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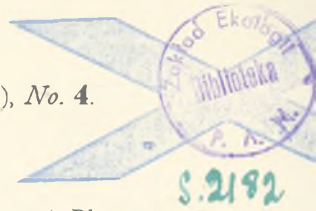
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IV. Observations on the Homopterous Insect *Phromnia* (*Flata*) *marginella* Oliv. in the Himalayas.

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Several instances have been brought to light of the Homopterous genus *Phromnia* (*Flata*) bearing a remarkable resemblance to certain flowers. The earliest with which I am acquainted is Prof. Gregory's¹ account, published in 1896. In the frontispiece to his book he figures a cluster of insects belonging to this genus, closely congregated on the upper part of a stem, and bearing a curious resemblance to a flowering spike. The species to which he refers exists in two forms, viz., a green and a reddish one. In the illustration, the insects are represented so grouped on the stem, that the green individuals occupy the upper portion, and the red individuals are situated just beneath them, on the lower portion. In this attitude they are curiously like a red-flowered spike with the green unopened buds above. In 1902 Hinde² published an article on this same subject. He remarks that he had many opportunities of seeing the insect and still oftener its larva in British East Africa, and his paper is accompanied by coloured drawings made in the field by his wife. He states that Prof. Gregory's plate was

¹ J. W. Gregory, "The Great Rift Valley," pp. 273-275.

² S. L. Hinde, "The Protective Resemblance to flowers borne by an African Homopterous Insect, *Flata nigrocincta* (Walk), *Trans. Ent. Soc., Lond.*, 1902, pp. 695-700; pls. xxvi.-xxvii. Also "Proceedings," pp. xxvi. and xxvii.

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apparently drawn from dried specimens in England, and that the green forms are not noticeably smaller than the red forms, in spite of their being represented so in Prof. Gregory's figures. He, furthermore, adds that he has never seen the insects grouped together according to their colours, but invariably mixed; and neither has he noted the larvæ and imagines on the same stem, nor even together on the same bush or tree. He also states that he has never seen the imagines on vertical stems, but always on those which are actually or approximately horizontal. It by no means follows that Prof. Gregory was mistaken in his impressions, but the curious condition which he describes appears to be far from common. Hinde's specimens have been compared with Gregory's by Prof. Poulton in the British Museum, who states that both the series belong to the same species, viz., a form slightly different to *Flata nigrocincta* (Walk.), but evidently closely allied and perhaps specifically identical with it. Hinde remarks that both he and his wife recognised a strong superficial likeness between the mixed group of insects, and the flowers and buds of a leguminous plant with which they are perfectly familiar. He states they have mistaken the groups of insects for the flowers and *vice versa*. Prof. Gregory (p. 275) considers that the eggs of *Flata* are laid from below upwards, so that the insects towards the top of the stem would be the youngest and most immature. Prof. Poulton states that the difference in colour cannot be due to immaturity, as old worn examples of the green form are known to occur. The first specimens of a group to emerge may, however, be red, and those that issue later green; and Prof. Gregory may have come across undisturbed groups which, therefore, had the green specimens above and the red ones below. Hinde's observations may have been made upon

examples which had re-assembled, and thus lost the arrangement which it is possible they may have possessed on emergence from the pupa.

In 1912 Mr. Gahan³ exhibited before the Entomological Society of London a small series of *Phromnia superba*, Melich., a "dimorphic" species of Homoptera taken by Dr. A. C. Parsons in Northern Nigeria. In a letter Dr. Parsons remarks that one day when he was in the jungle his attention was arrested by a dove-coloured "pea flower." On attempting to gather it the "blossoms" flew up in a cloud of fluff about his head, and then re-settled individually among the brushwood. He mentions that the folded wings are the exact shape of the keel of a pea-flower, and the insects were all arranged on the bare stem of a bush. Their heads were all pointing in the same direction, their colour graduating from green at the top of the twig to a deep dove-colour, that would indicate the lowest blossom below. Mr. Gahan remarked that Dr. Parson's observations were a strong confirmation of those of Prof. Gregory. At the same meeting of the Entomological Society W. A. Lamborn⁴ exhibited a series of specimens of the genus *Flata*, all taken together from one plant about 70 miles E. of Lagos. He states that the insects were "dimorphic," pink and green forms being intermixed as they rested on the same plant. He had not noticed any definite arrangement according to colour as observed by Dr. Parsons although he was acquainted with the same species.

While touring in the Himalayan foot-hills of Kumaon in the Naini Tal district during June and July, 1909, I came across some examples of an Indian species of the genus, viz., *Phromnia magnella*, Oliv. They occurred in

³ Vide *Proc. Entom. Soc. Lond.*, pp. lxxxviii.-xc.

⁴ *Proc. Ent. Soc. London*, 1912. p. xc.

4 IMMS, *Homopterous Insect Pluomnia (Flata) marginella*.

the jungle around the Sat Tal lakes at an elevation of about 3,500 feet.

The larvæ were found plentifully during the middle of June, clustered on the leaves and twigs of several species of small forest trees. They are covered posteriorly (*Pl. II., Fig. 3*) with long white waxy filaments, which render them very conspicuous even from a distance of 12 or 15 yards. The clusters of these larvae bear a resemblance to groups of small white blossoms. I may add that two friends who were with me at the time, and neither of them entomologists, quite believed them to be flowers until the insects dispersed by a series of leaps when disturbed. The white filaments of the larvae, when removed, stick tenaciously to any object brought in contact with them. For this reason I believe that, in all probability, they render the insects distasteful to birds. If a larva be seized by a bird, the filaments would cling to the outside of its beak, and would probably be removed only with difficulty, after causing the bird a good deal of discomfort. The larvae were found both on horizontal and vertical twigs, and also on the leaves, but exhibited no marked arrangement according to the age of the individuals forming any particular cluster. No examples of the perfect insect were then to be found. The larvae suck the juices of plants, and gradually increase in size after each moult until the arrival of the monsoon season, when the perfect insects commence to emerge. Some fourteen days later I revisited San Tal, and a few of the larvae were still noticeable, but the majority had reached the winged state. A number of the exuviae of the larvae attached to the trees were evident with their waxy filaments still intact and it needed close examination to distinguish them from living insects.

The mature insect exists in two forms, a pea-green

and a pinkish-buff, both having pearly white hind wings. It is nocturnal, so far as my observations go, and during the day is found resting in closely packed longitudinal groups on the twigs and branches of small forest trees; the heads of the insects all point in the same direction. The green form is considerably more abundant than the buff coloured one, and only on two occasions I noticed both forms on a branch together. In these two instances they were intermixed and exhibited no definite arrangement into the green forms above and the buff-coloured examples below. I am not, however, prepared to assert that this arrangement never occurs, and if Prof. Poulton's interpretation be correct, it must of necessity be rare to come across such an occasion. It is to be hoped that Indian entomologists will endeavour to clear up this interesting feature, and the early part of July should be the most likely time in the Himalayas to conduct observations. The insects bear a considerable resemblance to leaf or flower buds just about to open, and the buff-coloured examples appear very like unopened petals. Out of seven colonies which I came across, all were disposed along the middle or base of branches among the foliage, and not at the apices of the twigs (*Pl. I., Fig. 1,* and *Pl. II., Fig. 2*). This fact rather mitigates against the resemblance, though they closely harmonised with the surrounding foliage. Whether the resemblance is sufficient to deceive their enemies I am not in a position to say. In this connection, however, it is noteworthy that when individuals settled singly on leaves after being dispersed, they were certainly more conspicuous to human eyes than when grouped together on the twigs and branches. Kershaw⁵ states that two species of the genera, *Salurnis* and *Geisha*, closely allied to *Phronnia* and found

⁵ "Notes on *Flata*," *Journ. Bombay Nat. Hist. Soc.*, 1912, xxi., p. 609.

in S. China, are solitary as a rule, though several individuals may sometimes be found on the same bush. On the other hand, he remarks that an Australian species, *Neomelicharia furtiva*, is gregarious, having the same habit as *Phromnia* of many individuals resting closely together on the same twig or branch.

In addition to Sat Tal, I have found *Phromnia marginella* near Ganai in British Garhwal, and it is also known from the Central Provinces, Dehra Dun, Sikkim, the Naga Hills, Cachar, Mussoorie, Margherita (Assam), Tavoy, and Siam.⁶ It also occurs plentifully in Ceylon, and Mr. E. E. Green informs me that both forms are met with in that island, but the green form predominates there. He states that he has never seen the two forms intermingled in one colony, though he would not be prepared to state that it never happens. On the few occasions that he has observed the buff form, the whole colony has been of that colour. *Phromnia marginella* has been confused in literature with the Indian wax insect *Ceroplastes ceriferus*, Sign. (Fam. Coccidae), which appears to be comparatively rare, and has never been commercially utilised, though it produces some amount of wax. It has also been confused with the Chinese white wax insect (*Ericerus pe-la*) by Staunton,⁷ and in Westwood's edition of Donovan's "Insects of China." Although this error was pointed out by Hutton,⁸ it has been repeated by later writers. It is further noteworthy that *Ericerus*, like *Ceroplastes*, belongs to the family of the Coccidae and not to the Fulgoridae.

Bugnion and Popoff⁹ have investigated the wax

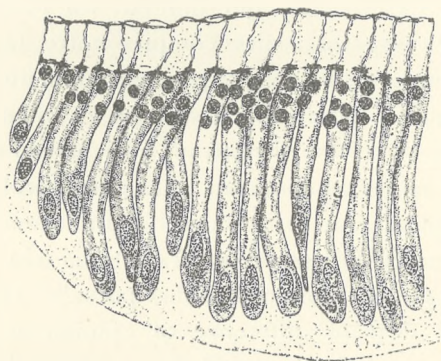
⁶ E. C. Cotes, "White Insect Wax in India." *Ind. Mus. Notes*, vol. ii., p. 97.

⁷ "Embassy to China." London. 1797, vol. i., p. 353.

⁸ *Journ. Asiatic Soc., Bengal*, 1848-55, vol. ii., p. 379.

⁹ *Bull. Soc. Vaud. des Sci. Nat.*, 1907, vol. lxiii., pp. 549-63, pls. xl-xlvi. and four text-figs.

glands of the larvæ of *Phromnia marginella*, obtaining specimens from Gimgatenagap in Ceylon at an altitude of 2,165 feet. They were found on January 26th on *Salacia reticulata*, a plant belonging to the Hippocrateaceæ. They state that the wax glands are situated beneath a chitinous disc, placed at the extremity of the abdomen, and divided into a series of twenty plates. These plates are arranged in four rows—two rows to the right and two to the left of the anal and genital apertures. Each plate is studded with small pores, which are the orifices of the wax glands



Text-fig.—Vertical section through a wax plate of a larva of *Phromnia marginella*, showing the pores in the cuticle and the elongate wax-secreting cells beneath. (After Bugnion and Popoff.)

secreting the long white filaments. In addition, there are also three small plates on either side of the sixth abdominal segment, two on either side of the fifth, and one or two on either side of the fourth. There are also scattered isolated pores on the dorsal side of the body, which is powdered with a small amount of wax. As shown in the accompanying *text-figure*, the cuticle covering the wax plates is very thick and traversed with vertical striae. Beneath the cuticle is the hypodermal layer, chiefly evident by its

small rounded nuclei. The wax-secreting cells are specialised cells derived from the hyperdermis and are greatly elongated with the nuclei at their inner ends. Each wax cell is traversed by an elongated cavity into which the wax secretion congregates, to be ultimately discharged through the corresponding pore to the exterior. With regard to the structure of the cuticle, Bugnion and Popoff remark: "L'emploi d'un grossissement plus fort a permis de constater que les stries verticales ne sont pas des canalicules, mais répondent au contraire aux lammelles chitineuses qui limitent les pores. Les pores sont les espaces clairs compris entre les stries. On voit de plus: (1) que chaque pore surmonte une cellule unique: (2) que le pore offre à sa base un collet rétréci, large de $2\frac{1}{2}$ μ , la chitine l'enserrant à ce niveau dans un épaississement en forme d'anneau. La partie profonde de la cuticle apparaît sur les coupes obliques comme une lame jaune percée de trous ronds à contours très accusés. Ces trous répondent aux collets des pores." There has been a good deal of difference of opinion as to the chemical nature of the waxy filaments of the larvae of the Flatid group of the Fulgoridae. Spinola¹⁰ makes a general statement with regard to the wax secreted by the 'Fulgorelles.' He says that it dissolves entirely in alcohol and gives off a distinct odour of horn when burnt in a flame of a candle. Coates¹¹ states that Murchison examined the white filaments of a Fulgorid which was either *P. marginella*, or a species closely related to it, and remarked that they were composed of what he believed to be wax. An examination made by T. H. (now Sir Thomas) Holland on Coates' behalf of the filaments of larvæ of *P. marginella*, preserved in the collections of the

¹⁰ "Essai sur les Fulgorelles." *An. Soc. Ent. Fr.*, T. viii., 1839, p. 197.

¹¹ *Loc. cit.*, p. 92.

Indian Museum, has not confirmed Murchison's statement. The white filaments attached to the specimens in the Indian Museum were found to consist of fibrous matter which not only refuses to melt but, on the contrary, decomposes when heated, does not dissolve in naphtha, and under the microscope appears to consist of minute particles of a filamentous nature. That observed by Murchison melted on heating into transparent colourless wax, which was readily soluble in naphtha, crystallised on cooling into acicular spicules, arranged in stellate masses, such as is readily observable in the wax secreted by *Ceroplastes ceriferus*. These observations seem to the present writer to show that Murchison probably was not dealing with *P. marginella*, but with an allied species. In selecting material for analysis it is desirable to use the distal two-thirds of the filaments as the basal portion when amputated frequently comes away with portions of the chitinous integument which is liable to give misleading results. Kershaw¹² states that the waxy filaments of the Australian *Salurnis marginellus*, Guer. dissolve instantly in spirit, and melt with heat, are of a waxy nature, but a large part consists of hollow filaments or hairs, much broken and interlaced, insoluble in either spirit or potash, apparently much resembling in chemical nature the hairs which project beyond the anal segment of certain leaf-hopper nymphs. I am indebted to the kindness of Professor A. Lapworth, F.R.S., for making an analysis of the white filaments of the larvæ of *P. marginella*, which he states are closely allied to Chinese white wax in chemical composition. He remarks that it is freely soluble for the most part in chloroform, but is sparingly soluble in alcohol even when heated, but dissolves after some hours boiling in methyl alcoholic potash. On pouring

¹² *Loc. cit.*, p. 608.

the product into water, acidifying, extracting the ether, drying and evaporating the latter, a semi-crystalline mass was left. This was neutralised with methyl alcoholic baryta, dried at 100°C. and extracted with acetone. The acetone dissolves a crystalline material, probably one of the higher fatty alcohols. Indications of cholesterol were absent; the barium salts, remaining after extraction with acetone, were treated with warm hydrochloric acid, the liquid extracted with ether, then dried and evaporated, and a solid fatty acid was left. This had all the characters of a higher fatty acid. The substance is unaffected by five minutes' heating at a temperature of 100°C. with strong sulphuric acid, showing that it is not of a glucositic nature.

In addition to wax, the larvæ of *Phromnia marginella* excrete a liquid giving a sweet taste, which falls on the leaves where it hardens. According to Cotes,³ in Garhwal it is recorded that the natives eat this excretion, and term the insects which produce it "Dhaberi," meaning sheep, in allusion to their habit of clustering together and jumping away when disturbed. Nothing appears to be known as to method of origin of this fluid, whether it is excreted through the anus or by means of special glands.

³ *Loc. cit.* p. 97.



EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1.—A photograph showing two groups (*a* and *b*) of *Phromnia marginella* congregated along branches in their characteristic resting attitude. (Sat Tal., July, 1909.)

PLATE II.

Fig. 2.—An enlarged photograph of the lower group of insects seen in the preceding plate.

Fig. 3.—A photograph of a group of larvae of *Phromnia marginella* on a leaf of a species of *Grewia*? (Sat Tal., July, 1909.)

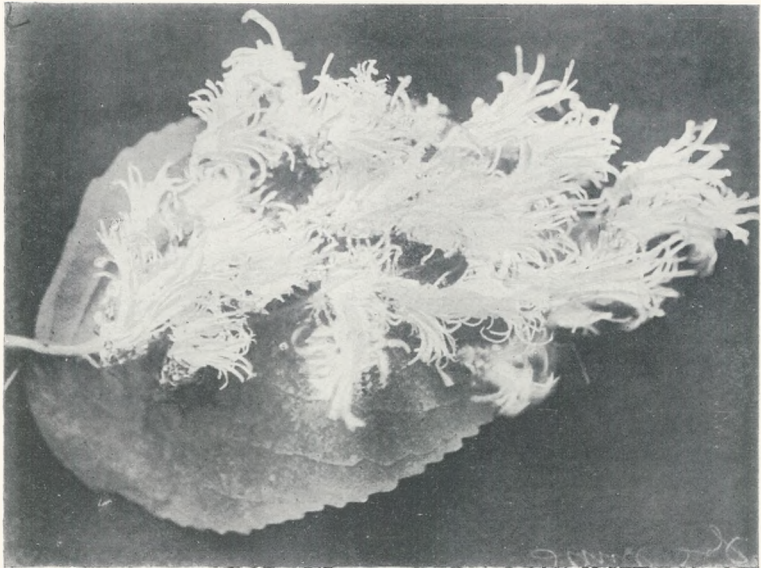


A. D. Inuus pl. st.

Fig. 1.



Fig. 2.



A. D. Inms phot.

