

H. ELTRINGHAM, M.A., D.Sc., F.Z.S.

*On the Scent Organs of Opsiphanes
cassiae lucullus, Fruhst. (Lepidoptera
Brassolidae).*



From the TRANSACTIONS OF THE ENTOMOLOGICAL SOCIETY OF LONDON,
JULY 31, 1929



S. 20

TRANSACTIONS
OF THE
ENTOMOLOGICAL SOCIETY
OF LONDON

VOL. 77.

1929.

ON THE SCENT ORGANS OF *OPSIPHANES CASSIAE LUCULLUS*,
FRUHST. (LEPIDOPTERA, BRASSOLIDAE)

By H. ELTRINGHAM, M.A., D.Sc., F.Z.S.

[Read December 5th, 1928.]

PLATE I.

IN our *Transactions* for 1926, p. 367, *et seqq.*, I described the structure of a peculiar gland in the abdomen of the male *Eryphanis polyxena*, Meerb. (BRASSOLIDAE). In this insect there are no brush-organs, though there are, on the hind-wings, brands bearing special scales not, apparently, correlated with the abdominal glands. Whether these two separate organs give rise to different scents at different times, or whether their volatile products combine in the air to produce a single effect, we do not know. There is not, however, in *polyxena*, any special mechanical distributing apparatus, unless indeed the inner margin of the hind-wing acts in that capacity in relation to the lateral abdominal gland.

In 1923 an account of the scent-organs in *Opsiphanes tamarindi sikyon*, Fruhst., by J. H. Jurriaanse, appeared in *Tijdschrift voor Entomologie*, LXVI, p. 147, and a short notice of it was given in the *Entomologist*, 1924, p. 94, with a reproduction of the original text-figure.

The acquisition of suitable material has enabled me to make a more complete study of these organs in another species of the genus. A glance at a series of specimens of *Opsiphanes* will show that there are, on the hind-wings of the males, two brushes, one arising from the wing-membrane just below the middle of the submedian nervure, and the other from the lower edge of the cell, just opposite the origin of the first branch of the median. Plate I, fig. 1, is a diagram of the hind-wing of *Opsiphanes cassiae lucullus* ♂. *Sb* is the submedian brush, partly expanded, and *Mb* the median. If the abdomen of the insect be examined there will be found, laterally placed on the fourth and fifth segments, a bare patch, in the middle of which are two depressions, the larger in the fourth and the smaller in the fifth segment.

TRANS. ENT. SOC. LOND. 1929.—PART I. (JULY)

B

Each of these depressions is covered with a mass of special scales, and it will be observed that the submedian brush of the wing is capable of making contact with this abdominal organ when the wings are closed. The appearance of this abdominal patch is shown in fig. 2. Further examination shows that this organ is a secreting gland very similar to that of *Eryphanis polyxena*. We have, then, an abdominal gland as in *polyxena*, but differing in the fact that it acts in conjunction with a brush on the wing, which doubtless serves as a distributor of the volatile secretion, in the same way as, the positions being reversed, the abdominal brushes in the Danaine butterflies act as the distributors for the glands which, in those insects, are situated on the wings.

If we now examine the brush arising from the discoidal cell in *Opsiphanes*, its distal portion will be found to lie in a groove formed by a slight folding of the wing-membrance, close to the first branch of the median nervure, fig. 1, *g*. Lifting the brush with a needle, the groove or hollow in the wing-membrane is found to be lined with very dark, rather glistening scales. The distribution of these scales is variable. I have examined three examples of the insect suitably preserved. In one of them the dark scales formed a patch on the wing-membrane only, not extending to the nervure. In one of the others the special scales were also found on the nervure; whilst in the third, a small scaleless area intervened between those on the membrane and those on the nervure.

Fig. 3 is a much enlarged view of these organs as seen on the wing. *Mb* is the median brush with its distal end lying on the heavily scaled part of the wing. *Sb* is the submedian brush. Both are in their closed or resting condition. At *H* are some of the long hairs with which the space between the median and submedian is rather densely clothed. All the above features can be observed in ordinary dried examples in a cabinet. For the histological investigation of the organs, suitably preserved material is necessary, and for this I am greatly indebted to Senhor Roberto Spitz of São Paulo, Brazil, who, through Dr. Karl Jordan, very kindly sent the specimens carefully preserved and packed.

The glands on the sides of the abdomen are really duplicated, as in *Eryphanis polyxena*, the posterior being much the smaller, as shown in fig. 2. They consist of a dense layer of special secreting cells, each surmounted by a scale. A section of one of these gland-cells with part of its scale is shown in fig. 4. The cells bear a considerable resemblance to those found in *Eryphanis*. There is a large and conspicuous nucleus, *n*, often containing vacuoles.

The general cell-substance is finely granular, and where it surrounds the insertion of the scale assumes a faintly radiate striation as represented at *rs*. The scale-socket is rather complicated. The scale-stalk, *st*, is attached to a thick-walled chitinous tube, *cht*, further thickened and somewhat swollen at its inner end. From this tube there arises, above the middle of its length, a funnel-shaped structure, *ft*, the upper and outer edge of which joins the thick chitin, *ch*, of the external surface of the gland. This outer chitin not only forms a stout socket externally, but descends to form a still deeper internal socket, *is*. Round the chitinous extension of the scale-stalk is a second chitinous tube, *chit*, the upper end of which is distended and the lower end nearly closed, leaving only a minute aperture through which, in some sections, granules, presumably of the secretion, may be seen passing. The scales attached to these sockets are rather irregularly shaped, striated, bag-like structures, several of which are shown together at fig. 11. Under a very high power there is apparently some indication of openings at the distal extremities, but probably the whole scale is permeable.

The apparatus thus closely resembles that of *Eryphanis*, but possesses in addition the submedian brush, which no doubt acts as a distributor of the secretion. The cells and scales are similar in both the large and small abdominal glands.

Fig. 5 is a transverse section of the wing, cutting through the glandular patch *gs, gs*, the median brush *bh*, and the first branch of the submedian nervure. At *ds* are seen some of the heavy dark scales which sometimes extend on to the nervule, but in this example are restricted to the surface of the wing. The space between the two wing-membranes and its extension into the nervule is lined with glandular cells, *gs*, from which arise two kinds of scales. In this section, those on the nervule, *n*, apparently resemble ordinary scales such as are found on other parts of the nervules, though, as already stated, special dark thick scales may sometimes be found extending right on to the nervule and replacing those of the ordinary form. Whether special or ordinary scales are present, we find beneath them actively secreting gland-cells, two of which are represented highly magnified at fig. 6. They differ from those of the abdominal glands in being shorter and more irregular in shape, and in having, round the scale-sockets, a vacuolated area, bordered by a radially striated cytoplasm more distinct and more sharply defined than in the abdominal cells. In the space just below the socket there is almost always found a small darkly-staining particle, *p*, which sometimes has a tubular, sometimes a granular appearance. It may be a trace of a minute duct normally extending into the cell from the centre of the scale-stalk. Between these gland-cells are smaller, undifferentiated cells, *ud*. Fig. 7 is a magnified view of one of the dark special scales, some of which are seen in section at *ds*, fig. 5. The hairs of both the median and submedian brushes have the same structure, being merely fluted cylinders with rather thick walls, as shown in section in fig. 9 and in side view in fig. 10.

If we make a longitudinal section of either of the brushes we see the structure shown in fig. 8. The hairs, *h, h*, arise from sockets of an ordinary type, but each hair has, at its base, between the wing-membranes, a large, heavily nucleated cell, *c*, the function of which is obscure. The appearance suggests activity, but the hairs show no signs of containing any secretion. It is conceivable that, since the hairs are used in life to take up and distribute the scent-material of the glands, they may be subject to some wear and tear, in which case the cells may be merely trichogenic, providing for continued growth. Similar cells are often found at the bases of insect hairs. On the other hand they may produce a volatile fluid which, when excreted, serves as a vehicle for the more viscous product of the gland-cells. Microscopic examination of perfectly fresh material might throw some light on this process, although such investigation could only be conducted where a supply of the living insect is available.

At fig. 8, *f, f*, are certain elongated nucleated structures, and these constitute the most interesting and unusual feature of the organs. Normally the brushes lie closed and flat on the surface of the wing in the positions shown in fig. 3. They are, however, capable of being erected, and the submedian brush is represented partially expanded in fig. 1. A series of dried specimens will usually show the brushes in both these conditions. Since the hairs are erectile there must be some mechanism controlling their movement. No trace of striated muscle can be seen in sections such as that shown in fig. 8. Other than the elongated cells described there is no structure which could conceivably control the expansion and contraction of the brushes. In view of their position the contraction of these cells would, by drawing together the upper and lower

wing-membranes, cause an erection of the brush. There would seem to be two possible explanations of their action. Either they are themselves contractile under a nervous stimulus, or they are merely elastic, and normally stretched by the blood pressure in the intermembranal space, but, when that pressure is removed or decreased, contract by their own elasticity, and so cause the approximation of the wing-membranes, and the consequent erection of the brush.

Unfortunately none of my material bears a brush in the expanded condition. Sections of such material would at least show whether, in that state, the cells are shorter and thicker, although even then the muscular, or alternatively the elastic nature of the fibres would not necessarily be disclosed. If this part of the wing be cleared and stained, the preparation thus made, when pressed flat on a slide, shows more or less fibre-like tissues radiating from the bases of the brush-hairs. Whether muscular or elastic, the mechanism seems to be of an unusual character, and not, so far as I am aware, found in other organs of this kind.

We have, then, a male butterfly with two separate and independent scent-organs, the different products of which may be simultaneously diffused and produce an effect only obtainable by the "nascent" action of the chemical substances involved. On the other hand, one gland may be repugnatorial and the other sexual. This, however, seems unlikely, since neither structure is to be found in the female. In the genus *Heliconius* both sexes have repugnatorial glands, although in different positions (*Trans. Ent. Soc.*, 1925, p. 269), but in that genus the male has special scent-scales on the wings quite independent of the gland, and presumably homologous with the scent-scales of Pierine and other butterflies.

EXPLANATION OF PLATE I.

Scent organs of the male *Opsiphanes cassiae lucullus*.

- FIG. 1. Hind-wing. *Mb*, median brush. *g*, glandular area of wing. *Sb*, submedian brush, partially expanded.
2. Lateral view of abdomen showing position of abdominal glands.
 3. Magnified view of part of hind-wing. *Mb*, median brush. *Sb*, submedian brush. *H*, portions of the long hairs found on this area of the wing.
 4. Highly magnified section of one of the abdominal gland-cells, with socket and part of one of the scent-scales. *st*, scale-stalk. *ch*, chitin of external surface. *ft*, funnel tube. *is*, internal socket. *cht*, chitinous tube. *cht*, secondary chitinous tube. *rs*, radially striated area of cell. *n*, nucleus.
 5. Section of nervule 2 of hind-wing. *n*, nervule. *gs*, *gs*, gland-cells. *ds*, dark thick scent-scales. *bh*, hairs of brush.
 6. Two of the gland-cells from hind-wing. *p*, darkly staining particle, probably part of a duct. *ud*, undifferentiated cell.
 7. One of the dark thick scent-scales.
 8. Section through base of submedian brush. *h*, *h*, bases of brush-hairs. *c*, cell attached to base of a brush-hair. *f*, contractile (?) fibres.
 9. Transverse section of a brush-hair.
 10. Surface view of a brush-hair.
 11. Several scales of the abdominal gland.

Length of gland-cell, fig. 4, .1 mm. Length of scale, fig. 7, .26 mm. Length of median brush, fig. 3, 5 mm. Diameter brush-hair, fig. 9, .01 mm.



H. Eltringham, del.

Vaus & Crampton, Ltd.



