing in June and July.

LARVÆ short, stout, rounded, hairy, tapering to each end, and compressed at the incisions; dull purplish, with the dorsal line and a series of dorsal spots whitish and very conspicuous; the latter placed on alternate segments, and formed by horse-shoe shaped dorsal markings, bisected by the dorsal stripe; head black; body covered with short grey hairs. Varies considerably in the number and disposition of the dorsal markings, but the dorsal stripe is always whitish. (Fenn.)

On hawthorn, blackthorn, pear, and apple, in April and May; but also feeds—very small—in the autumn, and hibernates. Mr. Fletcher says that the eggs hatch in the beginning of August; in the middle of September the young larvæ draw a few threads across some depression in

which it lies, and that some remained without moving till the middle of May. So far as has been noticed it feeds always exposed on the leaves both by day and night.

PUPA very blunt at each extremity, not swollen in the middle; tail without hook, spine, or bristle; dull brown; head slightly darker. Very tightly enclosed in a shell-like triangular cocoon of a whitish colour, thickly dusted with purple and with a projecting beak at the top. This cocoon is closely glued down to the bark of a stem on one side, and on the other fastened down with fine bands of whitish silk. (Fenn.) Its surface is closely covered with morsels of the bark. In pupa two or three weeks.

The moth sits, head downwards, in the daytime, on a trunk or branch, or among the leaves of hawthorn or sloe, or on palings near, or walls among pear trees, with head uplifted and fore wings closed so as to completely cover the hind, showing, from its blackish basal colouring and raised scales, a curious tippit or cloak-like appearance. It is easily disturbed in the daytime, and flies freely at early dusk. A tendency to suicide appears to be among its more noticeable characteristics, as it is constantly found in water tanks and rain-water butts, near wall fruit trees.

Very common in hedges and orchards in the South and East of England, and not scarce in the southern and western Midlands as far as Leicestershire, Derbyshire, Staffordshire, and Herefordshire; but not extending far into the west, as I find no record in Devon; and although it is recorded commonly in Glamorganshire, I never saw it in Pembrokeshire. Records in the North of England appear to be few, though it is widely distributed in Yorkshire. In Scotland it is found rarely in Perthshire, and even in the districts of Tay and Moray, but confined to woods. In Ireland it was recorded as common by the late Mr. E. Birchall, but no other records appear to exist; and it is probably absent from that country. Abroad it is found throughout Central and the temperate

parts of Northern Europe, as well as in Spain, Southern France, Italy, and Dalmatia.

2. **N. strigula**, *Schiff.*—Expanse, $\frac{7}{8}$ inch. Fore wings ovate, greyish white, with numerous slender wavy black lines; hind wings grey.

Antennæ rather slender; in the male with short, distinct, ciliated pectinations; in the female simple; brown, with a white basal tuft; head white, with the projecting palpi grey; thorax grey; abdomen brownish, barred with white. Fore wings broadly ovate, with strongly rounded costa and apex, but the other margins less rounded; greyish white. At the base of the costa is an elongated dull grey blotch, terminating in a tuft of raised grey and white scales; first line black, curved, indented, and enclosing a faint row of dark grey spots. Beyond the middle of the costa is an irregular blackish blotch or group of blackish streaks, from which arises the second line, curved greatly outwards, and then crossing the wing, very much indented, and having each indentation pointed into a black streak. Between the two lines is another elongated dark grey spot on the costa, and below it two more tufts of raised scales in a line with the first, and of a whitish colour, below which the central space is clouded with faintly grey lines and dashes. Hind-marginal space clouded with grey, intersected by a subterminal line, which is irregular, indented, and edged within with connected black streaks and smoky clouds, as also is the hind margin; cilia whitish, barred with dark grey. Hind wings rounded, pale grey, rather darker along the hind margin; cilia paler. Under side of fore wings pale grey, streaked with darker; of hind wings whitish, dusted with grey, and having the apex grey; cilia whitish. Not very variable; but Mr. F. J. Hanbury has a specimen, taken in Essex, in which the space between the first and second lines is devoid of markings, and forms a pale central band.

On the wing in July.

LARVA stout; thickest at the third and fourth segments, tapering behind, flattened beneath. Head round, grey-black; body pale buff or pinkish-buff; dorsal stripe yellowish or pinkish-white, broad, and edged with brownish-grey; sub-dorsal lines brownish-grey, interrupted between the segments; the usual spots all edged with brownish-grey, and bearing tufts of radiating hairs. On the seventh segment is a conspicuous blackish-grey blotch across the back, dividing the dorsal line; sides pinkish-red, densely covered with hairs; under surface pinkish, hairs in front mixed, pale brown and dark grey, but after the fourth segment yellowish, and on each side of the last segment are a few very long hairs, pointing and curving back so as to resemble a forked tail. (Condensed from Buckler.)

April to June—and probably also feeding (very small) in the autumn, and hybernating—feeding on oak, principally upon the under surface of the leaves, which are not bitten through.

PUPA not stout, but with rather long wing-cases; dull dark brown, with wing-cases reddish-brown. In a small, silken, boat-shaped cocoon, about one-third of an inch long, and assimilating perfectly in colour with the surface of the bark upon which it is constructed. (Buckler.)

The moth sits in the daytime upon the trunks and branches of oaks, with its head downwards and its wings in a close triangle, and from its grey colour is extremely inconspicuous. It flies in the evening and at night, and comes occasionally to sugar when spread on the oak trunks. Usually scarce, though in the year 1871 it was very plentiful in the New Forest, and rather common in 1877; in 1881 it was common in Abbots Wood, Sussex; but these cases are exceptional. Always extremely local, confined to oak woods, and has been found in Surrey, Sussex, Kent, Hants, Berks, Gloucestershire, Somerset, Essex, Suffolk and Norfolk. In Ireland it was recorded at Killarney by Mr. E. Birchall, but this has

not been confirmed. Abroad it has a wide range through Central Europe, Sweden, Italy, Livonia, Dalmatia, Northern Turkey, and parts of Asia Minor.

3. **N. confusalis**, *Hüb.*; **crystalalis**, *Stainton*.—Expanse, $\frac{7}{8}$ inch. Fore wings clear white, with slender, angulated cross lines, and raised black and white tufts between them; hind wings greyish-white.

Antennæ, in the male, furnished with pairs of tufts of bristles, of which the central is the largest; in the female simple; in both whitish above, brownish beneath, and much thickened at the base with white scales; head, palpi and thorax white, with a brownish bar across the collar; abdomen brownish, with whitish rings. Fore wings narrowly ovate, with all the margins and the apex rather rounded; white, slightly dusted with grey, with a tuft of conspicuous raised white scales near the base; first line arising in a blackish spot on the costa, black, curved, and outwardly uniting with a larger black spot and tuft of raised whitish scales, in the discal cell; second transverse line also arising from a black costal spot, which extends itself so as to touch a third tuft of raised scales, —dark grey and white—thence bent outward, and then broadly back, making an inward curve before reaching the dorsal margin, being also dotted with black on every nervure, and edged on its inner side, through a part of its extent, with a series of black and grey dashes. Outside this second line the space is much clouded with grey, in which is a whitish transverse line, preceded and followed by series of black dashes on the nervures, and grey arches between them; cilia pale grey, dotted and dashed with dark grey. Hind wings rounded, white, with greyish nervures and a dark grey streak across the end of the discal cell; cilia white, intersected with pale grey.

Under side of fore wings pale grey, with whitish clouds on the costa, and the cilia whitish; of hind wings whitish, dusted with grey, and with two grey lines at the base of the whitish

cilia; body and legs white. Very constant in colour and markings.

On the wing in May and June.

LARVA rather flattened, not stout; head rather small, anal prolegs extended; usual tubercular spots slightly raised and furnished with tufts of short divergent bristles, and in each a central long hair; those of the anal segment with several long hairs. Head red-brown with three longitudinal streaks; dorsal region broadly yellowish tinged with red, and with numerous black streaks placed longitudinally—two on the second segment, three each on the third and fourth, four each on the following three; upon the succeeding three segments three red streaks each, three black streaks on the twelfth, and a larger streak—long and forked—on the thirteenth. The yellow surface is edged by irregular subdorsal blackish lines, and the lateral surface below this is dull reddish; hairs yellowish brown, mixed with blackish.

In July and August on oak, beech, blackthorn, and probably other trees. By some authors said to feed on tree-lichens.

PUPA nearly cylindrical, slightly thickest at the shoulders, blunt behind, rounded in front, with the head depressed; pale brown, darker on the back; limbs well marked; wing-cases pointed; last five segments fringed at the side with delicate hairs (Fletcher). In a curious rounded cocoon raised like a small projecting knob, thicker at one end than the other, and exactly resembling the corner of bark or piece of park-paling to which it is attached.

In pupa through the winter.

The moth sits in the daytime, head downwards, on the trunks of trees, and usually on the edge of a projection of bark, and would, from its white colour, be most conspicuous, but that it so nearly resembles a small triangular blotch of bird's-dung on the bark. It doubtless flies at night, but is rarely captured on the wing.

By far the most widely distributed species in the genus, but hardly ever plentiful except in very large woods in the south of England—such as the New Forest. Not uncommon in woods, and in the better wooded districts, throughout the South of England from Kent to Devon; also in the Eastern, Midland and Western Counties to Lincolnshire, Derbyshire, Herefordshire, and Pembrokeshire; and in several localities in Yorkshire. In Scotland it has been found in Ayrshire, and, rather commonly, at Moncrieff Hill, Perth. In Ireland widely distributed; at Howth, near Dublin, in Wicklow, Mayo, Galway, Down, and near Lough Swilly, Londonderry. Abroad its distribution appears to be rather local—in France, Belgium and Western Germany, but there is a probability that it has been in some districts confused, as with us, with closely allied species.

4. **N. centonalis**, *Hüb.*—Expanse $\frac{3}{4}$ inch. Fore wings short, white, with slender brown transverse lines or light brown bands, and a row of raised brown tufts of scales; hind wings whitish.

Antennæ rather short, slender, but abundantly furnished with bristles, in two rows, in the male; simple in the female; whitish, with a broad, flattened tuft of white scales at the base; head white, with a dense mass of flattened white scales between the antennæ; palpi long, brownish-white; thorax and abdomen whitish. Fore wings short and broad, with margins very slightly curved, apex rounded, hind margin rather oblique, white; the costa clouded at the base, and spotted beyond it, with fawn-colour, the spots in the middle portion being minute, and those towards the apex rather large; in the discal cell is a row of three tufts of raised light brown scales; first line curved but very indistinct, existing mainly as a series of three brown dots, one of which is the first tuft of raised scales, but it is generally edged with fawn-coloured clouds; second line dark brown, straighter but sinuous, and in some degree parallel with the hind margin, it

also is strengthened with dots, one of which is the third raised tuft, and clouded, on the inner side, with fawn-colour which shades off into the central space; inside this second line is a faint, indented, additional brownish line, outside it a broad white stripe; hind margin softly clouded with fawn colour, through which runs a white-margined brown sub-terminal line; cilia whitish, intersected and dashed with brown. Hind wings rather broad, rounded, whitish; hind margin brown; cilia whitish. Sexes alike. Under side of fore wings brownish-grey with the nervures darker; of hind wings white, much flecked and dusted with grey; margin brown.

Very variable. In some specimens the shading of fawn-colour disappears, leaving the transverse lines very distinct and delicate; in others these also become more or less obsolete, until some specimens are clear, pure white. In the other direction the fawn shades become intensified into broad bands, one occupying the whole middle area of the wing, another the hind marginal space, while the lines and raised spots are darkened; and all possible intermediate shades occur. Both extreme forms have been reared by Mr. W. H. Tugwell and Mr. Robert Adkin. Abroad our darker varieties seem to be the more constant and typical forms.

Middle of July to middle of August.

LARVA half an inch long, stout, tapering to the head, which is small, the usual raised spots each with a tuft of radiating hairs, the lowest at the sides having longer hairs, and those of the anal segment much longer tufts, pointing backwards. Head blackish brown with a pink transverse streak; body pink or purplish-pink; dorsal line ochreous-yellow, passing between series of velvety-black wedge-shaped spots in the front of each segment; subdorsal lines very slender, undulating, blackish; spiracular lines pale yellowish, interrupted, and indistinct; spiracles black; hairs greyish-brown; legs and prolegs pinkish. (Buckler.) Mr. W. H. Tugwell's description differs a little from this. He says that the general

colour is semi-translucent brown-pink, with a narrow, but well defined, yellow dorsal line, and on each segment six small fleshy tubercles, arranged in rows—three on each side of the dorsal line—and from which spring tufts of short brown hairs; spiracular lines not very distinct; belly and claspers naked, of a semi-transparent brown-pink. Also that the young larvæ are pale brownish-yellow, hairy and sluggish, a character which they retain through life.

August and September, then hibernating and feeding up in the spring. By keeping them in a warm room, however, Mr. Tugwell induced his larvæ to feed up in November and produce moths in December. On *Trifolium pratense*, *T. procumbens*, *T. minus*, *T. repens*, *Lotus corniculatus*, *Medicago lupulina*, and even *Potentilla anserina*. It is curious to note that while those larvæ which fed up under favourable circumstances in the autumn cast their skins only five times, Mr. Buckler counted nine moults in those which hibernated and fed up in the spring.

PUPA very cylindrical, blunt behind; chestnut-brown; in a short, rounded, rather boat-shaped cocoon, thickest at one end, placed on a dry stick or stem, and formed of silk and the raspings of the stem. Mr. Tugwell says: "When the larva is about to spin its cocoon it selects a grass culm or other stem, and having spun a little pad of silk upon it, commences to nibble off portions of adjacent stems, and with them builds out two side pieces like an open boat, the stem forming, as it were, the keel. It is most curious to watch this construction going on; the larva stretches itself out as far as it can reach without leaving its hold of its work, in order to gather this building material, which it collects, and with it, builds up, so to speak, plank by plank, its house. As soon as these side pieces are finished, which occupies some thirty-six hours' labour, it commences at the lower end to draw over the two sides so that their edges just meet, and spins them thus firmly together, working steadily upwards

until nearly closed in; the larva then enters the cocoon, draws over the top or headpiece, and lines the interior with silk." The operation, so carefully described, is of peculiar interest from the unusual method adopted of *préparing the cocoon before entering*, and then closing it up.

The moth is very sluggish, and hides in the day time among herbage close to the ground. At dusk it runs up the grasses and sits about upon the short herbage, but flies later at night, and has been taken by means of a strong light. It was first discovered in this country in 1858, when a specimen was taken at Bembridge in the Isle of Wight. In 1879 it was found in a very restricted locality on the sandhills at Deal on the coast of Kent, and from females then taken eggs were obtained. From these, and from the results of further captures in the same place, the large majority of the specimens in our collections were supplied; but a few more examples have been secured in the Isle of Wight, at Folkestone, Kent, and on the cliffs on the coast of Sussex, near Hastings. I know of no localities, with us, outside these three counties. Abroad it is a very widely distributed and sometimes abundant species, found in Central and Southern Italy, Corsica, Livonia, Finland, Austria, Hungary, Saxony, and rarely in Eastern France; also in Armenia, Tartary, Siberia and elsewhere in the North and East of Asia.

5. **N. albulalis**, *Hüb.*; **albula**, *Staud. Cat.*—Expanse, $\frac{7}{8}$ inch. Fore wings broad with raised tufts of light brown scales, and a broad central pale brown band; hind wings pale grey.

Antennæ rather slender, but with distinct, solid, regularly ciliated pectinations of a brown colour, in the male; in the female simple; shaft, in both sexes, white, base clothed with snow-white scales; palpi long, pure white; head and thorax white; the top of the head with a flattened mass of white scales between the antennæ; abdomen brownish-white. Fore wings broad, with margins gently curved, apex squared, hind margin not very oblique, white, clouded with pale brown,

with three conspicuous tufts of raised brown and white scales along the discal cell; first line curved, slender, very pale brown; second line slightly sinuous but nearly parallel with the hind margin; space between these lines light brown, forming a broad central band, darkest towards the second line, but dotted with white along the costa; outside the second line is a faint transverse series of brownish clouds, and a light brown stripe, dashed with darker on the nervures, lies along the hind margin; cilia long, whitish, faintly intersected with brown. Hind wings ample, rounded, whitish-grey, shaded with extremely pale brown, rather darker towards the hind margin; cilia similar. Sexes alike. Underside of the fore wings dull grey-brown with whitish spots on the costa; of hind wings white, the costal half profusely dusted with brown, and with a brown central lunule; body and legs white. Variable in the degree of light brown shading in the central band and hind marginal space; and in the general colour of the markings, which tend in some degree to disappear. In Mr. W. H. B. Fletcher's collection is a specimen of a pure white except a very slender brownish transverse stripe, and I have one wholly white.

On the wing from the end of June to the end of July, and sometimes till the middle of August.

LARVA of even thickness, but with the head small, shining, pinkish, sometimes with brown markings; body pinkish-orange, pale pink, or even ivory-white; tubercular spots yellow, distinctly raised, and bearing tufts of hairs, of which those in the centre are much longer than the rest, and those on each side of the anal segment of double length; rather long tufts are also on each side of the head. Dorsal line double, light grey; subdorsal line indicated by oblong or angular black markings on the middle segment, and on the seventh and eleventh increased in size, so as in some cases to meet across the back; legs brown; prolegs pinkish or yellowish, tipped with brown; the shorter hairs white, the longer dark brown.

September to June, hibernating while small, and in the spring feeding on the young shoots of the food plants just as they spring from the ground. On Dewberry (*Rubus cæsius*), Raspberry (*R. idæus*), Strawberry (*Fragaria vesca*), *Potentilla reptans*, and even *Eupatorium cannabinum*.

PUPA half an inch long, cylindrical, and of nearly uniform width throughout, tapering a little at the anal extremity. The head is bluntly rounded, and the eye- and antenna-cases prominent. Colour of the dorsal surface deep reddish-brown, becoming gradually darker towards the head, which is nearly black; abdominal divisions rather paler than the ground colour. Ventral surface paler brown; eye-cases black, and the antenna-cases margined all round with black. (G. T. Porritt.) In a spindle-shaped cocoon fastened to a stem or culm of grass, formed of silk mixed with bits of the surface and the longer hairs of the larva, and looking exactly like a brown knot of the grass or thickened piece of stem. Mr. Tugwell says: "They nibble off pieces of the substance they attach themselves to, so as to imitate its appearance, and at first make up an open-sided affair just like a boat, and when all is completed to their liking pull together the two sides and join them into a spindle-shaped cocoon. They may be even seen to get out of their working in order to obtain the nibbled bark to finish with if they cannot reach far enough by merely stretching themselves out."

The moth hides in the day time among low herbage, and by close scrutiny may occasionally be seen sitting, head downwards, on a stem of dewberry near the ground; it may also, in warm weather, occasionally be disturbed and induced to fly in the afternoon. On warm evenings it flies at early dusk, but when the weather is chilly somewhat later, darting about with a sharp, lively action. It was first taken in this country in 1859 at Chattenden Roughs, a large wood near Rochester in Kent. For years the locality was kept a secret, but about

1874 it became more generally known, and as the moth was then very common in portions of the wood which were comparatively open, with scattered clumps of bushes and a thick undergrowth of rank grass, dewberry, and other herbage, large numbers were secured. Constant persecution has, however, rendered it very much scarcer, and there is serious danger of its extermination in this, its only known reliable locality in these Islands. A single specimen has been secured by Mr. W. H. B. Fletcher in the Isle of Wight. Abroad it is widely distributed, though not very common, in Eastern France, Holland, Germany, Hungary, Dalmatia, Piedmont, Sardinia and in Bithynia and other parts of Asia Minor.

Family 6. **LITHOSIDÆ.**

Antennæ slender, threadlike, in the male with rows of bristles; collar conspicuous, thorax narrow and weak; abdomen rather slender but blunt; fore wings long and narrow, of delicate texture; hind wings ample, very thin.

LARVÆ with sixteen legs, hairy.

PUPÆ short, smooth, in a close cocoon.

Genus 1. **NUDARIA.**

Fore wings short and rather broad, rounded behind, very thin and weak, semi-transparent; hind wings very broad and filmy. Thorax slender and very weak.

LARVÆ bristly, short and sluggish.

1. **N. senex**, *Hüb.*—Expanse, $\frac{3}{4}$ inch. Fore wings short, broad, semi-transparent, brownish, with a dark brown dot; hind wings rather large and similar.

Antennæ rather short and threadlike, fringed in the male with short bristles, pale brown; head, thorax, and abdomen narrow and weak; pale brown. Fore wings short, broad, rather

squared, and so thin as to be much wrinkled; costal and dorsal margins very slightly curved, apex blunt, hind margin rounded, hardly oblique; dull pale brownish or drab, with a dark brown spot at the end of the discal cell, a brown dot at the base, faint indications of a first line shown by short brown dashes on the nervures before the middle; second line also a long curved row of brown dots and dashes on the nervures beyond the middle; cilia drab, with a brown dot at the end of each nervure. Hind wings long and broad, rounded behind, semi-transparent, extremely thin and delicate; whitish-drab, faintly brown at the hind margin, with an indistinct pale brown central lunule, and beyond it a straight transverse row of faint brown dashes; cilia whitish brown. Female similar, except that the fore wings are slightly narrower and more transparent. Underside yellowish-drab, with the nervures brown, darker toward the hind margin; costa of fore wings yellower; central spot visible; and before the apex a dark brown or blackish triangular cloud, or group of spots; body and legs pale brown.

Hardly variable except towards the obliteration of the few existing markings, specimens taken in the North of England being extremely pale in colour and having only faint brown dashes on a few of the nervures.

July and August.

LARVA $\frac{3}{8}$ inch long. Very stout, densely covered with tufts of hair. Head shining black; body waxy looking, deep reddish grey, the hairs of two descriptions, the more numerous stiff, pale brown with black points, slightly feathered, the rest longer and black, densely feathered with soft pale brown plumage. Legs glossy, tipped with black; prolegs pale grey, translucent.

August to May, hibernating. On *Lichen caninus* and on mosses such as *Hypnum sericeum* and *Weissia serrata*. Probably on various lichens and mosses which grow upon the ground in wet places. (Buckler.)

PUPA glossy, of a deep rich brown. In an oval cocoon of closely-spun silk, with the hairs of the larva woven in. Probably among dead leaves on the ground.

Entirely confined to wet fen-land and marshes. Hiding among the grass and low herbage during the day, and so sluggish that it cannot be disturbed; crawling up, on mild or warm evenings, to fly at dusk for a few minutes, after which it sits about on the low herbage and grass blades, hanging down exactly like a little bit of dead leaf. About midnight it rouses itself and flies about near the ground, and may then easily be attracted to a strong light; but even then will hang on to grass blades around, and simply bask in the rays of the lamp. Altogether an extremely sluggish and secret species, and easily overlooked, yet widely distributed in marshes, and sometimes making its appearance, on an especially favourable evening, in most unexpected places. I have found it even in a little bit of marshy ground enclosed by sea sand-hills. Like many other fen insects it will fly after rain and also during fogs. Abundant in the fens of Norfolk and Cambridgeshire and has been seen in multitudes at lamps in Wicken and Ranworth Fens. Fairly common in Suffolk, and found less commonly in boggy spots in Sussex, Berks, Hants, Dorset, Devon, Somerset and Glamorganshire. Also tolerably common in marshes near York and Scarborough, and therefore most probably in suitable places in the intermediate counties. In the year 1825 it was abundant at Whittlesea Mere, and was found in Battersea Fields, close to London; in the neighbouring Hammersmith marshes it maintained itself till 1860 or later, but these last localities have long been built over. I hear from Dr. F. Buchanan White that he has seen a specimen said to have been taken at Crieff, Scotland; and a single specimen was captured last year (1893) by Colonel Partridge, near Enniskillen, Ireland. Abroad it is common in the Alps, and widely distributed in the Northern half of Europe; also in the Ural range.

2. **N. mundana**, L.—Expanse, $\frac{3}{4}$ inch. Semi-transparent, brownish white; fore wings with faint brown transverse lines.

Antennæ short and threadlike, fringed in the male with delicate bristles; pale brown, rather thickened toward the base in both sexes, the basal joint having a large tuft of scales; head tufted with yellowish scales; thorax very weak, pale brown; abdomen similar. Fore wings ovate; costal and hind margins and apex much rounded; dorsal margin nearly straight; semi-transparent, very thinly scaled, smooth and shining; of the faintest shade of brown; the usual first and second lines light brown, curved and much indented, but not very distinct; between them is a brown dot in the discal cell; edge of the costa, and the cilia, light brown. Hind wings rounded, nearly transparent, shining and almost iridescent, faintly tinged with brown, especially in the cilia. Female with the body stouter, often with the wings rather smaller, very nearly transparent, and with the brown colour and markings much more faint or hardly perceptible. Underside of the wings iridescent, faintly brownish, nervures slightly browner; body and legs pale brown.

Hardly variable, except that specimens occur, in both sexes, but more especially in the female, having the wings colourless and quite transparent, except at the extreme margins. This form was described by Haworth as a distinct species under the name of *Hemerobia*.

July and August.

LARVA less than half an inch long; stout and bristly, of uniform thickness, with the usual spots raised, and emitting slender hairs. Head small, dark brown or blackish; body above bright yellow, with a greyish-brown dorsal stripe, a blackish dorsal spot on the eighth segment, pairs of sulphur coloured spots on six other segments, and a blackish-brown subdorsal line; tubercles and hairs dark greyish-brown; legs paler; undersurface pale greyish-brown.

From September to May, hibernating; feeding upon lichens, especially those which grow upon stone walls. Mr. E. Birchall found it in plenty in the West of Ireland on the orange coloured lichens with which the stone walls are there profusely decked. In Wales it is equally common on the similar lichens upon tiled roofs. Also on the green lichens and confervoid growths on old gates and palings in damp situations, and upon the trunks of trees. Sometimes to be found feeding in the sunshine, at others hiding under stones or other cover in the day, and feeding at night.

PUPA short and stumpy, pale green or yellowish. In a very slight gauzy network cocoon, through which the pupa is plainly visible; in any sheltered place among stones or on walls. In one case in which the larvæ had fed on the lichens upon the roof, I found numerous cocoons containing pupæ or unchanged larvæ on the wall on the inside of the building, they having crawled in through an open window. Neither larvæ nor pupæ were discommoded by the careful removal of the cocoons, and all emerged as moths.

The moth is inconspicuous and is rarely seen in the day time. It flies gently at dusk, and more generally towards midnight, when it also comes readily to light. The female, however, is seldom seen at large. Common and generally distributed in the South of England in woods and lanes, though not plentiful; formerly quite common at Sydenham on the south side of London. Scarcer in the Eastern and Midland Counties, and rather rare in fen districts; local but pretty common in Wales to Pembrokeshire; and not uncommon in Yorkshire, Lancashire, Cheshire, and Herefordshire. In Scotland found in Roxburghshire, at Garelochhead, Dunoon, Ardrossan, Renfrew and other Western localities; in the East at Craigie and Annateburn. In Ireland commonly in the rocky limestone district of Galway, and in Donegal and Londonderry. Abroad

generally distributed in Central, and the temperate portions of Northern Europe, Northern Italy, Dalmatia and part of Asia Minor.

Genus 2. **CALLIGENIA.**

Fore wings ovate with costa rounded, and beyond the middle, in the male, having its edge rolled back; hind wings ample.

We have one species only, and this not closely connected with either the preceding or following, and having no near allies in Europe; the very few species closely related to it being found in Japan, China, India, Mongolia, and the Andaman Islands.

1. **C. miniata**, *Forster*.—Expanse, 1 to $1\frac{1}{4}$ inch. Fore wings ovate, pale vermilion with blue-grey lines; hind wings broad, paler.

Antennæ short and rather slender, in the male with rows of bristles, of which the central one is rather long and curved, placed upon a pair of knobs on each joint; pale reddish. Head and thorax pale vermilion or yellowish-red; abdomen paler red, with black scales showing from beneath on each side, so as to form side stripes; anal tuft rather conspicuous, yellowish-red. Fore wings ovate, rather long, costa regularly arched, but from the middle to near the apex distinctly rolled back so as to give that portion a straight appearance; apex and hind margin much rounded; dorsal margin gracefully curved; rich bright vermilion, paler, or tinged with yellow, in the central area; edge of the costa from the base bluish-black; a round blue-black dot at the middle of the base; first transverse line, when present, curved and repeatedly angulated, faint blue-black, but usually incomplete or nearly obsolete; second line also blue-black, very distinct, complete, and most singular in form, consisting of a regular series of loops, or long scallops with very long points, the rounded

loops lying inward; close to one of these, or often merged in it, is a blackish dot or streak at the end of the discal cell, and very frequently a slender bluish line extends from this dot to the middle of the costa. Outside the second line is a row of blue-black dashes or dots before the hind margin and placed on the nervures; cilia yellowish red. Hind wings broad, rather angulated at the apex, rounded behind, thin and delicate; very pale vermilion, verging towards whitish at the base; cilia yellowish-red. Female similar, hardly stouter, but the fore wings are without the costal fold, and the abdomen is devoid of the blackish scales. Underside similar in colour to the upper, except that the base of the costa of the fore wings is more broadly blackish; the centre of the fore wings is occupied by a large blackish cloud in which the loops of the second line are extended and merged, and in the male the undersurface of the abdomen is covered with a thick mass of smoky-black scales; in the female it is pale reddish; legs reddish with the first pair of tarsi blue-black. In Mr. Sydney Webb's collection is a specimen entirely pale yellow, which was taken in the New Forest; in that of the late Mr. Bond another, and intermediate forms. Otherwise it varies but little, except in the degree of distinctness of the first transverse line.

On the wing in July.

LARVA half an inch long, stout, uniform in thickness, skin shining, densely covered with plumed hairs, except segments two and thirteen which have only short simple hairs, while in each other body-segment they are wonderfully plumose and verticillate, with plain tufts along the sides and above the feet. Head brown, the lobes outlined with black; body dark drab, the hairs being of a blackish mouse-colour, or a little paler behind the middle. (A very curious larva, seeming to carry minute hearse-plumes.) When young very dingy, foggy-looking, with a quantity of loose hairs on the back. (Hellins.)

August to May. Feeding throughout the winter, except in

severe frost, upon lichens on the trunks and branches of trees, and apparently also upon withered leaves. When young, Mr. Buckler found that they would eat withered sallow and oak leaves and various lichens, and towards the spring would even gnaw cut pieces of turnip, but finally settled down to *Lichen caninus*, eating especially the red waxy tips, and upon this arrived at full growth.

PUPA short, reddish-brown; in a long-oval, dark brown cocoon of slight but close texture, the plumed hairs being interwoven with the silk so as to stand upright and protect it. (Hellins.)

The moth is rather sedentary, not inclined to fly far from the place where it has fed up, so that several may be found about the same tree or large bush, though no others occur near. It sits in trees or high hedges in the day time, and when disturbed will fly a yard or two, or to the ground; but becomes lively at dusk, flying round its favourite tree or large bush—very often a holly. At dark it flies high, will come to light at night, and is rather fond of the sugar spread on tree trunks to attract *Noctua*; yet is never seen to frequent flowers. Widely distributed in woods, woody heaths, and well timbered lanes and hedges in all the Southern Counties from Kent to Devon, and Essex to Gloucestershire and Somerset; also in Pembrokeshire, Herefordshire, Warwickshire, Suffolk, and Norfolk. Rare in Cambridgeshire; apparently hardly noticed in the Midland Counties, but found in several localities in Yorkshire, which seems to be its northern limit here. In Ireland it was recorded as found in Galway by the late Mr. E. Birchall, but I know of no more recent captures. Abroad its distribution is very wide—Northern Europe, except the extreme Northern portions, Central Europe, Dalmatia, Siberia, Tartary, and probably large portions of Asia, since it is found in Japan with the first transverse line complete and strongly marked, though variable. This variety is named *C. rosaria*.

Genus 3. **SETINA.**

Fore wings rather broad, spotted, rounded behind, thin in texture and hardly opaque.

1. **S. irrorella**, L.—Expanse of male 1 to $1\frac{1}{4}$ inch, of female $\frac{3}{4}$ inch. Fore wings semi-transparent, ochreous-yellow with rows of black dots; hind wings paler.

Antennæ slender, black, fringed, in the male, with delicate bristles. Head small, black; collar yellow; thorax black with yellow shoulders and a yellow blotch behind the middle; abdomen black with a light yellow anal tuft. Fore wings rather long and somewhat triangular, being narrow at the base, broad behind, with the costa nearly straight, apex and hind margin rounded, and dorsal margin straight; semi-transparent ochreous-yellow or whitish-ochreous, brighter in colour at the margins, and with the extreme costal margin deep yellow; first and second transverse lines oblique and nearly parallel, but only indicated by series of black dots all placed upon nervures; near the hind margin is another series of black dots all placed *between* nervures, but varying in number, commonly three at equal distances apart, but frequently one or two more are placed near the apex, and sometimes the row is increased and rendered irregular by others placed intermediately; cilia yellow. Hind wings long and ample, very thin and delicate and nearly transparent; pale creamy ochreous, sometimes spotless, in other cases with one, two, or three faintly blackish spots at the apex, and, more rarely, an addition of a few more in a row near the hind margin; cilia yellow. Female much smaller in expanse, with narrower fore wings and much shorter hind wings, but similar in colour and markings; abdomen short, thick, and cylindrical. Underside of the fore wings pale grey with the margins broadly yellow, the black dots of the hind margin distinct, those of the two transverse lines obscure; hind wings very pale greyish-yellow; thorax, abdomen and legs black; anal tuft yellow.

There is variation in the intensity of the black dots forming the two transverse lines, especially in the middle area of the fore wings, where, in rare instances, the black colour also runs along the nervures between them, thus forming a black V, or even by a similar union of the outer dots the figures IVI in a prostrate direction. These forms, though rare, have been repeatedly obtained, and in the collection of the late Mr. F. Bond is one so marked on one side only; while Mr. S. J. Capper has one with the markings thus VI, the upper pair of dots not united. Another striking variety in Mr. Bond's collection has a broad smoky band along the hind margins of all the wings, and three black streaks from the base of the fore wings; another belonging to Mr. C. A. Briggs has the fore wings regularly suffused with smoky grey-brown and the hind wings yellow-brown. In mountain districts in France and Switzerland, especially at high elevations, variation is further extended and more pronounced; a form with all the nervures of the fore wings smoky-black throughout, and with cloudy hind wings, is known as variety *Andereggii*, while another, even more broadly black veined, with blackish hind wings, is called *Riffalensis*. The variety with the central black V is known as *signata*, but these varietal names are of little moment, the varieties being themselves unstable and varying towards each other. (It is somewhat remarkable that in several allied species (?) precisely similar aberrations occur—*S. roscida*, in which both sexes are of the form and size of the female *irrorella*, with similar spots, but of a deeper general ochreous colour, having a variety, called *melanomos*, in which the hind wings are clouded with smoky and the fore wings smoky-black from the base; *S. aurita*, which is of a rich ochreous, almost orange, with much larger subterminal spots, but otherwise similar to *irrorella*, having a form known as *Ramosa*, with black stripes down the nervures of the fore wings; while *S. Kuhlweini*, which is also of a deep ochreous yellow, has the additional spots on the hind wings near the margin as in strongly marked *irrorella*. These species are not known with us.)

The present species is on the wing in June and July.

LARVA $\frac{3}{4}$ inch long, moderately stout, tapering a little at each extremity; usual spots slightly raised, and studded with tufts of rather long hairs. Head small, black; body blackish-brown above, with the dorsal stripe composed of a series of brilliant deep yellow acorn-shaped spots, one divided on each segment; subdorsal stripe white, mixed with yellow, and much interrupted; sides reddish-grey or purplish-grey; subspiracular stripe light-yellow, edged above with dark brown; raised spots blackish, except along the subdorsal region, where they are white; hairs blackish brown; legs dark brown. (Buckler and Hellins.)

From August to May on the lichens which grow on the edges and bare stony places on sea cliffs, and on large stones on the coast a little above high-water mark; some of the lichens being blackish-brown, others bright yellow. Feeding exposed, and fond of bright sunshine, but wonderfully protected by its close resemblance to the lichens. Will also feed upon lichens which grow upon the soil of the cliffs, and may be reared upon a turf cut from such a situation, or upon tree-lichens, if kept in the sunshine and frequently sprinkled with water.

PUPA short and stout. In a loose flossy silken cocoon among small stones, or under stones or oyster-shells, above high-water mark; or in interstices of the rocks.

The moth is rather sluggish, the female particularly so; but the male flies in the early morning sunshine and again in the afternoon. When at rest, hanging from a blade of grass or the leaf of some low plant, its semi-transparent, limpid appearance has obtained for it the common name of the dew moth. Doubtless the female flies at night—probably both sexes. Extremely local in this country. Stephens states that it formerly occurred on Dartford Heath, Kent, and that in 1816 and 1817 it was abundant at Rochester. Now it

appears to be most strictly confined to the extreme edge of the coast, though one specimen—which surely must have been migrating—was taken by Mr. F. Norgate in Foxley Wood, Norfolk. It is common at Dover, Kent, and in the Isle of Wight, at the edge of the cliffs, and at Shoreham, Sussex, on the beach. Also found at Folkestone, Hastings, and elsewhere on the coast of Kent and Sussex, and rarely in Devonshire; in the Isle of Man; and on the Island of Ramsey, near St. David's, South Wales. Some years ago it was found in plenty on the lighthouse beach near Aldeburgh, Suffolk, and larvæ were found there commonly, but from some unexplained cause it seems to have disappeared. In Scotland it is recorded as having occurred at Crieff, Clydesdale, and in Aberdeenshire. Dr. F. B. White says: "Tweed, Tay, Clyde, and Argyle districts." In Ireland it is common in the rough limestone district of Galway. Abroad it appears to be rather a mountain, than a coast, species, and is found in Northern and Central Europe, especially in the Alps (at high altitudes producing local variations), as well as in Dalmatia, Siberia, and Asia Minor.

2. **S. mesomella**, *L.*—Expanse, male $1\frac{1}{2}$ inch, female 1 inch. Fore wings broad, rather squared, pearly-white or yellowish, with two black dots; hind wings grey.

Antennæ threadlike, with rows of minute bristles in the male, whitish above, dark grey beneath; head and front of the thorax yellow, back of the thorax silvery-white; abdomen slender, pale grey, shading into yellow at the hinder extremity. Fore wings broad, costa regularly arched, apex blunt and squared, hind margin rather straight and hardly oblique; dorsal margin almost straight from near the base; costa beyond the middle very slightly rolled back; opaque, pearly-white, or silvery greyish-white, rather shining; costal and hind margins yellow, shaded into the white surface; on the costa near the middle is a black dot, and opposite to it, near the dorsal margin, another; cilia yellow.

Hind wings broad and rather long, with blunt apex and rather sinuous hind margin; dark grey, sometimes shaded with whitish at the base, and with a whitish streak running in from the hind margin below the middle; cilia long, yellowish white or pale yellow. Female decidedly smaller, with narrower fore wings, and shorter, rather stouter body; otherwise similar. Underside of the fore wings dark grey, with costal and hind margins and apex bright yellow; dorsal margin silvery-white; of hind wings yellowish-white or greyish-white, with the cilia broadly pale yellow; thorax dark grey; abdomen yellowish, tinged with grey at the base; legs grey above, yellowish beneath.

A form of the male is not uncommon which has the fore wings shining pale yellow, faintly tinged with greyish or whitish in the middle, and with a yellowish tinge upon the hind wings. Beyond this, variation in this species is extremely rare, but Mr. S. Stevens has a yellow specimen devoid of the usual black dots.

On the wing in June.

LARVA nearly one inch long, stout and cylindrical; head smaller, shining black, and a velvety black patch on the back of the second segment; body velvety, blackish grey; usual tubercular spots raised, and thickly tufted with blackish densely-feathered hairs, so as almost to conceal the body, which is plain; legs shining black; prolegs grey. When younger, velvety black, with the hairs singularly spatulate. (Buckler.)

August to May on lichens, a favourite kind being one of immature form growing among moss on oak trunks; but doubtless one of the lichens which grow on the ground among heather is also chosen, and sallow leaves, either green or decaying, are not refused. It has also been known to feed on heather (*Calluna vulgaris*).

PUPA short and stout, pale brown, in a large, thin, semi-transparent cocoon of greyish silk, spun in any convenient hollow under moss or lichen. (Hellins.)

Very widely distributed on heaths and especially in open woods, hiding in the bushes during the day, but easily beaten out and induced to fly a short distance. On hot days it flies naturally soon after sunset and before dusk, flitting round a favourite spot, with an undulating motion, about a yard from the ground; but in the evening it becomes more active. Formerly abundant in the fens of Wicken, Yaxley, and Burwell in Cambridgeshire and Huntingdonshire, also at Swaffham Prior, but now said to be extinct in those localities. Moderately common in the woods of all the Southern Counties as far west as Devon; also found in some parts of Gloucestershire and Herefordshire; widely distributed in Norfolk; scarce in Suffolk and also in Pembrokeshire and North Wales; found on the mosses of Lancashire and Cheshire, and very locally in Yorkshire and Cumberland; rather common on Cannock Chase in Staffordshire, and probably not entirely absent from suitable localities in many other counties. In Scotland it has been found in Aberdeenshire, in Clydesdale, and other places in the Clyde, Solway, and Moray districts. Abroad it is common in all the temperate portions of Northern Europe as well as in Central, Southern and Eastern Europe; in Bithynia, Siberia, and many parts of Northern and Western Asia.

Genus 4. **LITHOSIA.**

Antennæ threadlike; thorax and abdomen moderately slender; fore wings very narrow and strap-like; hind wings broad, repeatedly folded, and, with the fore wings, pressed closely round the body. A small tuft of raised scales exists under the base of the fore wings in most of the species.

LARVÆ very hairy, feeding mainly upon lichens.

A table of the species may be useful:

A. Fore wings narrow.

B. Fore wings grey, spotted.

L. muscerda.

- B². Fore wings grey, unspotted, with yellow costal stripe.
 C. The yellow stripe extending to the apex. *L. complana.*
 C². The yellow stripe narrowed off before the apex. *L. complanula.*
 B³. Fore wings greyish-white, unspotted.
 D. With slender yellow costal stripe. *L. caniola.*
 D². Without costal stripe. *L. pygmaeola.*
 B⁴. Fore wings rich shining-ochreous. *L. aureola.*
 B⁵. Fore wings dull brownish-ochreous. *L. helveola.*
 B⁶. All the wings smoky-black. *L. rubricollis.*
 A². Fore wings not very narrow.
 E. Fore wings shining-grey, *L. griseola.*
 E². Fore wings shining-yellow. *L. griseola, var. stramineola.*

The last is indicated here because of its very distinct appearance, which long led to its being regarded as a separate species.

1. **L. muscerda**, *Hüb.*—Expanse, $1\frac{1}{8}$ to $1\frac{1}{4}$ inch. Fore wings narrow, purplish-grey with four or five black dots; hind wings yellowish-grey.

Antennæ slender, delicately fringed with two rows of fine oblique bristles; light brown; head, thorax, and abdomen fuscous; fore wings long and narrow, with two or three longitudinal creases or wrinkles lying between nervures, one from below the base of the median nervure to the anal angle, being the most deeply marked; costa and hind margin slightly curved, apex angulated, dorsal margin nearly straight; rather shining fuscous or purplish-grey, with a broad, slightly paler stripe along the costa; near the dorsal margin, before the middle, are two small black dots placed obliquely; and near the costa, beyond the middle, three or four rather larger black dots also placed obliquely, but in

the opposite direction, so as to point towards the anal angle; cilia pale fuscous. Hind wings broad with the apex bluntly pointed, rounded behind; pale grey tinged with yellowish at the base and along the dorsal region, shading into dark fuscous at the apex; cilia yellowish grey. Female similar, with fore wings rather longer, broader, and more pointed. Underside of the fore wings dark fuscous; nervures prominent; of hind wings yellowish fuscous; body and legs grey. Slightly variable in the number and distinctness of the black dots.

On the wing in the latter part of July and through August.

LARVA $\frac{3}{4}$ inch long; rather stout, cylindrical, tapering very little at either end; the usual tubercular spots, on each segment, raised and furnished with tufts of hairs, which are short but abundant; head small, blackish; body velvety blackish-brown, marbled with reddish-grey; dorsal stripe and subdorsal line deep black; raised spots and hairs brown; on the back of the second segment is a pair of deep red spots, and on the thirteenth a pair similar but smaller; beneath the spiracles is a fine reddish-grey line; under-surface pinkish-grey; legs shining, dark reddish-grey; prolegs similar. (Buckler.)

August to May on lichens, and probably mosses, in the wettest fens. In confinement it has fed upon *Lichen caninus*, *Hypnum sericeum*, and *Weissia serrata*, also on decayed willow and bramble leaves. Only known as reared from the egg, its home among the thick bushes and tall coarse herbage of the fens offering almost insuperable obstacles to the discovery of so obscure a larva.

PUPA short, stout, very blunt behind, shining dark chestnut brown; in a thin, webby cocoon of greyish silk, outside which is a finer and thinner cocoon of white silk; in a curled-up bramble leaf. (Buckler.)

This is an excessively local species, found only in the

wettest portions of fens and marshy woods; most partial to the small thickets of alder, willow, and *Rhamnus* in such places; never observed in the day time, when it probably hides in the thick undergrowth, but readily obtained when flying at dusk at the edges of these thickets or "carrs," when its flight is of a tacking, swaying character, but tolerably swift. This flight is soon over; but towards midnight it flies again about the trees and is much attracted by a strong light, settling down at once on the lamp, or on any neighbouring object upon which the light shines, and remaining quite inert. Also occasionally attracted by sugar placed on the fen plants for the benefit of *Noctuæ*. Towards morning it takes a third flight.

Curtis, in his "British Entomology," relates the finding of the first specimens noticed in this country, in a ditch at Horning Ferry, Norfolk, before 1830. A few years later it was found by the Rev. J. Landy Brown, flying commonly in the evening among alders near the same spot. This locality—Horning—with Ranworth Fen on the other side of the river Bure, has continued to be the headquarters of the species, with us, to the present time, and I found it quite plentifully in the latter fen twenty years ago. Since then it has been less common, especially so in certain years, but it may be found at Irstead and other parts of the long stretch of narrow fens on the River Bure, as well as at Brundall Fen, on the Yare, below Norwich; but, strange as it may appear, no single specimen appears ever to have been taken in the fen districts of Cambridgeshire and Huntingdonshire. It has, however, been taken at Lakenheath, on a little fen of the river Ouse, which is connected at its outlet with both the Bure and the Yare. A very few specimens have been taken in a marshy portion of the New Forest, in Hants, by Mr. W. H. B. Fletcher, and at a marsh at Sandwich, Kent, by Mr. Charles Fenn. I know of no other locality in the United Kingdom; but abroad it is found through Central Europe, Livonia, Dalmatia, Tartary, and probably other parts of Asia, since a variety,

rather small and with indistinct spots, is found in Japan. It is not closely allied to any European species, but some nearly related species are received from India.

2. **L. aureola**, *Hüb.* ; **sororcula**, *Staud. Cat.*—Expanse, 1 to $1\frac{1}{4}$ inch. Fore wings narrow at the base, spotless, golden yellow ; hind wings pale yellow.

Antennæ threadlike, but with a double row of delicate bristles, set rather far apart, black-brown ; head and thorax deep yellow ; abdomen slender, blackish, dusted with yellow scales, and with the anal tuft deep yellow. Fore wings narrow at the base, broader behind, with the costa much rounded beyond the middle, and its extreme margin sometimes slightly rolled back ; apex and hind margin rounded, dorsal margin slightly curved ; shining rich yellow, with the costa more deeply yellow ; without markings, but sometimes having the middle portion of the wings faintly shaded with hoary-grey ; nervures rather depressed, and there is a deep crease, or wrinkle, in the dorsal area ; cilia yellow. Hind wings rather ample, with the apex bluntly angulated and hind margin rounded ; pale yellow ; cilia deeper yellow. Female similar, with the abdomen rather short. Underside of fore wings dark grey, with the margins rich yellow, the hind margin broadly so ; hind wings whitish-yellow ; body dark grey dashed with yellow ; anal tuft orange ; legs black above, yellow beneath. Hardly variable except a little in the general depth of yellow colour, which also fades rapidly during life ; but in Dr. Mason's collection is a specimen with the costa edged with blackish, the cilia smoky, and the wings shaded with blackish.

On the wing in the middle of May and through June.

LARVA $\frac{3}{4}$ inch long ; rather flattened and slender, tapering a little at each end ; covered with short bristles in spreading tufts. Head blackish-brown ; second segment brown, reddish in front, the general colour of the back white, divided by

black dorsal, intermediate, and broader subdorsal stripes, but this pattern interrupted on the fourth, eighth, and twelfth segments by brownish-black patches covering the back; on the ninth by the absence of the black stripes, leaving a conspicuous white space; while the fourth and twelfth segments are further obscured by greater density of raised masses of hairs. Sides, legs, and undersurface brownish-grey; the folds between the third and fourth segments white; a white spot on the third above the legs, and a white line similarly placed on the fourth; dorsal tubercles behind the third segment orange-red, and along the sides two similar rows of tubercles; hairs brownish-grey. Very active in its habits. (Hellins.)

July, August, and September, on lichens upon oak trunks.

PUPA short, rounded, rather thick, extremely smooth and glossy; dark brown, in a very slight cocoon in moss. The larva spins up in the autumn and passes the winter in the pupa state.

Not a common species, but widely distributed in woods in the South of England. Fond of sitting during the day in thick overhanging branches of oak or beech, from which it is readily beaten out, but falls to the ground without much fluttering. Flies about the trees at late dusk and through the night, and will come occasionally to sugar or to light. It was formerly found as near to London as Hampstead. Not scarce in oak woods in Kent, Surrey, Hants, Dorset, Essex, Suffolk and Norfolk, and in beech woods in Berkshire and Buckinghamshire; said to be rare in Cambridgeshire and in Sussex. There is a record that it was taken fifty years ago near York, but this seems probably erroneous. In Ireland it was found commonly at Killarney by the late Mr. E. Birchall, and also reared from larvæ found there. Abroad it is found in Central Europe, Denmark, Hungary, Dalmatia, Northern and Eastern Turkey, Southern Russia,

and Armenia; and in the National Collection there is a specimen labelled "Northern India."

3. **L. helveola**, *Ochs.*; **helvola**, *Hüb.*; **deplana**, *Staud. Cat.*—Expanse, $1\frac{1}{8}$ to $1\frac{3}{8}$ inch. Fore wings narrow, dull yellow-grey or brownish-yellow, spotless; hind wings paler yellowish, often with a greyer border.

Antennæ slender and threadlike, but in the male fringed with tufts of bristles, rather long and curved, especially the central one, arising from swellings or knots on the joints; brown. Head yellow; thorax ochreous in front, pale buff or pale grey behind; abdomen yellowish-grey. Fore wings of the male rather long, of somewhat even width, channelled with longitudinal wrinkles and covered with raised scales which give them a rough powdered appearance; costa nearly straight, but curved a little before the apex, which is somewhat squared; hind margin very slightly curved and hardly oblique; dorsal margin gracefully curved, slightly hollowed before the anal angle, which is blunt; dull greyish-yellow or yellowish-buff with an indistinct ochreous stripe along the extreme edge of the costa, but broader near the base; apex and hind margin tinged with ochreous; cilia glossy yellow. Hind wings very broad and ample, the apex extending beyond the anal angle of the fore wings, but rounded off shorter behind; very pale buff or brownish-yellow, shading into brownish-grey at the margins; cilia yellowish. Female rather stouter, with simple antennæ; fore wings broader; surface smooth; the costa decidedly more rounded, and the ochreous costal stripe much more distinct; general colour more slate-grey with a softening of yellowish; hind wings yellow-grey, hardly greyer at the margins; cilia paler. Or wholly dark grey, except a broad ochreous costal stripe to the fore wings. Under-side of the fore wings yellow-grey, more yellow at the margins, and with the costal margin broadly ochreous; hind wings very pale greyish-yellow; body ochreous; legs yellowish.

Not very variable, but the greyish border of the hind

wings sometimes assumes the character of a broad grey marginal band. Specimens taken in the New Forest, Hants, are rather large and handsome; and those formerly obtained near York were unusually yellow, especially the females, some of which attained a rich ochreous-yellow. This sex, which at first sight differs much from the male, was formerly described as a distinct species under the name of *L. depressa*.

On the wing in July.

LARVA $\frac{3}{4}$ inch long; cylindrical, tapering a little at each end; head rather small, brown or whitish; dorsal half of the body pale grey, whitish-grey, or white, edged by a broad subdorsal row of black elongated, or lunate, spots; the enclosed dorsal surface crossed by a black bar on the fourth segment, having a large triangular black spot on the eighth, and another on the twelfth; between these the dorsal line is indicated by a pair of slender, interrupted black lines. Sides below the subdorsal spots and undersurface grey, brownish-grey, or greenish-grey; hairs grey. (Hellins.)

August to June, on coarse lichens growing upon trees, especially yew, beech, and oak.

PUPA in a cocoon under the bark of trees.

The moth hides in the daytime in large yew bushes or trees, and in the branches of oaks and beeches, and may readily be beaten out from these shelters, when it flutters or tumbles towards the ground. At dusk and at night it flies freely. Found most plentifully among yew trees and bushes upon chalk hills in Surrey, such as Norbury Park and Box Hill; also not uncommonly in the New Forest, Hants, but exceedingly local. It is said to have been taken near Almondsbury, Gloucestershire, and once at Stowmarket, Suffolk. Four specimens were secured, in the year 1876, at a lighthouse on the coast of Norfolk, but these may have been migrating. Formerly it certainly occurred in the neighbourhood of York, and Mr. N. Young has a specimen taken by himself at Rotherham. Abroad it is found in France, Switzerland,

Germany, and other parts of Central Europe; in South Sweden, North Italy, Livonia, Southern Russia, and some parts of Asia. Specimens from Japan exist in the National Collection under the varietal names *pavescens* and *lævis*.

4. **L. pygmæola**, *Dbl.*.—Expanse $\frac{7}{8}$ to $1\frac{1}{4}$ inch. Fore wings very narrow, pointed, silvery yellowish-white; hind wings yellowish, shaded with grey.

Antennæ threadlike; very slightly fringed in the male with minute bristles; yellowish-white. Head and thorax bright yellow or yellowish-white; abdomen dark brown, thinly dusted with whitish scales; anal tuft pale yellow. Fore wings very narrow, with a deep longitudinal crease or wrinkle; costa very slightly curved; apex almost acute; hind margin slightly rounded and rather oblique; dorsal margin curved from the base, then nearly straight; shining yellowish-white or greyish-white, but in the latter case having the margins whiter. Hind wings broad and rather short, rounded, but slightly emarginate before the apex; pale yellow or yellowish-white, broadly clouded with dark grey along the costal region and to near the middle of the wing, where it gradually shades off; cilia all yellowish-white. Female smaller and stouter, with the hind wings rather more clouded with grey; otherwise similar. Underside of fore wings dark grey, with the outer half of the costa, the apex, and the hind margin sharply edged with bright pale yellow; hind wings dark grey in the costal half, shading gradually and regularly off to yellow in the middle; remainder pale yellow; cilia bright yellow; body grey; legs grey, tinged with pale yellow.

Very rarely variable in the shade of colour of the fore wings, which occasionally become of a shining yellow. Mr. S. Stevens has one of a pure silvery-white; Mr. S. Webb one entirely of a dark smoky-grey, approaching to slate colour; and, in Mr. F. Bond's collection, one entirely grey. Staudinger included this species as a variety of *L. lutarella*, a species

having its fore wings rich yellow, ochreous, or whitish-yellow, and varying paler, with the hind wings dark grey and pale yellow, pretty equally divided. But in this species the dark grey colour of the hind wings on the *under* side appears always to run to long jagged points along the nervures; while in all the *L. pygmaeola* which I have examined, including yellow specimens in Dr. Mason's collection, the grey colour is softly and regularly shaded off into the pale yellowish or whitish. In the male of *L. lutarella*, moreover, the antennæ appear to be always more strongly ciliated with longer, distant bristles. In Professor Zeller's collection (presented by Lord Walsingham to the British Museum) are numerous *L. lutarella*, including a pale variety, but all evidently distinct from *L. pygmaeola*, which last is present in the collection under the name *Succia*, Boheman. Herrich-Schäffer and Guenée appear to agree as to the distinctness of the two.

July and August.

LARVA short and rather thick, tapering a little behind; brown on the back, with a thick black dorsal line; subdorsal lines dark brown; sides rather paler brown, with a dirty white line along the spiracles. The tubercles with short brown hairs, and the head black. (Buckler.)

August to June. Supposed to feed on lichens growing on the ground among moss, but the larvæ in confinement were not reared.

PUPA undescribed.

The moth is sluggish, sitting upon the ground among lichens, moss, and coarse grasses upon sea-sandhills. At dusk it flies for a short time, then sits about upon the marram grass and other plants, looking much like a *Crambus*, and flies again late at night. It was first discovered about the year 1847 on the extensive sandhills near Deal, Kent, and although constantly collected there has maintained itself up to the present time. No other British locality is known.

Abroad its range is doubtful from its confusion with *L. lutarella*, but it appears to occur in Sweden; and Guenée says that he finds it, in France, in dry sandy woods near Paris and Chateaudun. Staudinger adds Holland.

5. **L. caniola**, *Hüb.*—Expanse, $1\frac{1}{8}$ to $1\frac{1}{4}$ inch. Fore wings narrow, shining, greyish-white, with the costa yellow to the apex; hind wings whitish.

Antennæ slender, very regularly fringed, in the male, with delicately curved bristles; grey tinged with yellow and with the base deep yellow; head and front of thorax rich yellow; back of thorax pale grey; abdomen grey with the apical tuft yellow. Fore wings long and narrow, slightly broader beyond the middle, with the costal margin very gently curved to the apex, which is blunt and almost angulated; hind margin very slightly rounded; dorsal margin nearly straight; very pale shining grey, or whitish-grey; costal margin narrowly edged with yellow, which in some instances is faintly shaded into the somewhat pale costal stripe; cilia whitish-grey. Hind wings rather ample, the apex nearly as long as the fore wings; rounded behind, very thin and delicate; white, usually with a faint tinge of grey towards the costal margin; cilia shining white. Female similar, with simple antennæ, and the fore wings slightly shorter. Underside of fore wings dark grey, with the apex and hind margin broadly whitish-yellow and the nervures grey; hind wings pale grey, with the hinder half and hind margin whitish; body pale grey; legs yellow, with the front of the tarsi greyer. Hardly variable except in the shade of greyish of the fore wings.

On the wing in July and August, or occasionally before the end of June.

LARVA one inch long; rather slender, thickest in the middle; head round, grey-brown or slate-grey; body brown, varying to slate-grey, with a slender, undulating blackish dorsal line; subdorsal lines composed of rather wedge-

shaped orange spots, edged with wedge-like black streaks, and interrupted by white dots; spiracular line dusky-orange; body covered with very short light-brown hairs in tufts on the raised spots. (Buckler.)

September to May or June, sometimes on lichens, at others on leguminous plants—*Lotus corniculatus*, *Anthyllis vulneraria*, and *Trifolium repens*; and when it has taken to one class of food it seems reluctant to change to the other. Guenée says: "Principally, perhaps exclusively, on the lichens which grow on the walls, and especially on the tiles of roofs." On one occasion, at Bolt Head, Devon, Mr. G. C. Bignell found twenty larvæ feeding upon lichen on the rocks; these refused to eat anything else, and were reared upon lichens. On another occasion he found larvæ at Torcross, Devon, feeding on *Anthyllis vulneraria*. At Howth the late Mr. E. Birchall found the larvæ lying upon stones in the sunshine on a bank among *Lotus corniculatus*, and reared them upon the blossoms and leaves of that plant; another time he obtained them from orange-coloured lichen on the rocks.

PUPA rather stout and short, slightly thickest in the middle, very blunt behind; eye-cases prominent, blackish; otherwise shining dark chestnut brown. In a slight cocoon on the ground.

The moth hides itself during the day in thick masses of herbage at the foot of the sea cliffs or in overhanging plants in their crevices, and may occasionally be beaten out, when it drops. At dusk it flies freely, and is fond of blossoms of *Galium verum* and *Senecio jacobæa*, and is also readily attracted to "sugar." Later at night it flies higher and more generally, and comes readily to a strong light. In the morning dusk it takes a third flight. Abroad it is said often to frequent cities, its larvæ feeding on lichens on the roofs of the larger public buildings; but here it is only known as confined to the coast, and almost to

the rocks or undercliffs within a few yards of high-water mark. First found in these islands in 1864, when a worn specimen was taken at Torquay, Devon; and several specimens, by myself, at the lighthouse on the rocks of the Hill of Howth, Dublin. In this last locality it proved to be tolerably common, and was freely collected and reared by the late Mr. E. Birchall, and continued to be found, in fair numbers, until between 1870 and 1875, when so vigorous an onslaught was made upon it by professional collectors that it was not again seen there until 1890, when a specimen was taken by Mr. G. V. Hart. The only other Irish locality of which I am aware is Tramore, Waterford, where specimens were obtained in 1866. Meantime, it has been found, though not commonly, in various places on the English coast—Torquay, Dartmouth, Torcross, Bolt Head, in Devon; near Rye, Sussex; and at Romney Marsh, Kent; and I again found it, though rarely, in two places close to the sea, at the foot of cliffs, in South Pembrokeshire; whence it seems probable that close search only is required to obtain it in other similar places. Abroad it is common in Central and Southern France, Spain, Italy, Austria, the Tyrol, Carniola, and Dalmatia.

6. **L. complana**, *L.*—Expanse, $1\frac{1}{8}$ to $1\frac{3}{8}$ inch. Fore wings shining slate-grey, spotless; costa broadly yellow to the apex; hind wings yellow, sometimes shaded with pale grey.

Antennæ threadlike, slightly fringed, in the male, with delicate, rather distant, bristles; grey. Head and front of thorax rich orange-yellow; back of thorax slate-grey; abdomen shining grey with the last three segments tinged with yellow or else wholly yellow; anal tuft yellow. Fore wings long, narrow, of fairly even width; costal margin very slightly curved, and having a sort of fold of scales beneath; apex blunt and squared; hind margin nearly straight; dorsal margin almost straight from near the base; shining slate-grey with a rather broad, sharply-defined, deep yellow stripe along the

costa continuing of equal width to the apex; cilia yellow. Hind wings broad and ample, nearly equalling the length of the fore wings, with rounded apex and hind margin; pale yellow, slightly deeper yellow at the hind margin and apex, and usually having the costal margin slightly clouded with grey; cilia pale yellow. Female very similar, of equal size, with simple antennæ and without the tuft under the costa; the hind wings sometimes rather more tinged with grey. Underside of the fore wings slate-grey with the costal margin narrowly yellow, and hind margin broadly whitish-yellow; hind wings pale yellow, whitish or greyish in the middle; body grey; legs rich yellow.

Variable in size and in the colouring of the hind wings, and the variations generally climatal. Examples from the South of England are large, with the hind wings yellow; but in Suffolk, with equal size, a tinge of grey occurs, and in the mosses of Lancashire and Cheshire the individuals are nearly always decidedly smaller, and the shade of grey has become deepened in varying degrees, so that in some instances almost the entire hind wings are of a leaden-grey. In these last the fore wings are also of a darker grey. These variable Lancashire specimens were at one time supposed to form a distinct species, described under the names of *L. molybdeola*, Guenée, and *L. sericca*, Gregson; but no line of distinction appears to exist. Intermediate specimens are found in the fens of Cambridgeshire, and the size decreases as the insect goes further north.

On the wing in July and the beginning of August.

LARVA one inch long; rather stout and even in thickness; head rather small, rounded, black; body purple-grey, sparingly covered with tufts of short bristles of the same colour, arising from the raised spots, which are purple-brown; dorsal line slightly darker. The subdorsal-line consists of a row of oblong yellow or orange-yellow spots, each having at its anterior end a white dot, and broadly edged with black on the under side; this—the subdorsal—line is indistinct or obsolete

on the first three segments of the body or only represented by white spots; spiracular line pale yellow or faintly reddish, slenderly edged with brown above and more broadly so beneath; legs dark brown; prolegs brownish. Larvæ of the dark variety are also darker but similar, having the black edging of the subdorsal spots more decided and more complete. These spots are found to vary greatly in form, from triangular or wedge-shaped to reniform, oval, or even roundish, and these variations take place among the offspring of typical specimens of the perfect insect. (Buckler and Hellins.)

August to June on lichens, moss, withered leaves, or even fresh leaves of *Polygonum aviculare* and *Trifolium arvense*, blossoms of *Lotus corniculatus*, or grass. Apparently not very particular as to food, but probably feeding often on the lichens which grow around the stems of heather, though it will freely eat those growing on trunks of oak, ash, and willow. Guenée says that the larvæ may readily be found among dead leaves on the ground, under oak trees, where they hide during the day.

PUPA stout, reddish-brown. In a very slight cocoon of silk under a stone or moss.

The moth is rarely seen in the day time, as it usually hides among low plants, especially heather, and if disturbed falls down, with its wings tightly rolled round it, as though dead. At dusk it flies rather briskly, but when caught instantly feigns death, and rolls like a morsel of stick to the bottom of the net. On warm evenings may occasionally be found flying in dozens around a young fir tree, or isolated bush, on a heath, where probably a freshly emerged female is concealed. Very fond of blossoms of thistle and of *Scabiosa arvensis*, upon which it may be found quietly settled after dark, at which time it is more inclined to escape by means of its rather long and strong legs than by its wings. A local species, occurring sometimes in woods, far more frequently on heaths; abundant on the heaths of the New Forest, Hants, and in Dorset, Surrey,

Berks, Suffolk and Norfolk; even found on sea-sandhills in the latter county; widely distributed but less common in Kent, Sussex, Essex, Devon, Gloucestershire and Herefordshire; scarcer in Cambridgeshire, but probably to be found in suitable spots in all the Southern, South Midland and Eastern Counties; apparently rare in South Wales. In Yorkshire it has been found in several localities, and in some of the mosses of Lancashire before they were drained and ploughed up it was—including the darker variety—comparatively common. After having, from this cause, disappeared from this district for a number of years, it was—still in the dark form—most fortunately re-discovered in 1890 by Mr. J. Collins of Warrington, and, though scarce, there is now hope that this interesting variety will maintain itself, and that further investigation may probably reveal it on other boggy heaths further north. In Scotland there is a record of its capture in the Southern district, which, however, has not been confirmed. In Ireland it was recorded by the late Mr. E. Birchall as having occurred on the Hill of Howth. Abroad it is found over the greater portion of Europe, and in the North-east of Asia Minor; but its range is probably much wider, since specimens, named *L. antica*, Walker, have been brought from Ceylon.

7. **L. complanula**, *Bdv.*; **lurideola**, *Staud. Cat.*—
Expanse, $1\frac{1}{4}$ to $1\frac{3}{8}$ inch. Fore wings slate-grey, spotless; costa rounded, with a yellow stripe which tapers off before the apex; hind wings yellow.

Antennæ slender; in the male ciliated with minute bristles, especially beyond the middle; dark grey, yellowish at the base. Head and front of thorax yellow; back of thorax, and also abdomen, slate-grey; anal tuft yellow. Fore wings rather narrow at the base, and becoming gradually broader; costa rounded, more especially towards the apex, which is bluntly angulated; hind margin curved and much rounded off at the anal angle; dorsal margin gracefully curved towards the base;

rather glistening slate-grey, with a broad yellow stripe along the costal margin to near the apex, but narrowing to a point on the curve before the tip is reached; cilia pale yellow. Hind wings broad and ample, very thin in texture; apex blunt, hind margin rounded but slightly hollowed below the apex; very pale yellow, slightly deeper in colour at the margins; cilia glossy yellow. Female with simple antennæ, otherwise similar; very slightly smaller and sometimes a shade darker. Underside of the fore wings dark grey with the costal margin and apex broadly deep yellow; hind margin very broadly pale yellow with grey nervures; hind wings pale yellow with the costa deeper yellow, sometimes edged with a greyish cloud; body dark grey; legs yellow with dark grey tarsi. Not variable.

On the wing at the end of June and through July.

LARVA one inch long, rather uniform in thickness; head rounded, black; second segment black at the back; body dull purplish, thickly covered with short purplish or brownish hairs; dorsal line black; subdorsal line slender, blackish, the usual raised spots also blackish; from the fifth to the twelfth segment is a broad lateral stripe, of a rich orange colour, enclosing the spiracles and extending to the prolegs, the spots and hairs on this portion being also of an orange colour; legs and prolegs purplish. When young the colour is more bluish-black, or slate colour, with black raised spots and hairs, and the lateral stripe and hairs yellow. (Buckler.)

August to May or June. Said to feed on lichens on tree trunks, but in confinement will eat leaves of oak, willow, wild apple, *Rhamnus*, *Cornus*, *Clematis*, and even low-growing plants. Apparently the leaves of trees are its usual food.

PUPA rather short and stout, rounded, blunt behind, chestnut-brown, in a thin silken cocoon.

The moth rests in the daytime amongst the leaves of trees, whence it is easily beaten out, but usually falls to the ground

as though dead. It flies about trees and bushes in the evening, and also late at night, when it comes freely to light, and even at times to "sugar" on trees, and to flowers, especially those of *Clematis vitalba*, and thistle. It is the most generally common species of the group, and formerly was plentiful in the outskirts of London, coming commonly to the gas lamps. There it is now less frequent, but occurs generally, and often abundantly, throughout the southern half of England as far as Derbyshire, Cheshire, and South Lancashire. In North Lancashire it is scarce, and local in Yorkshire. In Scotland it is recorded in Clydesdale, and at Bridge of Allan; also in Aberdeenshire, and as far north as Moray. In Ireland it has been found in Galway and Kerry, and is said to be widely distributed. Abroad it is common in Central and the greater part of Southern Europe; in Livonia, Armenia and Asia Minor; also evidently in some parts of Africa, since it has been received—and named *Vicaria*—from the Congo.

8. **L. Griseola**, *Hüb.*—Expanse, $1\frac{1}{4}$ to $1\frac{3}{8}$ inch. Fore wings broad, shining, spotless grey (or yellow); costa narrowly pale yellow; hind wings yellowish-grey or pale yellow.

Antennæ slender, regularly fringed with delicate bristles in the male; reddish-brown or dark grey, yellow at the base. Head pale yellow; thorax grey, yellow in front; abdomen rather broad, yellowish-grey, more yellow behind, with a very short yellow anal tuft. Fore wings rather broad; narrow at the base but rapidly widening; costa much arched; apex bluntly angulated; hind margin much rounded; dorsal margin rather straight, shining slate-grey; costal margin broadly pale yellow at the base and to near the middle, where it shades off, leaving only the extreme edge yellowish; cilia grey; hind wings broad and ample; apex bluntly rounded, with a slight hollow below it in the hind margin, which is otherwise rounded; pale yellowish-grey with the base pale yellow, or the yellower colour invades the middle of the wing, or sometimes occupies its whole surface; cilia yellowish. Female

similar, with simple antennæ; very slightly larger. Under-side of the fore wings slate-grey with the costal margin yellow, and the hind margin often yellowish-grey, or pale yellow with grey nervures; hind wings and body pale yellow; legs grey.

There is a permanently recurrent variety, common in some of its more fenny haunts, in which the grey colour of body, legs, and wings entirely disappears and is replaced by yellow, sometimes pale yellow, at others a richer colour, or with, in some cases, a superficial shade of greyish. This variety is also yellow on the underside, with the exception, sometimes, of a grey cloud on the fore wings beneath. This yellow race was longed looked upon as a distinct species under the name of *L. stramineola*, Doubleday, and it was not until the ordinary grey form had been reared, by the Rev. J. Hellins, from eggs of the yellow race which I obtained for him, that the identity of the two was thoroughly established. Intermediate varieties—grey clouded with yellowish—are occasionally found, but they nearly always fade after death into one of the two established colours. A specimen, however, taken in Berkshire by Mr. W. Holland, although of the grey form, has the costal margin broadly and strikingly yellow throughout. In the collection of the late Mr. F. Bond are two of a peculiar dull dark yellow, almost brownish-yellow; whence obtained is not known.

On the wing in July and August.

LARVA one inch long; stout and uniform in thickness; head small, brilliantly black. Body covered with stiff dark brown hairs, which are short on the back, longer on the sides, and still longer at the extremities; colour rich velvety blackish above, dingy blackish-brown below. Dorsal line deep black, enclosed in a broad purple-black dorsal stripe, outside which, on each side, is a narrow orange stripe containing a row of black raised dots, and spreading into a broad orange blotch on the second and third segments, and on the thirteenth into

two large squared marks. Spiracular stripe pinkish-grey, much interrupted by the usual raised spots. Undersurface and legs purplish-grey. Variable, sometimes the whole dorsal surface being purplish-black or purplish-brown, or the orange-yellow prevails and occupies most of the space, leaving only the lines grey.

September to May on lichens, particularly *Lichen caninus*, and other species growing on trees and bushes in swampy places; but will eat mosses, withered leaves of willow, and also leaves of plantain and other low-growing plants.

PUPA short, stout, reddish-brown; its anal segments not usually withdrawn from the old larva-skin. In a thin silken cocoon, into which bits of moss and lichen are interwoven, under a stone or other protecting surface. (Hellins.)

The moth loves moist, shady places, very damp woods, marshes where there are plenty of alders or willow bushes, but most especially fens. It hides, among undergrowth principally, in the daytime, but may occasionally be seen sitting about on the leaves of bushes. At dusk it flies freely in a swaying, tacking manner about bushes and trees or over the undergrowth of the fens, and is not averse to "sugar" placed to attract *Noctua*, nor to honey-dew on willow leaves. Late at night it flies again very generally, and is strongly attracted by light. It appears to be more particularly lively on damp, drizzling evenings. When flying at dusk the yellow variety is by far the more conspicuous. Extremely abundant in the larger fens of Norfolk and Cambridgeshire; in the former accompanied by the variety *stramincola* in very considerable numbers, while in the fens of Cambridgeshire the latter is comparatively rare. Found also in some plenty in the New Forest; at Chertsey, Surrey; and near Reading, Berks, in each case accompanied by *stramincola*; otherwise the latter is scarce, or even very rare, or absent; while the typical grey form occurs probably in every marsh of sufficient extent, and damp wood in the southern and eastern counties;

also, though far less commonly, in Devon, Somerset, Pembrokeshire, Herefordshire, Cheshire, and even Yorkshire, where it has been found commonly near Scarborough. Dr. F. B. White records it in Scotland, in Moray, but I know of no record in Ireland, though it is difficult to believe the species to be totally absent. The variety *stramineola* appears to be confined to England, but the typical grey form is widely distributed through the temperate portions of Northern Europe, Central Europe, Northern Italy, and Finland; also in the Ural Mountains, Siberia, Tartary, and Japan.

9. **L. rubricollis**, *L.*—Expanse, $1\frac{1}{4}$ inch. Sooty-black, with a red collar, and the abdomen tipped with orange-yellow.

Antennæ threadlike, very slightly fringed with fine bristles in the male; black; head smoky-black; collar scarlet or orange red; thorax smoky-black; abdomen black on the back, from the base more than half its length, then light orange-yellow. Fore wings long, not very narrow, and rather even in width; costa and hind margin gently rounded; apex blunt; dorsal margin nearly straight; hind wings rather broad, but not very ample; apex blunt; hind margin slightly hollowed below it, then rounded. All the wings unicolorous smoky-black; when freshly emerged almost velvety black, but soon fading a little. Female with simple antennæ; otherwise similar. Underside smoky-black, except that the tongue, which is short, is pale yellow; and the abdomen is bright ochreous.

I have seen but one variation—a male from the New Forest, in the collection of Mr. F. N. Pierce, having hind wings of a pale grey. Stephens records a specimen having an elongated, naked patch on the fore wings, but this would simply be from failure of the scales. It is a conspicuous and striking-looking insect, totally unlike the other species in the genus, and, so far as I know, having no very near allies in any part of the world.

On the wing from the end of May to the beginning of July.

LARVA one and a quarter inch long. Elongated, tapering to each extremity; head rounded, blackish; body grey, freckled with yellow, especially upon the back; dorsal line slender, whitish; subdorsal line irregular, undulating, and broken, black; spiracular line similar; the usual spots crimson, forming rows down the body, and emitting tufts of grey or grey-brown hairs; legs and prolegs grey except the anal prolegs, which are blackish. When young the spots are of the colour of the body, and the lines broader black, interrupted between the segments.

July to October or November, on lichens upon the trunks and branches of trees, more especially fir, oak, and beech, and on the lichens which grow on old park palings, fences, and gates. Hiding in the daytime in chinks of the bark of trees, as well as among the lichens, but sometimes moving about in the afternoon. The minute powdery lichens are relished as much as those of larger size.

PUPA short and stout; abdomen tapering but blunt behind; shining red-brown. In a flimsy, silken cocoon, very close-fitting, under moss or fragments of rubbish, at the foot of a tree or on the ground under leaves, in some cases several spinning up close together. The larva remains in the cocoon for nearly a month before assuming the pupa state, which is continued through the winter.

The moth flies in a lively manner about the branches of trees in the midday and afternoon sunshine, and in certain years, when from unknown causes its numbers have enormously increased, the more favoured trees in woods are surrounded by flying, dancing multitudes almost as thick as swarms of bees. This was the case in 1856, when the woods in Kent and the New Forest appeared alive with them. The same was noticed in 1872 and 1881, and last year (1893) in the New Forest it was somewhat similar. In 1858, as recorded by Mr. G. Balding, the woods near King's Lynn appeared as though in a black snow-storm. In other

years the numbers are far less, and in some it is hardly seen. Before and after flight it sits about the trees and on the ferns and bushes under them, confining itself mainly to woods. There must also be a night flight, since the insect has been found to come to sugar, but, from the blackness of the moths, and their flight being around trees, this is little noticed.

Probably common, in its favourite years, in almost all the woods in the South of England as far north as Herefordshire, Cambridgeshire, and Norfolk, but this happens rarely, and as a rule it is not abundant except in a few very favoured spots in the southern coast counties. In Cheshire, Yorkshire, and Cumberland it is scarce and extremely local. Apparently more widely distributed in Scotland. Twenty years ago Sir Thomas Moncrieff took it not uncommonly at Moncrieff Hill, Perth, but from that time it seems to have disappeared there; said to occur at Thornhill, Dumfriesshire; at Invermay, Balthayock, Fyvie, and elsewhere in the Solway, Argyle, and Dee districts. In Ireland it was taken formerly in the Dublin district by the Rev. J. Bristowe, and has been found at St. Clerans, Galway, by the Hon. Miss Lawless; one specimen has been obtained at Castletown, Cork, but the species does not appear to be very generally distributed in Ireland. Abroad it is found throughout Central Europe and the temperate portions of Northern Europe; in Sicily, Dalmatia, Siberia, Tartary, and Asia Minor. I know of no species nearly allied to this in any part of the world.

Genus 5. **ŒNISTIS.**

Fore wings long and rather narrow, slightly contracted beyond the middle; hind wings ample; thorax and abdomen of moderate breadth.

This genus, consisting of but one species in Europe, is closely allied with the preceding and sometimes included in it. The male has the button of scales on the underside of the base of the fore wings.

1. **Æ. quadra**, *L.*—Expanse, $1\frac{1}{2}$ to 2 inches. Fore wings of the male grey, spotless, with the base yellow, edged with blue-black; of the female yellow, with two opposite black spots; hind wings of both pale yellow.

Antennæ slender in the male, ciliated with short, slender bristles, blackish; palpi and face blue-black; upper part of the head orange; thorax rich ochreous or orange-yellow; abdomen brown, thinly covered with yellowish-white scales toward the base, but yellower behind; anal tuft yellow, mixed with smoky-grey. Fore wings long, narrow at the base, rapidly widening, but from the middle almost of even width, yet rather tending to become narrower towards the hind margin; costal margin gently and regularly curved; apex very blunt; hind margin oblique and slightly rounded; dorsal margin strongly rounded from the base, then nearly straight; shining slate-grey with a faint intermixture of glistening yellow, usually having a broad ill-defined darker grey shade near the hind margin; base deep yellow, except at the costa, which is sharply blue-black for about a quarter of an inch; cilia grey. Hind wings very ample, with the apex bluntly rounded, and below it the hind margin for some distance almost straight, thence rounded; pale yellow, shaded with pale grey along the costal region; cilia yellowish. Female larger, with simple antennæ, and rather different in the shape of the fore wings, the costa being slightly bent beyond the middle, where the wings are broadest; bright light golden-yellow, with a conspicuous blue-black or smoky-black spot on the costa just beyond the middle, and another, rather smaller, near the middle of the dorsal margin. Hind wings pale yellow at the base, shading into golden-yellow at the hind margin; cilia bright yellow; head and thorax also yellow. Underside of all the wings in the male pale yellow; the costa of the fore wings broadly clouded from the base with smoky-black, and the remainder of the fore wings and costal region of the hind clouded with pale purplish-grey;

thorax and sides of the abdomen yellow; legs long, blue-black; undersurface of abdomen smoky-black, with a bluish gloss. Underside of the fore wings of the female dull yellow, with the two black spots faintly visible; hind wings whitish yellow, deeper in colour at the margins; thorax and abdomen deep rich yellow; legs long, blue-black.

Rather variable in size in both sexes, the largest males being larger than the smaller females, otherwise variation is rare; but in Dr. Mason's collection are two females without the black spots, and a male with the grey of the fore wings a very deep slate colour; in that of the late Mr. F. Bond is a female having the costal spot large and extended along the margin into a streak; while Mr. S. Stevens has one in which this takes place on one side only on the upper surface, on both sides below, and Mr. S. J. Capper possesses a male having the margins and apex purplish black.

On the wing in July.

LARVA $1\frac{1}{2}$ inch long; moderately stout, tapering a little in front and behind; usual spots slightly exserted and bearing radiating tufts of hairs curled a little at their tips; anal prolegs protruded. Head rounded, shining black; dorsal portion of the body bright primrose-yellow; dorsal line pale grey, double and chain-like, edged with black wedges on the second segment, and interrupted on the third and fourth by a large black cross, and on the eighth by a black bar; subdorsal line broad, velvety black, interrupted by a round orange-coloured spot on each segment, except the last two, on which the spots are black. Below the subdorsal region the yellow colour is bounded by a stripe of reddish-grey, shading downwards into yellowish-grey, and below the spiracles to darker brownish-grey. Hairs grey or blackish; legs and prolegs dark brown. (Buckler.)

September to June, hibernating when small. Feeding upon *Lichen caninus*, but only on the dark surface thereof, avoiding the paler inner substance; also on other lichens,

especially those which grow upon oak, and at times even nibbling oak leaves. Very active and lively, running rapidly over its food when disturbed, yet docile in confinement, and easily reared. Nevertheless, it has a depraved habit of eating its companions in confinement. Mr. W. H. B. Fletcher says that its hairs have urticating properties when handled by a person having a tender skin.

PUPA rather cylindrical, rounded in front, very blunt behind, glossy black. In a large, rather loose, roundish silken web, in which the larval hairs are interwoven, and having inside it a slighter case of finer silk. Under moss or lichens on the trunks of oak trees or at the base thereof ; or at times underneath leaves, under the trees.

The moth usually sits in the daytime upon oaks, either on the trunk or branches among the lichens or among the leaves ; and its wings being closely rolled round its body, the resemblance to a rolled-up leaf is sufficiently close to serve for concealment. Sometimes it hides in fir trees. When disturbed it darts toward the ground, hardly opening its wings, but will catch by its long, strong legs at any twig or projection in its way and hang there. At dusk it flies strongly, and also at night ; and is very fond of the sugar daubed on the trees to attract *Noctua*. Also occasionally found attracted by flowers, such as those of the lime tree, or even those of Umbelliferæ. Usually found in large woods, and in them much attached to particular spots ; but apparently it has also a remarkable taste for wandering long distances, since the notices of capture of isolated specimens in unexpected districts are rather numerous. Its headquarters in this country is the New Forest, Hants, and here in some seasons it is common or even abundant. Formerly it was said to be common at Amesbury, Wilts, and at Kimpton ; also in Epping Forest, and in other large woods near London, especially at Black Park. Even close to London casual specimens have been taken at New Cross, Highgate, and Putney. In Kent, Sussex, Hants,

Dorset and Devon it is widely distributed, though usually scarce ; and the same may be said with regard to Norfolk, Suffolk and Essex ; yet it has been found commonly at Aldeburgh. Rare in Gloucestershire, Surrey, and Cambridgeshire, though it has occurred at Chatteris, Ely, and near Wicken, in the latter county. Also recorded from Tresco, Scilly Isles ; Redcar, Scarborough and elsewhere in Yorkshire ; Newby Cross, Cumberland, near Hartlepool, Durham, South Shields, and Newcastle-on-Tyne ; also, on the Scottish border, in Berwickshire. In Ireland, a single specimen appears to have been obtained in the county Wicklow in 1877. Abroad it has a wide range—South Sweden, throughout Central Europe, Livonia, Dalmatia, Siberia, Armenia, Tartary, and Japan ; specimens in both sexes from the last-named country, though placed under the name of *Dives*, being precisely identical.

Family 7. ARCTIIDÆ.

Antennæ in most cases shortly, but strongly, pectinated with solid rays or teeth in the male ; fore wings generally broad, and rather squared ; hind wings usually ample ; in most species with all the wings handsomely coloured, and in many cases with striking markings of irregularly-placed bands, stripes, and spots.

LARVÆ very hairy, usually not tufted.

PUPA of ordinary rounded form, moderately blunt behind, in a loose, silken cocoon.

This family includes many of the most brilliantly-coloured species of the group, having the most eccentric markings, and in some cases being among the most variable. The hind wings are frequently as brilliantly-coloured as the fore wings, in many cases more so. These brilliant species are commonly known with us as “tiger-moths.” Why, it is difficult to conjecture, since their stripes are by no means regular nor parallel.

Genus 1. **EULEPIA.**

Antennæ of the male with short, solid pectinations; fore wings rather narrow, but broadening gradually from the base; hind wings with a hollow in the margin below the apex; thorax and abdomen not stout.

1. **E. grammica**, *L.*; **striata**, *Staud. Cat.*—Expanse, $1\frac{1}{4}$ inch. Fore wings pale yellow with black longitudinal lines; hind wings yellow with black margin.

Antennæ rather slender, but in the male regularly pectinated, the teeth being short, thick, and densely covered with fine bristles; shaft pale yellow, pectinations black. Head black; palpi yellow, densely covered with scales. Thorax pale ochreous having a black spot on each half of the collar, a black stripe down the middle of each shoulder-lappet, and another down the middle of the back; abdomen deep yellow with a dorsal row of black spots or cross-bars. Fore wings rather narrow, elongated, especially so at the apex; costa very slightly curved; apex and hind margin rounded; dorsal margin straight; dull pale ochreous with black longitudinal stripes edging the nervures, but each stripe broken and slightly shifted or displaced before the hind margin, the portions beyond the line of displacement being thickened; costal and hind margins edged with a black line; at the termination of the discal cell in the middle of the wing is a transverse spot or short bar; cilia yellow. Hind wings broad and ample, with the apex rounded, and the margin beneath it hollowed and thence rounded behind; deep rich yellow with a broad black stripe along the dorsal and hind margins, terminating before the anal angle; a large black lunule in the middle of the wing touches the costal black stripe; and there are dashes of blackish from the base; cilia rich yellow. Female stouter and rather broader in expanse; fore wings much paler yellow, and

having only faint indications of the black longitudinal stripes, which indeed are often obsolete; hind wings paler yellow than in the male, with the markings of a dull black; antennæ simple. Underside rich yellow, with the central spot in each of the wings indicated by a pair of black dots; a row of black spots or streaks near the hind margins, those of the fore wings often prolonged into black lines on the nervures; base of the fore wings somewhat clouded with long black dashes; abdomen deep yellow; legs blackish above, yellow beneath. Occasionally a variety of the male takes the paler colour of the female.

June and July.

LARVA dark brown, with an orange streak on the back and a white one on the sides, reddish-brown warts covered with foxy-red hairs, and reddish-brown prolegs. (Kirby.)

Hoffman describes it as black-brown, with an orange-yellow dorsal stripe; on each side two rows of red-brown spots with fox-red hairs; and above the feet, on each side, a whitish longitudinal line; head black-brown.

August to May, hibernating in a web-like nest on the ground among low plants; feeding upon *Festuca duriuscula*, *Hieracium pilosella*, *Artemisia*, *Plantago*, *Calluna*, and other plants.

PUPA red-brown; in a greyish-white loose cocoon.

The moth is said to frequent warm, dry places, especially heaths, but is so exceedingly rare in this country that little is known of its habits. Stephens (1829) recorded that he had seen two indigenous examples, both males, and taken in 1815 near Windsor; and that one specimen had been taken by Mr. Donovan in the Isle of Anglesea. One specimen, labelled "taken at Windsor," is in Dr. Mason's collection.

In the year 1859 the capture of one specimen in Essex, and of another in North Wales, was announced and apparently confirmed, one of the specimens being exhibited at a

meeting of the Entomological Society of London in February, 1862, by its captor, and particulars of capture given. Mr. Hodgkinson records the capture of a specimen, about the year 1832, in Wharfedale, Yorks, obtained by a local collector by shaking branches of trees. It is now in Mr. Hodgkinson's collection. Finally Mrs. Fraser, a most acute and reliable observer, furnishes the following information: "In June, 1859, near Bettws-y-Coed, North Wales, while walking one evening along a road with heather-clad banks, I found a beautiful *Eulepia grammica*, which looked as if just recently emerged, at rest on a spray of heather. I had no box with me, but a companion made a pocket by rolling up a letter, and into this the insect allowed itself to be taken. We hurried on to a friend's house about a mile away to get a box, but *grammica* was restless, and you may have a faint idea of my feelings when I saw it suddenly emerge from the little paper pocket and escape! Of course, I hunted up and down the locality for days afterwards, but never saw another. I know *grammica* very well; there is not the least doubt about the specimen." The localities of these captures appear to point to a dying out, rather than to an immigrating species, and it is noticeable that three of the records are in North Wales, where much ground is still practically unworked.

Abroad the insect is found almost all over Europe, as well as in Asia Minor, Syria, Armenia, and Siberia, the last-named region producing also a dark variety, with the hind wings suffused with black, and known as *E. funerea*.

2. ***E. cribrum***, *L.*—Expanse, $1\frac{1}{4}$ to $1\frac{3}{8}$ inch. Fore wings elongate, whitish, with dark grey lines and cross-stripes; hind wings grey.

Antennæ of the male with short, regular, distinct pectinations, which are ciliated with fine bristles and of a dark grey colour, the shaft being whitish. Head grey in front, whitish above; thorax greyish-white, with two round black spots on the back of the collar, and one on each shoulder-lappet;

abdomen whitish, with a dark grey bar on the back of each segment; hinder segments tinged with yellow; anal tuft yellow. Fore wings long and rather narrow, especially at the base; costal and dorsal margins nearly straight; apex blunt; hind margin curved and oblique; silvery-white, with three, or sometimes four, transverse oblique bands of cloudy dark grey spots, through which pass longitudinal stripes of dark grey lying beneath the nervures; hind margin dashed with short, wedge-shaped dark grey streaks; costal margin narrowly blackish-grey; cilia shining white. Hind wings broad and ample, rounded, except that the hind margin is hollowed beneath the apex; pale grey or whitish grey, with the base and costal and hind margins darker grey; cilia silvery-white. Female very similar, with simple antennæ; abdomen short and rather stout, and the wing markings showing a tendency in many cases to disappear from the base and hinder area, leaving the central portion with dark stripes, sometimes much clouded. Underside of fore wings uniform dark grey, with white cilia; of hind wings dull pale grey, sometimes whitish towards the dorsal margin, but with the hind margin slightly dark; cilia greyish; body and legs grey.

Variation sometimes takes the direction of suffusion, the longitudinal grey stripes becoming extended, and absorbing the bands of spots. In other cases the fourth transverse band of spots almost disappears, leaving the apical portion of the fore wings whitish with a few grey streaks. Other specimens are very white, with the spots small but regular; while in others the spots coalesce, stretch out into streaks, or shade off into longitudinal clouds, when both fore and hind wings become smoky-grey. In the collection of the late Mr. F. Bond, now in Mr. Sydney Webb's possession, are two very large female specimens of a beautifully white-grey, with but two transverse lines of small dots. A well known and very beautiful variety, found in Southern Europe, and known as var. *Candida*, is entirely silvery-white, without a trace of the dark markings.

On the wing from the middle of June, through July, and sometimes, in late seasons, to the middle of August; but in only one generation.

LARVA $1\frac{1}{4}$ inch long; plump, rather thickest in the middle; head small, brownish-black; body purple-brown or dark brown, with the incisions of the segments paler brown; dorsal line broad, white; tubercular spots raised, white or pale brown, tinged with black, and furnished with spreading tufts of short dark brown hairs or bristles; spiracular stripe pale brown; legs blackish-brown.

August to May on *Erica cinerea* and *E. tetralix* (H. Goss); but Freyer records that he reared larvæ upon *Lactuca sativa*; and young larvæ have been known to eat grass, such as *Aira flexuosa*. Other recorded food plants are *Calluna vulgaris*, *Vaccinium myrtillus*, leaves and flowers, especially the latter; *Aira capitosa*. It is said to feed at night, and to be fond of stretching itself out upon the wiry grasses which grow on heaths.

Pupa short, thick, black-brown. In a light-coloured silken cocoon.

The moth hides among heather in the daytime, but keeps on the alert, and when disturbed, especially in the hot sunshine, rises and flies with great swiftness to a distance, when it again settles on the heather, rising again when approached for another short flight. At other times, when the weather is dull or cool, it often will not fly, but drops to the ground with wings closely folded, and slips away with great agility among the heath stones, so that it can hardly be seen. When captured flying, it will at once drop down in the net, feigning death. A little before sunset it flies naturally over the heather. Entirely confined, so far as this country is concerned, to the extensive heaths of Dorset and Hants, especially those on the borders of the two counties, near Ringwood and Wimborne. Here in some seasons it is fairly

common, but from its swiftness, and trick of hiding close to the ground when indisposed for flight, not very easy to obtain in numbers. There is a record of the capture of a single specimen on Wimbledon Common, near London, in 1872. Abroad it is widely distributed throughout Northern, Central, and Southern Europe, and is found in the Ural Mountains.

Genus 2. **DEIOPEIA.**

Antennæ simple; fore wings triangular, narrow at the base, very broad behind; hind wings broad and ample.

1. **D. pulchella**, *L.* Expanse $1\frac{1}{4}$ to $1\frac{3}{4}$ inch. Fore wings white, with abundant pink and black dots; hind wings white, with blackish margin.

Antennæ rather short and threadlike, but with the joints notched, furnished with pairs of oblique bristles arising from every joint; blackish. Head whitish, with the crown ochreous, and the palpi yellow tipped with black; thorax yellow or yellowish white, with a round black spot on each half of the collar, two on each shoulder-lappet, and three down the middle of the back; abdomen clear smooth white. Fore wings nearly triangular, very narrow at the base, gradually widening, and very broad behind; costal and dorsal margins nearly straight; apex obtuse; hind margin below it nearly straight, and not very oblique, rounded off at the anal angle. White, ornamented with alternate rows of black and crimson dots. Of the black dots two lie at the base, and are followed by a short curved row answering to the basal line; beyond are two more rows, answering to the usual first and second transverse lines, both much curved, and the second often partly duplicated; beyond these in the hinder area is a much straighter line of dots, and a final row lies along the hind margin. Between these black rows are placed the rows of crimson dots, but these are hardly so complete, and are much more liable to coalesce and run into

blotches or lines. At the apex are two short black streaks, closing the last crimson row. Cilia white, invaded by the final row of black dots. Hind wings long and very broad, with rounded apex, and the hind margin very little curved, except towards the anal angle; pure clear white, with a distinct black central lunule near the costal margin, and an irregular black band round the apex and hind margin, very broad round the apex, then much attenuated, again spreading into a broad blotch, and thence narrowing to the anal angle; cilia white. Female rather larger and stouter; otherwise similar. Underside handsome and strikingly coloured, the rows of black and red dots being replaced by stripes or blotches or broad bands of black and more vivid crimson; the marginal markings of the hind wings are also blacker, more sharply indicated, divided into blotches and dots, and also extended along the costal margin, the ground colour remaining pure white; abdomen white, with two rows of black spots; legs blackish, thickly dusted with white scales.

Rather variable, especially in the crimson spotting, which is often pale and sometimes partially obliterated; while the black spots vary much in size and distinctness. As a rule specimens taken in this country have all the dots rather small, more strikingly marked specimens being obtained in more southern countries. One of these forms from Asia Minor has the crimson spots very brilliant and partially confluent, while the black are almost obliterated. In Eastern Asia a form, otherwise normal, has the joints of the antennæ swollen into tiny processes from which the bristles spring.

September and October, but has been observed in July and August, and very rarely in May and June.

LARVA $1\frac{1}{4}$ inch long, rather slender, with the usual spots slightly raised and furnished with thin tufts of barbed hairs, blackish on the back, whitish at the sides. Head red-brown, body grey—dark or pale, spots large and

black; each segment crossed by an orange bar in which the black raised spots are conspicuous; dorsal line whitish; spiracular stripe white, sometimes branching out on the upper side; on the back of each segment, near the dorsal line, are two white dots. Very variable in depth of the general colour and in the distinctness of the markings. When younger the bristles are fewer and the orange bars or spots brighter.

On *Myosotis palustris*, *M. versicolor*, and probably other species of Forget-me-not; also *Borago officinalis*, *Mirabilis jalapa*, *Heliotropium Europæum*, and *Solanum tomentosum*. Feeding on the leaves, mainly in the sunshine—indeed so dependent upon sunshine that in dull wet weather it refuses to feed at all. From this cause I lost all but one of a promising young family of larvæ (of French parentage, the eggs from which the previous brood had been reared having been sent to Mr. Tugwell, from Mentone, by the late Mr. Sidebotham). These were eagerly feeding upon *Myosotis* in a sunny window, and one had become full grown and had spun up, when a week of wet weather supervened, and the remaining larvæ refused to eat, or even to *move*, and all died, the single spun-up individual alone reaching the imago state. July—but doubtless in two broods, or more, wherever it can permanently exist—the first brood, after (probably) hibernating young, feeding up in May.

PUPA short, abdomen rather thick and blunt behind; glossy orange-brown, with the eye-cases and edges of the wing-cases blackish, and dark-brown transverse lines on the backs of the abdominal segments. In a very slight silken cocoon; probably on the ground among rubbish.

The moth is very rare in this country, and perhaps can hardly be called a permanent resident in the sense of regularly perpetuating its species. Its powers of flight are extraordinary considering the delicacy of its structure, and it has been known to fly on board ships hundreds of miles

from land. Mr. McLachlan furnishes the following particulars in the *Entomologist's Monthly Magazine* for 1885:—
“My friend, R. H. Scott, Esq., F.R.S., Secretary to the Council of the Meteorological Office, recently gave me a good specimen of *D. pulchella*, which had been forwarded by Captain Renaut of the sailing-vessel *Pleione*, one of those who keep a log-book in connection with the office. A memorandum accompanying the moth stated that it was captured on March 27th, 1885, in lat. $0^{\circ} 47'$ N., long. $32^{\circ} 50'$ W., the vessel at the time being homeward bound from Wellington, New Zealand, and had not touched at any other port. The position lies about 960 miles S.W. of the southernmost of the Cape Verde Islands; about 440 miles N.E. of the nearest point on the South American coast; and about 260 miles W.S.W. of the barren islet known as St. Paul. As the fact was interesting I obtained, through the courtesy of Captain Renaut, some additional information:—‘There were a great many about the ship—many hundreds I should say—as parts of the rigging, spars, &c., were covered with them. The wind for four days previously had been very light from various quarters, most N.W., N., and N.E., and many hours calm, with very little rain. The N.E. trade wind does occasionally extend to that position at that time of year, but we did not get it till lat. $1^{\circ} 0'$ N., long. $33^{\circ} 0'$ W. I may say that I have frequently in that part of the ocean had moths and butterflies come on board.’ The question now is, Whence did these insects come? *D. pulchella* has not, I think, been noticed in South America. St. Paul’s Rock may also be left out of consideration. I incline, therefore, to the Cape Verdes. After this experience in Mid-Atlantic, is it surprising that stragglers of this pretty moth occasionally visit our islands?”

Clearly it is not at all surprising, but exactly what might be expected. As a rule, our specimens are found on the south coast, sometimes within a few hundred yards of the

sea, where doubtless they have obeyed a natural instinct in settling down as soon as they descried suitable ground. Among coarse herbage in the more sheltered spots on the cliffs, stubble-fields—where *Myosotis arvensis* grows in plenty—turnip-fields, weedy banks, and similar, more or less sheltered, spots seem to be most frequently chosen. When disturbed, the moth flies but a short distance, settling again in a similar place, and from folding or almost rolling its wings tightly around it as it alights, looks much like one of the grass-frequenting moths of the genus *Crambus*, but it is shy and easily disturbed again. When captured it falls as though dead to the bottom of the net. It has been seen to be attracted by flowers in the sunshine, here more especially by those of Heliotrope; but abroad by Rosemary, Myrtle, *Cistus*, *Trifolium* and *Cytisus*, and while flying round them, from its white colour, has a resemblance to the common white butterflies. Doubtless the females, on arrival, deposit eggs; and there is equally little doubt that a few of the resulting larvæ in favourable seasons arrive at maturity, since the moths are occasionally taken in the most perfectly fresh condition; but the peculiarity of the larva, already noticed, of refusing to feed except in sunny weather, combined with our somewhat inclement climate, appears to put a stop to the natural increase, or even permanence of the species. It is necessary to insist the more strongly upon this, because the insect is clearly double-brooded *at least*, perhaps triple, wherever it is able to maintain itself; and *here*, when reared, the larvæ feed up quite rapidly—in a fortnight even—and remain but a short time in pupa; while the moth is scarcely ever found with us except in the autumn—a time when its rapid increase abroad has evidently induced migration in a species clearly predisposed to such a movement. If it were permanent with us, however rare, the occurrences of specimens of an earlier brood would surely be as frequent as those of the later. It was noticed by our earliest writers, always as a rarity, but has been taken in very many years, perhaps

almost every year. In 1871 there was either a considerable immigration or an exceptional opportunity for larvæ from the eggs of the usual migrants to feed up, since forty or fifty specimens were taken in different places throughout the country. About a dozen are recorded in 1874, and a score each in 1875 and 1876; also several in 1892. The localities are so numerous as to defy record. The great majority of specimens have been found along the south coast, at Dover, Folkestone, Hastings, Brighton, Worthing, Eastbourne, Ventnor, Christchurch, Bournemouth, Lulworth, Swanage, Torquay, Dartmouth, Plymouth, and elsewhere at the seaside, even down to East Looe, in Cornwall. More rarely inland in all these coast counties; still more rarely, apparently, or singly, in all the counties of the southern half of England. There are records in Herefordshire, Derbyshire, Cheshire, Lancashire, and Yorkshire; and one, quite recently in the present season, in Staffordshire, where the Rev. T. W. Daltry, to his great astonishment, disturbed the moth in a meadow. In South Wales it has been taken at Neath and in Monmouthshire; once in the extreme South of Scotland; and once at Ardmore, in the county Waterford, Ireland.

Abroad its range is most extraordinary; Central and Southern Europe, North Africa, Ashanti, South Africa plentifully—perhaps all over Africa—Asia Minor, Armenia, Northern and Southern India, Ceylon, the Philippines, Keeling Island in the Indian Ocean; New Guinea, New South Wales, Queensland, South Australia. No closely allied species is known in Europe, but several, and some of them very striking in appearance, are found in Northern India, Java, Sumatra, Mauritius, and North and South America.

Genus 3. **EUCHELIA.**

Antennæ threadlike, but each having a pair of delicate bristles. Fore wings narrow at the base, becoming rapidly

broader ; hind wings ample, rather elongated ; thorax narrow ; abdomen short.

1. **E. jacobææ**, *L.* Expanse, $1\frac{1}{4}$ to 2 inches. Fore wings smoky black with a red stripe and two red spots ; hind wings red, without markings.

Antennæ black, threadlike, with a few oblique, hardly perceptible bristles ; head, thorax and abdomen velvety black ; forewings rather triangular, narrow at the base, very broad behind, with the costa slightly curved, apex and hind margin rounded, and dorsal margin straight ; smoky blackish-grey with a light crimson or rather cinnabar-coloured stripe from the base near the costa to just before the apex, where it is slightly expanded ; another stripe of similar colour from the base runs along the dorsal margin tapering to a point beyond the middle ; and near the hind margin are two roundish crimson spots, one just below the apex, the other above the anal angle ; cilia smoky-grey. Hind wings rather long and very ample, regularly rounded at the apex and hind margin ; bright crimson, scarlet, or cinnabar, edged along the apex and hind margin with smoky-grey ; cilia smoky-grey. The bright colour of the hind wings agrees with that of the stripe on the dorsal margin of the fore wings and renders it very inconspicuous. Female rather larger and stouter, otherwise similar. Underside an exact copy of the upper ; body and legs deep velvety-black.

Usually very constant in colour and markings. One, in Mr. Bond's collection, has the red colour replaced by bright yellow. It is said to have been taken long ago in Horningsea Fen. One recorded in Devon had the hind wings blotched with yellow ; and another from Brighthampton is said to have had the markings of the fore wings ochreous while the hind wings were buff. In rare instances the dark colour of the fore wings becomes light olive grey, or the hind wings darkened with smoky grey. Such specimens are in Mr. S. Webb's collection ; and also one devoid of the dorsal crimson

stripe. Mr. C. A. Briggs has a specimen in which the crimson costal stripe is joined to the apical spot; while in Mr. A. Robinson's collection is one having the crimson stripe further continued in a more slender form along the hind margin to the lower spot. Mr. J. J. F. X. King possesses one which has a black streak running inward from the margin of the hind wings near the anal angle.

On the wing at the end of May and in June.

LARVA plump, cylindrical, tapering slightly at each extremity, head rounded, black; body regularly ringed throughout with bright yellow and purplish black; the anterior half of each segment being black streaked with purple, and the posterior half yellow; the whole thinly sprinkled with delicate hairs; legs, pro-legs, and tip of anal segment, black.

July and August; on *Senecio jacobæa* and *S. vulgaris* (ragwort and groundsel), often feeding gregariously in the day time, devouring leaves, buds and flowers, and reducing the plants to mere stumps. Occasionally on other species of *Senecio*, and has been found feeding freely upon *Tussilago farfara* (coltsfoot).

PUPA short, stout, blunt, and without hooks or spikes; uniformly dark reddish purple. Under moss or rubbish of any kind close to or beneath the surface of the ground, or in holes in a dry wall; forming scarcely any cocoon; passing the winter in this state.

Rather a sluggish insect, sitting about on its food-plant and other low plants, and especially in bushes, in the daytime, but flying readily when disturbed, and, from its bright colour, very conspicuous when on the wing. Flying of its own accord in the evening and early part of the night, and coming very eagerly to a strong light. When captured it feigns death and may be rolled about in the hand, or picked up by a wing, or a leg.

Abundant in the South of England, and especially so in the Eastern Counties, delighting in dry, sandy, and chalky districts, and in some parts of Norfolk, Suffolk, and Cambridgeshire so plentiful that a large red cloud of moths may sometimes be shaken out of a bush; scarce in the Midland Counties and in many of them absent, but plentiful in Charnwood Forest, Leicestershire; in limestone districts in Herefordshire and Shropshire; and on sandy coasts in Cheshire, Lancashire, Cumberland and Yorkshire; otherwise widely spread, but scarce in the Northern counties. In Scotland, it is found in the Clyde and Moray districts, and in the Isle of Bute. Sir Thomas Moncrieff found it formerly about Moncrieff Hill, Perthshire, but he believed it to be, there, an introduced species, and it ultimately died out. Common in many parts of Ireland, even as far north as Londonderry, and plentiful round Dublin, where it used to be one of the most abundant species on the gas-lamps in the suburbs.

Abroad it is common all over Europe, except the extreme north, also in Siberia, Armenia, and various parts of Asia Minor.

No species closely allied to this appears to be known from any part of the world.

Genus 4. **CALLIMORPHA.**

Antennæ threadlike, but with a pair of fine bristles to each joint; fore wings long and moderately broad; hind wings rather long, somewhat ample, very gaily coloured; thorax rather narrow, but abdomen stout.

1. **C. dominula**, L.—Expanse $1\frac{3}{4}$ to $2\frac{1}{4}$ inches. Fore wings metallic green-black with large whitish spots; hind wings crimson with black blotches.

Antennæ black, thread-like, but finely serrated, and with minute distant bristles; head deep black; thorax blue-black

with a longitudinal orange stripe on each side of the centre ; abdomen pale scarlet with a blue-black band at the base, a broad black dorsal stripe, and the anal segment, with its tuft, black. Fore wings long, rather narrow at the base, moderately broad beyond, with the costal margin gently curved, apex rounded, hind margin rounded and very oblique, and dorsal margin almost straight ; rich glossy metallic green-black with pale orange and creamy-white spots ; three of these are placed in a triangle before the middle of the wing, and are edged with deep black, the upper two being pale orange, or yellow dashed with orange, the lower creamy-white ; beyond these, three large creamy-white spots form a sort of transverse band from the costa to the anal angle ; towards the apex are three, four, or five more, all small and creamy-white ; and near the base of the dorsal margin is a single spot elongated and of a deep yellow ; cilia extremely short, green-black. Hind wings long and rather broad ; almost bluntly angulated at the apex, and with the hind margin, below it, straight, then rounded off ; rich crimson, crimson-scarlet, or pale scarlet, with a large elongated blue-black spot in the middle of the costal margin, from which a blue-black stripe passes round the apex, joins a large irregular blue-black blotch lying across the apex, and touches another irregular blue-black blotch on the hind margin ; another irregular and often divided deep black elongated blotch arising on the anal angle nearly meets it, so that except for a small central space the hind margin is bordered with black and banded with black blotches ; cilia scarlet or black, similar to the adjacent margin. Female rather stouter, otherwise similar. Underside of the wings an exact copy of the upper except that the three middle spots of the fore wings are all yellow ; thorax blue-black with a red spot under each shoulder, abdomen and legs deep black.

Some local variation takes place in the colour of the spots on the fore wings, these being in Pembrokeshire wholly creamy white, in Monmouthshire those near the middle of

the costa are partly white and partly yellow, while in Kent the yellow deepens to orange and occupies these two spots completely, sometimes extending to the third. Mr. A. E. Hall has a specimen with all the spots of the fore wings pale orange, and Dr. P. B. Mason one in which they are large and reddish, while one in the collection of the late Mr. F. Bond has them all of a lovely yellow. Others exist in several cabinets in which these spots are all dull black, the remainder of the fore wings being of the usual brilliant green-black, or even bluish-black. Another phase of variation is in the colour of the hind wings, which occasionally, though rarely, become pale yellow, bright yellow, dull golden, or orange, or the black spots are bordered with yellow. Mr. S. Webb has one with the hind wings black, another in which they are suffused with smoky-black, and a magnificent specimen in which the spots of the fore wings are very large, partly confluent and wholly white.

The form with yellow hind wings seems to have been described, as a species, under the name *Rossica*, *Kolenati*; and that with the pale spots tinged with reddish has been called *Bithynica*. On the wing in June.

LARVA rather elongated: head rounded, shining black: body black, with a broad bright yellow dorsal stripe, much intersected by the black ground colour, and enclosing two white spots on each segment; similar lateral stripes, each with one white spot on each segment; below these a row of white spots; usual spots raised into shining black warts emitting bunches of black bristles; legs black. (C. Fenn.) When young the tubercular spots are white, and the yellow interrupted stripes paler in colour.

July or August to May, hibernating, when small, close to the ground among its food-plants, coming forth in April and then rapidly feeding up. At this time it is extremely active, and feeds eagerly in the sunshine. Polyphagous, and apparently having local tastes as to food plants. In the chalk

and coast districts of the South of England, it is said to feed on *Cynoglossum officinale* (Hound's-tongue), and also on stinging nettle; but in the fens of Cambridgeshire its favourite food is *Salix repens*, though it greedily eats blackthorn, bramble, other species of willow, groundsel, meadowsweet (*Spiræa ulmaria*), and various other low growing plants.

PUPA stout; head blunt and rounded; tail having several stout bristles placed side by side; dark red, shaded on the head back and abdomen with blackish. In a slight cocoon of white silk among leaves and rubbish on the ground. (C. Fenn.)

The moth appears to fly only in bright sunshine, and I have even seen it flying over trees at the edge of a wood on a very hot day, but usually it seems to be sluggish and to sit about among the herbage, making itself far less conspicuous than appears probable in so gorgeous an insect. Formerly it must have been far more abundant and widely distributed than at present; Stephens says that it was at one time plentiful near Charlton and Blackheath, but then (1829) was getting scarce near London. It was also most plentiful at Whittlesea Mere and Burwell Fen, but was nearly exterminated in those localities when they were drained. It still lingered in Wicken Fen, and in 1873 had become abundant there, so that larvæ were seen in thousands; but has since been less common in that district. In 1858 it was most plentiful at Deal, and still occurs, though seldom in profusion, in that neighbourhood. It is found, here and there, in marshy places in Hants, Dorset, and Devon, and very rarely in Sussex. In Gloucestershire and Monmouthshire more widely distributed, and probably through South Wales, since I have found it in wood-paths in Pembrokeshire. In Berkshire it has been found in the marshy meadows near the Kennet and formerly extended up the Thames valley to near Oxford. In Wiltshire it has been found plentifully near Salisbury. Rare in Hertfordshire, Suffolk, and near Cambridge. In 1878 two specimens were taken at Burgh near Aylsham, Norfolk, but these may

possibly have been descendants of larvæ which were sent into Norfolk from Wicken in 1873, by Mr. F. D. Wheeler, and turned out in Ranworth Fen. No district would seem more suitable to the species than these Norfolk fens, yet there is no other record of its occurrence there.

Abroad it is found throughout the temperate portions of Northern Europe, Central Europe, Italy, Central Spain, Turkey, Greece, Dalmatia, Southern Russia, Armenia, and Asia Minor.

2. **C. Hera**, *L.*—Expanse 2 to $2\frac{1}{2}$ inches. Fore wings very broad; blackish, with straight white stripes; hind wings crimson, with black spots.

Antennæ black, slender and threadlike, but having, in the male, two rows of minute, hardly distinguishable, slender bristles; tongue rather long, bright chestnut; top of the head deep yellow; palpi black, and above them, on the face, is a round black spot; collar black, edged with yellowish white; thorax creamy white, almost occupied by three long tapering black stripes, one down each shoulder lappet, and one down the back; abdomen dull pale scarlet, with a row of small black spots down the middle of the back. Fore wings somewhat triangular, being narrow at the base and extremely broad behind; costa gently and regularly curved; apex very bluntly angulated or almost rounded; hind margin straight and hardly oblique, but rounded off towards the anal angle; dorsal margin straight. Deep velvety black with a greenish gloss. From the costa proceed six creamy-white stripes, the first, arising at the base, is slender, short and very oblique; the second extremely short and slender; the third, from before the middle of the costa, is broad and straight, proceeding towards the anal angle, before reaching which it tapers to a point; the fourth, from the middle of the costa, is oblique, short, slender, often tinged with deep yellow; the fifth, broad, extending from the costa beyond the middle to the anal angle; the sixth, also broad, from the costa near the apex,

proceeds almost parallel with the hind margin to the anal angle, forming there, with the fifth, a large creamy blotch which throws off creamy streaks inward and outward, so as to enclose two black spots and some marginal dots or small spots. This large creamy blotch is often dashed or clouded with deep yellow from the margin, and the sixth stripe is tinged with the same at its costal extremity. The whole dorsal margin is occupied by a straight creamy-white stripe which also joins the blotch at the anal angle. Cilia on the margin of the black portions blackish, but with one or two yellow dashes; on the creamy margin deep yellow.

Hind wings long and very ample, rounded behind; rich crimson-scarlet with black spots; one in the middle of the wing large, roundish or ovate; another forming a large irregular blotch in the apical space, and having a smaller one outside it; a large ovate spot near the middle of the hind margin, and a very small one near the anal angle.

Underside extremely brilliant; costal region and stripes of the fore wings orange-yellow, except that several white spots lie toward the apex; central area broadly banded and blotched with black; basal area dull scarlet; hind margin broadly deep yellow; hind wings pale scarlet, or partially orange red, the large central and apical black blotches of the upper side hardly visible, but that in the middle of the hind margin deep black; body and legs whitish, tinged with orange; tarsi barred with black.

There is one constant, and frequently recurrent, variety in which the scarlet of the hind wings and of the abdomen is replaced by yellow, usually a deep rich yellow. This is known as variety *lutescens*, but is connected with the typical form by specimens having hind wings of every intermediate shade of orange, orange-red, and dull red. A complete series of such is in the cabinet of Mr. A. Robinson. There is also occasionally variation in the number of black dots or small spots along the margin of the large creamy blotch at the anal angle of the fore wings, and in rare instances these are all absent.

On the wing at the end of July and through August.

LARVA nearly cylindrical, but slightly tapering at each end; head rather small, rounded, notched above, black; general colour pale brown, dark brown or blackish, with the raised spots paler or sometimes yellow, and each bearing a spreading tuft of stiff pale brown hairs or bristles; dorsal line paler brown, yellow, or orange yellow, repeatedly constricted and interrupted; spiracular lines whitish, broken up into a series of spots, many of them double, and delicately edged with black; spiracles and legs black; pro-legs very pale brown or grey, with darker markings.

September to July, hibernating, when very small, close to the ground, and feeding up in the spring and summer. On lettuce (*Lactuca*), dandelion (*Leontodon taraxacum*), *Borago officinalis*, *Lamium album*, *Plantago*, nettle, groundsel and low-growing plants generally, especially those growing in the shelter of bushes or on banks.

PUPA of moderate thickness, rounded, rather blunt behind. In a very slight cocoon of silk, with little or no admixture of hairs. On the ground under loose moss or rubbish. The hairs in this species seem to remain firmly attached to the larva skin.

Rather a sluggish species. Said to fly in the daytime, and sometimes very active in the hot sunshine, yet certainly prefers to hide itself in hedges or bushes, whence it may, in its very restricted localities, be occasionally beaten out. Even then it does not fly at once but drops down, and if unnoticed, will rouse itself after a few seconds and fly wildly over the road or hedge. Said to have a special fondness for sitting in hedges close to field-gates; and also to be found in corn-fields. Abroad it is reported to frequent stony places covered with flowers, especially in hilly districts. Mr. G. C. Bignell says that in bright sunny weather it flies so strongly and so freely that it may readily be mistaken for a wasted *Argynnis Paphia*. A specimen flying thus and seen to alight,

was so on the alert that it flew away again before a net could be placed over it. Nevertheless there appears to be no doubt that it also flies at night, and its capture at light is recorded.

There appears to be no doubt that this species is a comparatively modern immigrant to this country. No mention is made of it by our earlier authors. The first record appears to be of a single specimen at Newhaven, Sussex, in 1855. Four years later the capture of several specimens, sitting on bramble leaves, on a hill-side near Wrexham, North Wales, was announced, and the specimens were exhibited at the Entomological Society in 1862. In 1868 one was recorded as taken at St. Leonards, and another at Patcham near Brighton; and in 1877 one at Bonchurch, Isle of Wight. In addition to these, one at least has been secured near Dover. But all these appear to have been merely casual specimens—single immigrants, or specimens introduced in some accidental manner—and the insect does not seem to have effected a settlement in either of these localities.

In August 1871 Mr. D'Orville of Exeter found a specimen sitting upon a blossom of *Tanacetum vulgare* at night; two years later others were taken at Hazelwood near Loddswell, Devon. In 1881 it was found at Dawlish. In 1882 the species must have become firmly established, since Mr. W. Brooks states that the first specimen taken by himself at Starcross, "excited no surprise as the inhabitants had seen the species before." From that time to the present it has been found year by year, and apparently in increasing numbers, over that portion of Devonshire extending from Exeter to Teignmouth. Eggs have also been obtained and specimens reared by Mr. A. Robinson, of which beautiful examples have been furnished for the purpose of this work.

Although so recently settled in this country, it has long been known to be common in the Channel Islands on the coast of France. It ranges through Southern and Eastern France, Holland, Belgium, Germany, and many parts of

Central Europe, throughout Southern Europe, Syria, Persia and Eastern Asia.

Genus 5. **EUTHEMONIA.**

Male with pectinated antennæ, the pectinations solid and fringed with minute bristles; fore wings very broad behind, with nearly straight margins; abdomen long and slender. Female with simple antennæ; narrow fore wings; and stout body.

1. **E. russula**, *L.*—Expanse $1\frac{1}{4}$ to $1\frac{3}{4}$ inch. Male, fore wings broad, yellow with red spot and margins; hind wings whitish with blackish spot and border. Female, fore wings narrow, orange-red with a red spot; hind wings reddish with the base, margin, and spot black.

Antennæ of the male regularly and densely pectinated, and fringed with rather short bristles; shaft yellow, pectinations grey. Head and thorax dull yellow, covered with long loose scales; abdomen long and slender, pale yellowish, with a central dorsal row of smoky black spots or bars; anal tuft pale yellow. Fore wings nearly triangular; narrow at the base, very broad behind, with the costal and dorsal margins nearly straight; apex bluntly angulated; hind margin rather rounded, not very oblique; dull yellow, with the margins and cilia light scarlet, and at the end of the discal cell a large kidney-shaped spot of a reddish colour, containing in its lower portion four small blackish spots. Hind wings long and of moderate breadth, very regularly rounded, glossy whitish, often clouded with grey from the base; having a more or less distinct broad cloudy-grey band before the hind margin, which is often divided by pale nervures, and in the middle of the wings a large kidney-shaped grey or blackish spot; cilia broadly light scarlet.

Female quite different, considerably smaller, with much shorter and stouter abdomen, narrower fore wings and smaller hind wings, antennæ threadlike, rather short, red-

dish; head and thorax orange-red or greyish-red; abdomen pale orange, strongly barred with a dorsal series of black stripes. Fore wings orange-red with the nervures and reniform spot deeper red; hind wings reddish-yellow or orange, with the central spot, the sub-marginal band, and the whole basal area, broadly black; hind margin and cilia orange-red.

Underside of the fore wings in the male much clouded with smoky black, and with the central spot large and black, but surrounded with yellowish; margins broadly light red, or orange with the cilia red; hind wings yellow, with red margins, the central spot small or absent; legs reddish with tufts of bright red scales on the tibiæ; abdomen yellowish. Underside of the wings of the female orange, more red at the margins, with black shades from the base, and black central and sub-marginal blotches, varying in intensity according to the depth of colour of the upper side; legs dark red; abdomen mingled red and blackish.

Variable in the markings of the hind wings on both sexes. In the male these are sometimes suffused from the base with paler or darker grey; the sub-marginal band also varies greatly, being in some specimens broad and dark without pale intersecting lines, in others broken up by pale nervures into narrow bars, or in some cases being nearly or quite obsolete. In the female the basal black blotch sometimes embraces and conceals the central spot or even reaches the sub-marginal band at its dorsal extremity; while in some few cases the hind wings are almost totally black. These last are usually from the north.

On the wing in June and the beginning of July. Occasionally a portion of a brood of young larvæ will feed up rapidly and produce the moths at the end of August or in September. In this country this appears only to have occurred in captivity, but on the Continent the species is known to be regularly double-brooded.

LARVA rather slender, each segment rounded and covered

with rather short soft hair which is longest on the hinder segments. Head dark grey; body purplish brown with a broad, even, white dorsal stripe containing a yellow spot on each segment; subdorsal and spiracular stripes dark brown; spiracles ringed with black; below each of them a white dot; legs brown; hairs brown. When younger the spots in the dorsal stripe are crimson, and the spiracles are placed in large black spots.

July to May, hibernating small (except in those instances in which a few in confinement feed up in August). On plantain, dandelion, scabious, hawkweed, chickweed and other low-growing plants. A very active larva, coiling itself when disturbed but suddenly uncoiling and running with great swiftness.

PUPA elongated, rather rugose and angulated in front; segments ridged. Anterior portion dark brown with pale grey stripes at the back of the head and wing-cases; hinder segments chestnut brown. In a slight silken cocoon at the roots of plants.

Almost confined to heaths, wild places among bracken, and the open portions of heathy woods. The male is very active when disturbed in the sunshine, flying up to a height of about twenty feet in the air and then dashing off, but unless carried further by the wind, settling again at a distance of twenty or thirty yards, to rise with still wilder haste if followed. Yet it does not fly freely of its own accord in the daytime. Late in the afternoon the female may sometimes be seen flying much more gently, and both sexes may be found sitting on heather and heath-grasses at night. The natural flight appears to be more particularly in the early morning before daylight and at this time it will occasionally visit a strong light. Common, though sometimes rather local, on heaths in all the Southern and Eastern Counties of England and in South Wales, but rather scarce in Devonshire. Formerly plentiful in the fen district of Cambridgeshire and the

adjoining counties, but hardly to be found there now. Apparently scarce or absent in the Midland Counties except Stafford and Derbyshire. More frequent on the heaths and moorlands of Cheshire and Lancashire, and, very locally, in Yorkshire. In Scotland in many localities—Roxburghshire, Troon, Cloven, Broxy, Methven, Banchory, Inverurie, Money-musk, Kinnoull; very scarce and local in Aberdeenshire. In Ireland widely distributed in the South and West—Bantry Bay, Killarney, and elsewhere in Kerry, Galway, Sligo, Donegal, and even in the North East near Belfast. Abroad it is common nearly all over Europe, Siberia, Tartary and Asia Minor.

It may be well to point out here that the kidney-shaped spot in the fore wings of the male of *E. russula* is formed exactly as the spot well known as the reniform stigma in the fore wings of multitudes of species of *Noctuina* and *Pyralides*; and occupies precisely the same position in the fore wings; while the central spot in the hind wings of this species corresponds in position with the lunule seen in the hind wings of very many *Noctuina*.

Genus 6. NEMEOPHILA.

Antennæ short, pectinated in the male with strong, solid, ciliated teeth; serrated in the female; thorax not very stout. Fore wings moderately broad; hind wings rounded, rather small; abdomen short, tapering in the male, stout in the female.

1. *N. plantaginis*, L.—Expanse $1\frac{1}{2}$ inch. Fore wings black, with irregular branched creamy stripes; hind wings orange yellow, with black stripes and spots.

Antennæ of the male shortly but densely pectinated, blackish; head black; collar orange, divided by a large circular black spot on the back; thorax black, with longitudinal yellowish-white stripes edging the shoulder lappets,

and also on each side of the centre; abdomen orange-yellow, with a very broad black stripe down the back, tapering off a little to the anal segment. Fore wings rather triangular, narrow at the base, not very broad behind, with the costal and dorsal margins nearly straight, the apex very slightly angulated, and the hind margin gently rounded and rather oblique; black-brown with creamy white stripes and blotches, of which a long straight stripe proceeds from the base, parallel with the dorsal margin, nearly to the anal angle, becoming forked at its extremity; a short wedge-shaped blotch lies on the base of the costa; beyond it is a larger and more reniform spot touching the costa, or in some cases detached and roundish-ovate or pear-shaped; still beyond is a stripe crossing from the costa to the anal angle rather obliquely, and itself crossed by another stripe arising near the apex of the wing, making a wide elbow before it crosses, and very often proceeding to join the upper fork of the straight dorsal stripe; cilia extremely short, creamy white. Hind wings with the apex and hind margin regularly rounded; light yellow with black stripes and spots—one black stripe from the middle of the base makes a broad elbow in the middle of the wing by uniting with a large irregular central spot; another from the base near the dorsal margin attains the anal angle; round the hind margin is a series of black blotches forming a broken sub-marginal band, inside which are two or three large black spots; cilia yellow.

Female similar in size and shape of wings, and mainly so in markings, but with much stouter abdomen; the pale stripe of the fore wings more yellow, sometimes reddish in the costal area; hind wings yellow, with the black stripes from the base expanded and joined together, so that a great black blotch occupies the basal half of the wings; the sides of the abdomen sometimes bright red.

Underside similar to the upper, but with the dark markings of the wings hardly so sharply defined, and the colour of the paler portions more yellow or even tinged with reddish;

body, in the male, mixed yellow and black; in the female with a broad longitudinal deep black stripe; legs black.

Rather variable in the extent and connections of the pale stripes of the fore wings, and in rare instances these are much reduced, or, on the other hand, extended over the wing surface. Mr. Sydney Webb has an extraordinary series of varieties, some with the ground colour of both fore and hind wings clear white; one with the fore wings yellow and the hind white; another with the stripes of the fore wings absent from one portion, confluent in another; and one in which almost the entire fore wings are creamy white without markings; also specimens in which almost the entire hind wings are black, or the central portion devoid of markings, or with only marginal spots. A specimen in Mr. S. Stevens's collection is entirely black except some pale lines in the fore wings and a few dots in the hind; and a female has the fore wings orange, and the hind lurid red; while Mr. Capper has a specimen of the same sex having fore and hind wings alike creamy white, and Mr. J. Harrison several with a broad yellow stripe along the costa from base to apex. Some specimens reared by Mr. R. Adkin from Sussex larvæ have the pale stripes of the fore wings obscured with smoky black; and a female, from Marlborough, in Mr. A. Robinson's collection has the outer half of the fore wings mainly occupied by a broad band of cream colour, with the markings reduced to a few small spots. There is moreover a permanently recurrent variety known as var. *hospita*, in which the cream colour or yellow in the males is completely replaced by whitish, the hind wings especially being clear white. Several specimens of this form are said to have been taken in the Church Stretton district, Salop, but it is known as a permanent form only on the higher portions of hills and mountains in Scotland. The females found with it do not take by any means the same direction of variation, but have the black markings of the hind wings much extended and intensified, and the orange portions often tinged with dull

red. Dr. Mason has two males of this var. *hospita* in which the hind wings have no trace of the usual central black markings, and Mr. S. Stevens one in which they are reduced to a few marginal spots.

On the wing in June, occasionally at the end of May, or lasting into July, according to the season; and in rare instances specimens of a partial second generation have been known to occur in August and September.

LARVA cylindrical with the segments slightly thickened. Head round, deep black; body smoky black, with the tubercular spots bluish-black, bearing spreading tufts of long black hairs; on segments five, six, and seven, however, the spots are orange and the tufts of hairs orange-red or red-brown, forming a conspicuous broad reddish belt before the middle. The hairs from the lowest row of spots are, moreover, sometimes grey or orange-yellow, and those of the last segment are longer than the rest. Legs and forelegs black or grey. When very young it is of a dull pale green with the hairs long.

July to May, hibernating when nearly half grown, among the food-plant on the ground. But—more especially in confinement—it occasionally happens that some few larvæ of a brood feed on rapidly, at once, and produce perfect insects in August, September, or even October. On plantain, especially *Plantago lanceolata*, lettuce, groundsel, *Helianthemum vulgare*, *Poterium sanguisorba*, and doubtless other low-growing plants. Said to be fond of sunning itself on plants; also very active in its movements.

PUPA shining, dark red brown. In a loose cocoon among its food-plants.

A very lively species, the males flying actively in the sunshine and assembling freely around a freshly emerged female. Attached to open woods, heaths, hill-sides, espe-

cially chalk and limestone hills, and in the north extending high up the mountains; said also to have the habit of sitting very conspicuously upon the blackest patches of earth on open heaths. It seems probable that the female flies most at night. Very widely distributed in England; occurring in all the southern counties; becoming abundant in Berkshire and Gloucestershire, especially on the slopes of chalk hills; scarce and extremely local in the Eastern Counties; and apparently absent from Devonshire and Cornwall. In Wales it extends as far west as Glamorganshire. Formerly abundant in Huntingdonshire, and, less so, in Cambridgeshire, but has become scarce or disappeared from those counties. Still found in Worcestershire, Herefordshire, Derbyshire and Leicestershire, though locally; and more plentifully in Yorkshire, the heaths and moors of Lancashire, and in the Isle of Man. In Scotland it is very widely distributed—from Roxburghshire to Shetland and the Hebrides, being common in the Island of Mull. The white variety, *hospita*, is found in the Hebrides, also at Braemar, Aboyne, the Forest of Birse, and generally on the mountains of Perthshire, occurring, according to Sir Thomas Moncrieff, at elevations from 600 to 2000 feet above the sea-level. In Ireland this variety does not seem to occur; but in its ordinary forms the species is found in Kerry, Connemara, Galway, Sligo, West Meath, King's County, Tyrone, Fermanagh, Donegal, Londonderry, and Belfast, being plentiful in Island Magee near the mouth of Belfast Lough, where it especially frequents the edges of cliffs overhanging the sea.

Abroad its range is extremely wide—throughout Northern and Central Europe, the mountains of Southern Europe, in Siberia, Tartary, and Japan. In Siberia the form known as *hospita* is found, its female having the hind wings varying towards red, and also the aberration having the markings of the hind wings almost obliterated. In Japan is a race of large specimens—named *leucomera*—the fore wings having broad black markings, and another of a

yellower colour—called *macromera*—but evidently belonging to the present species. From North America a smaller variety is obtained, having the ground colour of all the wings white.

Genus 7. ARCTIA.

Antennæ of the male pectinated with solid teeth, which are fringed with fine bristles, or sometimes with short tooth-like branches. Thorax broad and heavily clothed with scales; abdomen robust; fore wings ample, stout and strong; hind wings very broad and rounded; of gay colours.

1. **A. caja**, *L.*—Expanse $2\frac{1}{4}$ to 3 inches. Fore wings creamy white with large irregular dark brown blotches; hind wings brilliant crimson with blue-black spots.

Antennæ of the male shortly pectinated, shaft stout, usually white, occasionally dark brown, pectinations brown; of the female stout, slightly serrated, white. Head and thorax covered with very long, loose, partially erect, dark brown scales like a rich fur, except that the collar is edged behind with dark crimson (close to this are two small valves from which, when annoyed, a yellowish liquid is exuded). Abdomen rich scarlet, with a row of broad blue-black bars down the back. Fore wings stout and very ample, with all the margins gently rounded, the apex hardly angulated, and the anal angle rounded off; deep dark chocolate brown irregularly broken up by creamy white stripes and blotches—an oblique transverse band near the base, having branches running from it into the base; two sharply defined triangular, or streamer-like, blotches on the costal margin; a second broad transverse band from the costa beyond the middle to the centre of the dorsal margin; and a third from the costa near the apex, crossing, with wide angulations to the anal angle and nearly always uniting in the middle with the second band, so that a roughly formed cross composed of these two bands, in the hinder area, is the most

conspicuous marking on the fore wings. In most instances the first and second transverse bands are united by a horizontal stripe. Cilia very short, brown or white, agreeing with the adjacent margin.

Hind wings very ample, with the hind margin regularly rounded; dark scarlet, with large rounded, ovate, or irregular blue-black spots or blotches, which are faintly edged with yellowish. These spots form—roughly—two series: one, two, or three in a transverse row before the middle of the wing, the central being the largest, the most permanent, and nearest the base; and three others, all large, placed in a row before the hind margin; cilia yellow. Female similar, rather larger and stouter.

Underside having the markings as on the upper, but the creamy white portions of the fore wings suffused with pale scarlet or orange-red over the basal portion, sometimes also round the margins and tinging the central area; or the latter portions are yellowish; hind wings of a paler scarlet than above; body brownish or blackish with numerous tufts of scarlet scales along the sides and at the edges of the segments; legs black-brown with scarlet tufts.

Perhaps the most variable in markings of all Lepidopterous insects, hardly any two individuals being precisely alike. The more ordinary phases of variation are in the increase, or decrease, of the proportions of the white stripes to the brown ground colour, in the fore wings; in one direction by the brown predominating and narrowing or breaking the stripes and blotches, or wholly or partly obliterating them in uncertain and irregular degrees; in the other by the white stripes increasing in width and extent, uniting together, and reducing the brown colour to irregular isolated patches, or even to mere spots. These two tendencies are in rare instances carried so far that the fore wings become wholly brown-black or creamy-white. In the hind wings the outer row of blue-black spots is nearly always present though varying greatly in size, and the anterior of them very

frequently extends into a blotch which reaches the costal margin; but the inner row constantly varies in size and number either by coalescence or disappearance; but all sometimes unite and spread over the wing; or the three outer unite and form a broad constricted band of intense blue-black; or all dwindle, or become faint, leaving the hind wings almost entirely scarlet. Another regular form of variation is where yellow is substituted for scarlet in the colouring of the hind wings and body; this usually occurs with the markings of quite normal character, and seems to be an extension of the ordinary yellowish edging of the black spots. Intermediate specimens of a pale scarlet are not unfrequent. Perhaps the strongest tendency, however, is to darker forms—extension of the brown or brown-black of the fore wings and of the blue-black spots of the hind, so that many specimens have been reared entirely of a smoky black, but strangely enough, the large majority of these have been cripples, of which the wings have never properly expanded. Dr. Mason has a specimen of which the fore wings are whitish-drab and the usually darker portions merely outlined with brown, and another of darker brown colouring, similar markings and the hind wings black-brown with black spots. Also, reared by Mr. Geo. Baker, a wonderful specimen of which the fore wings are red-brown with a dusting of suffused pale spots, one wing darker than the other, and the hind wings reddish, suffused unequally with blue-black, obscure black spots and orange margins, but neither fore wings nor hind wings are uniform; another has dark brown fore wings with the pale stripes reduced to mere lines, the hind wings brilliant blue-black except the base and dorsal margin, and the hind margin deep black. The late Mr. E. Hopley had one with the fore wings wholly cream-white, the hind wings rosy-crimson, and the spots orange-yellow. In Mr. S. J. Capper's collection is one with the fore wings white except the edge of the apex and a dark central spot; another having the hind wings smoky black with the usual spots blue-black;

a third with grey-red hind wings; and two which have, in each case, one fore wing uniformly black-brown, in one case the right, in the other the left. Mr. C. A. Briggs has a specimen with the fore wings of a pale yellowish-brown without markings except a few brown spots in the central area, and Mr. J. A. Clarke one having in the left hind wing a stripe of the colour of the fore wings. Mr. Sydney Webb possesses a specimen with the pale markings of the fore wings tinged with rosy, another with a fore wing on one side unicolorous brown, the opposite wing being normal, but its hind wings are nearly uniformly deep black; another with all the markings of ordinary shape but only faintly indicated in pale buff in the fore wings, in faint blackish on the hind; and in Mr. Bond's collection one having the fore wings buff without markings, and the hind wings with only yellow indications of the usual black spots; others with white fore wings, or wholly brown, or smoky black. It is indeed hopeless to attempt to convey in words a definite idea of the gorgeous array of variations, extreme and intermediate, to be seen in some of these large collections. The vast majority of these strange forms are obtained in Lancashire, the West Riding of Yorkshire, and adjacent districts. For some reason totally unknown to us these curious sports of nature are there frequent, though in other districts nothing extraordinary is obtainable.

On the wing in July and the beginning of August. In confinement a partial second generation is sometimes obtained in August, September or October.

LARVA stout, very hairy, anterior segments slightly tapering; head black. From the fourth to the twelfth segments are dorsal and subdorsal rows of white raised spots from which arise long pale hairs, while the remaining numerous spots produce bunches of red-brown hairs of similar length; on the front segments are black hairs with whitish tips upon the back; rather pale ones below, legs black; prolegs pinkish grey.

When young, dusky pale brown with short hairs, the long hairs not being assumed until the larva is half grown.

August to May, or even June, on almost every kind of herbaceous plant, even including the common dog's-mercury, and on many shrubs: especially fond of nettles and garden weeds. Usually hibernating when rather small, but occasionally, if kept in a warm situation, in confinement, feeding up rapidly in August, and there is a record that, by means of heat, a third generation has been reared in October.

PUPA stout, not spiked nor hooked; dark purple-brown, with a very slight bluish efflorescence. In a dull yellowish silken cocoon among rubbish on the ground or under any sheltering corner.

One of our most familiar species, known to everybody as the "Common Tiger moth," and its larva as the "Woolly-bear." Not by any means an active species in the perfect state. Although so brilliantly coloured, it can rarely be induced, like so many of its allies, to fly in the daytime, but sits about on banks, or the bottoms of hedges, or under low herbage, and does not stir until dark, only becoming active after midnight. At this time, it will sometimes come in abundance to a strong light, making itself indeed a great nuisance, since it bangs against the lamp-glass, knocking off everything else with its strong wings and heavy body, and is so persistent that even if caught and pinched hard it will, in a few minutes, return as eagerly to the light as ever. Nothing but death seems, then, to check its enthusiasm. Strange to say, out of hundreds so seen, no variety of a noticeable character ever occurs. All the strange forms appear to be reared. It seems, indeed, that confinement of the larva has some occult influence in certain districts, in producing variation in this species; though artificial means have been tried with the most scanty results. Feeding the larvæ on bright coloured flowers was a complete failure. Walnut leaves are said to have produced better results, but this is very doubtful. Keeping the pupæ

at a low temperature is said to have some effect in producing darker colour in the moths. The late Mr. E. Hopley tried experiments in the direction of keeping larvæ feeding under glass of various colours; the only results noticeable were that those under violet glass fed faster than those under red, while yellow and black proved fatal to the larvæ. As it is a sun-loving larva, these results were natural enough.

This species seems to be found in every part of the three kingdoms, except perhaps in the Shetland Isles; inhabiting the gardens in the outskirts of towns, in some places even more commonly than the fields and hedgerows. Formerly this was the case in all the suburbs of London, the larva being everywhere visible, but for some years past, there is a great change in this respect and it is now comparatively seldom seen; indeed the same may be said of many districts in which it formerly abounded.

Abroad it is common all over Europe except in the extreme South; in Siberia, Tartary, Japan, the mountainous regions of Asia, through the Himalayas to Assam, and over large portions of North America, including Vancouver Island. In Japan besides being of large size it shows a slight variation in shape, its fore wings being rather more pointed. The proportions of the transverse stripes are also somewhat different. This form is known as *phaeosoma* and its variety with yellow hind wings as *auripennis*. In the Asiatic mountain region the form with paler brown colour in the fore wings seems to have become recurrent and is known as *orientalis*, while ordinary typical specimens from North America are distinguished by the name *Americana*.

2. **A. villica**, L.—Expanse 2 to $2\frac{1}{4}$ inches. Fore wings glossy black-brown with large creamy spots; hind wings rich yellow, with apex and spots deep black.

Antennæ shortly and closely pectinated in the male, the teeth very thick and solid; very slightly dentated in the female, wholly black; head deep black; thorax covered with long downy black-brown scales, but having a broad creamy

white stripe or blotch down each shoulder to the base of the fore wing; abdomen rather stout, dull yellow at the base, shading into dull crimson behind and at the sides, and having a row of small black dots down the middle of the back. Fore wings ample, rather narrow at the base, but rapidly broadening, with the margins and apex all rounded; shining velvety brown-black with creamy-white spots—one large and wedge-shaped in the middle of the base; two, also large, somewhat ovate, before the middle; two smaller, placed more obliquely, just beyond the middle but rather near the margins; beyond these two more, very large, almost forming a straight band from the costa to the anal angle; and a single smaller ovate or rather angulated spot close to the middle of the hind margin; occasionally one or two whitish dots are placed above this last towards the costa; cilia short, black-brown. Hind wings rather long and broad with rounded apex and hind margin; bright yellow, or pale orange, with black spots, of which two or three are placed in a straight line transversely before the middle, and three or four across from the middle of the costal margin to the anal angle, while the whole apical space is occupied by a large black blotch more or less broken up by one or more squared or irregularly shaped orange spots at the margin; cilia yellow or black, according to the colour of the adjacent portion. Female similar, but much stouter and rather larger in expanse.

Underside of the fore wings dark smoky brown with the spots as on the upper side, but having the costa, especially toward the apex, ornamented with a stripe of brilliant scarlet; hind wings deep orange with the black spots as on the upper side; the apical black blotch more smoky, and a broad ill-defined stripe of rich scarlet along the costal margin and round the apex, sometimes continued along the hind margin; thorax and abdomen black, scarlet at the sides; legs black with a scarlet stripe down the front of the tibiæ.

Variable in the size of the creamy spots of the fore wings, especially in the case of those near the base, which occasionally coalesce and produce a sort of triangular or Y-shaped

blotch from the base almost to the middle; not unfrequently the dorsal spots of the second and third pairs unite, or the large third pair unites into a constricted band. In the hind wings the spots vary greatly in number, some of them, especially toward the base, being often suppressed. There are many curious aberrations. Mr. S. Webb has one with the fore wings smoky black, except a few irregular pale spots, and the hind wings rather smoky; another with a black stripe across the base of the hind wings; and, in Mr. Bond's collection, one with the fore and hind wings buff, having dark markings only along the margin of the fore wings; another with the hind wings beyond the base entirely black, and another with large buff blotches on one fore wing. In the cabinet of the late Mr. H. Doubleday in Bethnal Green Museum is a specimen entirely of a deep smoky black; Mr. S. Stevens has one with fore and hind wings wholly yellow except the margin and a cross stripe on the fore wings; Mr. C. A. Briggs one with the hind wings suffused with smoky black; Mr. S. J. Capper one with the usually black portion of the fore wings leaden-grey dappled with darker; Mr. Crowley one with the hind wings pale cream colour and the spots of the fore wings pure white; and Mr. H. Goss a specimen having one fore wing black with two small spots, and the other also black, but with six or seven small pale spots.

On the wing in May and June. There is a record of one or two out of a large brood, reared in Devonshire, which fed up rapidly in confinement, producing the moths in October, but no record of a second generation out of doors appears to exist.

LARVA rather stout, each segment being a little thickened; whole surface abundantly covered with soft hairs. Head prominent, light red or crimson; body black, with the edges of each segment dark red; hairs dark red; spiracles white; legs black; prolegs red, the anal pair rather prolonged. When young the head is lighter crimson; the body with the hairs entirely smoky black; prolegs pink.

July to May, hibernating when partially grown, coming out to feed in the middle of March and thence feeding up rapidly. On dock, teasle, chickweed, groundsel, millfoil, nettle, lettuce, strawberry, and low plants generally, and has no objection to feeding upon young shoots of the common furze (*Ulex Europæus*).

PUPA blackish, in a slight silken cocoon among weeds and rubbish.

This handsome moth loves to sit on hedge banks, rough hill-sides and cliffs, starting up, if disturbed, and flying freely in the sunshine. Its time of natural flight is, however, at night, and it is readily attracted by a strong light. Most common on the south coast of England, but not scarce throughout the southern counties from Kent to Cornwall and Gloucestershire. Formerly not at all scarce in the outskirts of London, as at Dulwich, where larvæ were regularly found thirty years ago, and at Kensal Green. Scarce, though widely distributed, in Norfolk, Suffolk, and Cambridgeshire; but hardly observed further north nor in the Midland counties. There is a record of its capture at Bowdon and Delamere in Cheshire, but the circumstances, if correct, were very exceptional. I know of no instance of its occurrence in Scotland or Ireland, though it was at one time reported to exist in the latter country. Abroad it is common all over Europe except the extreme north; also in Armenia and Asia Minor. In some parts of Southern Europe the colour of the spots of its fore wings is wholly yellow, and in some cases they coalesce into yellow stripes. A dull yellow variety obtained at Syracuse has received the name of *Konewkai*.

Genus 8. PHRAGMATOBIA.

Antennæ of the male with scarcely visible pectinations, consisting of minute tufts of fine hairs; fore wings rather narrow, hardly broader towards the hind margin; hind wings

short and angulated at the apex; thorax and abdomen very stout.

1. *P. fuliginosa*, *L.*—Expanse $1\frac{1}{4}$ to $1\frac{1}{2}$ inch. Fore wings dull brownish-red or smoky red, semi-transparent; hind wings pink, shaded or spotted with smoky black.

Antennæ short and slender, very faintly pectinated in the male; greyish-white. Head and thorax dull red, reddish-brown, or orange-brown; the latter stout and densely covered with long loose scales; abdomen short and stout, bright scarlet, with a black stripe, or row of triangular black spots, down the middle of the back, and a row of black spots down each side. Fore wings narrow and rather blunt, costal and dorsal margins very slightly curved, hind margin almost retuse below the blunt apex, rounded towards the anal angle; thinly scaled and almost diaphanous in the middle; dull red, red-brown or red-grey, with the nervures darker, and, at the end of the discal cell, one or two small black spots; cilia dark crimson. Hind wings short, angulated at the apex, thence rounded behind but slightly emarginate towards the anal angle; semi-transparent, pale crimson, often paler or greyish towards the base and costal margin, and with a broad ill-defined smoky or blackish band along the apex and hind margin; principal nervures dark grey; two small black spots or streaks in the centre of the wings; cilia dark crimson. Female with the fore wings slightly narrower and more ovate, having the hind margin more regularly and obliquely rounded off; antennæ simple; body very stout; otherwise similar to the male.

Underside of the fore wings brighter red, but shaded with brown at the hind margin; spots indistinct; of the hind wings light crimson-scarlet, having the blacker marginal band and the two black dots as above; body dull red; legs blackish with a red stripe down the tibiæ.

Very liable to climatal or local variation. In the South and South-East of England, the general colour is bright red,

sometimes even a rich ruby red, the hind wings being very rosy; and the dark band near the margin of the hind wings is broken up, in many specimens, into a series of separate cloudy spots. In more inland and western districts the band is unbroken though the bright colour is maintained, but as one proceeds northwards a more smoky tint is gradually assumed until in Scotland, especially in mountain districts, the fore wings are commonly darkened by an admixture of brown or grey, and the hind so entirely suffused with smoky grey that the sub-marginal band commonly disappears, melting into the general smoky grey or blackish colouring. Very often the only trace of the light crimson colour left in the hind wings is in the cilia, or perhaps a slight stripe down the dorsal margin; the abdomen is also blackened by extension of the dorsal stripe. These dark specimens have received the varietal name *borealis*, but no line of distinction exists; specimens are found of every possible intermediate tint. In the North of Ireland, with males of the ordinary brighter colour, are females with the hind wings almost totally dark grey. A very curious variety has been taken near Belfast by Mr. C. A. Watts, a male with fore and hind wings *whitish*, very nearly transparent, and altogether contrary to the general tendency of its variations. Dark specimens occur casually in the south—one reared from a larva found at Folkestone has the hind wings grey, even bluish-grey toward the hind margin; and a specimen reared by Mrs. Bazett, from a larva found in Hampshire, has the hind wings divided in colour down the middle; the outer half being grey, the inner bright red.

On the wing in May and June, and again, as a partial second generation, at the end of July and in August. There is even a record of the rearing of a third generation in September.

LARVA stout, but tapering off a little in front. Head small, smoky black, mouth yellow or reddish; body purplish brown

or smoky brown, with the segmental divisions darker; a yellowish interrupted dorsal line, and a row of faint spots of the same colour indicating the spiracular line, hardly visible; whole body thickly clothed with light brown hairs, which spring in tufts from the usual raised spots, but form an even surface, being close and very abundant; legs blackish. When half grown, however, the general colour is bluish grey with the hairs shorter, more bristly, and less noticeable, but with dorsal and spiracular stripes yellow.

July to May, the full grown larvæ retiring to hibernate at the roots of plants and remaining quiescent till February or March, when the first bright days bring them out to sun themselves before spinning up. But a proportion feed more rapidly than the rest, becoming full grown in about a month from the hatching of the eggs, and producing the perfect insects late in the summer. Young larvæ from the eggs of this later brood hibernate in the same manner as the rest, and, so far as is known, emerge almost as early in the following season. On plantain, dock, yarrow, and almost all low growing plants, even *Listera ovata*. This larva is extremely active, running with great swiftness and travelling sometimes long distances, especially when full fed and before hibernating. But in the spring its activity on a sunny bank is very pretty to see. It is moreover extremely hardy, and has been found frozen, and completely enclosed in ice, without injury to its vitality.

PUPA stout; black, with the hinder edge of each segment rather paler, thorax much rounded. In a rather dense cocoon of brownish silk among low plants near the ground, often attached to a leaf or stalk.

The moth is a restless creature, very active on its feet, and will sometimes run over the grass almost as fast as its larva. It also flies a little in the sunshine with rather a heavy buzzing action, but is far more active at night, flying freely at midnight, and coming readily to a strong light. It frequents

the open parts of woods, hill-sides, marshy meadows, mountains, and all sorts of wild uncultivated spots. Not often observed in the moth state, though a rough wind will sometimes drive it on a sunny day from its haunts to shelter in corners close to houses. Very widely distributed, and probably to be found in suitable places all over the United Kingdom, since it is recorded from the south coast to the Orkneys, and in many parts of Ireland. Abroad its range is extremely wide: throughout Europe, Eastern, Northern, and Western Asia, and, in North America, throughout the United States and Canada to the Hudson's Bay Territory. Specimens from the last named district have been called *rubricosa*, but they present no special varietal features. Another form, of slightly different colour, has received the name of *fervida*. The dark variety found in Scotland, and called *borealis*, occurs also in Lapland.

Genus 9. SPILOSOMA.

ANTENNÆ pectinated in the male, with solid, ciliated teeth, dentate in the female. Thorax stout, abdomen moderately so; fore wings rather broad, and usually somewhat pointed at the apex; hind wings ample, rounded.

1. **S. mendica**, *L.*—Expanse $1\frac{1}{4}$ to $1\frac{1}{2}$ inch. Male entirely smoky brown, or blackish, with a few blacker dots in the fore wings; female semi-transparent, white, with black dots on all the wings.

Antennæ distinctly and closely pectinated in the male, wholly black; head covered with long erect scales of a greyish buff; thorax robust, densely covered with soft erect scales, smoky brown or blackish; abdomen rather short, tapering, smoky brown, with a series of blackish bars down the back; fore wings rather short and broad, with costal and dorsal margins slightly rounded; apex bluntly angulated; hind margin almost perpendicular but faintly elbowed below the middle and thence rounded off to the anal angle; thinly

scaled; smoky brown or smoky black, darkest towards the costal margin, and with two or three black spots or dots on the costa, two or three nearer together on the dorsal margin, one, rather larger, a short distance from the base in the middle of the wing, and one or more beyond the middle (these last clearly indicating the usual second transverse line), cilia smoky brown. Hind wings rounded, smoky brown or blackish, semi-transparent, sometimes with two or three faintly indicated black cloudy dots before the hind margin; cilia smoky brown.

Female, antennæ black, very finely dentate; head and thorax covered with long, fluffy, white scales; abdomen stout and rounded, white, with a row of black spots down the back and another down each side. Fore wings thinly scaled and semi-transparent, clear white, with black dots as in the male but far more distinct and often more numerous; this is more emphatically the case on the hind wings, where besides an increase in number and size of those near the hind margin, a central spot is faintly indicated; and there is also an additional dot, or even two, below the apex of the fore wings; cilia white.

Underside of the fore wings of the male smoky brown, rather paler than above, usually with slight indications of the black dots, and in addition a central spot to the hind wings; body grey tinged with yellow; legs black with yellow tufts beneath: female, wings as on the upperside; abdomen white with two rows of distinct black spots; legs black, the first pair with bright yellow tibiæ.

Not generally very variable but liable to local race variation of a very constant character. Of this nature is a form known as *var. rustica*, in which the males are dull white, creamy white, or very pale brown, instead of blackish, the females being large and having but few black dots. This variety, principally found in Ireland, is remarkably constant, generation after generation, reared in captivity in England, producing similar results, the white males

almost always having a tinge of colour from creamy to faintly brownish or being softly clouded with brown or greyish, but never approaching to the typical form. Another race has been found in Yorkshire and more particularly in the neighbourhood of Huddersfield, and has been continued in repeated broods by Mr. G. T. Porritt, having the males of a deep sooty black, with blacker blotches or spots, and a row of small blotches on the hind wings; and the females strongly ornamented with an increased number of black dots, the ordinary spots also enlarged into cloudy blotches and the whole showing a strong tendency, in both sexes, to form themselves into the first and second transverse lines, common to so many species, or into cloudy bands, while some specimens are also strongly clouded with blackish towards the hind margin. These, however, are extreme variations; with them are many normal and intermediate specimens. A form intermediate between the type and the var. *rustica* has been reared by Mr. R. Adkin by crossing. A pretty variety of the female is obtained in Oxfordshire by Mr. A. Sidgwick, in which the usual costal dots have become perfectly round spots, larger in size, united by a black line, and placed at accurately regular intervals. Mr. S. Webb has a female specimen with numerous large roundish marginal grey spots; others thickly scaled and with smoky margins; and one which has but a single black dot on each fore wing. Mr. C. A. Briggs has also a single-dotted female, but its fore wings have the costa smoky black, broadly so at the base; and a male, originally in Mr. B. Cooke's collection, of a white colour, but with the black dots as sharply marked as in the female. From a larva found near Durham Mr. J. Gardner has reared a greyish-white male of quite a different tone of colour from the var. *rustica*. Mr. J. E. Robson has a female from the same district having the fore wings clouded with pale brown and the black spots reduced in number to two upon the median nervure; its fore wings are moreover very broad

and almost ovate. Of var. *rustica* the Rev. W. F. Johnson has obtained, at Armagh, a male of a creamy white, but with nearly the whole fore wings, and the hinder half of the hind wings, softly clouded with grey between the nervures; specimens almost as pale as this have been reared by Mr. Charles Fenn from larvæ found at Eltham, Kent, and others are reported from Epping Forest.

On the wing in May and June.

LARVA short and rather stout. Head round, shining light brown; body dull greyish brown, with the tubercular spots paler brown ringed with grey; hairs short and soft, extremely dense, golden brown; spiracles pale, ringed with black; beneath them is a row of white dots; legs and prolegs yellowish brown. Excessively active. When alarmed it drops down and curls into a ring for a short time, then uncurls and glides away with such smoothness and rapidity as to seem to slide.

June to August upon low plants generally, but partial to dock, chickweed, plantain and red nettle, and will at times eat the leaves of birch.

PUPA short, thick, and swollen in the middle, very blunt behind, but having a short straight spike; shining black-brown. In a thin cocoon of silk mixed with the larval hairs, fitting as closely as possible, so as almost to squeeze the pupa. Among rubbish, on weedy banks, or under any slight protection. In this state through the winter.

A sluggish species and, so far as the male is concerned, very rarely captured in the imago state. The female is often taken, having a habit, when part of her eggs are laid, of flying lazily in the sunshine, when she is very conspicuous. The male has also, though rarely, been found flying in the daytime, but its time of flight is after dusk and through the night, and it comes now and then to a strong light.

Very widely distributed, and often common, in all the

Southern counties as far north as Cambridgeshire, Oxfordshire, and Gloucestershire; still widely distributed, though much less common, in Norfolk, Suffolk, Herefordshire, Leicestershire, Derbyshire, and Glamorganshire. Local but sometimes common in Cheshire, Lancashire, Yorkshire, on the coast of Durham, Northumberland, and Cumberland. In Scotland common in Aberdeenshire, and found in the Solway, Tweed, and Tay districts, and as far north as West Ross. Scottish specimens appear to be of the normal type. In Ireland very widely distributed in the counties of Cork, Kerry, Waterford, Wicklow, Dublin, Limerick, Armagh, and Antrim, but never common. Almost every specimen of the male there met with has been of the pale variety *rustica*, but there is a single record of the occurrence of a normal blackish example. Common throughout Europe, except in the colder portions of the north and the extreme south, also in Siberia, Asia Minor, and other parts of Northern Asia. The pale variety *rustica* is said to be common in Eastern Hungary.

2. **S. lubricipeda**, L.—Expanse $1\frac{1}{2}$ to $1\frac{3}{4}$ inch. Pale buff; fore wings with an oblique stripe of black dashes running across the wing to the tip; hind wings with two or three black spots.

Antennæ of the male very shortly pectinated, wholly black; head and thorax densely covered with raised buff-coloured scales; abdomen tapering, dull yellow, with a row of black spots down the middle of the back, and another down each side. Fore wings broad with all the margins very slightly curved, apex bluntly angulated, hind margin oblique, anal angle rounded but rather full; colour buff; an elongated black spot lies on the costa near the base, and another beyond the middle; opposite the first, at the base, are one or two black dots placed perpendicularly, opposite the second is a faint discal spot; from the middle of the dorsal margin arises a row, or tapering stripe, of black spots, which regularly diminishing in size, or distinctness, passes obliquely across

the wing towards the apex, and is frequently continued to the apex by junction with another row of short black streaks, but in other cases avoids this apical row of streaks and curves inward to the second costal spot—thus forming a (normal) second line; outside this, and close to the hind margin, are a few minute black dots varying in number from one or two to a slender row; cilia yellow. Hind wings rather broad, with the apex and hind margin rounded; whitish buff, deepening in colour towards the dorsal margin; having a blackish central spot, and, usually, one, two, or three similar small spots near the anal angle; cilia yellow. Female slightly larger, with simple black antennæ; wings paler, almost creamy white, markings similar.

Underside paler than the upper in both sexes; discal spots of the fore wings distinct, and also an oblique row of black spots corresponding with a portion of the oblique row on the upper side, but shorter, and with the spots broader and blacker; sometimes a second spot, beyond the discal, is visible, but the remaining spots of the upper side are not reproduced. In the hind wings the spots of the upper side are strongly emphasised; abdomen pale buff or whitish with two rows of small black dots; legs black with large tufts of buff scales on the tibiæ.

Variable in colour, in the male from rich ochreous to greyish-buff, in the female from pale greyish-buff to white; also in the number and intensity of the black spots, particularly those of the oblique stripe, most of which are frequently obsolete on the upper side, but show through from beneath; in other cases these are intensified and extended, the completed row curving to the costa and forming a normal "second line," while another row makes its appearance near the base, crossing the wing perpendicularly from the black costal spot and forming a normal "first line." In a specimen found at King's Lynn, these lines are very strongly shown in short black blotches, with a similar continuation to the apex of the wings and a hind-marginal row of blotches. This form has

become recurrent in some parts of Yorkshire and Lincolnshire, and in some cases very strongly marked indeed, the hind wings also being furnished with additional spots, in some cases to the extent of producing a long curved central line or stripe.

Occasionally, in the London suburbs, specimens occur with the hind wings equally strongly spotted or blotched, the fore wings being comparatively normal, but in these cases the underside is very strongly marked. Between the strongly marked and ordinary specimens every possible intermediate gradation is found. Very different from these, and forming a most remarkable aberrant race, is the variety known as *zatima*, Cramer, *radiata*, Haworth, and great has been the interest and even excitement aroused by it within the last two or three years. In it the usual black dots or dashes and the oblique fascia are obliterated, but from the hind margin, run inward bars of smoky black occupying the spaces between the nervures, so that radiating black bars occupy the whole marginal area of fore and hind wings, except the nervures, in a varying degree, sometimes to the middle of the wings, and occasionally running almost to the base of the hind, though the middle of the fore wings always remains buff. The costal and dorsal margins are black, and with the extended black colour, the sharply defined creamy white nervures, and the yellowish cilia, this variety forms an object well worthy of the admiration it has excited. The first specimen seems to have been obtained early in the century by Mr. Haworth, from Yorkshire; this is now in the collection of Dr. Mason at Burton-on-Trent. In 1837 the late Mr. J. C. Dale obtained specimens from Saltfleet, Lincolnshire. These it was stated had been reared, with more ordinary specimens, from larvæ fed on elder (*Sambucus*). More recently Mr. W. H. B. Fletcher has obtained similar specimens from Mablethorpe, Lincolnshire, and Mr. G. Dawson has reared one from a Cumberland larva. Other examples are in the collection of the late Mr. F. Bond. Several years ago (1891) a specimen was reared from among a mixed lot of English pupæ by Mr.

J. Harrison of Barnsley, and, as it was a female, he tried the experiment of pairing it with a male of the strongly marked Yorkshire form, with normal markings. The result was satisfactory—a series varying from the extreme (*radiata*) black and rayed variety, through the more strongly marked, to ordinary and typical specimens. By selection in breeding he, to a great extent, eliminated the ordinary forms, and obtained a breed of pure *radiata*. Eggs from these forwarded to Mr. W. H. Tugwell furnished grand results, the variety not only breeding freely, and purely, but increasing in size, and also producing a full second generation in the year. Very beautiful specimens have been provided, by both gentlemen, for the purposes of this work. Outside these well-ascertained forms variation is slight; Mr. S. J. Capper has a white female from Cheshire, wholly devoid of markings; and others with the fore wings immaculate. Specimens in many collections in which black lines or stripes run along the costal and dorsal margins, or with the markings elongated into short streaks and bars, are merely advances towards the extreme variety already noticed.

On the wing in June. Occasionally a second generation is reared, in confinement, in the autumn.

LARVA rather even in thickness; head round, brown; mouth black; body greyish brown, densely covered with hairs, which are reddish brown, rather even in length; dorsal line pale reddish, very faintly indicated; a broad dirty yellow spiracular stripe occupies the lower portion of the sides down to the legs; spiracles white; legs yellowish brown. When very young uniformly pale yellowish; as it grows it becomes greyish, and gradually brownish, with the hairs pale, short and bristly, and the spiracular line white. Always very smoothly nimble and active in its movements—hence its name.

July to September, on low-growing plants. Especially attached to gardens; feeding mainly on weeds but not disdaining any herbaceous plant, often most destructive to ferns

in ferneries and greenhouses ; also eating the leaves of shrubs, bushes, and even young trees, and a whole brood has been found feeding upon the leaves of the fig-tree, which in this country seems to be attacked by no other lepidopterous insect.

PUPA stout, stumpy, with rounded abdomen, tail blunt, but with several very short bristles ; shining dark red-brown. In a closely-fitting cocoon of silk mixed with the larval hairs ; among rubbish or under any slight shelter. Remaining in the pupa state through the winter.

A sluggish insect in the daytime, sitting about on walls and among plants, flying soon after dusk and through the night, readily attracted by any light.

Extremely plentiful in the south of England, including the metropolis, and common throughout the country to the north-west of Scotland, though scarce or absent in the north-east of that country. Also common throughout Ireland. Abroad it ranges over all the temperate portions of Northern Europe, Central Europe, Southern Russia, Tartary, and Siberia. Probably, taking new climatal variations, its range is still wider. A form known as *S. tigrina* from Southern India is of the same shape, proportions, and colour, but its markings, as is the case with the var. *radiata*, have taken a different range, being altered into irregular spots, blotches and longitudinal stripes on the fore wings, and with the hind wings much spotted and clouded, the markings being quite indefinite. Another called *Dalbergi*, also from India, has the shape and pattern of markings quite normal but colour heightened by being tinged with reddish, the abdomen sometimes yellow, sometimes crimson, and the tarsi crimson. This leads to very similar forms, known as *punctata*, and *seriatopunctata*, from Java, none of which seem to furnish satisfactory points of distinction.

The variety *zatima* or *radiata* appears to be confined, besides England, to Holland and the Island of Heligoland, in which last locality it is said to be common.

3. **S. menthastri**, *Schiff.*—Expanse $1\frac{1}{2}$ to $1\frac{3}{4}$ inch. Fore wings white with numerous black dots; hind wings white with a few small black spots.

Antennæ shortly but strongly pectinated in the male, blackish; head and thorax densely covered with long fluffy white scales; abdomen bright yellow with a row of rather squared black spots down the middle of the back and a row down each side. Fore wings broad, with blunt, almost squared apex, and gently rounded margins; clear white or creamy white with numerous black dots which appear to be scattered promiscuously over the wings, but have really a certain arrangement which becomes obvious in the more strongly marked specimens, a curved transverse line of dots becoming thus visible before the middle, a still more curved and elbowed transverse series beyond the middle (forming the usual first and second lines), a row of short streaks in pairs running in from the apex, and a row of pairs of short streaks close to the hind margin; other dots cluster about the end of the discal cell, or indicate a transverse line near the base of the wing; cilia white. Hind wings broad and rounded, with a conspicuous black central spot, and a varying number of small, often divided, black spots within the hind margin, one of which near the apex is the most permanent; cilia white. Female slightly larger with stouter body, and the antennæ very shortly pectinated or dentate, with the underside greyish; otherwise similar. Underside of all the wings white, with the black dots of the upper side faintly indicated or partially absent, especially so in the middle portion of the fore wings; but the apical row of short streaks is usually distinct, and the central and sub-apical spots of the hind wings very pronounced. Abdomen whitish with two rows of black dots; legs black with dense tufts of white scales on the tibiæ.

Very variable in the size and number of the black dots on the fore wings, ranging from an almost complete absence thereof to their increase and aggregation into transverse rows, or

elongation into streaks. Nor does there seem to be any fixed rule as to the order of their suppression, in some individuals all the dots being absent, except the rows of short streaks near the apex and hind margin, in others all except those about the discal cell and in the middle of the wings. One specimen, captured in London, has the dots few and small except round the hind margins of all the wings where they are clustered together, and, with an added row in the cilia, make a very pretty border. In the hind wings the central spot and that near the apex seem to be nearly always present, though the latter is sometimes reduced to a mere speck. Another phase of variation appears to be local or climatal in some degree. It is where the fore wings become yellowish buff, creamy buff, or even of a brownish-ochreous. The head quarters of this range of variation appears to be in Lancashire and other parts of the north-west of England, and in the north of Ireland including Belfast. Specimens from these districts, varying in tone of colour, also take the usual variations in number and disposition of the black dots; and some of the paler buff forms are rendered more beautiful by having the nervures broadly white. Doubtless the same tendency exists in the west of Scotland, for Mr. J. J. F. X. King has the brownest specimen yet seen, obtained from that district. Specimens from other parts of Scotland, the east especially, show a tendency to alteration of the spots into black streaks lying between the nervures. Mr. W. H. Tugwell has one such from Forfarshire, and Mr. S. J. Capper specimens in successive stages, from spots to long black streaks, brought from the East of Scotland. One specimen, taken in Scotland seventy years ago by Sir Patrick Walker, and named *Walkeri* by Curtis, shows an exaggeration of this tendency in a remarkable degree, its fore wings being filled in between the nervures with black in the manner of the var. *radiata* of *S. lubricipeda*. This specimen is now in the collection of Dr. Mason at Burton-on-Trent. It differs from the variety just mentioned in having normal white hind wings. Mr.

S. Webb has one of which the fore wings are white, but the hind clouded with black, and in the late Mr. Bond's collection, one wholly black, another with the costa and apex smoky black, and one white with scarcely a single black dot.

On the wing in June, and, rarely, specimens of a second generation in September.

LARVA moderately stout, tapering slightly in front; head small, shining black; body brown, densely covered with long even hairs of a deep purplish brown; dorsal stripe broad, orange-red or dull red; legs black; prolegs dark brown tipped with reddish. When younger of a brighter light brown with the dorsal stripe yellow or orange, a brown or greyish sub-dorsal line, and a bluish sub-spiracular line; spiracles white.

July and August, or when, in rare instances, the moths emerge in autumn, larvæ may be found in October; but they are not known to hibernate in this stage. On all sorts of low-growing plants, but more especially on weeds in gardens; where weeds are not tolerated it does not disdain cultivated plants, but is less destructive than the last species. Like this also its motions are very rapid.

PUPA stout, with the abdomen much rounded and its segments drawn close; tail very blunt with short bristles; shining dark purplish-brown or blackish-brown. In a soft but closely fitting cocoon of silk and the long larval hairs, in sheltered corners and at the foot of walls. In this condition through the winter.

A very quiet sluggish insect in the daytime, and a most familiar object, sitting on any wall, fence, or hedge-bank. If disturbed it draws in its legs and body and feigns death. It flies strongly after dark and is much attracted by light, settling on windows and gas-lamps. Hardly so plentiful as the last species, yet common throughout the country to the west and north of Scotland, though more scarce or even rare

in the east of that country. Also common in all parts of Ireland. Found all over the continent of Europe except the extreme North and South; also in Asia Minor, Armenia, Siberia, Tartary, Japan, and Abyssinia. From Japan a form, called *punctarum*, Cramer, with redder coloured abdomen, and the arrangement of spots quite unstable, appears to be no more than a variety of this species, and very probably the same may be said of *S. virginica*, which is of the same shape and proportions, but has the fore wings pure white except a single faint dot at the apex of the discal cell, and generally three black spots on the hind wings; and is apparently the representative of this species throughout North America.

4. *S. urticæ*, *Esp.*, *papyratia*, *Marsh.*—Expanse $1\frac{1}{2}$ to $1\frac{5}{8}$ inch. Fore wings rather narrow and pointed, white with a few black dashes near the costa; hind wings white, spotless.

Antennæ of the male very shortly pectinated, upper side of the shaft white, under side and pectinations black. Head and thorax covered with loose, fluffy, raised white scales. Abdomen yellow with the tip whitish, a row of squared black spots down the middle of the back, and another row down each side. Fore wings rather narrow, costal and dorsal margins very slightly curved, apex produced to a blunt point, hind margin rounded but oblique; white with the faintest possible tinge of creamy toward the costal margin, one black dot near the middle of the costa, occasionally a few black dots scattered over the middle area of the wing, and often a short row of fine black streaks running in from the apex; cilia white. Hind wings rounded, entirely white. Female similar, with threadlike antennæ very slightly dentated. Underside of all the wings white, sometimes with the spots of the upper side of the fore wings faintly indicated, that toward the middle of the costa and two or three before the apex distinctly so; hind wings with a black central spot or lunule which is not visible above; abdomen yellowish-white with

two rows of black spots; legs with the tibiæ covered with long, fluffy, white scales, the tarsi black outside, white within.

Not very variable, though there is a tendency to suppression of the few black dots of the fore wings, that close to the middle of the costa being the most permanent, but it is often reduced to a mere point. Mr. F. J. Hanbury has specimens of a pure spotless white, reared from larvæ obtained in Kent. In Mr. S. Stevens's collection is one with several extra black spots at the base and near the costa, and upon the hind wings a large distinct black spot as in *Menthastris*, yet with the narrow wings of the present species. Specimens are known having a collection of dots or even a number of short black streaks along the wing not far from the costa, but their nativity does not appear to have been clearly established. In the collection of Mr. Auld is a specimen in which the usual black spots down the back of the abdomen are replaced by white, so far as I know a unique aberration.

On the wing in June.

LARVA cylindrical, rather elongated; head round, black; mouth yellow; body dark purple-brown, tubercular spots black, abundantly tufted with bunches of blackish-brown hairs of equal length; spiracles distinctly white; legs brown, prolegs yellow.

July and August on *Lysimachia vulgaris*, *Mentha aquatica*, *Rumex hydrolapathum*, *Pedicularis*, *Iris*, and many other fen and marsh plants, preferring those which grow under the shelter of willow and other bushes.

PUPA similar to that of the last species, but very short and stumpy; deep dark chocolate-brown, the spiracles showing as oval pale brown streaks on each segment. In a soft, rather loose cocoon of brown silk and larval hairs, among rubbish and dead leaves at the roots of plants. In pupa through the winter.

Almost confined to fens, marshes, ditch sides, and wet meadows. Sluggish and rather secret in habits, and seldom seen in the daytime; it flies at dusk and through the earlier part of the night and comes rather early to a strong light. Formerly it is said to have been found in marshy places near London, especially about the Croydon Canal, the Isle of Dogs, Plaistow and Hackney Marshes, and it was found at Lea Bridge in 1859. It may still be met with in wet places at Sheerness and elsewhere in East Kent; near Lewes and Brighton, Sussex; and at Kimmeridge, Dorset; but its home certainly is in the fen districts. At Burwell Fen it used to be pretty common until the fen was destroyed; at Wicken, and elsewhere near Cambridge, it still occurs though not in abundance. Very widely distributed all over the fens of Norfolk and the borders of Suffolk, and in some places tolerably common. In Leicestershire it has been found near Burton-on-Trent; and in South Wales—on a wet moor, with numerous ditches, in South Pembrokeshire—larvæ were found in plenty in the year 1854 by Mr. W. H. Blandford. They were, however, very unhealthy, many were to be seen dead on the plants, and of those secured the majority died, so that but few moths were reared. Possibly this western locality is the extreme verge of its range in that direction. In Scotland it is rare, but Dr. White testifies to having seen a specimen from West Ross. It is also recorded from the Solway and Clyde districts, one specimen even by the river Kelvin, near Glasgow. I know of no instance in Ireland. Abroad it is found throughout central and the temperate portions of Northern Europe, including Western France, North Italy, and Bulgaria, also in Southern Russia, Tartary, China and Japan, though specimens from the latter countries pass under the name of *Sanguica* (Walker).

Family 8. **LIPARIDÆ.**

Antennæ of the males rather short, curved downwards or back, strongly pectinated; of the females very short, slightly pectinated or dentate; fore wings broad, often ovate; hind wings much rounded.

LARVÆ hairy, generally brightly coloured, usually with prominent tufts of hairs, and frequently with two fleshy protuberances on the twelfth segment.

PUPÆ usually with tufts of straight hairs, especially on the dorsal region; in a cocoon of silk and larval hairs.

Genus 1. **PORTHESIA.**

Antennæ of the males much curved and strongly pectinated; of the females short and very inconspicuous; fore wings rather short and broad, with long loose hair-like scales on the dorsal margin; hind wings short and much rounded; bodies of males rather slender, of females very stout, in both with a thick dense terminal tuft of scales.

LARVÆ with dense tufts of bright coloured hairs.

PUPÆ hairy; in a slight tough cocoon of silk, interwoven with short brittle hairs.

1. **P. Chrysorrhœa**, *L.*—Expanse $1\frac{1}{4}$ to $1\frac{3}{4}$ inch. Dull white; abdomen and anal tuft dark brown.

Antennæ of the male curved downward, and strongly pectinated with long, slender, solid teeth, which are fringed on each side with minute hairs, and towards the end bent forward, emitting a long slender bristle; the rows of teeth placed near together and each seeming to be united through its whole length by the long bristles; shaft white, teeth pale brown. Head and thorax covered with very loose fluffy

snow-white scales which overhang the base of the abdomen; its remaining portion being dark brown, with a spreading dark golden-brown anal tuft. Fore wings broad, somewhat triangular, with the costal and dorsal margins nearly straight, apex rounded, hind margin rounded and oblique; dull silky white, with a thickly-scaled glistening appearance in a cross light, and with a very faint tinge of brownish towards the costal margin, which tinge, in preserved specimens, gradually increases and extends to the nervures; usually spotless. A fringe of long white scales on the dorsal margin stands up over the back when the wings are closed; hind wings ample, round, spotless, dull silky white; cilia all white. Female similar, but having upon the short antennæ distinct though short pectinations; abdomen stout and cylindrical with a still larger rounded anal tuft or bunch of dense golden-brown scales. Underside of all the wings snowy white, in the males with a smoky black stripe along the costa; body rather silvery white except the brown apical tuft; legs whitish with long tufts of pure white scales.

Variation very slight, but occasionally a small black dot is visible at the apex of the discal cell of the fore wings, and two or three short blackish streaks near the anal angle. In the collections of the late Messrs. Doubleday and Bond are specimens having three black dots placed triangularly at the apex of the discal cell; Mr. S. Webb has some with the short black streaks at the anal angle, and above them other very small dots parallel with the hind margin, indicating a normal second line, and Mr. C. A. Briggs has specimens having both the discal dots and the dotted indications of the second line, the dots placed singly or in pairs. Other specimens are known having the base and margins rather brownish.

On the wing at the end of June and in July.

LARVA one inch and a half long; nearly cylindrical but slightly tapering at the extremities; head narrowed and rather long, with the lobes pointed in front, grey, with a

darker spot in the upper part of each lobe; body dark brown with an irregular blackish dorsal line interrupted by a raised red tubercle on the third, fourth, tenth and eleventh segments, each tubercle bearing a short tuft of hairs; sub-dorsal and spiracular lines represented by rows of yellowish-brown spots, and between these rows an interrupted line of white spots or crescents; immediately above the feet is a third row of round yellowish spots. The spots and the body generally clothed with short reddish-brown hairs. Sometimes the body, from the fourth segment, is of a pale bluish-grey, the anterior portion being light brown, but the markings remain unaffected.

August or September to June, constructing a nest when very small, in which to hibernate. This is usually effected gregariously, the nest being placed near the ground among the stems of bushes. Other nests are made by the larvæ, as they grow, for security while changing their skins, and they remain in companies till well grown. On hawthorn and blackthorn, and even bramble. But in those seasons in which it abounds the larvæ feed freely on rose, on all sorts of fruit trees, and, upon the coast, on the sea-buckthorn (*Hippophae rhamnoides*).

PUPA blackish-brown, with some small tufts of hairs on the back and sides. In a thin, tough, dirty-brown cocoon, among the twigs of its food-plant. Sometimes five or six cocoons are enclosed in a common web in a hawthorn bush, and when the larva has been plentiful they are to be found in all parts of the bush. With the silk composing the cocoon are interwoven the hairs of the larva, which become brittle, and, when the bush or hedge is disturbed, are thrown out as a fine dust, which, sticking to the skin of the hands, face, or neck of a passer-by, causes an intense irritation, with inflammation which closely resembles nettle-rash. It is on record that a thick hawthorn hedge upon which larvæ and cocoons have been abundant, has retained, for months, the power of thus

afflicting any tender-skinned person rashly assaulting it with the beating-stick. Mr. H. Moncreaff noticed a larva rubbing its hairs across the scarlet tubercles on its back, and upon examination found at the base of each tubercle a valve, opening to a gland from which an oily substance exuded. This oily substance he found, on being applied to the skin, to produce at once inflammatory swellings and all the irritation usually caused by contact with the hairs. This irritating property appears therefore to be external to the hairs and to retain its virulence, unimpaired, when dry, and for long periods. The irritation is usually supposed to be mechanical, arising from fragments of the hairs sticking into the skin, but Mr. Moncreaff's explanation, derived from actual experiment, appears to be the true one.

The moth sits by day upon the bushes, and with its tufted first pair of legs stretched forward, and long loose dorsal scales, looks like a pure white entangled piece of down. It flies at dusk and is readily attracted by a light. It is said to possess in some small degree the urticating property of the larva and cocoon, but by no means with equal virulence. This stinging effect has been ascribed to the dense scales of the anal tuft, but otherwise to the long hair-like scales of the inner margin of the fore wings. Persons whose skin is not tender do not appear to be affected by it.

Apparently almost confined to the southern and eastern coast counties of England, though found occasionally at Whittlesford and elsewhere on the low chalk hills of Cambridgeshire. In 1857 it was said to be abundant at Chesham, Bucks, and there is some reason to believe that its range was formerly much wider than at present. Its most favoured district is certainly the coast of Kent and Sussex, and in some years it has abounded to such an extent in the Isle of Sheppey, at Herne Bay, Folkestone, Deal, Hastings, Chichester, and Gravesend, as to become a complete pest, stripping the hedges of their leaves, and rendering them

obnoxious to the innocent pedestrian. It has been taken, though not commonly, in Wiltshire, Gloucestershire, Somerset, Devon, Suffolk, Norfolk, and rarely in Yorkshire and Durham. There are even two records in Scotland, one of them by Sir Thomas Moncrieff, who secured a male specimen which came to light at his window. It seems improbable that these were other than migrating individuals. In Ireland it was recorded by the late Mr. E. Birchall, but apparently in error. Abroad it is found in Sweden, throughout Central and Southern Europe, in Northern Africa, and in Asia Minor.

2. *P. auriflua*, *Fab.*, *Schiff.*; *similis*, *Staud. Cat.*—
 Expanse $1\frac{1}{4}$ to $1\frac{3}{4}$ inch. Glossy white; anal tuft bright yellow.

Antennæ of the male curved down at the apex; very strongly pectinated, the teeth also bent at their tips and strongly fringed with fine hairs; pale buff with the shaft white. Head and thorax covered with long, loose, pure white scales; abdomen rather slender, white, with the anal segment and a large anal tuft bright yellow. Fore wings broad, with all the margins and the apex smoothly rounded; pure, clear, silky white, with the extreme edge of the costa at the base tinged with smoky black, and a small patch consisting of three spots of the same colour, at the anal angle. Dorsal margin edged with long hair-like scales of a pure white and most evanescent. Hind wings slightly elongated, much rounded, silky white; all the cilia rather long, pure white. Female larger, but with very short antennæ, which are shortly pectinated; fore wings usually entirely white; abdomen very stout, with a still thicker rounded anal tuft of dense, straight, yellow scales; otherwise similar. Underside of the fore wings of the male white, with a large smoky black cloud lying along the costal region, but not reaching its edge, shaded off across the wings so as to tinge the greater portion of their area, but leaving the hind margin pure white; of hind wings snowy-white; in the female, fore and hind

wings alike snowy-white ; body white, except the yellow anal tuft ; legs thickly and broadly covered with fluffy snow-white scales down to the claws, especially so in the first pair.

Hardly variable, but, rarely, a smoky black spot appears near the base at a short distance from the dorsal margin, and one or two more near the apex or hind margin, the latter indicating, with the blotch at the anal angle, the position of a normal second line. One specimen in Mr. S. Webb's collection has such a line faintly indicated as a sort of sub-marginal band.

On the wing at the end of June and through July. Occasionally examples of a very partial second generation are found in October.

LARVA hairy, stout, cylindrical, compressed at incisions of segments, humped, the fifth and sixth segments being the largest. Ground colour black ; dorsal line bright scarlet, interrupted on the fifth, sixth, and twelfth segments, on which are slight eminences with white spots ; spiracular line dull red ; head black with a yellow spot on the mouth ; under-surface spotted with orange and yellow. All the usual spots emit tufts of long hairs. (C. Fenn.)

August to June on hawthorn and fruit trees ; but sometimes on various other trees, more especially beech and oak. The young larvæ live in a common web or nest of their own construction, made of the leaves of their food-plant, two or three of which they draw together with silken threads, also fastening them to the twigs in the same manner. They eat only one surface of the leaves, returning to the nest when hunger is satisfied. In October each young larva makes a small cocoon-like hybernaculum within a similar nest, which is then formed under bark, or in a curled leaf near the ground, or else on the thick stems of the food plant, and in this pass the winter. On awaking in the spring they gnaw the buds until the leaves appear, continuing to live gregariously until the last moult, near the end of May, after which they scatter, and feed openly

and conspicuously, returning no more to the nest. The hairs of the larva have urticating properties, but not to the extent of those of the preceding species; the most unpleasant effects being, it is said, produced by the broken up hairs of the cast skins. Mr. Moncreaff states that the irritation may be allayed by rubbing the inflamed surfaces with bruised dock leaves.

PUPA stout, slightly hairy, tapering rather rapidly towards the tail, which is hooked; dark brown, incisions of segments dull pale brown. In a thin, but tough, silken cocoon of a brownish colour, placed among leaves or twigs or under any convenient projection. The larval hairs are not worked into the cocoon to any considerable extent, and it does not seem to possess irritant qualities.

The moth sits, in the daytime, upon the bushes on which it has fed as a larva, in the most conspicuous manner. Yet with its long and strongly tufted legs stretched out in front, and the long dorsal scales standing up over its back, bears a most deceptive resemblance to a white downy feather caught by a thorn. It flies freely at dusk and is readily attracted by a light. Its flight, however, is slow and rather weak. Although it may usually be handled freely without inconvenience, persons having very tender skins have suffered much from urticating properties which appear to exist in the dorsal scales, and also in those of the anal tuft, which are used by the female for the purpose of covering her eggs.

A most abundant species in the South and East of England, and to be found commonly in the Midlands, and as far north and west as Lancashire, Cheshire, Herefordshire, Gloucestershire and Somerset. In Devon it is said not to be found west of Torquay and Exeter. Its range in Wales is also limited, since I never saw it in Pembrokeshire or Carmarthenshire. In Yorkshire it is abundant in the eastern district, local in the western, and in some parts rare, as also it is in Durham. In Scotland a single specimen was taken by

Dr. F. B. White on the shore of the Solway Firth, in Kircudbrightshire, and another in 1872 at Aberdeen by Professor Traill. In Ireland it was recorded as common by Mr. E. Birchall, but no recent record seems to exist. Abroad it is plentiful, and often destructive, in Central, Southern, and Eastern Europe, and is found in Armenia, Western Siberia, Tartary, Northern India, Japan, and even Java.

Genus 2. LIPARIS.

Antennæ of males rather curved, strongly pectinated; of females hair-like; fore wings very broad and shining, with nervures swollen; hind wings rounded; abdomen in both sexes moderately stout; anal segment very slightly tufted.

1. *L. salicis*, *L.*—Expanse $1\frac{1}{2}$ to 2 inches. Wings shining satiny-white; thorax and abdomen white.

Antennæ of the male gently curved, strongly pectinated with rather straight teeth, which are dark grey or blackish, the back of the shaft being white; head and thorax covered with long loose snowy-white scales of a downy softness; abdomen rather robust, blackish, somewhat thinly clothed with silky-white scales. Fore wings broad and ample, with the costa very slightly rounded; apex blunt; hind margin oblique, and, with the dorsal margin, gently and gracefully rounded; pure shining satiny-white without markings; nervures thickened, especially toward the base; hind wings rather long and ample, well rounded; clear satiny-white, with the nervures slightly visible; cilia all white. Female larger, with slender antennæ, which, however, are distinctly, but obliquely, pectinated, and abdomen stout and rather thinly covered with scales; otherwise similar.

Underside of body and wings entirely satiny-white; tibiæ strongly tufted with long white scales; tarsi black, ringed with white.

When perfectly fresh this species is of a lovely shining

white, and well deserves its common name of the *Satin moth*; but in preserved specimens a faintly brownish discoloration appears in time along the subcostal nervure, and gradually spreads to the other nervures of the fore wings. Otherwise it is hardly variable, except that in occasional examples the whole surface of the wings has a faint tinge of smoky-blackish from an admixture of minute dark scales among the white. Mr. S. J. Capper has a specimen in which the apex and hind margin of the fore wings are distinctly shaded with blackish.

On the wing in July and August.

LARVA one and a half inch long; rather flattened above and beneath; each segment having subdorsal and spiracular raised spots, or tentacles, from which arise tufts of short spreading bristles. Head rounded but distinctly lobed; dark grey, blacker on the upper portion, with two whitish spots; lower portion protected by numerous hairs, longer than those on the body; second segment whitish or yellowish in front, red behind; the remaining segments each with a crimson dorsal spot, immediately followed upon each by a clear bright white spot, small on the first three segments, large, broad and conspicuous, sometimes even divided, on the remainder, except the last, which is black behind the red spots; each segment having also the raised subdorsal and spiracular spots of a bright crimson; all the dorsal surface, round and between the crimson and white spots, is black; on each side is a slender clear white longitudinal line, edged above and below with black; below this is a broad blue stripe extending to the legs and prolegs, which are also blue; this blue stripe encloses the lower row of crimson raised spots; hairs reddish.

August to June or July upon poplar and willow, and on the coast upon sallow. The larvæ hibernate when not more than a quarter of an inch long; each in a tiny cocoon-like web in some chink of the bark of the tree on which it

feeds. On coming out in April from hybernation, they are so small as to appear as though but just hatched, and are very dull and dingy in appearance. A fresh silken covering is prepared for each change of skin up to the fourth. The larvæ feed mainly at night, hiding by day in chinks of bark, more especially on the underside of branches, where, when well grown, they are easily seen.

PUPA glossy black, with abundant tufts of white hairs arranged in six rows on the back and sides, four of the rows commencing from the head. In a thin silken cocoon between leaves, or in the angles of the bark of the trunk, or branch, of the tree on which the larva has fed, or in any suitable corner.

The moth sits by day on the trunks and branches of poplar and willow trees, or on fences, and is quite conspicuous and extremely sluggish. At night it flies actively, comes freely to light, and has even been seen upon the sugar used to attract *Noctuæ*.

It is extraordinarily and perplexingly irregular in numbers, appearing in favourite places, such as the Isle of Sheppey, in certain years, in such multitudes that the poplars are stripped of their leaves, and the moths in the evening almost remind an observer of a snow-storm. In other years but few are seen. These fluctuations are the more difficult to explain since the larvæ are most distasteful to birds, and appear to be almost exempt from the attack of insect parasites. On the Continent it is more constant in its numbers, and so injurious as greatly to check the growth of the poplar and willow trees, and its destruction is an important part of the duty of the foresters. Formerly it was plentiful throughout our Southern counties, including the outskirts of London, where its beautiful larvæ were conspicuous on the undersides of the branches of every poplar, while in 1857 the willow trees in and around the suburbs were almost stripped of leaves. More locally it was also common in the Eastern and Mid-

land counties. Now it appears never to be seen around London, and to have become scarce or extinct in very many of its old haunts, so that its actual present range is uncertain; but along the South Coast, and on that of Lancashire, it is still common. In the fen districts of Cambridgeshire and Norfolk it is now rarely found, though formerly plentiful. In the west it extends, or has extended, to Herefordshire, Gloucestershire, and Somerset, and even very rarely to Devon; specimens have also been taken at Barnsley and elsewhere in Yorkshire, and in Durham. In Scotland it is recorded, rarely, from Aberdeen, Pitcaple, Inverurie, Peterhead, and from Ayrshire. In Ireland from Galway. Abroad it is found throughout Central and Northern Europe—often as a destructive pest—and in Spain, Northern Italy, Corsica, Turkey, Southern Russia, Siberia, Tartary, China, and Japan.

(**Leucoma V-nigra**, *Fab.*—This species, which is satiny-white with a black V in the middle of the fore wings, was recorded as British by Haworth, but his description appears to indicate that he had before him a pale specimen of the female *Hypogymna dispar*. But Stephens correctly describes it, mentioning several specimens believed to be British, one of them taken at Bromley, in Kent. Westwood also records it as taken near Darenth, Kent, and it is well figured as British by Wood. Thirty years ago the late Mr. E. G. Baldwin recorded the capture of specimens of the nativity of which he felt satisfied, as follows:—"I have a specimen which was given me by Mr. S. Jessop, of Rawmarsh. The insect was taken twenty years ago in Tinsley Park, between Rotherham and Sheffield, by a man named Siddell, who did not know the value of the moth he had captured. Mr. Jessop informs me that he met him early in the morning and asked what he had in his box, which, being opened, revealed four or five specimens of *vau-nigrum* (at the time considered by them to be only *S. salicis*). They were pinned with large common pins and some were alive, not having been killed by

the pinch they had received under the thorax." However it may have been fifty years ago, there is no reason to suppose that this species has at any more recent period inhabited this country).

Genus 3. **HYPOGYMNA.**

Antennæ short; fore wings of the male short and very broad, of the female long and rather ovate; hind wings rounded; thorax and abdomen of male slender, of female very stout.

1. **H. dispar**, *L.*—Expanse of male $1\frac{1}{2}$ to $1\frac{3}{4}$ inch; of female $1\frac{3}{4}$ to $2\frac{1}{2}$ inches. Male, body slender, wings broad, pale brown clouded with dark brown and having rippled lines; female, body stout, wings long, whitish with rippled lines and a central black **V**-mark.

Antennæ of the male short, stiff, inclining forward, curiously curved with the tip pointing downward or backward, strongly pectinated with solid, long, curved teeth, each tooth densely ciliated with fine hairs and tipped with longer bristles, the two rows of teeth being placed more than ordinarily close together; brown, the shaft sometimes rather paler. Head, and slender thorax, dark brown covered with rather long, loose, raised scales; abdomen slender and tapering, dark brown with a rather long brown anal tuft. Fore wings short and very broad with rounded costal and hind margins, blunt apex, and nearly straight dorsal margin; pale umbreous or whitish-brown, almost covered with a clouding of dark brown and rippled dark-brown lines; nervures usually darker brown; at the base is generally a brown or black dot or two, followed immediately by a transverse row of brown dots, beyond which is the usual first line, dark brown or black, irregular and undulating; the second line is also dark brown, rippled, curved, and scalloped throughout, and precisely imitated by another transverse line placed half-

way between it and the hind margin; the space beyond this being clouded with dark brown. Between the first and second lines is usually a broad ill-defined central brown cloud, crossing the wing and partially obscuring a black dot in the discal cell and a black crescent or V-mark at the extremity of the cell. Cilia brown with regular, almost squared, black-brown spots, which are sometimes very faint. Hind wings rather long, much rounded, pale brown or umbreous, with darker brown nervures, and sometimes a cloudy brown band along the hind margin, most distinct upon the nervures; cilia pale brown, sometimes dappled with darker.

Female extremely different (hence its name). Antennæ short, and shortly but distinctly pectinated, not curved down; black. Head and thorax downy in appearance from abundance of soft, raised, yellowish-white, or brownish-white scales; thorax robust; abdomen very stout and heavy, brownish-white shading to browner towards the anal segment, which is broadly and bluntly tufted with dense yellow-brown scales. Fore wings longer and rather narrower than in the male, very ovate, margins all rounded, apex hardly angulated; white, faintly tinged with brownish, especially towards the costa; first and second transverse lines rippled and scalloped throughout, the second deeply so; between them is a cloudy transverse central stripe which crosses a distinct black V-shaped mark at the extremity of the discal cell; between this mark and the first line is a round brown spot in the cell, and another lies at the base of the median nervure; outside the scalloped second transverse line is another, similar, much less distinct, often partially obliterated; and on the costa are three brown spots or blotches, from which arise, respectively, the two transverse lines and the central shade; cilia whitish, chequered with broad, squared, dark brown spots. Hind wings shorter than in the male, semi-transparent whitish; nervures faintly brownish; cilia whitish, with a row of dark brown spots.

Underside of the male—all the wings pale brown, rather

darker towards the hind margins; fore wings with a large ill-defined central lunule or V-mark, and beyond it faint cloudy indications of the second transverse line; hind wings with an angulated or lunate central spot; cilia all pale brown spotted with darker; body and legs very pale brownish. Female with the underside of all the wings dirty white, shaded with brownish toward the costal margins, and in the fore wings with faint indications of the markings of the upper side; cilia whitish spotted with brown.

Variation in the male is mainly in the intensity of the brown ground colour, which sometimes is very pale or even becomes whity-brown, the central shade and hind marginal space remaining dark brown. More rarely the whole of the fore wings is clouded with blackish-brown, obliterating the markings, but the base usually remains paler. In the female variation manifests itself mainly in the greater or less distinctness of the transverse lines and shade, which in some specimens are strikingly distinct, in others hardly perceptible; but however faint the other markings may be, the black discal V is nearly always distinct. Great numbers of reared specimens have been found to exhibit, in the hind wings, a large notch or circular piece apparently cut from the margin. This has occurred in specimens believed to be derived from a native source, but which had been in-bred for so many generations that apparently the strain had become exhausted, and there has probably now been for some years no remnant of the British race. A gynandrous specimen is in the collection of Mr. S. Webb, its right side being female, left male.

On the wing in August.

LARVA moderately stout, cylindrical, lateral spots raised into tubercles emitting bunches of very long black, and shorter brown, hairs; dorsal spots with bunches of black bristles. A tubercle on each side of the head emits a bunch of very long hairs pointing forward; head extremely large,

rounded, not shining. Body black or dark brown dusted with whitish or pale yellow; subdorsal spots enlarged and forming a pair of tubercles on each segment, dark blue on the second to the sixth, and deep claret-coloured on the seventh to the twelfth; dorsal and subdorsal lines whitish, ill-defined; head yellow, much marbled with black or dark brown, and with a conspicuous dark brown dash on each side of the face; legs reddish brown; pro-legs tinged with pink or dull orange. (C. Fenn.)

April to July on sweet gale, hawthorn, elm, oak, lime, willow, sallow, blackthorn and other trees and bushes, but especially on apple, plum and other fruit trees. The winter is passed in the egg state; after hatching, at the beginning of April, the young larvæ commence at once to grow steadily and pretty rapidly, feeding vigorously in fine weather, but in cold or wet weather collecting together in sheltered portions of the higher branches, where a slight common web is constructed for temporary shelter. No larva is more easy to rear in confinement. Abroad it is, in some seasons, terribly destructive, stripping not only the fruit trees, but the forest trees, of their leaves, and seriously retarding their growth.

PUPA rather short and stumpy, cylindrical, then tapering rapidly off to the tail. Dull brown, with a few slight tufts of very short hairs on the back. In a thin tough silken cocoon in the interstices of bark, or in the angles of twigs of trees.

The male moth flies actively in the sunshine; its wings are hardly dry before it proceeds in eager search for the female. The latter sits quietly close to the cocoon from which she has just emerged, and very soon commences to lay her eggs, in a mass, upon the bark or other substance upon which she may be sitting, covering them carefully with the dense scales of the abdominal tuft, which she detaches for the purpose. A very large portion, if not the whole, are usually deposited

before night, when, if at all, she takes flight. It is extremely doubtful whether this species is now an actual living inhabitant of these islands. In the first half of the present century it inhabited the fens of Norfolk, Cambridgeshire and Huntingdonshire, and was sometimes to be found in great abundance; but it is not clear that this was more than a temporary extension of the species to this island. Curtis's remarks (about 1830) are as follows: "At the time Donovan wrote (1792) these moths were so rare that he could not obtain British specimens to figure in his work; it is not easy, therefore, to conceive the joy I experienced, when a boy, on finding the locality of the Gypsy Moth. After a long walk I arrived at the extensive marshes of Horning in Norfolk, having no other guide to the spot than the beds of *Myrica gale*; and on finding the beds of that shrub, which grows freely there, the gaily-coloured caterpillars first caught my sight. They were in every stage of growth, some of them being as large as a swan's quill. I also soon discovered the moths, which are so totally different in colour as to make a tyro doubt their being legitimate partners; the large loose cocoons were likewise very visible, and on a diligent search I found bundles of the eggs covered with the fine down from the abdomen of the females, which is said to be scratched off by the males, to protect them as soon as they are laid. With eggs, caterpillars, chrysalides, and moths, I soon returned, enjoying unmixed delight in my newly-gained acquisitions, and looking forward with pleasure to the feeding and rearing my stock the following year."—"British Entomology," p. 767. There is something so genuine and hearty about this account that I reproduce it exactly, though it is hardly necessary to explain that the male is not so well trained as to undertake the office of covering the eggs with down—this is the work of the female. The Rev. E. C. F. Jenkins, writing in 1859, says: "Thirty years ago the fens about Whittlesea Mere were most interesting . . . the moth *L. dispar* was very plentiful." The late Mr. H. Doubleday recorded that it disappeared

there about 1836, and had not been seen since. Also that when he was at Yaxley Fen in 1839, "the larvæ swarmed on the gale and dwarf sallows. In 1846 it was still common there. In 1845 Mr. F. Bond found it abundantly at the same place and at Holme and Ramsey Fens, and about the same time it was found by the Rev. L. Jenyns at Burwell Fen. No later records of its appearance in any numbers in this country seem to exist, and it must have disappeared almost entirely from the fen districts about 1850. These fen specimens seem to have been of large size, and of so vigorous a race that their descendants are claimed to have been continued, brood after brood, to quite a recent period. If so, they soon fell off in size, but the numbers of eggs and larvæ obtained were so great that again and again batches were turned out in various parts of the country, including their old fen haunts, but apparently without any effect in re-establishing the species. In 1872 Dr. F. D. Wheeler found two larvæ on hawthorn at Monkswood, Hunts; another was found near Cherry Hinton, Cambridge, by the Rev. G. H. Raynor about 1875; a few more were found on hawthorn in Warwickshire in 1885; and several other captures of larvæ, more or less dubious, are on record. In 1870 a female moth was taken, sitting on a birch trunk in the New Forest, by Mr. A. Ficklin, and Mr. W. Holland captured a male flying in a wood near Odiham, Hants; and in 1887 a female was obtained sitting on an oak in the New Forest. Two female specimens are recorded from Brampton Wood, Huntingdon, about 1870, and other solitary captures appear to have been made, at different times, at Wigmore Wood and Chattenden, Kent; but in all these cases there has been room for doubt whether the specimens captured were genuinely wild, or the result of larvæ turned out in the hope of establishing a colony.

Abroad it is found, often most abundantly, almost all over the Continent of Europe, Northern Africa and Northern and Western Asia. From Japan a large form is obtained—and called *Japonia*—and a small one, named *umbrosa*—neither of

which appears to be specifically distinct from that under notice.

Genus 4. **PSILURA.**

Antennæ short, curved back; fore wings elongated, broad and ample; hind wings hardly rounded; abdomen of the male rather stout at the base, rapidly tapering; of the female stout, with the apex very sharply pointed.

1. **P. monacha**, *L.*—Expanse of male $1\frac{1}{2}$ to $1\frac{3}{4}$ inch, of female $1\frac{3}{4}$ to $2\frac{1}{2}$ inches. Fore wings white, with thick black transverse lines abundantly broken into arches; hind wings whitish with spotted margin; abdomen dull red.

Antennæ of the males prominent, rather curved back, strongly pectinated with long solid curved teeth, of which the two rows lie parallel and almost touching each other; the shaft dark grey, becoming whitish towards the tip, the long pectinations pale grey. Head thickly covered with loose creamy-white scales; thorax white, with a black stripe across the collar, three deep black spots placed triangularly on the back, and a blackish stripe down each shoulder; abdomen stout at the base, but tapering rapidly, and slender in its hinder portion; pale crimson, shading off to whitish at the base, and with a row of black spots down the middle of the back, which spread into black bars on the hinder segments. Fore wings broad, elongated, with rounded costa, blunt apex, hind margin rounded and very oblique, and dorsal margin nearly straight; glossy white with abundant black arched markings—a black blotch at the extreme base followed by three or four small roundish black spots forming a sort of irregular cross line; first transverse line broad on the costa, repeatedly and strongly angulated, second transverse line placed considerably beyond the middle, curving in a wide sweep, but angulated and scalloped so regularly as to form nearly a dozen arched and pointed curves in its course; outside it, toward the hind margin, is a third line, undulating and similarly

composed of arches and sharp angles; in the middle of the wing before the second line is a cloudy black transverse line or stripe, similarly angulated, and touching, or sometimes including, a large lunule at the end of the discal cell; a black spot lies in this cell close to the first line; cilia white, spotted with black. Hind wings moderately broad, not long, rounded, but with the margin straighter towards the anal angle; very pale grey dusted with whitish, and with a narrow, gracefully curved, darker grey border much indented on its inner side, and preceded by a whitish ill-defined band; cilia white with large black spots.

Antennæ of the female black, with short solid pectinations; thorax stout; abdomen also stout, but tapering behind to a point, which is finished off by a long protruded ovipositor-sheath. Fore wings decidedly longer than in the male, but not broader in proportion; ground colour often slightly creamy; black markings more loose and irregular; otherwise similar.

Underside very handsome, the fore wings having a black stripe along the base of the costa, which is thence broadly yellowish with two interrupting black spots or blotches; middle portion dark grey, broken into bands by cross-bars of yellowish grey, and shading off to whitish along the dorsal margin; hind wings whitish faintly tinged with brown; two blackish lines from the costal margin merge into transverse curved stripes which nearly cross the wings, and a third lies along the hind margin; cilia all white with large black spots; under part of thorax brownish white; of abdomen pinkish with a row of alternate black and crimson spots down each side; legs black barred with white.

Variation in this species is confined mainly to the central cloudy angulated stripe or line of the fore wings, which sometimes is nearly or quite suppressed, at others is thickened, spread, and intensified in different degrees, forming a broad black blotch on the dorsal margin, and a series of thick connected blotches or bars extending across the wing, or in some cases it spreads so as to fill much of the space between the

first and second lines ; in such specimens the other markings are also thickened and often run into blotches. Another phase of variation is that of the form well known on the Continent under the name of *eremita*, in which the wings are wholly suffused with smoky black, the markings usually showing slightly through it. In this country several entomologists, by assiduously rearing from the darkest forms of a selected dark stock, have nearly, if not quite, succeeded in producing this variety. Old specimens nearly approaching to it also exist in several of the larger collections ; and a single example was taken at Brandon in 1875 by Dr. F. D. Wheeler. In the course of the experiments just mentioned, carried on by Messrs. Fletcher, Fenn, Hall, and others, for production of black specimens, other very pretty forms have been evolved, some of a silky yellowish grey, others with the whole central area black, or wholly of a pale smoky or a sooty black, and of these some, not so handsome, have casual irregular white blotches. It is worthy of note that the black suffusion, when present, extends equally to the hind wings. Mr. S. Webb has a very singular aberration, of normal colouring, but the black markings are deprived of the usual elongated points, curves taking their place throughout.

On the wing at the end of July and in August.

LARVA stout, hairy, flattened, the lateral spots swollen into tubercles emitting tufts of dark greyish-brown hairs ; dorsal spots with bunches of inconspicuous blackish bristles ; second segment with a conspicuous tubercle on each side, projecting forwards, and furnished with a tuft of long hairs ; pro-legs rather sprawling, the anal pair extended backwards. Whitish, pale grey, or greenish grey dusted with blackish, with a broad brown dorsal band extending between the sub-dorsal lines, which are black and sinuous. This dorsal band is conspicuously interrupted by a paler blotch of the ground colour on the fourth, eighth, and ninth segments, and is divided by the broad inconspicuous dorsal line. The pale

blotches are sometimes wanting in the darker varieties. Third segment with a large, deep velvety-black dorsal patch; spiracular line black, appearing vandyked from its uniting the raised lateral tubercles; above it is a faint greyish line. Under-surface dull greenish. Head rounded, brown, delicately reticulated with ochreous, or ochreous dotted with black. Legs brown, a minute red dorsal tubercle on the tenth and eleventh segments. A variety has the fourth segment suffused with whitish and two waved grey lateral lines. (C. Fenn.) Occasionally a black variety occurs, or of mixed brown and black.

April to July on oak, birch, elm, lime, willow, and aspen, also apple and other fruit trees, and more particularly upon the various species of pine and fir. Eggs laid in August in the chinks of the bark of trees, remain in that condition through the winter, and hatch in April. The young larvæ are said to sun themselves upon the tree-trunks for a few days before proceeding to feed, after which their progress is rapid, but they continue to resort to the tree-trunks by day. Abroad this species is sometimes most destructive in fir forests, but is said to feed only on the mature leaves (needles) and not to injure the younger shoots.

PUPA stout, highly polished; back and abdomen with numerous tufts of pink hairs; head tufted with black hairs; shining bronze-brown. (Fenn.) Sometimes the general colour is almost black, always brilliantly glossy, and the tufts of hairs vary in colour from red-brown to yellow. In a thin, loose, semi-transparent cocoon of white silk in a chink of the bark of the tree, frequently upon the trunk, and distinctly visible.

The moth is almost exclusively attached to woods. It sits quietly upon tree trunks or branches in the daytime and flies only at night. When sitting upon a lichen-covered trunk its black markings on a white ground harmonise wonderfully with the lichens, so that it is by no means so conspicuous as might from its appearance be expected. The male is strongly

attracted by light, and the female also to a less extent. Very widely distributed in England, but not usually very common. Perhaps most plentiful in the New Forest, Hants, and in more moderate numbers throughout the southern counties to Devonshire; less common in the eastern and midland counties, but found as far west as Swansea, Glamorganshire, and northward to Lincolnshire and some parts of Yorkshire. Further north I find no record, and Mr. Birchall's statement that it was not uncommon in Ireland appears not to be confirmed. Abroad it is widely distributed and sometimes abundant in Central Europe and all the temperate portions of Northern Europe, in Northern Italy, Spain, and Greece. It has probably also a very wide range in Asia; from Japan it is received, quite typical in both sexes; from Northern India much larger, with typical markings and very handsome, some of the females expanding to $3\frac{1}{2}$ inches, but named *superans*, and a slightly different variety, *concolor*. Another large form, white, with the markings of the middle of the fore wings partially obsolete, from Bhotan, is named *cara*; it also is found in Sumatra and Borneo. Thus the variation in Asia appears to be in the direction of whiteness and large size, with suppression of the black markings, while in Europe it is in the opposite direction.

Genus 5. **LÆLIA.**

Antennæ of the male of moderate length, very strongly pectinated; of the female short and slender; fore wings of the male very broad, of the female much narrower; legs not tufted.

1. **L. cænosa**, *Hüb.*—Expanse $1\frac{1}{2}$ to $1\frac{3}{4}$ inch. White; fore wings of the male clouded with yellowish drab.

Antennæ of the male large and prominent, slightly curved; very strongly pectinated, the rows of long, solid, ciliated teeth inclining towards each other; grey with the shaft white; palpi yellow; head and thorax creamy-white, tinged with buff; abdomen slender, whitish. Fore wings very broad and

squared, with the costa hardly curved, the apex very bluntly angulated, the hind margin almost straight and hardly oblique, the dorsal margin rounded; very pale buff or brownish white, faintly tinged with smoky-brown toward the costa; nervures rather thickened and slightly tinged with brown; above the median nervure is an ill-defined longitudinal stripe or space of the whiter ground colour, above and below which are the portions of the wing most tinged with brownish; usually devoid of markings, but in some specimens an exceedingly faint angulated row of minute dots indicates the position of what should be the second transverse line; cilia creamy-white. Hind wings broad and ample, nearly as long as the fore wings; rounded; creamy-white with a faintly brownish line along the hind margin; cilia white; legs buff. Female quite different; antennæ short, with small distinct black pectinations; the shaft white; head white, with bright yellow palpi; thorax and abdomen stout, glossy white. Fore wings comparatively narrow, with the margins gently rounded and the apex scarcely angulated; creamy-white or pure white, with the faintest possible tinge of brownish along the nervures; hind wings long and broad, rounded; clear white, with faintly brownish nervures; cilia all white; legs bright yellow.

Underside of the fore wings in the male greyish-buff, with the dorsal margin whitish, and the costa tinged with smoky toward the apex; hind wings creamy-white; cilia white; body pale buff or whitish; legs yellowish. In the female similar to the upper side; legs bright yellow.

Not variable except in the occasional presence of dots, indicating a transverse line beyond the middle, in the male. Mr. F. J. Hanbury has several showing this rather distinctly, and in the collection of the late Mr. F. Bond is one in which the line of dots is fairly complete, indicating the course of the line to be from the costa, not far from the apex, to near the middle of the dorsal margin, with a considerable bend outward.

On the wing in July.

LARVA rather short, cylindrical, of tolerably uniform thickness; head broad, rounded, dull brown, with numerous hairs pointing forward; second segment with two long tufts of black hairs projecting forward over the head; on the fifth to the eighth segments are dense round flat-topped tufts or brushes of upright hairs, of a light reddish colour, tipped with dark grey; the anal segment has a large and dense spreading mass of blackish hairs pointing backward, and over these is a long similar tuft arising on the twelfth segment; body dull olive-brown, with the dorsal stripe black, with indistinct rows of subdorsal blackish rings, and a general covering of reddish grey hairs; legs and pro-legs pale brown.

August to June on *Cladium mariscus*, *Arundo phragmites*, and other fen grasses.

PUPA undescribed; in a long, slender, rather shuttle-shaped cocoon, placed upon the stem of its food plant.

The moth sits on fen plants in the daytime, and flies rather late at night, having a soft, gentle flight. The male is readily attracted by a strong light; the female is said to be very sluggish. It is reported to have been first found in this country by the late Mr. J. C. Dale, in the year 1819, at Whittlesea Mere, and he afterwards met with it at Yaxley and Burwell Fens. While Whittlesea Mere continued in existence the insect was so plentiful that no particular interest seems to have attached to it and it is hardly recorded, but doubtless it had existed in that district from an early period. In Wicken Fen also it was so plentiful that the sedge-cutters collected and supplied any number of larvæ at a shilling a dozen, and in that Fen it was abundant so late as 1860, larvæ, pupæ, and imagines all readily found in all parts of the Fen. In 1865 it had become scarce, and the last larvæ found appear to have been in 1871, when two were taken. In 1873 Dr. F. D. Wheeler introduced at Wicken the powerful attracting lamps now so much in use there, and in that year the light was visited by forty of the moths, all males. By

1874 it had become so rare that four only were taken in that year, and casual specimens in the following years until about 1880, when there is every reason to fear that it became extinct. For this the new method of collecting was in no respect to blame, since the females were not attracted by it. The cause of this rapid decadence must remain a mystery. It can only be conjectured that from long isolation the constitution of the whole local race broke down. So far as these islands are concerned this species appears to have been absolutely confined to the small district of Cambridgeshire and Huntingdonshire containing the fens already specified. In those of Norfolk, although equally suitable, it does not appear that it has ever been met with. Abroad it is found in Northern France, Northern Germany, Hungary, Catalonia, and Bulgaria; also widely distributed in Asia. Specimens from India and Java, which are rather small, but which have the row of black dots in the male complete, have received the names of *angulifera* and *suffusa*; while those from China and Japan, having a faintly increased tinge of brownish along the costa in the female, are known as *sangarica*. A form from Australia, in which the male is paler in colour and devoid of the dots, and the female has a tinge of yellowish on the costa, is called *obsoleta*; in all probability it is not specifically distinct.

Genus 6. **Dasychira.**

Antennæ of the male very short, decidedly arched, strongly pectinated; of female still shorter, and slender; fore wings elongated and ovate; thorax and abdomen stout, tufted; legs with dense tufts of long scales.

LARVÆ with extremely dense brushes of dorsal hairs.

PUPÆ in a tough strong loose cocoon.

1. **D. pudibunda**, *L.*—Expanse of male $1\frac{1}{2}$ to $1\frac{3}{4}$ inch, of female $1\frac{3}{4}$ to $2\frac{1}{2}$ inches. Fore wings greyish white; of male

with a very broad cloudy-grey central band, of female with two dark grey transverse lines; hind wings white with a cloudy grey spot; fore legs long, tufted, sprawling.

Antennæ of the male gracefully curved, with the tips downward, strongly pectinated, the two rows of long closely set teeth rather near together; shaft white, pectinations bright brown. Head whitish or greyish-white; thorax pale grey, densely covered with downy scales; collar very broad and edged behind with dark grey; at the back of the thorax is a large smoky black spot; abdomen whitish, with one, two, or three black bars on the basal segments. Fore wings rather broad with gently rounded margins and bluntly angulated apex; whitish grey, much obscured by transverse dark grey cloudy markings, a straight indented perpendicular line near the base; the usual first and second transverse lines, which are very dark grey or blackish, the first rather curved and partially duplicated, the second more oblique, curved and angulated in the middle; between these lines is a broad shaded dark grey central band, enclosing a large reniform grey spot, edged with black, at the end of the discal cell; half-way between the second line and the hind margin is a more or less distinct rippled, or scalloped, dark grey shaded line, much broken, and edged outwardly with whitish; cilia whitish grey spotted with dark grey. Hind wings rounded, greyish white, with a dark grey cloud from the anal angle partially or completely crossing the wing, and a dark grey central lunule; cilia white. Female larger, stouter, and quite different; antennæ very short, but regularly pectinated with short teeth; whitish; head, thorax, and abdomen very pale grey or greyish white. Fore wings ovate with the costa more rounded; greyish white or pale grey, with a partial, straight, transverse stripe from the costa near the base; the first line thick and strongly marked, bent inward, dark grey or grey-brown; second line also rather thick, but not so sharply marked, of similar colour, partly duplicated; the rippled

clouds toward the hind margin indistinct; cilia white with regular black spots. Hind wings white, with the cloudy transverse band from the anal angle sometimes nearly complete, and with an indistinct central lunule; cilia white, sometimes spotted with grey or black. Underside glossy greyish white, tinged with grey towards the base of the fore wings; in the male all the wings have a distinct black central lunate spot, that of the fore wings being large and elongated; beyond this is a dark grey, or blackish, stripe from the costa half way across each wing; in the female the lunate spots and the cross stripe are greyer and less distinct, but the first and second transverse lines are visible; cilia white, spotted toward the apex of the fore wings with black; body whitish; the legs, especially the first pair, very densely clothed with long scales; grey above, whitish beneath.

Variation in the male is mainly in the breadth and intensity of colour of the clouded central grey band; in the female in the ground colour, from white to grey, and in the depth of colour of the transverse lines. Some male specimens have the markings exceedingly strong and dark, both transverse lines blackish, double, with white interspace, and between these lines a broad slate-coloured central band, the scalloped clouds of grey towards the hind margin also very dark. In rare instances the female is strongly but more evenly clouded with brownish-grey.

On the wing in May and June. Occasionally, in confinement, a partial second generation is produced in August or September, or even as late as November.

LARVA $1\frac{1}{2}$ to 2 inches long. Head round, surrounded with hairs; body plump, rather thickest in the middle, covered with moderately abundant hairs and having on the fifth to eighth segments four large flat-topped bunches or tufts of extremely dense hairs, and on the twelfth another tuft more slender, of double the length and running to a point. Head green; body green clouded with whitish, or yellow clouded

with greenish; hairs green or yellow; dense round obtuse brushes yellow; long anal tuft pink; dorsal spaces between the tufts broadly deep black; and a row of black spots on the sides of the ninth and following segments; legs and pro-legs green or yellow, like the body. In other cases larvæ are pale brown, pale reddish brown, or umbrous, with the head of a similar brown, the dorsal tufts light reddish, greyish, or smoky black; the long anal tuft pink, brown or black; scattered hairs generally similar to the body; and the black subdorsal spots on the hinder segments elongated, connected, and sometimes formed into double lines.

July to September, on hop, hazel, lime, birch, oak, plum, pear, and other trees and plants; feeding quite conspicuously on the leaves and apparently not resorting at all to the trunk or limbs for concealment. It is extremely common in hop-gardens, where from its curious anal tuft of hairs, like a raised tail, the larva receives the common name of the "Hop-dog."

PUPA rounded, with rather projecting wing-cases, stout abdomen, and rather sharp anal spike; chestnut-brown, or darker brown, with the edges of the wing-cases and two bands on the abdominal segments paler. In a large ovate loose silken cocoon among dead leaves or rubbish close to the ground; passing the winter in this state.

The moth sits in the day-time upon low plants, shrubs, ferns, or bushes, or upon hedge banks; always with its long densely-tufted fore legs stretched out in front, and bears a most extraordinary resemblance to an entangled downy grey feather, or a mass of the cottony seeds of the large sallow. It flies freely at night, when the males may be assembled by means of a freshly reared female. It also comes readily to light, the male especially being so attracted. It is common in the southern half of England, and sometimes abundant in the larva state; extending throughout South Wales, and to Staffordshire, Derbyshire, Lincolnshire, Cheshire, Lancashire,

Yorkshire, and even Cumberland; yet it does not seem to have been observed in Scotland except in two instances of single specimens, supposed to have been introduced. In Ireland it has been found in Wicklow, Waterford, Cork, Kerry, and Galway. Abroad it is common throughout the temperate portions of Northern Europe, Central Europe, Piedmont, Northern and Eastern Turkey, and Southern Russia, possibly even extending far into Asia, since a form brought from Japan, and known as *pseud-abietis*, is probably nothing more than a variety of this species.

2. **D. fascelina**, *L.*—Expanse, $1\frac{3}{4}$ to $2\frac{1}{4}$ inches. Fore wings dull grey, sprinkled with black atoms; transverse lines orange-red and black; hind wings spotless grey; anal tuft smoky.

Antennæ of the male rather curved, strongly pectinated, the rows of teeth near together, grey, shaft whitish. Head and thorax dark grey-brown, abdomen grey-brown, slightly barred with darker and with the anal tuft smoky-grey. Fore wings rather ovate, with the costa nearly straight, except near the apex, which is rounded; dorsal and hind margins rounded; whitish-grey or brownish-grey with the costal region more hoary; whole surface dusted over with black atoms; near the base is a cloudy blackish transverse stripe, not very distinct; first line curved, orange-yellow, much obscured by black dots; second line oblique, indented, faintly orange, nearly covered by black dots; beyond it is a similar cloudy transverse line of faint orange and black atoms edged outside with whitish; at the end of the discal cell, in a whitish cloud, is an indistinct grey or blackish lunule, often only indicated by its margins, or almost suppressed; cilia grey, usually with a row of black atoms or dots close to the wing-margin. Hind wings broad, rounded, but with rather a sinuous hind margin; entirely pale brownish-grey, or occasionally with a darker grey transverse shade before the hind margin. Female larger and considerably stouter;

antennæ slender but slightly pectinated; dark grey. Fore wings longer and rather more pointed; markings similar, but rather more obscure, the lunule being rarely visible, while the black atoms of the cloudy orange line near the hind margin are often massed into blotches; otherwise similar to the male.

Underside smoky-grey with the costal margin whitish, and a central black lunule which touches a smoky-black cloud or band lying half across the fore and hind wings from the costal margins; cilia whitish, edged with smoky; body and legs smoky-grey, the latter strongly tufted with scales.

Not very variable, but ranges from an almost total absence of markings to strongly marked transverse lines. Occasionally the ochreous colour, although not very distinct in the transverse lines, is mottled and sprinkled over the fore wings. In Dr. Mason's collection is a specimen which is streaked longitudinally with black, and in that of Mr. S. J. Capper is one having black transverse lines, the second double and very strongly marked.

On the wing in June and July.

LARVA nearly two inches long. Head round, blackish, tufted with hairs; body increasing slightly in thickness to the twelfth segment; anal segment sloping rapidly off to the rather extended pro-legs; body brown or blackish, covered with hairs, which arise in large loose tufts, generally brown or smoky-brown or else yellowish; on the backs of the fifth to the ninth segments are five erect, flat-topped, exceedingly dense tufts, or brushes, of hairs, whitish or greyish, but becoming blackish at the tips; on the back of the twelfth segment is a much longer dense tuft of hairs, black, and forming a blunt tip pointing somewhat backward; on the sides, but much concealed by the hairs, are two or three rows of yellowish spots; legs and prolegs brown.

August to May on hawthorn, willow, heather, broom, and even on the blossoms of furze. The very young

larvæ hibernate in a thin silken web in a fork of a branch of their food-plant, three or four commonly occupying the same nest, which they protect with a few dead leaves drawn closely around them. In the spring they feed openly and conspicuously, but are extremely difficult to rear in confinement, unless placed upon a growing plant, and allowed plenty of air and sunshine.

PUPA shining black, densely covered with tufts of brown hairs; in a tough soft silken cocoon, in which the larval hairs are interwoven, among rubbish and leaves close to the ground.

A sluggish species, sitting on its food-plant in the daytime, with extended legs, and looking like an entangled downy dark grey feather. It flies at night, but is seldom captured on the wing. In England usually found near the coast, but occasionally also on heaths. Very rare in the South, though the larva has been taken on heaths in Dorset; also at Crowthorn, Berks; and there is a single record in Sussex. In the Eastern Counties larvæ have been found, in Suffolk and Cambridgeshire upon broom, in Norfolk on hawthorn on sheltered banks, and at Skegness, Lincolnshire. Also at Llandudno, North Wales; much more commonly on the coast of Cheshire, Lancashire, and Cumberland, and more locally in Yorkshire. In Scotland it is much more generally distributed, being found in Roxburghshire, Clydesdale, near Loch Long, Aberdeenshire, Kincardineshire, Perthshire, and abundantly in Sutherlandshire, especially on heaths and moors. In Ireland it is recorded in King's County, and from the Bog of Allen. Abroad it is found throughout Northern and Central Europe, in Piedmont, and in Western Siberia.

Genus 7. **DEMAS.**

Antennæ of the male of moderate length, rather shortly pectinated; of the female simple; fore wings elongated, ovate;

thorax and abdomen stout, the latter with dorsal tufts; legs with dense tufts of long scales.

1. *D. coryli*, *L.*—Expanse $1\frac{1}{4}$ to $1\frac{1}{2}$ inch. Fore wings red-brown to the middle, thence whitish clouded with grey; hind wings pale brownish with spotted cilia.

Antennæ of the male of moderate length, regularly pectinated with thin solid teeth, curved forward at their tips; light brown. Head and thorax abundantly clothed with rather long, loose, greyish-white, grey, or brown scales; the thorax stout, and irregularly ornamented with short transverse bars of blackish-brown in series of three each on the shoulders and back; abdomen moderately stout, pale grey, indistinctly barred on each segment with dark grey or brown, and having on the back a row of tufts of raised scales. Fore wings not broad; costal and dorsal margins nearly straight; apex bluntly angulated, almost rounded off; hind margin rounded, especially so towards the anal angle; pale grey, greyish-white, or pale brownish-grey; first transverse line black, three times angulated, and sloping outward to both costal and dorsal margins; second line erect from the dorsal margin half-way across the wings, then curving widely outward before turning to the costa, the dorsal half black and distinct, the remainder light brown and often obscure; usually the black portion appears to be continued to the costa by a black streak, which, however, is really a portion of a central clouded stripe which almost embraces a large spot or blackish ring at the end of the discal cell; this central clouded stripe is most irregular, often filling the whole space between the first and second lines with a broad blotch of chocolate, or red-brown, or purplish-grey, containing blackish angular lines; outside the second line is an oblique indented, cloudy line, beyond which the hind margin is tinged with darker grey or brownish; cilia pale grey, shaded with darker, but interrupted with yellowish dashes. Hind wings rather small, rounded, pale brownish or yellowish-grey;

usually with a faint purplish-grey band before the hind margin; cilia greyish dashed with pale yellow. Female similar, but with the antennæ only slightly indented.

Underside pale yellowish, clouded toward the hind margin with grey; having on each wing a faint indication of a brown central streak, and sometimes one or two cloudy bands crossing the wings; cilia dark grey chequered with yellowish dashes; thorax and abdomen whitish; legs whitish, tufted with long downy white scales; tarsi barred with black.

Variable in the ground colour, the grey or whitish often tinged with brown or purplish; more so in the colour and intensity of the broad central band, which occasionally is no darker than the rest of the fore wings, and indeed hardly indicated, but varies through every shade of brown and purplish-brown to deep dark chocolate, and in the darker specimens spreads so toward the base as to give the effect of fore wings half red-brown, half whitish-grey; those in which the red colour is absent usually show the ringed stigma very distinctly, and outside it a couple of black short lines indicating a renal stigma. A specimen from the north of Ireland has a large, round, white apical blotch.

On the wing in May and June, and a second generation in August and September. Specimens have been known to emerge even in November.

LARVA. Head rounded, lobes rather distinct; body plump, thickest in the middle, tapering behind. Colour of the body usually some shade of reddish-brown, but varying from light reddish or purplish-brown to pale buff, or dull yellowish, or even to white; head varying similarly, generally reddish or yellowish, sometimes clouded with dark brown or even grey. Body covered with rather thinly tufted soft hairs; second segment having also on each side a long pencil of red, grey, or blackish hairs; a short blunt dorsal tuft each upon the fifth and sixth segments, bright red, pale red, or blackish,

not following the colour of the body; twelfth segment also with a short dorsal tuft, similarly coloured; dorsal stripe rather broad, much interrupted, grey, blackish, or mixed black and red, sometimes broken up into dots and dashes; subdorsal line a series of dashes or streaks, usually dark grey or brown, not always visible; spiracular region usually occupied by a broad stripe of red, red-brown, red and yellow, or even grey and white, most uncertain; spiracles whitish or yellowish, ringed with black; legs and prolegs pale reddish, yellowish, or grey. In the paler specimens some of the usual raised spots, from which the hairs spring, are distinct and slightly ringed with black.

June and July and again in September, on beech, oak, hazel, hornbeam, maple, and birch, preferring bushes to trees, and particularly affecting hill tops and sides, and hedges in other exposed situations. When not feeding it hides between two leaves, and when about to cast its skin forms a slight web in a similar habitation.

PUPA rather short, stout, and wrinkled; anal point with two hooks; reddish-brown. In a thin silken cocoon among leaves, moss, or rubbish, or even in crevices of bark (C. Fenn). It passes the winter in this condition, but pupæ from July larvæ usually produce moths in the autumn.

The moth sits on the trunks or branches of trees or bushes in the daytime and is very seldom observed; it flies at night along hedges and wood-paths, but is rarely so captured. The male is so restless that it hardly waits for its wings to dry before moving, and rapidly becomes worn. Very widely distributed, and sometimes found commonly in the larva state. Plentiful in Devonshire, and also in Berks and Bucks on the hills among beech. Less commonly in all the southern and eastern counties and in the west to Herefordshire and Lancashire; found also rarely in Staffordshire, Yorkshire and Northumberland, and most likely not entirely absent from suitable spots in any English county.

In Scotland it is frequent in the Clydesdale district, at Dunoon, Paisley, and Gairlochhead, frequenting the birches in the gullies which run up into the hills; common in Aberdeenshire and Kincardineshire, and found in Perthshire and Roxburghshire. In Ireland it has been found at Killarney, and several times near Belfast, Londonderry, Lough Swilly, and in Donegal. Abroad it is common in Central Europe, the temperate portions of Northern Europe, in Northern Italy, and Southern Russia.

Genus 8. **ORGYIA.**

Antennæ in the males short, curved, strongly pectinated; fore wings short and broad; hind wings round. Females almost apterous, with extremely short slender antennæ.

LARVÆ brightly coloured, with dense dorsal tufts of hairs.

PUPÆ hairy, in a loose cocoon.

1. **O. Gonostigma**, *Fab.*—Expanse $1\frac{1}{4}$ inch. Male slender; fore wings rich chocolate-brown, blotched behind with orange, and with white spots; hind wings dark brown. Female very stout, almost wingless.

Antennæ of the male short, curved, strongly pectinated, with long curved teeth, the two rows of which incline towards each other; dark brown. Head tufted with dark brown scales; thorax and abdomen both slender, dark brown or blackish-brown. Fore wings very short and broad, with rounded costal and dorsal margins; apex bluntly angulated, and hind margin slightly oblique and straight, curving off to the anal angle; rich dark chocolate-brown, faintly clouded on the costa with whitish-grey, which lies somewhat in patches, the second patch extending into faint brown lines which enclose and divide a dark brown indistinct spot at the apex of the discal cell; near the base of the wings is another faint dark brown line placed so as to form a slender ring;

first line hardly perceptible as a darker shade; second line an indistinct, curved series of short crescents of blackish clouding, beyond which the wing is clouded with orange-red, more especially toward the apex and anal angle, where also it is edged with white crescents; before the hind margin is a faint succession of blackish clouds; cilia pale brown, broadly spotted with black. Hind wings rounded, uniform blackish-brown, with light brown cilia. Underside of the fore wings smoky black-brown to beyond the middle, then pale smoky-brown, with the apex still paler, and white; cilia blackish with light brown dashes; hind wings dark smoky-brown with a yellowish line at the extreme margin and light brown dashes in the cilia; body dark brown; legs similar, the first pair moderately tufted with long scales.

Female totally different; antennæ minute, slightly toothed; head brown; thorax small, dark grey-brown; abdomen very large, coarsely ovate, dark brown, covered with downy scales; legs light brown; wings undeveloped, just visible as minute flaps of dark brown membrane, useless for any purpose of locomotion.

Not variable.

June, and again at the end of July and in August, or even September, in a partial second generation. On the Continent regularly double-brooded.

LARVA. Head rounded, body rather long, each segment thickened a little; anal prolegs rather extended. Head blackish, spotted above with brown; second segment with a long fascicle, on each side, of clubbed black hairs pointing obliquely forward; the fifth to the eighth segments each with a dense dorsal tuft of hairs of exactly the same length so as to form flat-topped brushes of a brown colour; on the twelfth segment a long black or dark grey tuft of hairs inclining backward; remainder of the body clothed sparingly with reddish hairs. Body blackish-grey with a broad white dorsal line, dappled and speckled with black; a subdorsal

row of red-brown oblique spots uniting into a line on the hinder segments, and a broad red-brown spiracular stripe. Behind the tuft on the twelfth segment is a red bar, and a white one across the anal segment below it; legs and prolegs reddish. When young the body is more reddish-brown, with the dorsal stripe broadly blackish and white, interrupted by the tufts of hair.

July, September, to end of May, in two generations, the second hibernating. On oak, sallow, hawthorn, blackthorn, hazel, beech, bramble. Rather irregular in its habits. Mr. W. Machin obtained a batch of eggs at the end of June, which hatched in the middle of July; of the larvæ a portion fed rapidly up and produced rather small moths in August and September; others fed more slowly until the middle of October, when they also spun up, and produced moths of larger size in November; the remainder of the brood fed still more slowly and hibernated. This state is undergone on twigs of the food-plant near the ground, but with very little protection. The larvæ feed in the daytime in the bright sunshine.

PUPA very stout, swollen in the middle; back covered with numerous greyish-brown hairs; colour shining dark bistre-brown, the incisions dull orange. In a small round thin cocoon of silk and felted larval hairs to which it is affixed by a terminal hook. The cocoon is placed within a ball of leaves drawn together by the larva. (C. Fenn.)

The male moth flies in the sunshine with a swift strong action. So far as is known it does not fly at all at night. The female remains upon the cocoon from which she has emerged, and when fertilised lays the whole of her eggs—from four to five hundred—closely side by side upon the tough cocoon, covering them carefully over with her scales. A very local and uncommon species in this country. Formerly—in 1852 and long after—it was plentiful upon Wimbledon Common and in Coombe Wood, both near London, but has

long since been exterminated by excessive collecting from the former locality, and probably from the latter. It is now found, rarely, in Devonshire, in the fens of Norfolk and Cambridgeshire, Suffolk, Bewdley Forest, Salop, and in various parts of Yorkshire. There is also a single record at Cannock Chase, Staffordshire. Abroad it is common throughout Central Europe, and great part of Northern Europe, and also found in Piedmont and Siberia. In Japan forms are found which are darker and more dull in colour, but agree most accurately in shape and markings. These have received the names of *thyallina* and *approximans*.

2. *O. antiqua*, L.—Expanse 1 to $1\frac{2}{3}$ inch. Male rusty-red with a white spot near the anal angle of the fore wings; body slender. Female nearly apterous.

Antennæ of the male short, curved, strongly pectinated, the rows of solid teeth leaning towards each other, and their tips incurved; shaft light brown, teeth dark brown. Head dark brown; thorax slender, dark brown, covered with long golden-brown scales; abdomen very slender, blackish-brown, faintly barred with paler. Fore wings very short, broad, with the costa strongly arched, apex blunt, dorsal and hind margins rather straight, with a blunt anal angle; dark tawny or rust-red; often tinged with smoky-brown along the costa and at the base; first line rather perpendicular, second more curved and sinuous, both indistinctly smoky-black; close to the second line and near to the anal angle is a rounded, or lunate, clear white spot edged with blackish; sometimes a faint series of dark brown clouds lies beyond the second line; cilia smoky-black with rusty dashes. Hind wings broad and rounded; rust-colour or dark tawny, sometimes tinged with darker brown; cilia dark brown dashed with paler. Under-side light rust-red or tawny, with the costa and base of the fore wings shaded with dark brown; a faint transverse dark brown cloud beyond the middle, and cilia clouded with dark brown: cilia of the hind wings also

dappled with dark brown; body brown; legs dark brown, dusted above with whitish; the first pair densely tufted with long scales.

Antennæ of the female minute, slightly toothed, brown; head and thorax blackish, thinly covered with light brown scales; abdomen very large and clumsy, ovate, grey-brown, covered thinly, but more thickly at the edges of the segments, with pale brown scales; wings merely short, soft, useless brown flaps of about one-eighth of an inch in length—quite functionless; legs dark brown.

The male is hardly variable except in the intensity of the dark markings of the fore wings. These, in the south of England, are usually faint, the moth being almost of a uniform rust-colour excepting the white spot; towards the north they become darker, the markings much more distinct, and the transverse lines sometimes quite black. Extremely well-marked specimens and of rather large size are obtained in Yorkshire and in some parts of Scotland, more especially Sutherlandshire. In Mr. C. A. Briggs' collection is a paler and much more yellow specimen, but this variation is extremely rare. Mr. W. H. B. Fletcher has one in which the white spot is of double the usual size, infringing upon the second transverse line and leaning toward the anal angle. At a meeting of the Lancashire and Cheshire Entomological Society in 1892 an extraordinary gynandrous specimen was exhibited; the head with antennæ were male; the wings small, sharply pointed and rather longer than is usual in the female; the body wholly female. Mr. C. A. Briggs has one somewhat similar, but the antennæ are not so well developed as in ordinary males, and the flap-like fore wings show a faint trace of the white spot.

July to September; and in rare instances specimens of a partial second generation appear in October.

LARVA. Head round, rather small; body thickened to near the middle, thence tapering off; hinder prolegs rather extended.

Head pale brown or blackish ; body purplish-grey, or smoky, with a whitish, or yellowish, dorsal line edged with black, and sometimes dotted with crimson ; a subdorsal row of large raised crimson spots ; spiracular line yellowish, much interrupted ; on each side of the second segment is a long tuft of blackish hairs, plumed and clubbed, some longer than the rest ; on the fifth to the eighth segments each a thick dense dorsal tuft of hairs of equal length terminating as obtusely as a shaving brush, yellow or yellow tipped with brown ; twelfth segment with a long dense dorsal tuft pointing backward and consisting of dark grey, dark brown, or blackish clubbed hairs ; the whole body covered with soft brown or creamy hairs. The red spots on the back, and the spots from which the lateral tufts of the second segment spring, are raised and rather in the nature of tubercles. Legs and prolegs brown.

April to June or July or even August, and in rare instances, in a second generation, in September. On hawthorn, blackthorn, sallow, lime, rose, willow, oak, and indeed on almost all deciduous trees and shrubs. The eggs hatch at intervals over a rather long period, consequently larvæ are feeding up all through the summer.

PUPA rather stout, glossy black-brown, with numerous small tufts of short whitish hairs ; on the back is a row of indistinct pale spots. In a thin but very tough cocoon of silk with larval hairs interwoven, in chinks of bark, under eaves, in crevices of walls or palings, or any protected spot ; but the female cocoon is very commonly spun up among the twigs of a hawthorn hedge, several leaves being drawn round it in such a manner that it is completely hidden. The underside of the cocoon is bare of leaves, and here the female lays her eggs in a close flat mass, all side by side, the eggs remaining here in perfect security through the winter. Although the female has no effective wings, the wing-covers in the pupa are normal and show no indication of this failure of structure.

The male moth is exceedingly active and lively, flying all through the day when the sun shines, but settling suddenly upon a tree or bush when it is obscured. When it alights its wings are shut obliquely down and its long tufted legs project forward, so that it looks like a bit of brown leaf. Its activity is extreme, and from its undulating, bounding flight it has received the common name of the "Vapourer." It has been seen flying round a vessel at sea, twenty miles from land. The female is quiescent, never leaving the surface of the cocoon from which she has emerged, during life.

An abundant species in most parts of the country, but more especially in London, in almost all parts of which the males may be seen dancing about the streets, squares, and gardens in the sunshine. Sometimes it becomes so abundant as to be destructive, and the trees in the parks and gardens are occasionally almost stripped of leaves by its larvæ. In one year recently—about 1886—the few hawthorn bushes which manage to exist in one corner of the quadrangle at Somerset House, Strand, were completely denuded of leaves, and the larvæ crawled about the walls and footpaths in every direction. How the apterous females reached these secluded trees is a problem difficult to solve. In 1890 the larvæ were in such multitudes at Norwich that in some of the gardens all the leaves of every kind of plant were devoured, and the creatures crowded into the very houses. As a general rule, however, the numbers are insufficient to cause serious injury, and the species does not appear to be regarded as injurious on the Continent. It probably occurs in every county in England and Wales, and in many is abundant, but in the north is more plentiful near the coast than inland. In Scotland it is abundant in many districts, extending as far north as Sutherlandshire. In Ireland much less common, though generally distributed. It is found nearly all over the Continent of Europe, as well as in North Africa and Armenia; also in North America, specimens received from Hudson's Bay territory and Nova Scotia, though called *nora*, being accurately the same species.

Family 9. **PSYCHIDÆ.**

Males with strongly pectinated antennæ, the pectinations consisting of solid, very slightly ciliated teeth, which in some cases are forked. Fore wings either broad behind or ovate; hind wings always broad. Both usually semi-transparent and hairy, or covered with close glistening scales. Females apterous, in many species devoid of limbs.

LARVÆ, with strong plates on the anterior segments; in cylindrical or spindle-shaped cases of silk, covered outside with vegetable refuse.

PUPÆ in the larval cases.

A very singular and aberrant group, somewhat resembling insects of the Order Trichoptera in the hairiness of the wings of many of the species; forming a tolerably complete passage to the Family Tineina by the Genera *Solenobia* and *Taleporia*; but, from general structure, more satisfactorily placed here, and rather closely connected with the last genus (*Orgyia*) through *Penthophora morio*—a semi-transparent winged, black species, with semi-apterous female, of which the larva lives upon grass, but is not a case-bearer. This last, though sometimes destructive on the Continent, is not known as a British insect.

Our species seem to divide well into three genera:—

Psyche—Males with stout hairy thorax and hairy wings; females without limbs.

Epichnopteryx—Males with slender thorax and hairy wings; females without limbs.

Fumea—Males with slender thorax and glistening, scaled wings; females apterous, having effective legs.

Genus 1. **PSYCHE.**

Male with the pectinations of the antennæ long, oblique, slender, and often massed together so as almost to appear

plumose; thorax stout; abdomen moderately so; both densely covered with very long hairs or hair-scales. Fore wings rather narrow at the base, broad behind; hind wings rounded, both semi-transparent, and thinly covered with hair-like scales. Female vermiform.

1. **P. villosella**, *Ochs.*; **nigricans**, *Curt.*—Expanse of wings of the male 1 inch. Semi-transparent, smoky-black, with blacker nervures; head and body smoky-brown; very hairy.

Antennæ of the male about one-half the length of the fore wings, with long pectinations lying obliquely forward in a loosely massed, irregular manner, the rays being very closely fringed with minute hairs; blackish. Head, and especially the palpi, densely tufted; thorax stout and strong; abdomen tapering; all three very densely clothed with long hair-like scales, which stand well up and give the insect a shaggy appearance. Fore wings rather narrow at the base, moderately broad and rather squared behind; costa slightly hollowed before the middle, rounded beyond it to the apex, which also is bluntly rounded; hind margin very straight; anal angle rather protuberant, but rounded; dorsal margin nearly straight. Hind wings rather short and broad, with rounded apex and somewhat sinuous hind margin. All the wings semi-transparent, thinly covered with dark smoky-brown or blackish hair-like scales; nervures distinctly black-brown, and margins edged with the same. At the apex of the bi-lobed discal cell of the fore wings is a blackish spot or faint V-mark; cilia all short, sharply defined, black-brown. Underside similar to the upper; legs all densely clothed with black-brown hair-scales. When preserved the blackness fades to some extent, the whole insect becoming browner, and the long scales of the thorax sometimes almost light brown. Otherwise not variable.

Female (when living) with the head very singularly formed, and curiously resembling—in miniature—that of a walrus; having a smooth, rounded forehead, beneath it two hollows,

like eye-sockets, between which the front of the head is rounded and prominent, like a swollen nose; antennæ soldered down on each side of it, and having their tips continued, straight down, into two sharp points just like the tusks of the walrus; no indication of palpi or tongue or of any organs in the solid brown mask of the face. On each side of the head, on the antenna case, is a black spot. Upper portion of the three following segments shining brown, like the dorsal plates of larvæ; lower portion creamy-white. On the underside of these three segments are minute papillæ representing the non-existent legs; whole remaining body creamy-white, devoid of scales, fat, and closely resembling a large maggot. (Described from a living specimen furnished by Mr. W. C. Boyd.) When preserved it changes to a grey or red-brown colour, and shrivels into a shapeless grub, of which even the head loses its curious form.

June and July.

LARVA stout, active; fairly cylindrical; living in a case, from which the first four or five segments are protruded when moving or feeding, the remaining portion never voluntarily leaving the case. Head creamy-white with a large black spot on the upper part of each lobe, these spots surrounded by double lines of dots; labium black, jaws brown. Second, third, and fourth segments creamy-white with an appearance as of porcelain, from large horny or chitinous plates with which the back and sides are covered. Upon these plates are black-brown longitudinal stripes, of which two, rather narrow, are in the middle of the back, and two, broader, on each side. The fifth and sixth segments are whitish, with small morsels of chitinous plate arranged on their dorsal region. Hinder portion of the body pinkish-white, excessively wrinkled. Legs large and well developed, with the joints conspicuous, whitish, spotted with dark brown, claws light brown. Prolegs very small, resembling minute nipples, except the anal pair, which are larger and

longer, and cling very tightly to the lining of the case, which is composed of a cylinder or spindle-shaped habitation of very thick, tough, soft white silk. Outside, this is completely covered with pieces of grass, heather-twigs, furze-twigs, bits of rush, fir-needles or any other dry vegetable fragments which are available, all being arranged so as to point obliquely backward and outward, and to form a somewhat formidable covering. A living larva now before me, having taken a sudden fancy to lengthen its case, has cut out irregular pieces of white blotting-paper and arranged them around it in front of the original twigs, giving the case a singular appearance. The case is only open at its lower end, and is there composed of silk so elastic that when the head of the larva is withdrawn, as it is at the smallest alarm, the mouth shuts together tightly, and effectually keeps out any intruder. But when full grown the larva fastens this end down to a heather-stem, furze-stem, the trunk of a tree, a paling, post, or other convenient and firm situation; turns completely round inside, opens out the upper end, spins a silken tube there, ready for egress, and assumes the pupa state within.

August to June—either June of the second or of the third year—this seems to be variable—on heather, furze, grass, and various other plants when at liberty. In confinement more dainty and capricious, sometimes feeding on bramble, strawberry, sloe, and hawthorn, or refusing all food, but of most extraordinary tenacity of life, so that a larva has been found to remain alive a year without feeding.

PUPA of the male light brown, of ordinary moth structure, in a cocoon in the case formed by the larva, but withdrawn halfway from the case on emergence. Of the female consisting only of segments, well marked, like those of a Dipterous pupa, having no covers of antennæ, wings, or legs, though the cover of the head forms a slight projection; pale in colour and maggot-like, in fact greatly resembling the female

moth. In a soft white cocoon inside the case, but occupying only a portion of its length; not withdrawn on emergence. The pupa state lasts usually about a month, but in some instances over a year.

For opportunities of studying this species in its different stages I am greatly indebted to Mr. W. C. Boyd and to Mr. W. McRae; and Mr. McRae, living close to one of the principal localities for the insect, has furnished much valuable information. He tells me that he has three times seen the male on the wing in each case in the sunshine early in the afternoon. Probably it also flies in the morning sunshine, but no other record seems to exist of the capture of the insect on the wing, and a record of finding two specimens sitting on a fence seems to show that flight does not last all day. It however emerges from the pupa about six P.M. Whenever a male is in the neighbourhood of a freshly emerged female it seems to become violently excited, so that, in confinement, its wings are soon battered to pieces, but its movements in this respect do not seem to have been observed out of doors. A statement has repeatedly been made by authors that the females of this and the closely allied species *never leave the case*. Either this statement is founded on an error of observation, or the habits of the creatures have undergone a recent modification. The female from which I made the foregoing description forced itself promptly out of the case on emerging from the pupa, and was found lying in the bottom of the box, where it remained alive but inert for, probably, a fortnight. It could not be induced to make any movement towards re-entry even when the open end of the case was pressed to its hinder extremity, and its only motion was an occasional roll over, and a continual and regular wave of pulsation running from head to tail. Yet Mr. Boyd has noticed that partially emerged females will wriggle back into the case at times. Mr. McRae writes me as follows: "The females on emergence fall to the ground, remaining where

they fall the most helpless objects imaginable, incapable of any motion except rolling over. In some cases they only succeed in pushing halfway through the pupa skin, which projects a little from the tail end of the case, and in this position remain till they die. From my own observation not only does the female, generally, completely free herself of the case, but it is only when she does so that any union with the male is possible." It is known, however, that in some instances the female remains in the case and there deposits her eggs, and that the male, by the power of telescopic elongation of his body, visits her in the case. This Mr. J. Jenner Weir has substantiated. One thing is however certain, that many females of this species, as well as of others in the group, have the power of depositing fertile eggs even when never visited by a male, though it is believed that only females are produced from such eggs. Whether the eggs are deposited in the case or on the surface to which the female has fallen, the young larvæ, which hatch in about ten days, lose no time in enclosing themselves in a little case of silk—thimble-shaped at first—which they speedily cover with any small vegetable refuse at hand. Additions to its size appear to be made at the open end, the tube of silk being spun a little further, and then additions of extraneous materials made to its outer surface. It appears to be next to impossible to rear these larvæ in confinement, their obstinate refusal of food even when enlarging the case, and their determination to lie over till another season rather than spin up, tend to exhaust them, and they ultimately die unchanged. To rear the moth, the full grown cases should be gathered as soon as spun up at large.

Apparently almost confined to the extensive heaths of Hants and Dorsetshire, and to the New Forest. It seems to have been originally found at West Parley and West Hurne in Dorset, by Mr. Dale, but has since been met with plentifully, though locally, at Studland, Ringwood, Wimborne, Bourne-mouth, and Lyndhurst; also recorded, very rarely, from Devon.

It seems to like dry heath-ground in sunny, sheltered places, but will also occasionally inhabit moist, swampy places.

Abroad it is found in France, Germany, Italy, Hungary, Dalmatia, Southern Russia, and Armenia.

2. **P. opacella**, *H. S.*—Expanse of the male $\frac{3}{4}$ inch. Head and body black, hairy; wings nearly transparent, tinted with blackish.

Antennæ of the male of moderate length, curved forward, strongly pectinated, the teeth long, slightly fringed, sloping obliquely forward, but not lying in a confused mass, and becoming shorter toward the apex; smoky-black. Head having the palpi completely concealed under a dense mass of long blackish hair-scales projecting forward and downward, and leaving only the eyes visible. Thorax stout, thickly covered with long, loose, soft, black hair-scales; abdomen tapering, black, covered on the upper side with long blackish scales, but at the sides with a line of projecting tufts of whitish scales; apex tufted. Fore wings rather narrow at the base, becoming moderately broad beyond the middle; costa, for two-thirds of its length, straight, then rapidly curved to the blunt apex; dorsal and hind margins gently rounded; anal angle rather full, but rounded off. Hind wings rather short, rounded. All the wings nearly transparent, covered with minute hair-like scales, which lie separately and do not touch or overlap; margins sharply blackish; nervures distinct, smoky-brown, the costal and subcostal nervures of the fore wings being also rather swollen; cilia blackish, extremely short, except on the dorsal margin of the hind wings, where they become long, like hairs. Underside like the upper, but the thorax more deeply black, and the abdomen shaded with whitish or silvery-grey hairs; legs blackish. Apparently not variable, but in preserved specimens the blackish colouring fades in some degree, so that the general colour, and more particularly the nervures, become tinged with brown.

Female in appearance a mere maggot. Head small, brown, horny, very smooth and shining, rounded in front, and without mouth-organs or eye-lobes, but with a dark spot on each side and a paler one above, and very short, glassy indications of the antennæ, which are mere portions of the hard mask which forms the head. Second and third segments each with a large, convex, shining, dark brown horny plate, extending down the sides, where it becomes more red-brown; fourth segment with a smaller paler plate. Body fat and maggot-like, pinkish-white or pale brownish-pink; devoid of scales, having a faintly brownish indication of a double dorsal line, a single row of round red-brown dots along the middle of the ventral surface, and slight ridges across the lower side of the anterior segments. Anal segment with a short, bluntly projecting ovipositor-sheath, and beneath it two rounded papillæ. At the sides of the seventh to ninth segments are small tufts of erect, soft white hairs. This description applies only to the living and freshly emerged female. When preserved it shrivels into a wrinkled and shapeless object of a reddish-brown colour.

End of March, April, and probably May.

LARVA pale grey, whitish beneath, apparently quite destitute of hairs; head shining black, jaws dark brown; second, third, and fourth segments each with a rather narrow dark grey horny plate which almost embraces the segment, having a blackish dividing line down the middle of the back and whitish spots on the sides; legs large and well developed, brown, with the claws black; prolegs minute, except the anal, which are small and coloured as the body. In a case, one inch in length and moderately thick, composed internally of soft, tough silk, and covered externally with small pieces of dried grass all pointing backward, morsels of bark, seed-capsules and other dried vegetable morsels.

When very young it seems to differ but little from the adult larva, but is dirty yellowish-white, with black head;

plate of the second segment large, black, embracing the segment but narrowed at the sides; other plates narrower, and all divided on the lateral fold. On the body are numerous minute raised dots arranged in a different order to that apparent in the generality of larvæ, and there are greyish plates on the two last segments. The first duty of the young larva appears to be to construct a case of silk and any substance that comes to hand, commonly gnawings of the case of its parent, in which the eggs are frequently deposited.

June to February or March, on grasses, and possibly on other low-growing plants, but its habits are imperfectly known. When full grown the case is usually to be found on the trunks of oaks, alders, or other trees in woods, or on rocks and boulders in open moors. But it more frequently produces a hymenopterous parasite than a moth.

PUPA of the male light brown, of the ordinary form; that of the female paler and more like that of a Dipteron, having no covers for wings or legs. In the larval case, which, when the larva is full fed, is fastened down, by the mouth end, to the lower part of the trunk of a tree or to a post or boulder; the larva then turns round, opens the hitherto closed end, spins a tube of silk so elastic that it closes when not in use, and then assumes the pupa state. Its habits were so well described by Richard Weaver, a well-known collector, forty years ago, that I quote his words: "I commence at the time the larva is full fed; it then finds a suitable locality for fixing the case; and now that end of the case which was formerly the aperture for the head and legs, for the convenience of feeding and crawling about, being no longer wanted open, the larva spins up that end, turns round in the case and sets it in order for use, forming another aperture, and that end of the case is lengthened in the shape of a funnel, it being made soft and elastic, but the end is not quite open till after the moth has burst from the pupa. The pupa of the female is thin and pliable, unlike

the pupa of the male, and with energetic twists of its body it is enabled to go up and down its gauze-like funnel with astonishing rapidity: the funnel serves for a weather-gauge for both male and female; it serves the female both in the pupa and perfect state, but for the male only in the pupa state. The female pupa moves up to the top of the funnel, and if the sun shines and the time has arrived for assuming the imago it liberates itself from the case and just thrusts its head out at the end of the funnel, and there awaits the arrival of the male until night comes on, or the sun is clouded, or it is disturbed; in either of these events it will move down to what is now the bottom of the case; next day, if all is right, it will be at the top of the funnel again. The body of the male is somewhat similar to a telescope: it lengthens out between every joint or segment. The female lays her eggs, which are covered with a glutinous moisture, within the case; she then falls through the aperture of the funnel, which opens downwards. The funnel of the male is considerably longer than that of the female. It is truly astonishing how fast the pupæ will travel up and down their funnels. They ascend occasionally to ascertain whether the sun is shining, and if not they will not burst the pupa cases, as the males fly only in the sunshine; they will thrust the pupa one-half out, and more, if it pleases them to come out and leave it." The insect must, surely, have been far more plentiful in Weaver's time than recently, or he must have had exceptional opportunities for observing it! But like the last species, the female moth certainly leaves the case, in some instances, immediately upon emergence from the pupa. This had occurred with those from which the foregoing description was made, and for which I am indebted to Mr. W. H. B. Fletcher and Mr. W. C. Boyd. Mr. W. Holland spent some time last spring in searching for cases in my behalf, but without success in that respect, though he had the far more unusual good fortune to capture a male moth on the wing. He says: "In crossing a common I saw some-

thing which looked pale and glistening in the sunshine flying over heather at some distance, so ran after it. It was flying rather high and at a good speed, yet still rather heavily considering the rate at which its wings moved. When I had it in the net its wings were still going at such a tremendous rate that I could not see them at all until it was in the killing-bottle. Blackish as it is, it is curious how pale it looked when on the wing." This specimen is before me, and in excellent condition, notwithstanding the exercise it had taken.

It is very rarely observed in the imago state, the specimens in collections being in most instances reared. The cases when spun up on the trunk of a tree or a large stone are sufficiently conspicuous. From the habit of the larva of feeding on grasses near the ground, immature cases are rarely found here. The species cannot be considered otherwise than scarce and extremely local, usually confined to sandy situations. In the South of England it is found in the New Forest, Woolmer Forest, Bournemouth, near Reading, Wokingham, and probably in many parts of the sandy heaths of Hants and Berks. There is a record of its occurrence in North Lancashire, but this does not appear to have been confirmed. In Scotland it has been found on the open heaths of the Rannoch district in Perthshire, where the full fed cases were found attached to out-cropping boulders and rocks on the mountain sides. Probably it will yet be found in other districts of both Scotland and England, its obscure and secluded habits causing it to be readily overlooked. Abroad it is not rare in Northern Italy, Germany, Norway, Finland, Livonia, Bulgaria and Armenia.

(*P. graminella*, *S. V.*; *unicolor*, *Staud. Cat.*, is a common species on the Continent, of about the size of *P. villosella*, but blacker and more opaque, with a similar female, and larva inhabiting a still larger and longer case, formed of dead grass and similar dried vegetable substances. So widely

distributed and common is it abroad that it ought surely to occur somewhere in this country. My only excuse for mentioning it here, however, is that I have in my own collection a male example, which was given me many years ago as a British specimen of *P. opacella*. By some misfortune the record of its locality is lost.)

(**P. muscella**, *Hüb.*, is a smaller species than *P. opacella*, of very curious form, the antennæ being extremely plumose, from massing together of the long pectinations, and the fore wings of the male being very narrow for some distance from the base, then broad and much rounded so as to take the shape of a battledore. Except for these peculiarities it closely resembles *P. opacella*. From the presence of a specimen in the British series of that species, in the collection of Dr Mason at Burton-on-Trent, there appears a probability that this obscure insect will also some day be found to inhabit this country. It is not rare in France, Germany, Hungary, and Switzerland.)

Genus 2. **EPICHOPTERYX.**

Antennæ rather short, regularly pectinated with solid, rather stiff teeth, not plumose. Thorax narrow. Abdomen slender, short. Fore and hind wings broad and rounded behind, covered with minute hairs rather than scales.

Female vermiform.

LARVÆ enclosed in a case of bits of dried grass or morsels of leaf or bark.

PUPÆ in the larva-cases.

1. **E. calvella**, *Ochs.*; **fusca**, *Haw.*; **hirsutella**, *Staud. Cat.*—Expanse $\frac{3}{4}$ to 1 inch. Body very slender, light brown; wings semi-transparent, broad, pale brown.

Antennæ of the male not more than one-third the length of the fore wings, regularly pectinated with short, thick,

almost clubbed teeth, which are densely clothed with extremely minute hairs; light brown. Head large, brown, with conspicuously black eyes. Thorax narrow and weak, dark brown, thinly covered with short, loose, grey-brown hair-scales. Abdomen slender, glossy, light brown, with numerous thin tufts of long silvery-white hair-scales situated at the edges of the segments. Fore wings broad, especially so beyond the middle, and very broad toward the hind margin; costa slightly arched at the base, then straight, but rapidly rounded off towards the apex, which also is rounded in a smooth curve which extends round the hind margin and anal angle; dorsal margin nearly straight; semi-transparent, pale brown, without markings, thinly covered with yellowish-grey hair-scales; nervures thickened, brownish; costal margin also brown. Hind wings rather long and not very broad, rounded behind; similar in colour and covering of hair-scales to the forewings, but slightly more transparent. Cilia all short, hairy, brown. Underside exactly like the upper; legs brown.

Female a maggot-like, cylindrical, or rather long-ovate body, without scales, effective legs, or antennæ. Head a mere brown horny mask; anterior segments also encased in horny chestnut-brown plates; body brown, and when dry shapeless. No fresh specimen has been available for description. Inhabiting the case formed by the larva, which it is said never to quit. (Stephens says: "Legs transparent, ashy-colour." This is curious!)

June and the beginning of July.

LARVA rather slender and cylindrical; head light brown with the face and eye-lobes edged with whitish; body pale pink, more whitish in front; second, third, and fourth segments covered down to the legs with thin, grey, horny plates, which are divided in the middle of the back by a white line, and regularly barred longitudinally with black-brown; legs well developed, pale brown; abdominal prolegs hardly visible;

anal prolegs larger and used to hold on to the inside of the case; anal segment with a blackish plate on the back. In a rather roughly ovate or spindle-shaped case, formed of small morsels of leaf and of dried stalks or other vegetable material, such as seed-capsules of plantain and sallow, and having short bits of dried grass placed upon it somewhat crosswise; very tough and thickly lined with soft silk. (Preserved females, larvæ and cases furnished by Dr. Mason and Mr. C. A. Briggs.)

August to May of the second year, feeding nearly two years. On sallow, blackthorn, oak, hawthorn, hazel, bramble, and hornbeam, subsisting upon the leaves; probably also on low-growing plants.

PUPA of the male of the usual moth-form, dark brown; of the female apparently maggot-like and resembling the female moth. That of the male divides down the outer margin of the wings, on each side, so that the covering of wings, legs, and antennæ is thrown off solidly in front when the moth emerges; it is also protruded considerably from the case. In a cocoon within the larva-case, which is fixed upon a plant by the end which had been used for the head and legs, the other being altered to allow the moth to emerge.

The male moth seems rarely to have been observed on the wing, but is said to fly mostly towards evening. Almost all the specimens in collections appear to have been reared. The cases are said first to have been found about the year 1820 in Hornsey Wood, Middlesex, and from that period for many years the insect inhabited that and the neighbouring woods at Highgate and Hampstead, also Winchmore Hill. In some years scarce, in others rather common, though it is recorded that they were so much infested with Ichneumons that even when the larvæ were most abundant very few were reared. The incessant growth of London has so greatly influenced these old localities for this insect, that it seems almost to have died out. Certainly for the last twenty years it has become much scarcer, and as the woods already men-

tioned have either disappeared or been strictly enclosed, there has been little opportunity for searching for it. In an excursion of the South London Entomological Society this year (1894) cases were observed in the Reigate district, Surrey, and if the wooded hills on either side of the Thames Valley were carefully examined the insect would almost certainly be rediscovered. Other records exist for Northamptonshire, Herefordshire, North Lancashire, and the neighbourhood of Darlington, and there is little doubt that it is more widely distributed in this country than has hitherto been noted. Abroad it is found in Holland, Belgium, France, and Germany.

If this species is really the *Hirsutella* of Hübner the name is singularly ill-applied, since it is one of the smoothest species in a very hairy group!

2. **E. pulla**, *Esp.*; **radiella**, *Curt.*—Expanse of male $\frac{1}{2}$ inch. Wings rounded, sooty-black, hairy; body very small.

Antennæ of the male rather short, curved downward, with long pectinations which are set far apart and slightly curved back; blackish-brown. Thorax and abdomen slender, shining black, thinly covered with brownish-black hair-scales. Fore wings broad from the base, ovate, with margins and apex all much rounded; semi-transparent, with the whole surface rather thickly covered with upraised smoky-black hairs or hair-scales, which give it a dull, shaggy appearance; blackest towards the base and round the margins. Nervures only faintly visible; cilia long, black, extending round the apex almost to the middle of the costal margin. Hind wings rounded, similarly covered with black hairs; cilia long, dense, black. Underside similar to the upper, but more thinly clothed with hair-scales, consequently more shining; cilia dense and black; legs blackish.

Female $\frac{1}{4}$ inch in length, short and thick, maggot-like;

reddish-yellow, with segmental divisions redder on the back; anal segment purplish; head very small, masked and tucked down, pale brownish or greyish, with the usual position of the mouth brown; no mouth-organs nor antennæ; legs merely indicated by minute, slender, glassy, yellow, jointed points without claws—mere papillæ, apparently without motion or functions—body thick and rounded, but with the segments distinctly visible as in a larva; tapering off rapidly at the eleventh and twelfth, and with the thirteenth segment small, bluntly terminated, except a small point or ovipositor-case projecting from the centre. This portion of the body has a vermicular motion, otherwise the creature seems quite inert. On emerging from the pupa the moth here described at once forced itself out of the case and fell prone to the bottom of the box in which it was confined. This, the only living female specimen which I have seen, was obtained by Mr. F. G. Whittle, who found the case during a protracted search for that of the following species. Preserved specimens, furnished by Mr. Webb and Mr. E. R. Bankes, are contracted, very short, deeply ridged, with the segments sharply edged and ovipositor-case prominent; reddish-brown, with the head darker.

The only variation to which the male of this species seems liable is in size, and perhaps in intensity of blackness, though that depends mainly upon its freshness when captured, or the degree of fading to which it may have been subjected either alive in sunshine or in the cabinet. Specimens, faded very brown, and partially denuded, appear to have been placed in a few collections under the name of *marginenigrella*. Another form, deep black and of larger size, reaching occasionally to nearly three-quarters of an inch in expanse, and said to be confined to marshy places, has been thought distinct, but apparently without cause. All intermediate gradations occur.

End of May, June, and even July.

LARVA dirty white, inclining to purplish, with two clearly

indicated black-brown stripes on each side, a very small spot of the same colour between the two upper lines, and a third line, rather irregular, above the stigmata. These stripes are interrupted by the intersection of the segments. Hairs on the body short and very delicate. Head blackish, shining, as also are the legs. In a case covered with smooth bits of dried grass, of a paler colour than those generally used by the allied species, and placed lengthwise in a more regular manner. In shape cylindrical and of pretty uniform thickness. Some of the bits of grass extend a little beyond the true case. The larva feeds on grasses and is not rare in fields, chiefly in hilly districts, but is not easy to find, as it keeps close to the ground among the herbage. (Bruand.) Cases found in this country agree most accurately with the foregoing description. M. Bruand goes on to say: "I have found, during many years, a number of cases of this species in a damp meadow. These are of a much larger size than those found on the mountains. The larvæ in these large cases pupate at least eight days after the others have emerged, and produce moths of a larger size. I think that this difference in size is caused by the damp locality. The larger I call the type, the other I have figured as var. *pulliparvella*. M. Lederer tells me that he finds these two sizes also at Vienna, but also considers them forms of the same species."

June to April, on grasses. Apparently feeding, at times, more than one year. Mr. C. A. Briggs found a full-sized case upon grass in July. The larva attached its case firmly to a box for about ten days, then woke up and fed on for the rest of the summer.

PUPA of a brown colour—that of the female resembling that of a Dipteron. In the larva-case, spun up on the stems of grasses or neighbouring plants, or, in rare instances, on a neighbouring post or other convenient object. In the pupa state about a fortnight.

The male moth flies in the daytime and, I think, only in the

sunshine, keeping about the grass on the sides of chalk hills, the edges of salt marshes, and generally in fields in its rather restricted localities. Mr. Sydney Webb says: "The females certainly attract an assemblage of males; I have frequently seen perhaps a dozen fluttering about and settling in a spot which indicated the presence of a female. They seem to arrive quite suddenly from all directions within a limited area, and almost every blade of grass within a square yard will have its occupant."

Found in suitable places in Kent, Surrey, Sussex, Hants, Dorset, Middlesex, Hertfordshire, Essex, and at Lakenheath, Suffolk. There is even, in the National Collection, a specimen labelled "Ilfracombe," but this locality seems to require confirmation. Mr. McLachlan tells me that many years ago he observed this moth in abundance in the Green Park in London, but there is no evidence that it is a constant inhabitant of the Metropolis, and this unusual circumstance may have arisen from the introduction of a quantity of fresh turf to the park from some chalky hill-side. Abroad it is common in France, Switzerland, and most parts of Central and Southern Europe, as well as in Bithynia and Armenia.

3. **E. reticella**, *Newman*.—Expanse of male $\frac{3}{8}$ inch. Extremely small and delicate; whitish, lined and dotted with dark grey.

Antennæ of the male not very short, black, regularly pectinated with long solid rays or teeth, which are slightly curved, but stand out distinctly apart, and are not ciliated, but are so brittle that few preserved specimens of the moth have them quite perfect. Thorax small and very slender, black, thinly covered with hoary scales; abdomen very small and slender, thickly covered with rather long white hair-scales. Fore wings short, broadly ovate, with rounded margins and apex; hind wings rather long, moderately broad, rounded behind; all the wings white with a faint purplish tinge, and having the nervures dark grey, and numerous irregular

dark grey cross stripes, so arranged as to divide the surface of the wings into a delicate network of grey lines and white interspaces. Cilia extending round the apex some distance along the costal margin, white, broadly chequered with broad grey spots which throw out delicate rays. The wings hardly possess a fixed pattern of markings, the cross lines are sometimes perpendicular to the costal and dorsal margins, at others rather oblique; moreover, they do not follow each other at regular distances, nor at the same distances in different specimens, nor indeed in the wings on the two sides of the same specimen, so that hardly any are accurately symmetrical. Underside similar to the upper, but a little whiter; legs whitish grey.

Female without legs or antennæ—a mere maggot—but having in the curious brown mask, which does duty for a head, two blackish hollows in the place of the eyes, a black spot where the mouth should be, and slight curved ridges at the side, which seem to suggest antenna-cases. Body red-brown, excessively wrinkled (in the dry specimen), segments deeply divided, anal segment abruptly cut off, but having in the middle a protruding ovipositor in three abrupt telescopic divisions, the final one being a mere point. For the sight of this dried and shrivelled specimen, which is only one-twentieth of an inch in length, I am indebted to Mr. B. A. Bower. It was reared from one of two cases, the sole result of long search by himself and Mr. Geo. Bird. A similar and most exhaustive search last spring, for the purposes of this book, by Mr. F. G. Whittle, was wholly without result so far as this species was concerned. I think, however, that when fresh the female would be about one-third of an inch long, with rather ridged segments, abruptly cut off anal segment, and protruded ovipositor. The present specimen seems to have forced itself out of its case after laying its eggs.

(It has been necessary to exercise especial care in obtaining authentic females of this and the last species for description, from the circumstance that in some of our best collections

those placed as females of these two species obviously belong to the next genus).

Middle of May to the end of June, in salt marshes.

LARVA small, moderately plump, rather thickest toward the hinder end; head shining black; second, third, and fourth segments each with a shining dark brown plate completely across the dorsal surface, and with a similar horny spot below on each side; body pale pink or pinkish-white; legs similar, but with dark brown claws; prolegs hardly indicated. In a soft, slender, close-fitting case, hardly cylindrical, but drawn in a little at the ends, composed of morsels of conferva mixed with silk and partially covered with short bits of soft dried grass, which also are dotted over with the mealy, dry, confervoid material, as though almost decayed when used, but carefully laid parallel and fitting very closely. So far as is known, living low down among *Spartina stricta*, on which grass the larva probably feeds, and from which it is occasionally swept up, but it also has been found upon *Artemisia maritima*, which had probably been merely used as a convenience for spinning up.

Probably feeding from July to April.

PUPA of the male brown, shining, with the cases of the wings, antennæ, and legs well developed, but all removed in a solid mask on emergence. Female pupa similar to that of a Dipteron. It remains in the case, but the pupa of the male is pushed halfway out for this purpose. In a cocoon within the larva-case, which is spun down firmly to a flower-stalk of *Spartina* or other plant, by the larva, before it turns round to assume the pupa state. Probably not more than a fortnight in pupa.

This is a beautiful little insect, so minute as to be most readily overlooked—more especially as it bears a wonderful resemblance to the curious tiny Dipterous insects with round hairy wings (*Psychoda*) which frequent damp, weedy spots. The male flies only in very still, warm weather, skipping in

the sunshine from blade to blade of the slender wiry salt-marsh grass (*Spartina*) or taking little flights of a few feet at a time. Mr. J. J. Walker, R.N., says: "I found it outside the sea-wall, in the Isle of Sheppey, where there is a rather luxuriant growth of grass and *Artemisia maritima*. The readiest way to obtain it is to sweep very lightly the tips of the grass and herbage, frequently examining the net. With a little practice, however, the creature may be detected on the wing. It looks like a *Psychoda* when flying. A still, hot, bright day seems to be essential to success."

First observed and recorded in 1847, and since found, though not very commonly, in salt marshes on the coast of Kent, rather more commonly in those of the Essex coast, also very locally on the coasts of Sussex and Hants, and even recorded, very rarely, on that of Devon. So far as this country is concerned, this is the extent of its range, and it does not seem hitherto to have been noticed abroad, except that it has been found by Dr. Heylaerts, of Breda, in Holland, but it is difficult to suppose that it could not be found, if looked for, in most of the salt marshes on the coasts of France, Germany, and Holland.

(*E. undulella*, *F.R.*—Also a very small species, though larger than the preceding, and with longer hind wings, white and reticulated in a similar manner, but with much more slender undulating cross-lines. Said to inhabit Hungary and Southern Russia. My only excuse for mentioning this pretty species as a possible inhabitant of these islands is that in Dr. Mason's series of *E. reticella*, which are (necessarily) British, there is a single example of it. Unfortunately no label is attached, and its place of capture is unknown, nor indeed was it recognised as distinct.)

Genus 3. **FUMEA.**

Antennæ of male rather short and regularly pectinated with teeth of very moderate length, regular, not very distinct,

not plumose; body very slender; wings rounded, opaque, with close glistening bronzy black-brown scales, which are rather large and loose.

Females apterous, but having antennæ and well-developed legs.

LARVA in a case formed of silk covered with bits of dried grass, or morsels of leaf, or bark.

PUPA in the larva case.

Easily distinguished from the two preceding genera by the wings being covered with scales and not hairy. Exceedingly difficult to distinguish among themselves, the characters being of somewhat doubtful value. A table of the species may be useful.

A. Fore wings broad and rounded—

B. Over half an inch in expanse; fore wings purple-brown, hind wings paler. *F. crassiorella*.

B². Half an inch in expanse; fore wings golden brown, hind wings dark. *F. intermediella*.

B³. Half an inch in expanse; fore wings very broad, purple brown. *F. roboricolella*.

A². Fore wings elongated—

C. Fore wings rather broad, bluntly pointed. *F. betulina*.

C². Fore wings narrow. *F. salicolella*.

C³. Fore wings broader, paler, more pointed. *F. tabulella*.

1. **F. crassiorella**, *Bruand*.—Expanse $\frac{6}{10}$ inch (15 mm.). Small, round-winged, bronzy; hind wings slightly paler.

Antennæ of the male rather more than one-half the length of the fore wings, slender, regularly pectinated with rather short teeth which lean obliquely forward, but are not massed together; dark grey. Head with the slender thorax and abdomen black-brown, covered with faintly shining scales; abdomen slightly tufted. Fore wings elongate-ovate with the costa slightly and regularly rounded; apex rather bluntly rounded off; hind margin also rounded to the anal angle,

which is slightly squared; dorsal margin nearly straight; whole surface smooth, not very thickly scaled, glistening purplish-brown or almost purplish-grey, costa slightly darker; cilia moderately long, similar in colour except at the extreme edge, which is paler. Hind wings rather long, bluntly rounded at the apex, gently rounded behind, purplish-grey, rather paler and more thinly scaled than the fore wings; cilia rather long, purplish-grey with paler tips. Under side like the upper, but a little paler in colour; cilia shining purple-brown.

“Female short, bent into a semicircle, almost spider-like; anterior portion slender; head very small, horny and shining; the body, which appears silky, is of a reddish colour, with six bars of black-brown colour in the form of rectangular parallelograms, which occupy all the dorsal surface after the fourth segment; on the upper portion of the three first segments, which are much contracted, is a blackish horny shield. The legs are long. The anal extremity is very obtusely terminated by a thick tuft of hairs or down, brown beneath, greyish-white or yellowish above, from which projects the ovipositor, 5 mm. in length, and composed of three sections, which withdraw one within another. Feet horn-colour. Antennæ so short that they can only be seen through a magnifier.” (Bruand.) I have copied Bruand’s description, since it appears not absolutely certain that we have in this country separated the female of this from those of the allied species. It, like them, withdraws its whole body from the case on emergence from pupa, but remains upon it, clinging tightly with depressed head, rounded body, and the anal segment pressed close down to the case and almost touching the under side of the head. Mr. Bond says that the females reared by him are larger and more obese than those of the other species. This is confirmed by the specimens from his cabinet which when dry are stout, with the head and dorsal region blackish-brown, under parts mixed browns, anal tuft very pale, ovipositor of moderate length.

· End of May, June.

LARVA dirty yellow or very light brown, tending toward wine-colour, with two deep red-brown dorsal lines, between which, upon each of the three first body-segments, are two deep-brown spots; beneath the stigmata is a longitudinal stripe of the same colour as the dorsal lines. All these stripes and lines are more strongly indicated upon the first body-segment than upon the two following, and are obliterated upon the fourth. Head horny, shining, of a light brown or red-brown, with five streaks and two dots of blackish-brown upon each lobe, and a dash of the same near the mouth; the upper line is bent in a degree oppositely to the lower. They start near together at the neck and meet again at their extremities; the second and fourth lines form a sort of cross, thence their points are turned toward the mouth; between is placed the third, which is paler than the others; the two dots are at the end of this third line, one above, the other a little below; upon the head and anterior segments are rather long and very slender grey bristles; on the rest of the body others shorter and nearly invisible. The case is composed of bits of dried grass, or twigs of dried plants, placed longitudinally and rather parallel. It is thick in proportion to its length, and much thicker than those of the following species. The young larvæ hatch in July, pass the winter as larvæ, and are full-grown at the beginning of April. After hibernation it appears on the first fine days of spring. One meets with it on rocks facing the east or south and against old walls covered with herbage and brambles. (Bruand.) Here again I have copied the original description, since there is some doubt about our own records. The cases were described by Mr. Mitford as more slender than those of *F. roboricolella*; moreover, they were all found in woods, and showed a preference for felled trunks of trees, and I fear that the different forms or species were mixed.

PUPA brown, in the case formed by the larva.

First recorded in this country in 1868 by the late Mr.

Bond, and afterwards by Dr. Knaggs and Mr. Mitford. So far as I can ascertain, all were reared from cases found in Hornsey Wood and Bishop's Wood, Hampstead, both in Middlesex. These localities have long been either destroyed or closed to the entomologist, but there can be little doubt that other woods in the London district will furnish the insect. Specimens in several collections appear very closely to agree with Bruand's description, and certainly are larger than the allied species, with rather paler hind wings. It is said to be found commonly in France, in Northern Spain, Southern Germany, and Hungary.

2. **F. intermediella**, *Bruand*.—Expanse $\frac{1}{2}$ inch. Wings ovate, rounded behind, shining dark golden brown; hind wings equally dark.

Antennæ of the male one-half the length of the fore wings, strongly pectinated, the teeth rather far apart, slightly oblique; dark brown. Head, with the slender thorax and abdomen, blackish-brown, closely covered with scales; abdomen very slightly tufted at the tip. Fore wings broad and rounded, nearly ovate, the costa being arched at the base and apex, but slightly straightened and rolled back in the middle; apex and hind margin rounded; dorsal margin rather straight; surface smooth and densely covered with glistening dark golden brown scales which show either golden or purple reflections according to the angle of light, but are brighter and more golden than those of the other species. From the middle of the wings to the hind margin the nervures are indicated by faint grooved lines. Cilia rather long and dense, similar to the wings. Hind wings rather elongated, rounded at the apex and behind; dark grey-brown, faintly glistening with bronzy purple scales; cilia darker. Under side similar, with the cilia extremely glossy; legs bronzy brown.

Female short, very plump, bowed into a curve so complete that the head and legs almost touch the anal segment.

Head dark brown, shining, without visible mouth organs, but provided with drooping antennæ, of moderate length, curved close to the head, simple in structure, dark brown, but each joint pellucid. Legs complete, dark brown, with the feet light brown, and curved slightly inward so as to be fitted for clinging to the case; apparently never used for walking, as the creature appears never to raise or straighten itself. Second segment covered by a broad, dark-brown, shining, horny shield, undivided and extending down each side to the legs; third segment with a similar narrower shield; each following segment with a broad rectangular blotch on the back; remainder of the body pale-pinkish; anal tuft light brown; anal segment with a telescopic ovipositor, which in life is not usually exerted to a great length except when depositing eggs in the bottom of its case; but at death is protruded as long as the whole body. June.

LARVA. Head rather large and prominent, dark brown or blackish, with faint yellowish lines; following three segments yellowish, each with a transverse blackish plate extending down to the legs, which are long and strongly made, blackish; body deep purple-brown. In a rather thinly constructed case of silk covered with slender bits of dry grass placed longitudinally, but not strictly parallel, since some rather diverge and give it a loose look. On palings, trunks of trees, stems of bushes, rocks and even walls, feeding on the minute powdery lichen which grows on damp wood; probably also eating leaves, and certainly allowing itself to be tempted by any dead insect which it may meet with. July to May, hibernating when almost full-grown.

PUPA light brown, in a cocoon in the larva-case. That of the male has distinct covers to the wings and legs, the whole of which are broken off in one piece on emergence, at which time the pupa is forced more than half way out of the case. That of the female is like that of a Dipteron, except

that a little bunch of covers for the legs exists close to the head. It is not protruded from the case. Only a short time in pupa.

This is our commonest species and is well known. The male flies in a very lively manner in the morning sunshine, and I have seen quite a gathering of the brisk little blackish creatures dancing over a bank, close to an old fence, at six o'clock A.M. There appears to be another flight late in the afternoon, but probably this is not continued throughout the day, and only occurs in the sunshine. Formerly very common round London, and the cases readily to be found on any old fence. Still common throughout the South of England, the Eastern Counties and the Southern Midlands; becoming more local further north, yet found in Yorkshire and Lancashire, and probably in suitable places in every intermediate county. Recorded from the West of Scotland, though apparently scarce there. Certainly common on the rocks at the Hill of Howth, near Dublin, but very little noticed, or else absent, from other parts of that country. Found all over the continent of Europe except the extreme north and south.

3. **F. roboricolella**, *Bruand.*—Expanse $\frac{1}{2}$ inch. Fore wings broad and very round, bronzy black.

Antennæ of the male, one-half the length of the fore wings, stout but often much curved and twisted, pectinated with slender teeth placed rather close together and moderately oblique; dark brown. Head, with the very slender thorax and abdomen, blackish brown, with rather bronzy closely-placed scales; abdomen very slightly tufted. Fore wings short and broad, very round behind; costa arched, apex and hind margin more than usually rounded; dorsal margin nearly straight; thickly covered with rather glistening purplish-black or dark purple-brown scales, of which the edges are slightly raised so that the wings do not look so smooth as in the last species; cilia darker, produced

slightly past the apex on to the costal margin. Hind wings rounded at the apex and hind margin, opaque, blackish-grey shot with purple; cilia similar. Under side like the upper; legs bronzy-brown.

Female similar to that of the preceding species, head shining dark brown, rounded in front, without mouth organs, but having brown drooping antennæ, legs long and well developed, dark brown, second and two following segments covered each by a dark horny plate, body dull brown, anal tuft pure white; ovipositor of great length, much longer than the body. Clinging closely to the end of the larval case, and with the body completely arched as in the last two species.

June, July.

LARVA purplish brown; head glossy black, with two tiny white lines forming a triangle between the eye lobes and pointing downwards; second segment with a black horny dorsal plate; third and fourth with three black stripes on each side; on the fifth these disappear. In a case of silk, covered usually with short lengths of dried grass, but not unfrequently with bits of dead stalk, or narrow strips of bark-skin which curve a little outward; generally a rather rougher looking case than those of the two other species.

July or August to May or June, on powdery lichens or on low-growing plants. Mr. A. H. Hamm has a brood now feeding up freely upon leaves of *Polygonum aviculare*, they also do not refuse sallow leaves, and have constructed their cases of bits of paper. Bruand regarded this species as more especially attached to oak, feeding on the minute lichens, but was uncertain whether it also gnawed leaves. Certainly it affects pine and birch trunks, and also rocks.

PUPA light brown; in the larva case, from which the male pupa forces itself when the moth emerges. Its whole front shield, of leg and wing cases, is thrown off unbroken. The female pupa is more like that of a Dipteron, and does not protrude from the case.

In hot, still, sunny weather the male flies actively at from 6 to 7.30 P.M. and doubtless also in the morning sunshine. From its close similarity to the preceding species its distribution is not readily ascertained, but it appears to be almost equally wide. I have specimens before me from various parts of the South of England; some from Leatherhead, Surrey, sent by Mr. C. A. Briggs, being large and unusually dark, while those obtained at Portland by Mr. E. R. Bankes are rather small. Others have been found in Buckinghamshire, and at Cannock Chase, Staffordshire, and Mr. W. H. B. Fletcher has specimens brought from Glengariff, in the South of Ireland. Doubtless intermediate localities are numerous. Abroad its range is equally doubtful; Bruand merely records it in France.

I do not feel profoundly convinced of the distinctness from each other of the last three species. We possess forms which correspond well with Bruand's descriptions; and these I have accepted rather in deference to his great care in determining species, and minute knowledge of their characteristics, and to the considerable faith in the separate species on the part of entomologists here, than to any strong belief of my own. It would have been very easy and convenient to follow Stainton in retaining all three under the name of *F. nitidella*. This last name has not been added as a synonym, or used for either, from the impossibility of determining to which it may belong. Certainly Hübner's figure of *nitidella* indicates a species with fore wings more pointed than is the case in either of these three, as also does that of Godart. Bruand went very carefully into this question, and I think his conclusion, that the name *nitidella* should be dropped, is incontestable. By an unfortunate combination of circumstances I have been prevented from consulting the papers of Dr. Heylaerts of Breda.

4. **F. betulina**, Z., **anicanella**, Bruand (?)—Expanse $\frac{6}{10}$

inch (15 mm.). Fore wings elongated, rather pointed, bronzy blackish-brown.

Antennæ one-half the length of the fore wings, much curved, regularly pectinated with curved teeth, which are placed rather close together, dark brown. Head, and the very slender thorax and abdomen, blackish brown, covered with closely set scales rather tinged with bronzy; abdomen but very slightly tufted at the tail. Fore wings rather elongated, as broad as those of *F. intermediella*, but longer and more pointed; costa very gently rounded and regularly thickened at the edge; apex somewhat produced and bluntly angulated; hind margin rounded; dorsal margin rather straight; glistening dark bronzy brown, smooth and opaque; cilia similar. Hind wings elongated, angulated at the apex, dark grey with a faintly-purplish gloss; cilia rather pale purplish-grey, very shining. Under side similar but more shining; legs dark bronzy brown.

Female with the body arched into a mere loop, blackish-brown when preserved, probably pale brown or pinkish when fresh; head rounded, chestnut-brown, horny, and shining, the lower part without mouth organs, but having a distinct articulation; antennæ shining brown, slender and drooping; legs brown, short but well developed; anal tuft broad and dense, clear white; ovipositor exerted, hardly so long as in the previous species. Probably resting on the outside of the larva case, as in other species, but I have seen no living example.

June.

LARVA purplish brown with the head black, a black plate on the second segment extending down the sides, and very narrow black plates, hardly more than mere lines, on the third and fourth; legs dark grey with the claws blackish. In a rather pointed blackish case, formed of silk and covered with irregular bits of dead leaf, or bark, or of lichen, the morsels not laid lengthwise, and apparently no lengths of

grass being used. Upon old bushes of willow, crab, blackthorn, and buckthorn, usually upon the branches which are much over-grown with small lichens, the case closely resembling a small bit of old dead twig.

July or August to May.

PUPA undescribed, in the larva-case.

First recorded in this country by Mr. Mitford, who gave unusual attention to the present group. He found cases in the Bishop's Wood at Hampstead, just outside London, and reared both sexes. It has also been obtained from Box Hill, Surrey; the New Forest, Hants; and Epping Forest, Essex. There is little doubt that it would be found in many of our southern woods, in damp spots where the bushes are rough with lichens, if carefully looked for. At present it is in very few collections, and little is known of its habits.

It appears to inhabit France, Germany, and Western Russia.

5. **F. salicolella**, *Bruand*; **salicicolella**, *Staud. Cat.*—
Expanse $\frac{1}{2}$ inch. Fore wings narrow, bronzy blackish-brown.

Antennæ of the male rather short and slender, narrowly pectinated, blackish brown. Head, and the narrow thorax and abdomen, blackish brown. Fore wings very narrowly ovate, with regularly rounded costa, apex also rounded regularly to the hind margin; dorsal margin comparatively straight; shining brownish-black; cilia similar. Hind wings rather short, rounded, pale grey-brown; nervures faintly darker. (*Bruand's figure.*)

Female similar to that of *F. crassiorella*, but smaller, the dorsal shields rather conspicuous; anal tuft light yellow-brown. (*Bruand.*)

June.

LARVA dirty grey or very light brown; head shining black without markings; jaws whitish; feet black; the whole upper part of the second segment is covered by a broad shield or black horny plate, divided by the whiter dorsal

vessel, so as to form two rather squared plates, sharply defined and edged in front with white; on the third segment are two plates, the lower parts being narrowed; on the fourth the plates are less sharply defined and consist of two indistinct spots; on the remainder they are obliterated. Living in a case which is a little constricted at the mouth, but swells out in the middle and terminates in a blunt point. It is covered with little fragments of bark of various shapes, and placed irregularly. (Bruand.)

July to May, on sallow and other bushes, feeding upon the lichens on the bark.

PUPA undescribed, in the larva-case.

Very little indeed is known of this species in this country. The rearing of two specimens, male and female, was recorded in 1858. To these I have not access. Mr. Mitford states that he found three cases, one of which produced a male, the others females; but unfortunately his specimens, which are in Dr. Mason's collection, do not appear to belong to this species. The male is certainly *F. betulina*. In Mr. Bond's collection is a case which may be correct, but nothing appears to have been reared from it. So little evidence is there that my only excuse for including this species as British is my own very distinct and accurate remembrance of a specimen which was obtained more than twenty-five years ago, by my early companion, Mr. E. G. Baldwin. This specimen, which I often examined, agreed exactly with Bruand's figure. It was taken at the Bishop's Wood, Hampstead, and, I think, in the *imago* state, by Mr. Baldwin, who is long since deceased. Unfortunately, this specimen cannot now be traced; I have tried in vain to discover what has become of my old friend's collection. Under these circumstances it has been necessary to describe the species mainly from Bruand's figure; but I feel certain that the insect only requires looking for in our southern woods. The only Con-

tinental country in which it seems to be known is France, and there far from commonly.

6. **F. tabulella**, *Bruand*; **sepium**, *Speyer, Staud. Cat.*—
Expanse $\frac{6}{10}$ inch. Male similar to that of *F. betulina*, but with fore wings paler and more pointed.

Antennæ of moderate length—more than one-half the length of the fore wings; regularly and distinctly pectinated, the teeth being longer than in the last species; blackish-brown; head, thorax, and abdomen brown. Fore wings rather narrow at the base, broader behind, intermediate in this respect between *F. betulina* and *F. salicolella*; costa rather straight and very slightly rolled back for the greater part of its length; apex rather bluntly pointed; hind margin distinctly rounded, and dorsal margin faintly curved; pale bronzy-grey, with the margin darker; cilia also darker grey; nervures faintly visible, grey. Hind wings more pointed at the apex than in the other species, and with that portion more produced and the hind margin but slightly rounded; rather roughly furnished with scales; pale grey, with the apex and cilia rather darker. Under side quite like the upper; legs and body grey-brown. Female very similar to those of the allied species; head a shining dark chestnut-brown mask, with very minute antennæ, just visible, arising from a couple of hollows; on the second segment a large dorsal shield extending down the sides, shining blackish-brown; two following segments with very narrow similar shields; body dull brown when dry, doubtless yellowish-brown when alive; anal tuft pale brown; ovipositor very long and conspicuous; legs long and well formed, yellowish brown. It sits upon the outside of the larva-case rather curved, but not bent in the same degree as those of the allied species, so that the ovipositor does not point down perpendicularly near the feet, but outwards.

July.

LARVA.—Head small, shining black, as also are the

anterior feet, and two plates placed transversely upon the upper part of the anterior segments; the rest of the surface of the body is blackish grey, slightly velvety, and with a light brown dorsal line. It lives in a stout, short ovoid case of a grey-black colour, but which takes the greenish hue of the lichen on which the larva feeds. It eats the lichens growing on old oak fences, on which it passes its life without moving far. In repose its case is held perpendicularly to the plane of its position, and is fixed thus when it arrives at the pupa state. (Bruand.) This description is a little contradicted by the author's diagnosis, which reads—"larva pale ochreous, dorsal-plate black"—and there is evidently some confusion here.

Full fed in June, but doubtless the larva feeds in the autumn, hibernates, and feeds up in the spring on lichens on trees and fences.

PUPA of the male short and thick, but extremely neat-looking; rounded in front and on the back, with very long wing and limb cases fitting closely and reaching far down the front of the abdomen, doubtless free at the tips, though this is difficult to see; abdomen very stout and short, with rows of minute tooth-like points; anal segment rounded and blunt, but with projecting points at the sides; uniformly light brown. (I have not seen the pupa of the female.) In the larval case, from the upper end of which the male pupa partly thrusts itself before the emergence of the moth.

A specimen of the male of this rare species was recorded as having been taken flying round beech trees at Mickleham, Surrey, in the year 1854. This specimen I have not seen; its wings are described as long and narrow, and of a pale brown colour. Another is said to have been taken in Epping Forest, among beech. A specimen in my late friend Machin's collection—which he gave to me—and which he reared from a case beaten out of blackthorn at Box Hill, Surrey, and believed to be this species, is *F. betulina*. Three

specimens labelled *tabulella* in the late Mr. F. Bond's collection appear to be *F. roboricolella*; and one from the collection of Mr. Mitford, but now in the possession of Mr. Philip Crowley, is certainly *Epichnopteryx pulla*, worn.

The only *fully* satisfactory evidence of the occurrence of the present species in this country has reached me, quite recently, from Mr. J. E. Fletcher, of Worcester, and, since next to nothing is otherwise known here of the insect, it may be well to quote his remarks: "In the spring of the year 1858 I beat from an old spruce (*Abies excelsa*) a single case-bearing larva, from which in the following summer appeared a small male moth, the wings of one side of which were cramped. By some misadventure the moth was lost. In the spring of 1877 I revisited the place—the Old Hills, near Worcester—and succeeded in obtaining four larvæ. Two I sent to the late Mr. Stainton, who wrote, July 10th, that he had bred a male moth from one case, and that it was in very good condition on one side, but rather crippled on the other. This specimen should be in the collection left by that gentleman. His second case and those that I retained yielded nothing. The last time I sought for the creature was in the spring of 1882, when I found five larvæ. From one of these was bred a female moth; from another a pupa fell out and died; a specimen of a species of *Braconidæ* came from the third, and the others contained dried-up larvæ.

"The LARVA is stout and brown, with head and corselet black; the boughs on which they occurred bore a good crop of lichen. The female moth emerges completely from its case and stands thereupon with its head towards the twig and its ovipositor directed outwardly and prominent. I watched the creature from time to time during two or three days before disturbing it, during which time it maintained the same posture."

With the foregoing information, Mr. Fletcher forwarded the female moth, the pupa, and a case, all of which have

been available for description. The case at once appeared to agree with that figured by Bruand, and the attitude of the female, as described, also agreed most accurately. Finally a search in the cabinet of the late Mr. Stainton, now in the national collection at South Kensington, revealed the male moth, unnamed, but also unmistakably agreeing with Bruand's description of *F. tabulella*. I know of no other localities than those named, but the insect should occur among the lichen-covered branches of trees in other parts of our damp western districts. Abroad it is but little known; Bruand says that in eight years he found the larva in two localities in France, in both cases on old oak fences; but that three years before writing he had beaten three cases, in another forest, from old mossy wych-elms.

F. sepium, *Speyer*, which Staudinger holds to be the same species, is found, besides France, in Central and Southern Germany, Belgium, and Eastern Russia.

It may perhaps be well, at the conclusion of this very aberrant family, to draw attention to the singular power possessed by the pupæ, in accordance with those of the *Sesiidæ*, *Zygænidæ*, *Zeuzeridæ*, *Hepialidæ*, and other families in the present group, and also in large groups of the *Micro-lepidoptera*, of forcing their way partly out of the cocoon, in some cases three-fourths of their length, before the emergence of the moth. This power is due in part to the presence of rows of small teeth, as often described, on the back of the abdominal segments, and sometimes to bristles on the same surface; but also, in a large degree, to the greater freedom and mobility of the abdominal segments themselves, of which one more segment than in other groups is capable of movement. In some of these, as already stated, the activity is extraordinary, and is wholly due to the twisting action of these segments. So obvious and complete is this distinction in mobility of segments, that in any arrangement based upon the structure of the *pupa*, this would inevitably become

a leading distinctive character. The subject has been treated quite recently, with extraordinary minuteness, detail, and philosophic acumen, by Dr. Algernon Chapman, in the *Transactions* of the Entomological Society of London, and is worthy of attentive study; but it would occupy far too much space in a work such as the present.

ADDITIONS AND CORRECTIONS.

(**Sesia conopiformis**, *Esp.*)—In the *Entomologist*, 1894, page 245, Mr. C. A. Dale states that he has taken a specimen of this species “beaten from buckthorn.” Occurring in France, Belgium, and Germany, and feeding on oak, it is not an improbable species to occur in these islands.

Zeuzera æsculi, *L.*—Mr. W. F. de Vismes Kane has written to me to state that the specimen referred to on page 146 as having probably been taken in Ireland was not so taken, but obtained from England.

Deiopeia pulchella, *L.*—With reference to the specimen alluded to on page 246, as having been taken by the Rev. T. W. Daltry in a meadow in Staffordshire, I am requested by Mr. Daltry to record that, although captured in his presence, it was actually taken by Mr. F. C. Woodforde of Market Drayton, in whose collection the moth remains.

Nemeophila plantaginis, *L.* (Page 264)—I am now informed by Major J. N. Still, of Seaton, Devon, that this insect does occur in that county, he having found larvæ on Dartmoor, from which he reared the moths.

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PLATE XLI.

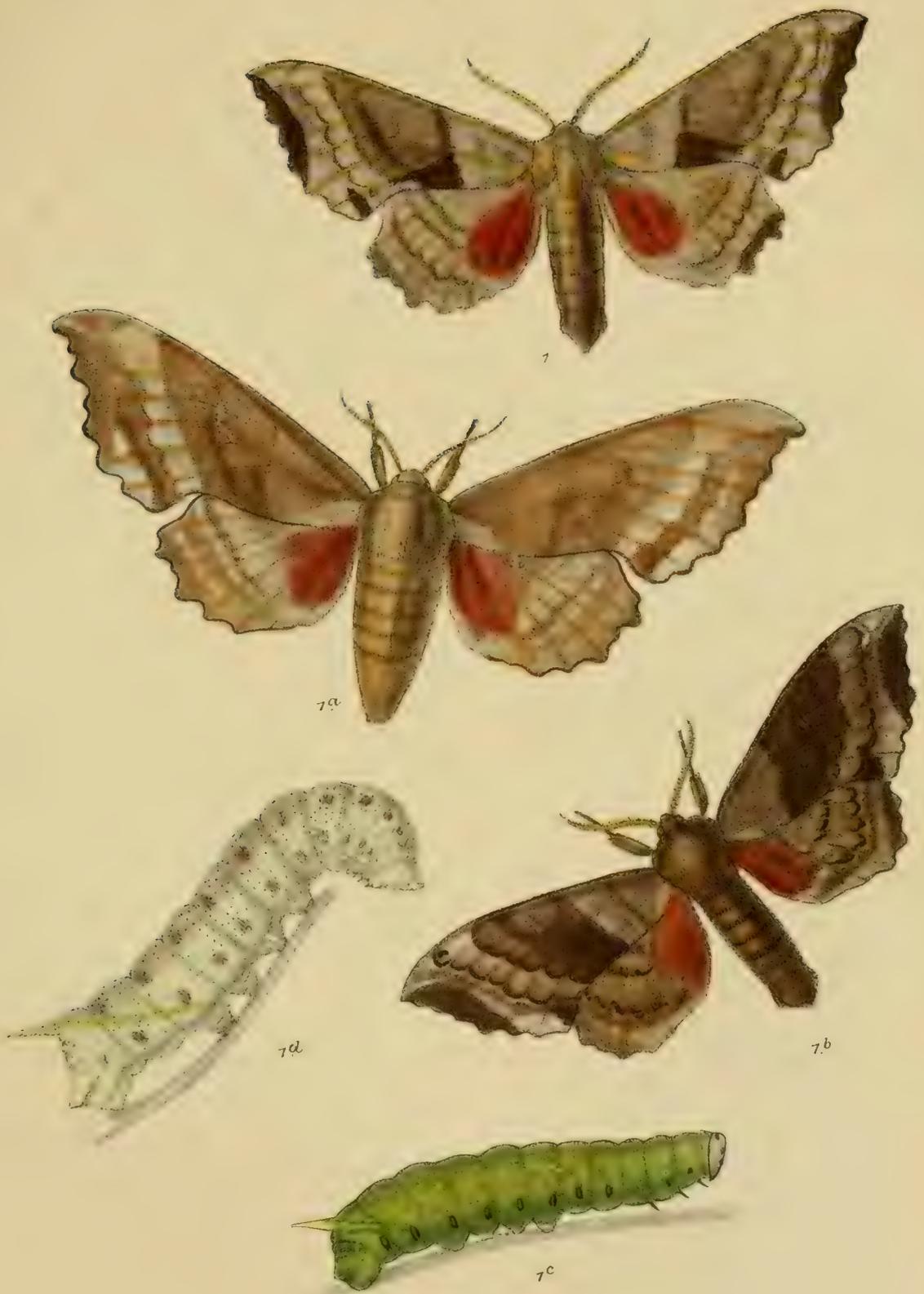
- FIG. 1. *Smerinthus ocellatus*, male.
1*a.* ,, ,, female.
1*b.* ,, ,, larva.
1*c.* ,, ,, ,, var.
1*d.* ,, ,, pupa.
2. Hybrid between *Smerinthus ocellatus* and
 S. populi.



R. Morgan, del. et lith

Vincent Brooks Day & Son, Imp

L. Reeve & Co, London.



R. Morgan, del et lith.

Vincent Brooks, Day & Son, Imp

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PLATE XLIII.

FIG. 1. *Smerinthus tiliæ*, male.

- | | | | |
|-----|---|---|--------|
| 1a. | „ | „ | female |
| 1b. | „ | „ | „ var. |
| 1c. | „ | „ | var. |
| 1d. | „ | „ | larva. |
| 1e. | „ | „ | pupa. |



R. Morgan, del. et lith.

Vincent Brooks, Day & Son, Lith.

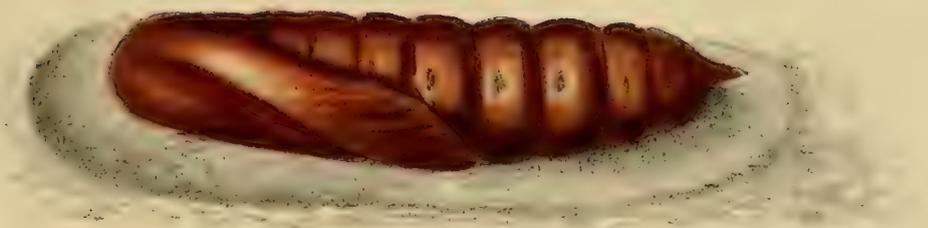
L. Reeve & Co, London

PLATE XLIV.

FIG. 1. *Acherontia Atropos*.

1*a.* " " larva.

1*b.* " " pupa.



R. Morgan, del. et lith.

Vincent Brooks, Day & Son, Imp.

L. Reeve & C^o, London.

PLATE XLV.

FIG. 1. *Sphinx convolvuli*, male.

1*a.* ,, ,, female.

1*b.* ,, ,, larva, from a figure by
 Mr. G. C. Bignell.

1*c.* ,, ,, pupa.



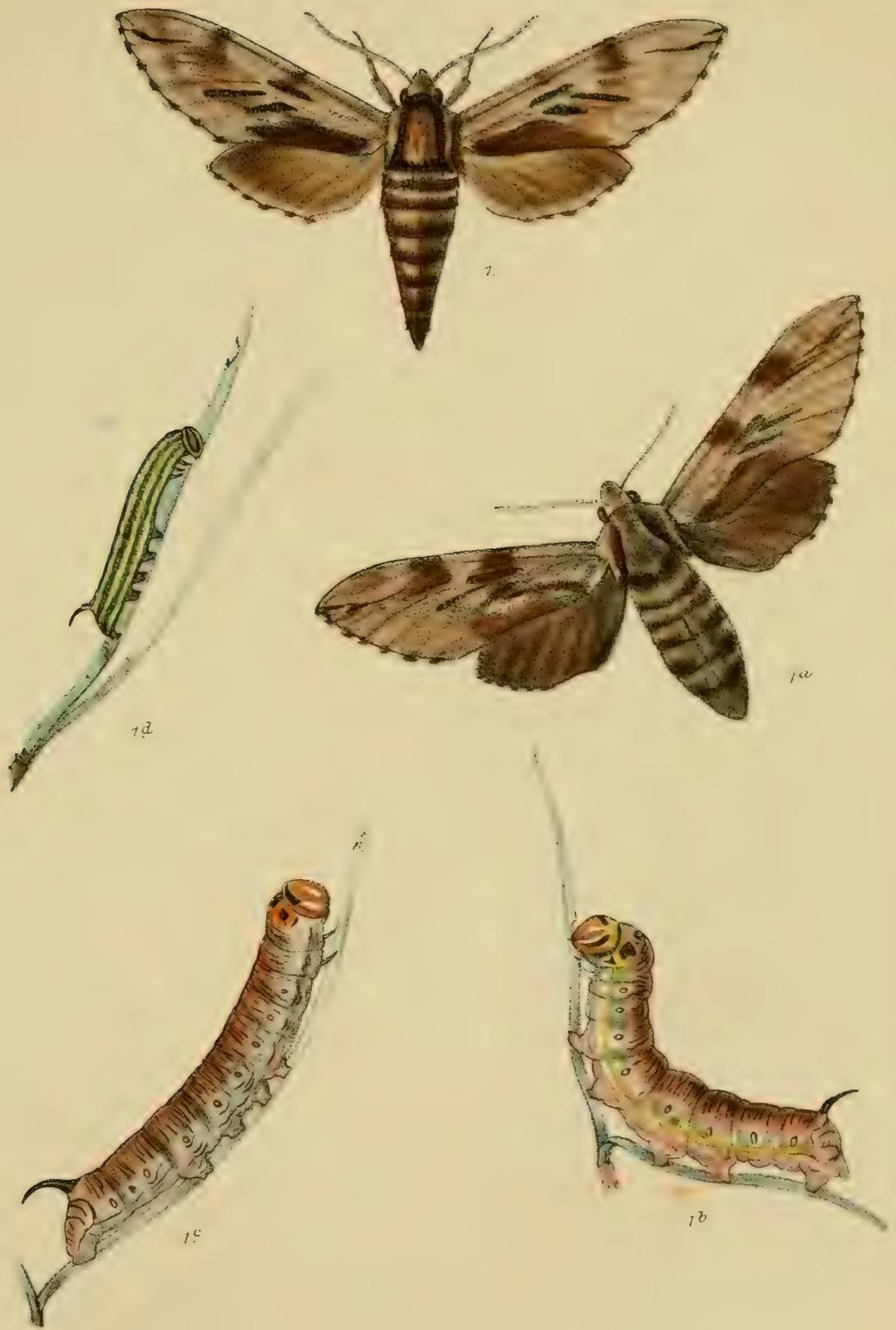
R. Morgan, del. et lith.

Vincent Brooks Day & Son Lith.

L. Reeve & Co, London

PLATE XLVI.

- FIG. 1. *Sphinx pinastri*, male, Mr. W. H. B. Fletcher.
- | | | | | | |
|-------------|---|---|--------------------------------|-----------------|-----|
| 1 <i>a.</i> | „ | „ | female, Lord Rendlesham. | | |
| 1 <i>b.</i> | „ | „ | larva, from figure by the Hon. | | |
| | | | | Mrs. Carpenter. | |
| 1 <i>c.</i> | „ | „ | „ | do. | do. |
| 1 <i>d.</i> | „ | „ | young larva, | do. | do. |



R. Morgan. del. et lith.

Vincent Brooks Day & Son. Imp.

L. Reeve & Co. London.

PLATE XLVII.

- FIG. 1. *Sphinx ligustri*, male.
1*a.* „ „ female.
1*b.* „ „ larva.
1*c.* „ „ pupa.



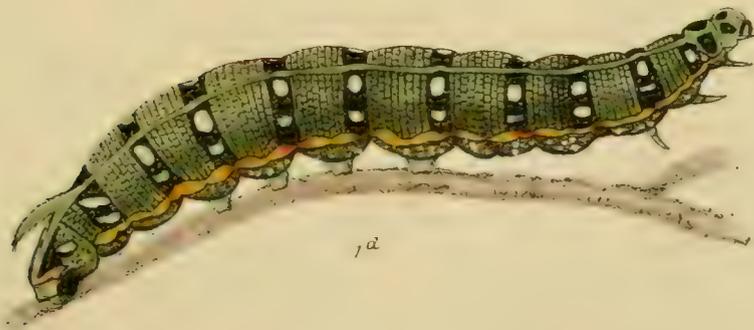
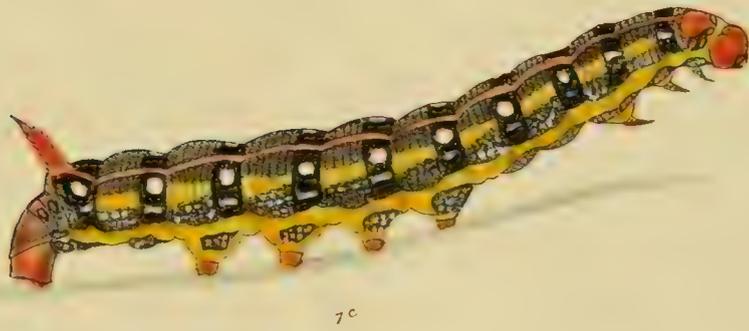
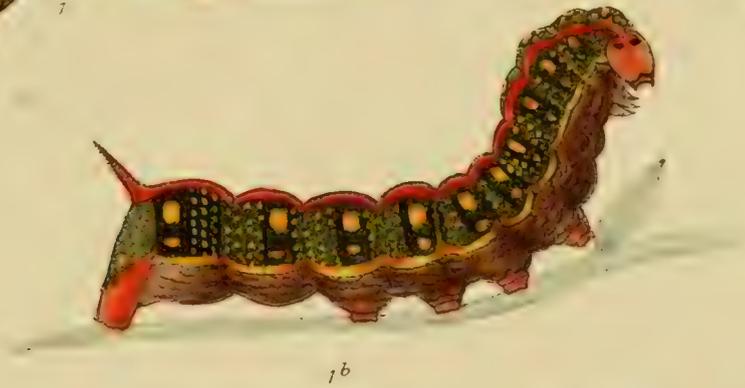
W. Morgan del. et lith.

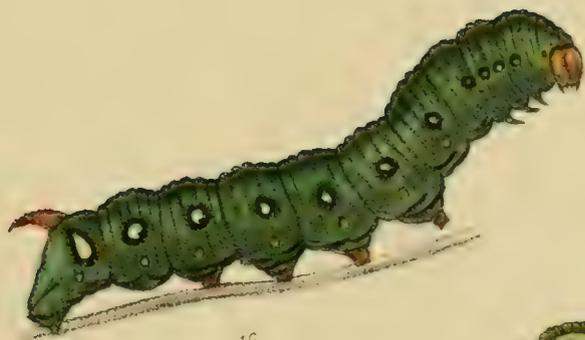
Vincent Brooks, Day & Son Imp.

Printed by W. & A. G. Lender.

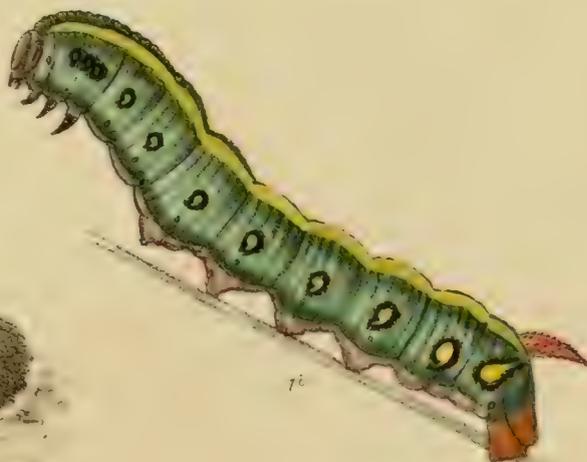
PLATE XLVIII.

- FIG. 1. *Deilephila euphorbiæ*, male. Norfolk.
- | | | | |
|-------------|---|---|-----------------------------------------------|
| 1 <i>a.</i> | „ | „ | female, from Devon,
Dr. P. B. Mason. |
| 1 <i>b.</i> | „ | „ | larva, from a figure by
Mr. G. C. Bignell. |
| 1 <i>c.</i> | „ | „ | „ from figure by
Mr. W. Buckler. |
| 1 <i>d.</i> | „ | „ | „ do. do. |





7c



7e



7d

R. Morgan del. et lith.

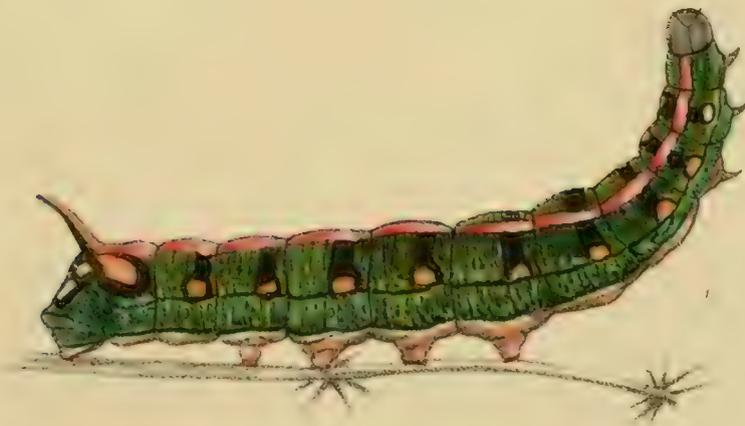
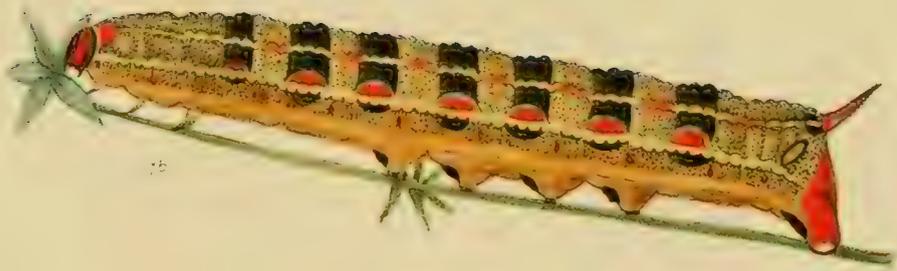
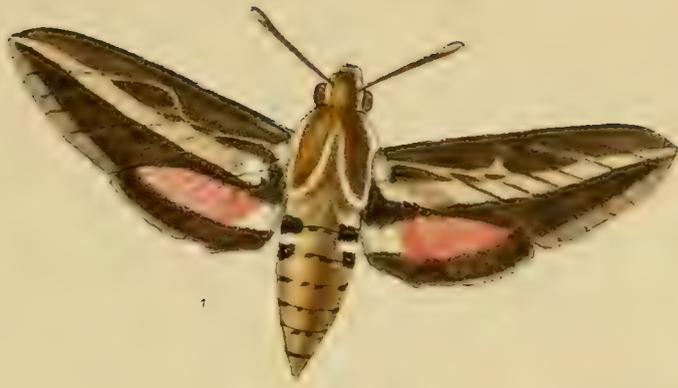
Vincent Brooks Day & Son, Imp.

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PLATE L.

FIG. 1. *Deilephila livornica*, male.

- | | | | |
|--------------|---|---|---------------------------------------------|
| 1 <i>a</i> . | „ | „ | female, Dr. Mason. |
| 1 <i>b</i> . | „ | „ | larva, from figure by
Mr. G. C. Bignell. |
| 1 <i>c</i> . | „ | „ | larva, var. |



R. Morgan del et lit

Vincent Brooks Day & Son Imp

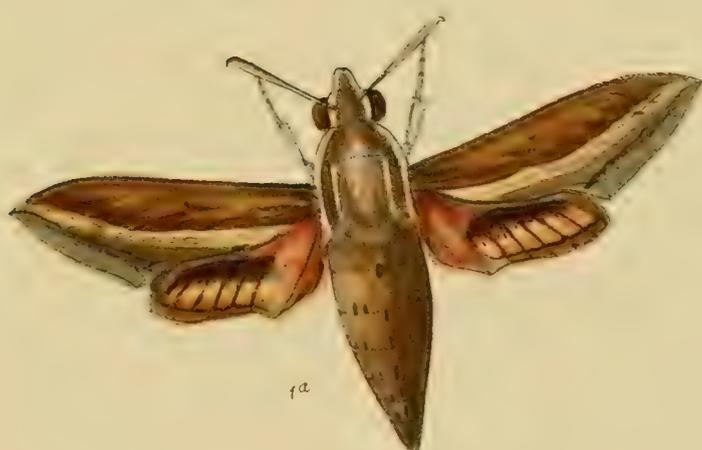
L Reeve & Co London

PLATE LI.

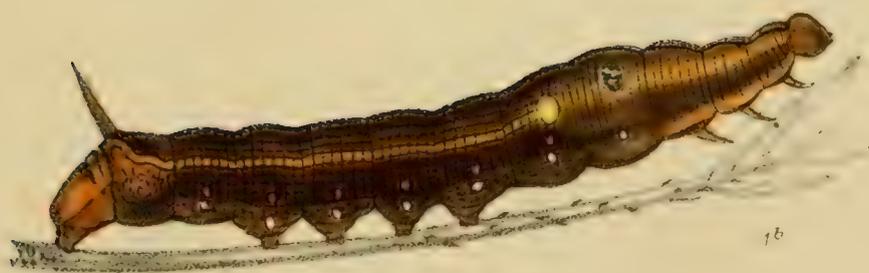
FIG. 1. *Chærocampa celerio*, male.

1*a.* ,, ,, female, Dr. Mason.

1*b.* ,, ,, larva.



1a

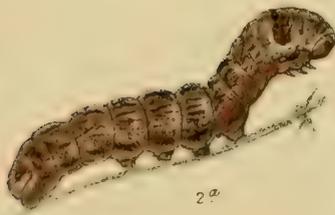
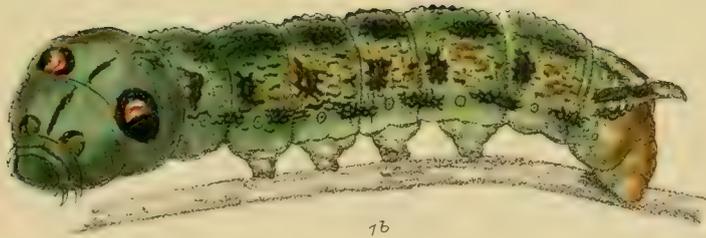


1b

PLATE LII.

FIG. 1. Chærocampa Elpenor.

- | | | | |
|-----|---|---|---------------------------------------------|
| 1a. | „ | „ | larva, from figure by
Mr. G. C. Bignell. |
| 1b. | „ | „ | with segments retracted. |
| 1c. | „ | „ | pupa. |
| 2. | „ | | porcellus. |
| 2a. | „ | „ | larva. |



R. Morgan del et lith

Vincent Brooks Day & Son Imp

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PLATE LIII.

FIG. 1. *Chærocampa nerii*, male.

- | | | | |
|-----|---|---|----------------------------|
| 1a. | „ | „ | female, Mr. G. T. Porritt. |
| 1b. | „ | „ | larva, Hoffmann. |
| 1c. | „ | „ | pupa, do. |



R Morgan del, et lith.

Wm. H. Burges Sculp & Son Lith.

L. Reeve & Co London

PLATE LIV.

FIG. 1. *Macroglossa stellatarum*.

1 <i>a</i> .	„	„	var. Mr. W. H. B. Fletcher.
1 <i>b</i> .	„	„	larva, Mr. Alfred Sich.
1 <i>c</i> .	„	„	pupa.
2.	„		<i>fuciformis</i> , just emerged.
2 <i>a</i> .	„	„	after flight.
2 <i>b</i> .	„	„	larva.
3.	„		<i>bombyliformis</i> .
3 <i>a</i> .	„	„	larva.

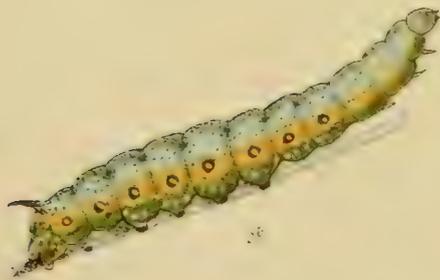
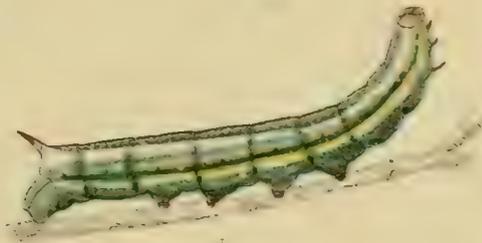


PLATE LV.

FIG. 1. *Sesia asiliformis*, male, Dr. Mason.

- 1*a.* " " female.
- 2. " *scoliaëformis*, male, Mr. W. H. B. Fletcher.
- 2*a.* " " female, Mr. S. Webb.
- 3. " *spheciformis*, male, Mr. A. Robinson.
- 3*a.* " " female.
- 3*b.* " " larva.
- 3*c.* " " pupa, Mr. A. F. Griffiths.
- 4. " *andræniformis*, Mr. S. Webb.

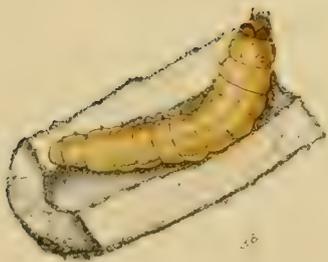


PLATE LVI.

FIG. 1. *Sesia tipuliformis*.

- | | | | |
|--------------|---|-----------------------|---------------------|
| 1 <i>a</i> . | „ | „ | larva. |
| 2. | „ | <i>cynipiformis</i> , | male. |
| 2 <i>a</i> . | „ | „ | female. |
| 2 <i>b</i> . | „ | „ | larva. |
| 3. | „ | <i>myopæformis</i> , | male. |
| 3 <i>a</i> . | „ | „ | female. |
| 3 <i>b</i> . | „ | „ | larva, Mr. A. Sich. |
| 4 | „ | <i>culiciformis</i> , | male. |
| 4 <i>a</i> . | „ | „ | female. |
| 4 <i>b</i> . | „ | „ | larva. |
| 4 <i>c</i> . | „ | „ | pupa. |





PLATE LVII.

- FIG. 1. *Sesia formicæformis*.
1a. ,, ,, larva.
2. ,, *ichneumoniformis*, male.
2a. ,, ,, female.
2b. ,, ,, larva.
3. ,, *philanthiformis*.
4. ,, *chrysidiformis*.
4a. ,, ,, larva.
4b. ,, ,, pupa.
5. *Sphæcia bembeciformis*.
5a. ,, ,, larva.
6. ,, *apiformis*, male.
6a. ,, ,, female.
6b. ,, ,, larva.



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I. Reave & Co. London

PLATE LVIII.

FIG. 1. *Procris globulariæ*.

- | | | | |
|-----|--------|-----------|------------------|
| 1a. | „ | „ | larva (Buckler). |
| 2. | .. | statices, | male. |
| 2a. | .. | „ | female. |
| 2b. | „ | „ | larva. |
| 3. | „ | Geryon. | |
| 3a. | „ | „ | larva (Buckler). |
| 4. | Zygæna | Minos, | male. |
| 4a. | „ | „ | female. |
| 4b. | „ | „ | larva (Buckler). |
| 5 | .. | exulans, | male. |
| 5a. | .. | „ | female. |
| 5b. | .. | „ | larva (Buckler). |



PLATE LIX.

FIG. 1. *Zygæna meliloti*.

- | | | | |
|-----|----|----------|--------------------|
| 1a. | .. | .. | var. |
| 1b. | .. | .. | .. Mr. S. Webb. |
| 1c. | .. | .. | larva. |
| 2. | .. | trifolii | |
| 2a. | .. | .. | var. |
| 2b. | .. | .. | .. |
| 2c. | .. | .. | .. Mr. W. Christy. |
| 2d. | .. | .. | .. |
| 2e. | .. | .. | larva. |
| 3. | .. | loniceræ | |
| 3a. | .. | .. | var. |
| 3b. | .. | .. | .. Mr. S. Webb. |
| 3c. | .. | .. | .. |
| 3d. | .. | .. | larva. |



PLATE LX.

FIG. 1. *Zygæna filipendulæ*.

1 <i>a</i>.	..	..	var:	
1 <i>b</i>.	..	..	..	Mr. B. G. Rye.
1 <i>c</i>.	..	..	..	Mr. S. Webb.
1 <i>d</i>.	..	..	..	..
1 <i>e</i>.	..	..	..	..
1 <i>f</i>.	..	..	..	..
1 <i>g</i>.	..	..	..	..
1 <i>h</i>.	..	..	..	..
1 <i>i</i>.	..	..	larva.	
1 <i>j</i>.	..	..	cocoon.	
1 <i>k</i>.	..	..	underside of a specimen having five wings. Drawn by Mrs. Richardson.	



R. Morgan, del, et lith

L. Reeve & C. Jordan

Vincent Brooks, Day & Son Imp

PLATE LXI.

- FIG. 1. *Macrogaster arundinis*, male.
1*a.* " " female.
1*b.* " " larva (Buckler).
2. *Zeuzera æsculi*, male.
2*a.* " " female.
2*b.* " " larva (Buckler).
2*c.* " " pupa "
3. *Cossus ligniperda*.
3*a.* " " larva.



R. Morgan del. et lith

Vincent, Brooks, Day & Son Imp.

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PLATE LXII.

- FIG. 1. *Hepialus hectus*, male.
1*a.* „ „ female.
1*b.* „ „ larva (Buckler).
2. „ *lupulinus*, male.
2*a.* „ „ female.
2*b.* „ „ male, variety.
2*c.* „ „ larva.
3. „ *velleda*, male.
3*a.* „ „ „ var.
3*b.* „ „ female.
3*c.* „ „ var. *Gallica*,
3*d.* „ „ larva.



R. Morgan del. et lith

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PLATE LXIII.

FIG. 1. *Hepialus humuli*, male.

- | | | | |
|-----|---|---|-------------------------------------|
| 1a. | „ | „ | female. |
| 1b. | „ | „ | male var. Shetlands. |
| 1c. | „ | „ | „ „ „ |
| 1d. | „ | „ | „ „ „ |
| 1e. | „ | „ | female var. Yorks., Mr.
Porritt. |
| 1f. | „ | „ | larva. |



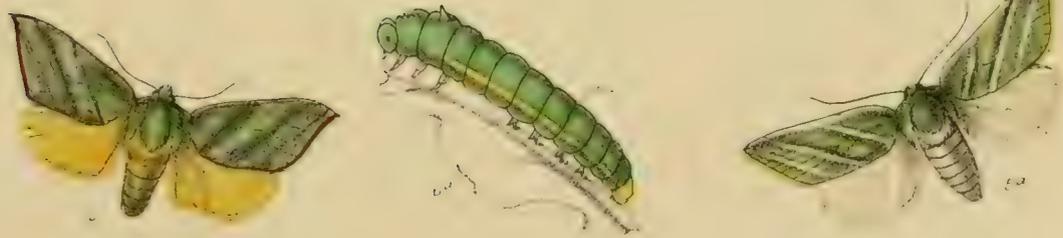
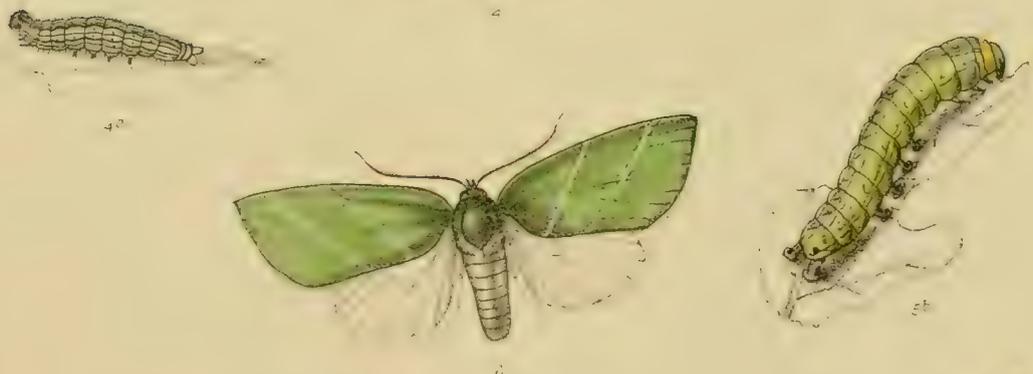
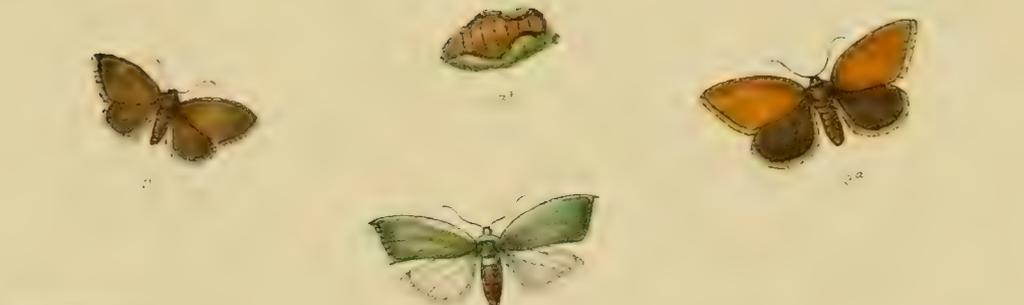
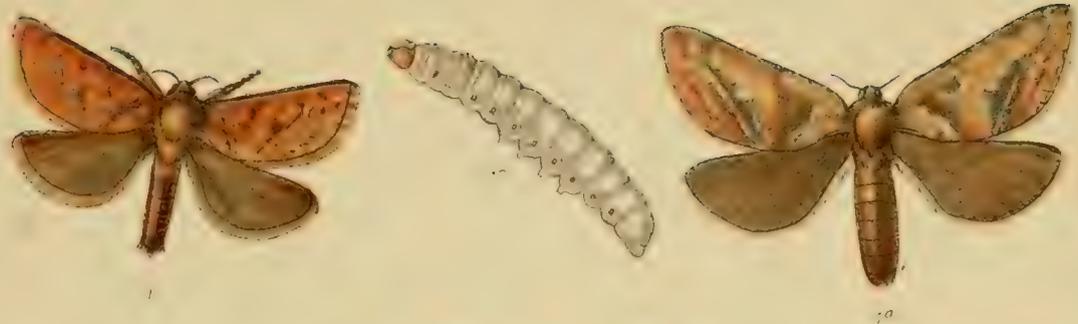
R. Morgan del, et lith

Vincent Brooks, Day & Son Imp

L. Reeve & Co. London

PLATE LXIV.

- FIG. 1. *Hepialus sylvinus*, male.
1a. " " female.
1b. " " larva.
2. *Limacodes testudo*, male.
2a. " " female.
2b. " " larva (Mr. Sich).
3. *Heterogenea asellus*, male.
3a. " " female.
3b. " " larva.
4. *Earias chlorana*.
4a. " " larva.
5. *Halias prasinana*, male.
5a. " " female.
5b. " " larva.
6. " *quercana*.
6a " " larva.



R. Morgan del et lith

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PLATE LXV.

FIG. 1. *Nola cucullatella*.

- | | | | |
|-----|----|---------------------|----------------------------------------|
| 1a. | ,, | ,, | var. |
| 1b. | ,, | ,, | larva, from drawing by Mr.
A. Sich. |
| 2. | ,, | <i>strigula</i> . | |
| 2a. | ,, | ,, | larva, Mr. Buckler. |
| 2b. | ,, | <i>confusalis</i> . | |
| 3. | ,, | ,, | larva, Mr. Buckler. |
| 3a. | ,, | ,, | pupa. |
| 4. | ,, | <i>centonalis</i> . | |
| 4a. | ,, | ,, | var. Mr. R. Adkin. |
| 4b. | ,, | ,, | ,, ,, |
| 4c. | ,, | ,, | larva, Mr. Buckler. |
| 4d. | ,, | ,, | cocoons, Mr. R. Adkin. |
| 5. | ,, | <i>albulalis</i> , | male. |
| 5a. | ,, | ,, | female. |
| 5b. | ,, | ,, | larva, Mr. Buckler. |
| 5c. | ,, | ,, | cocoon, Mr. W. H. Tugwell. |

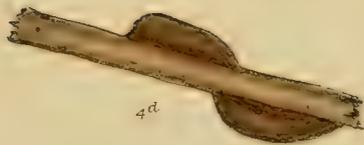


PLATE LXVI.

FIG. 1. *Nudaria senex*.

1a.	„	„	larva, Mr. Buckler.
2.	„	mundana,	male.
2a.	„	„	female.
2b.	„	„	larva.
3.		<i>Calligenia miniata</i> .	*
3a.	„	„	larva, Mr. Buckler.
4.		<i>Setina irrorella</i> ,	male.
4a.	„	„	female.
4b.	„	„	larva, Mr. Buckler.
5.	„	<i>mesomella</i> .	
5a.	„	„	var.
5b.	„	„	larva, Mr. Buckler.
6.		<i>Lithosia muscerda</i> ,	male.
6a.	„	„	female.
6b.	„	„	larva.



R. Morgan del. et lith.

Vincent Brooks Day & Son Imp

J. Reeve & Co London

PLATE LXVII.

FIG. 1. *Lithosia aureola*.

- | | | | |
|--------------|---|-------------|-------------------------------|
| 1 <i>a</i> . | „ | „ | larva, Mr. Buckler. |
| 2. | „ | helveola, | male. |
| 2 <i>a</i> . | „ | „ | female. |
| 2 <i>b</i> . | „ | „ | larva. |
| 3. | „ | pygmæola, | male. |
| 3 <i>a</i> . | „ | „ | female. |
| 3 <i>b</i> . | „ | „ | larva, Mr. Buckler. |
| 4. | „ | caniola. | |
| 4 <i>a</i> . | „ | „ | larva, Mr. Buckler. |
| 4 <i>b</i> . | „ | „ | pupa. |
| 5. | „ | complana. | |
| 5 <i>a</i> . | „ | „ | v. sericea, from Mr. Gregson. |
| 5 <i>b</i> . | „ | „ | larva, Mr. Buckler. |
| 6. | „ | complanula. | |
| 6 <i>a</i> . | „ | „ | larva. |



R. Morgan del. et lit.

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PLATE LXVIII.

FIG. 1. *Lithosia griseola*.

- | | | | |
|--------------|---------|--------------|---------------------------|
| 1 <i>a</i> . | „ | „ | var. stramineola. |
| 1 <i>b</i> . | „ | „ | „ intermediate. |
| 1 <i>c</i> . | „ | „ | larva, Mr. Buckler. |
| 2. | „ | rubricollis, | male. |
| 2 <i>a</i> . | „ | „ | female. |
| 2 <i>b</i> . | „ | „ | larva, Mr. G. C. Bignell. |
| 3. | Ænistis | quadra, | male. |
| 3 <i>a</i> . | „ | „ | female. |
| 3 <i>b</i> . | „ | „ | larva, Mr. Buckler. |



PLATE LXIX.

- FIG. 1. *Eulepia grammica*, male.
1*a.* female.
1*b.* larva.
2. .. *cribrum*.
2*a.* var.
2*b.* larva.
3. *Deiopeia pulchella*, male, Dr. Mason.
3*a.* female.
3*b.* larva.
4. *Euchelia jacobææ*, male.
4*a.* female.
4*b.* var. Mr. A. Robinson.
4*c.* larva.

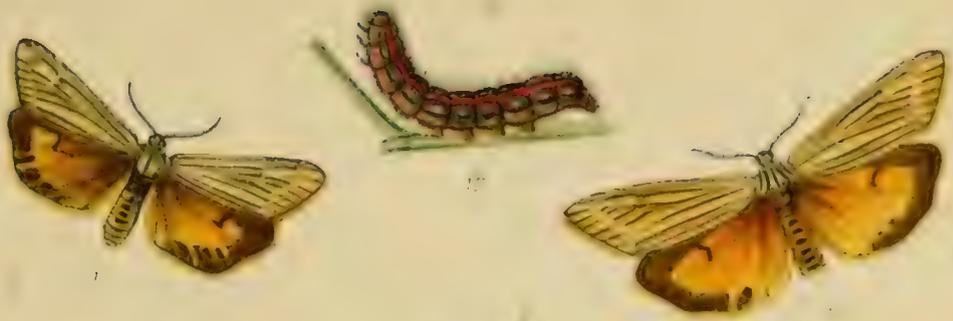


PLATE LXX.

FIG. 1. *Callimorpha dominula*.

1 <i>a</i> .	”	”	var. Mr. S. Webb.
1 <i>b</i> .	..	”	” ”
1 <i>c</i> .	..	”	” ”
1 <i>d</i> .	”	”	” Dr. Mason.
1 <i>e</i> .	”	”	” ”
1 <i>f</i> .	”	..”	larva, Mr. Buckler.
2.	”	Hera	Mr. A. Robinson.
2 <i>a</i> .	”	”	var. ”
2 <i>b</i> .	”	”	larva.



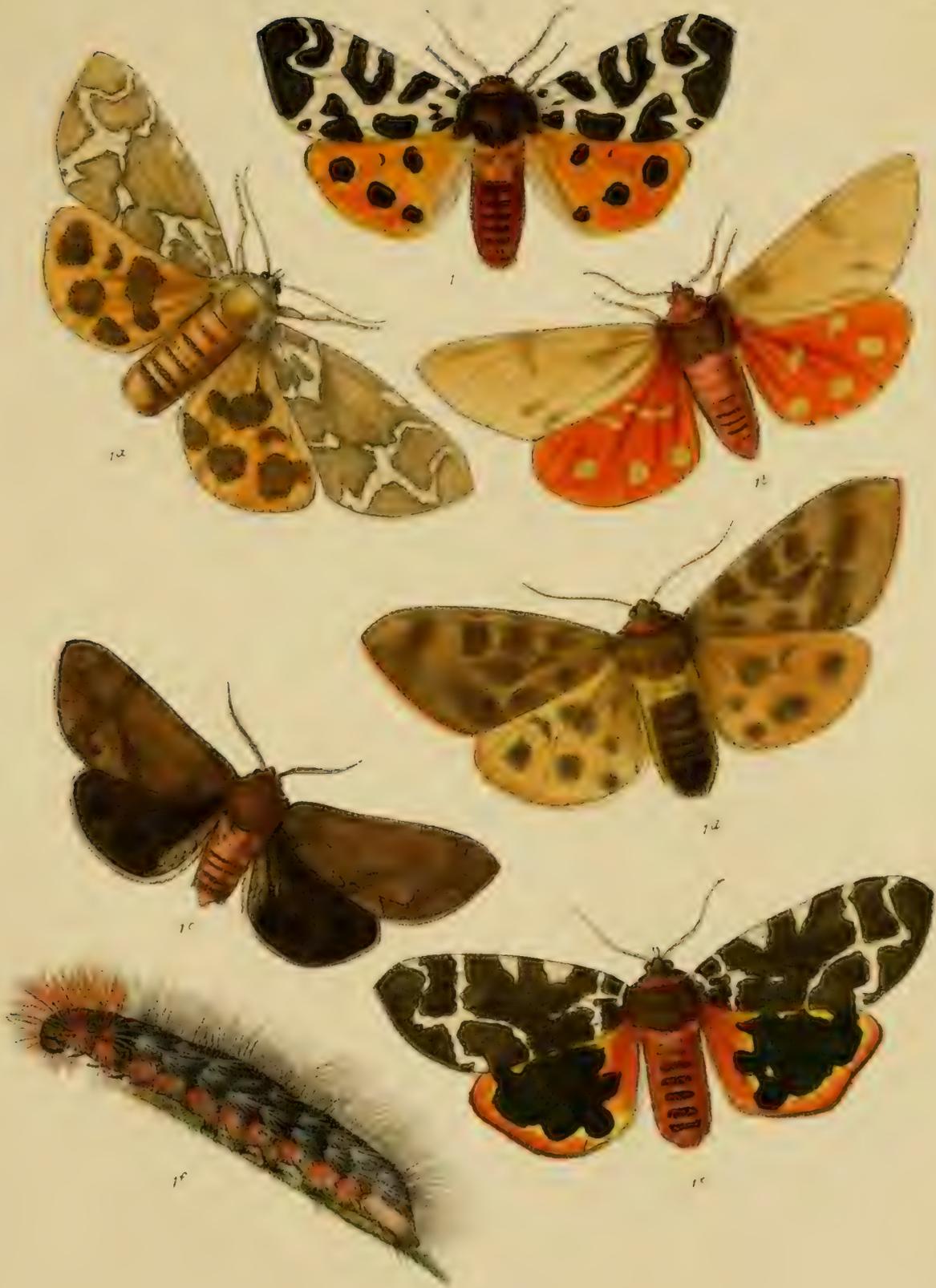
R. Morgan de Letri

L. Reeve & Co. London

PLATE LXXI.

FIG. 1. *Arctia caja*.

1 <i>a</i> .	„	var.	Dr. Mason.
1 <i>b</i> .	„	„	Mr. S. Webb.
1 <i>c</i> .	„	„	Dr. Mason.
1 <i>d</i> .	„	„	Mr. S. Webb.
1 <i>e</i> .	„	„	„
1 <i>f</i> .	„	„	larva.



R. Moran. del et lith

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J. Reeve & Co. London

PLATE LXXII.

FIG. 1. *Arctia caja* var. Dr. Mason.

1 <i>a.</i>	„	„	Mr. S. Webb.
1 <i>b.</i>	„	„	Mr. C. A. Briggs.
1 <i>c.</i>	„	„	Mr. S. Webb.
1 <i>d.</i>	„	„	„
1 <i>e.</i>	„	„	„
1 <i>f.</i>	„	„	„
1 <i>g.</i>	„	„	„



F. Moths of the Genus *Actias*

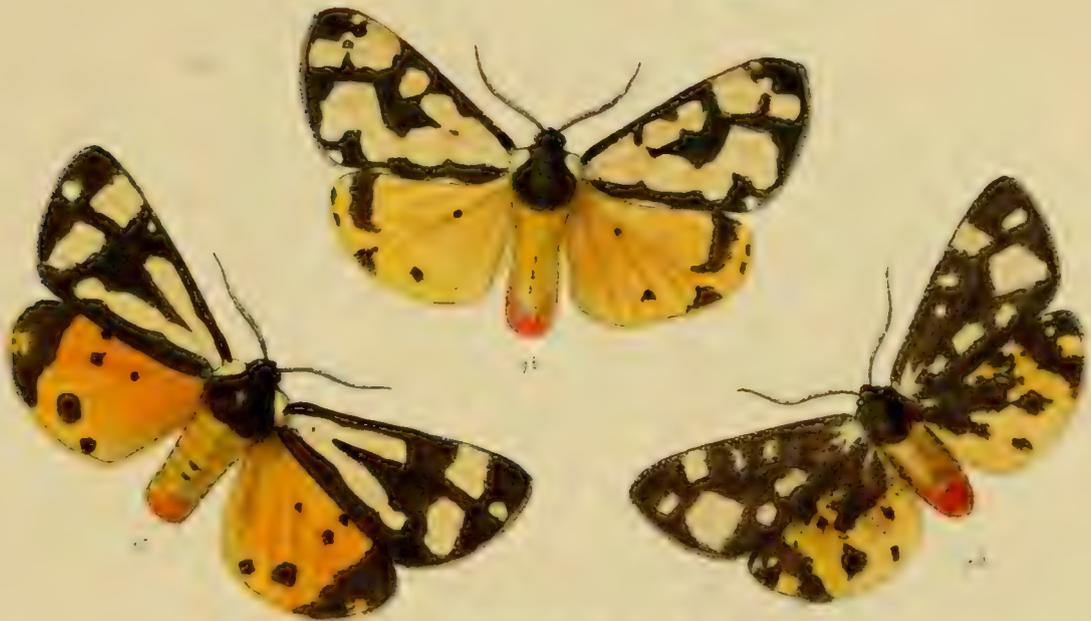
Illustrated by J. G. Rehn

J. G. Rehn & Co. London

PLATE LXXIII.

FIG. 1. *Arctia villica*, male.

- | | | | | | | | |
|-----|---|---|-------------------------|---|---|---|---|
| 1a. | „ | „ | female. | | | | |
| 1b. | „ | „ | male, var. Mr. S. Webb. | | | | |
| 1c. | „ | „ | „ | „ | „ | „ | „ |
| 1d. | „ | „ | „ | „ | „ | „ | „ |
| 1e. | „ | „ | female, var. | „ | „ | | |
| 1f. | „ | „ | „ | „ | „ | „ | „ |
| 1g. | „ | „ | larva. | | | | |



Chrysochloa

Chrysochloa

Chrysochloa





R. Morgan del et lith

Vincent Brooks Day & Son Imp

L. Reeve & C^o London

PLATE LXXVI.

FIG. 1. *Spilosoma lubricipeda*, male.

1a.	„	„	female.			
1b.	„	„	male, var. Yorkshire,			
						Mr. J. Harrison.
1c.	„	„	„	„	„	„
1d.	„	„	female	„	„	
						Mr. G. T. Porritt.
1e.	„	„	male	„	„	„
1f.	„	„	„	„	„	
						Mr. J. Harrison.
1g.	„	„	male, var. <i>radiata</i> ,			
						Mr. W. H. Tugwell.
1h.	„	„	female	„	„	„
1i.	„	„	„	„	„	„
1j.	„	„	„	„	„	
						Mr. J. Harrison.
1k.	„	„	larva.			



PLATE LXXVII.

FIG. 1. *Spilosoma menthastri*, male.

1 <i>a</i> .	„	„	female, creamy var.
1 <i>b</i> .	„	„	male, var.
1 <i>c</i> .	„	„	„ „
1 <i>d</i> .	„	„	„ North of Ireland.
1 <i>e</i> .	„	„	„ Dr. Mason.
1 <i>f</i> .	„	„	female, var. Mr. S. J Capper.
1 <i>g</i> .	„	„	male, var. Walkeri, Curt. Dr Mason.
1 <i>h</i> .	„	„	larva, Mr. G. C. Bignell.



PLATE LXXVIII.

- FIG. 1. *Spilosoma urticæ*, male.
1*a.* " " female.
1*b.* " " larva, Mr. W. Buckler.
2. *Porthesia chrysorrhœa*, male.
2*a.* " " female.
2*b.* " " male, var.
2*c.* " " larva, Mr. G. C. Bignell.
3. " *auriflua*, male.
3*a.* " " female.
3*b.* " " larva, Mr. G. C. Bignell.



Phalaena ...

Phalaena ...

Phalaena ...

PLATE LXXIX.

FIG. 1. *Liparis salicis*, male.

1*a.* " " female.

1*b.* " " larva, Mr. W. Buckler.

1*c.* " " " var. Mr. A. Sich.

2. *Hypogymna dispar*, male.

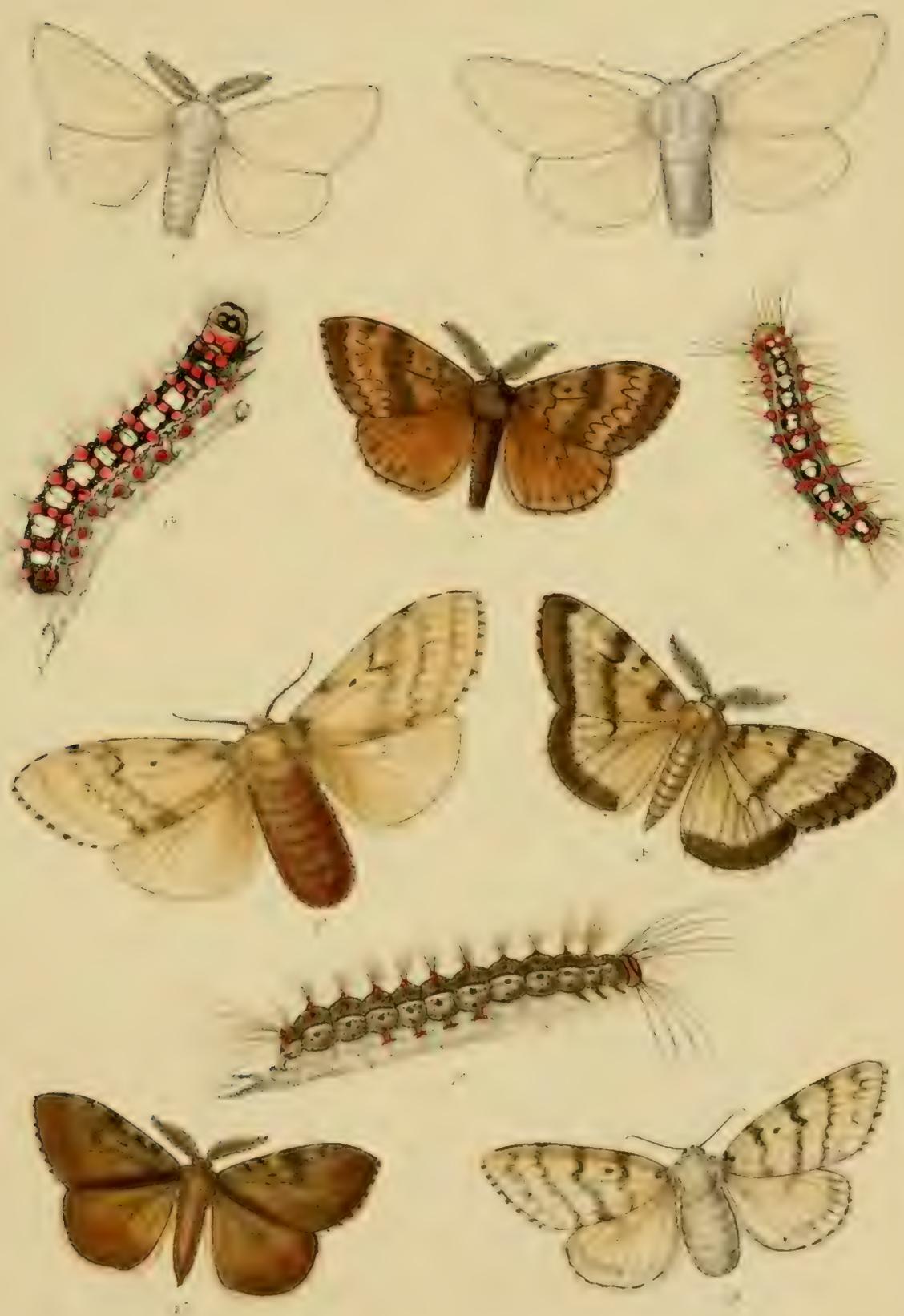
2*a.* " " female, old English form.

2*b.* " " male, var.

2*c.* " " " "

2*d.* " " female, present form.

2*e.* " " larva, Mr. G. C. Bignell.



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PLATE LXXX.

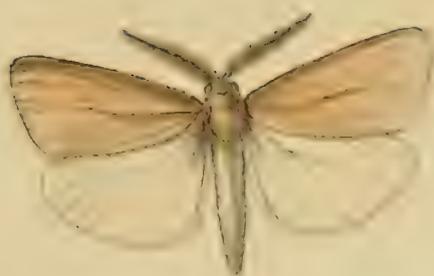
FIG. 1. *Psilura monacha*, male.

- | | | | | | | | | |
|-------------|---|---|--------------|---|---|---|---|--------------------------|
| 1 <i>a.</i> | „ | „ | female. | | | | | |
| 1 <i>b.</i> | „ | „ | male, var. | | | | | |
| 1 <i>c.</i> | „ | „ | female, var. | | | | | |
| 1 <i>d.</i> | „ | „ | „ | „ | „ | „ | „ | „ Mr. W. H. B. Fletcher. |
| 1 <i>e.</i> | „ | „ | „ | „ | „ | „ | „ | „ |
| 1 <i>f.</i> | „ | „ | male, var. | „ | „ | „ | „ | „ |
| 1 <i>g.</i> | „ | „ | larva. | | | | | |



PLATE LXXXI.

- FIG. 1. *Lælia cænosa*, male.
1*a.* " " female.
1*b.* " " larva, Mr. W. Buckler.
2. *Dasychira pudibunda*, male.
2*a.* " " female.
2*b.* " " male, var.
2*c.* " " female, var.
2*d.* " " larva, Mr. G. C. Bignell.
2*e.* " " " variety.



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PLATE LXXXII.

- FIG. 1. *Dasychira fascelina*, male.
- 1*a.* " " female.
- 1*b.* " " " var. Mr. S. J. Capper.
- 1*c.* " " " " " "
- 1*d.* " " larva.
2. *Demas coryli*, male.
- 2*a.* " " " var.
- 2*b.* " " female, var.
- 2*c.* " " " "
- 2*d.* " " larva, Mr. G. C. Bignell.



R Morgan del, et lith

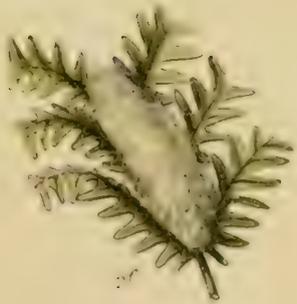
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PLATE LXXXIII.

FIG. 1. *Orgyia gonostigma*, male.

- | | | | | |
|-------------|----|----|----|--------------------------------------------|
| 1 <i>a.</i> | .. | .. | .. | var. |
| 1 <i>b.</i> | .. | .. | .. | female. |
| 1 <i>c.</i> | .. | .. | .. | larva, Mr. W. Buckler. |
| 2. | .. | .. | .. | <i>antiqua</i> male, London form. |
| 2 <i>a.</i> | .. | .. | .. | Yorkshire, Mr. G. T. Porritt. |
| 2 <i>b.</i> | .. | .. | .. | Sutherlandshire,
Mr. W. H. B. Fletcher. |
| 2 <i>c.</i> | .. | .. | .. | female. |
| 2 <i>d.</i> | .. | .. | .. | larva. |
| 2 <i>e.</i> | .. | .. | .. | pupa. |
| 2 <i>f.</i> | .. | .. | .. | cocoon. |



R. M. ...

...

...

PLATE LXXXIV.

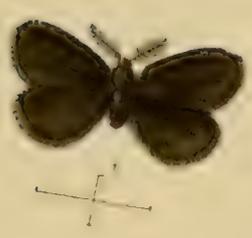
- FIG. 1. *Psyche villosella*, male.
1*a.* " " female, Mr. W. C. Boyd.
1*b.* " " larva " "
1*c.* " " " half-grown "
2. " *opacella*, male, Scotland, Dr. Mason.
2*a.* " " " Berkshire, Mr. Holland.
2*b.* " " case.
2*c.* " " " var.
3. *Epichnopteryx calvella*, male.
3*a.* " " " female, with case.



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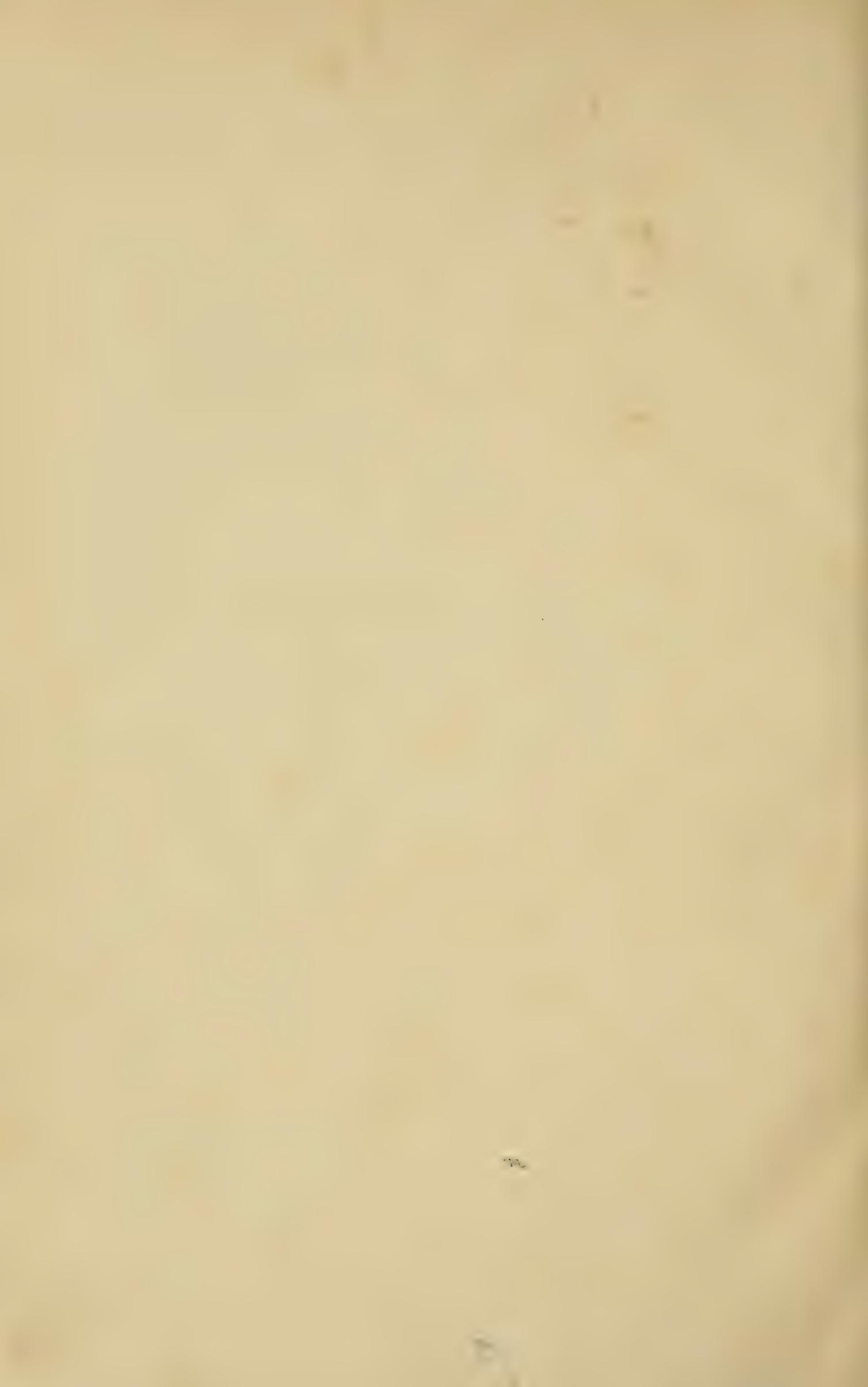




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