

I NOTES ON THE COLLECTION OF COCCI-  
DAE IN THE INDIAN MUSEUM

II.—FURTHER OBSERVATIONS ON THE GENUS  
*MARGARODES*.

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(Plates i—iv.)

The following particulars of the life history of *Margarodes* have been rendered possible by the discovery of fresh material of the two species, *papillosus* and *niger*, by Messrs. I. C. Coleman (Entomologist in the Mysore State) and T. Bainbrigge Fletcher (Entomologist to the Government of the Presidency of Madras), to whose assistance I am greatly indebted.

***Margarodes papillosus*, Green.**

(Pl. i, figs. 1-9; pl. ii, figs. 10-21.)

Adult male. Colour reddish. Legs, notal plates and eyes brown. A long slender backwardly directed tuft of silky white filaments on the dorsum of the abdomen, at the junction of the 7th and 8th segments. Abdomen subglobular, the sides inflated, the ventral segments more densely chitinous. Compound eyes large and prominent, involving the greater part of the head, but more widely separate—above and below—than in the male of *M. indicus*. A single ocellus on hinder edge of each compound eye. Antenna (pl. i, fig. 1) with 10 joints only; the 1st short and broad; the 2nd smallest, hemispherical; the 3rd short, narrowed at base, slightly longer than broad; the remainder elongate, gradually increasing in length to the 10th which is the longest; all the joints clothed with short hair. Legs well developed, with strongly thickened femora, especially those of first and third limbs; anterior leg (pl. i, fig. 2) with tibia short and stout, equal in length to tarsus and claw which are fused together: mid and hind legs (pl. i, figs. 3, 4) with the tibiae elongated and comparatively slender, equal in length to femur (minus trochanter), approximately four times length of tarsus. Claw of first leg simple; that of second leg deeply bifid; that of third leg deeply trifid (pl. i, fig. 5). The spines on the outer edge of tarsus and apical part of tibia of 2nd and 3rd legs are strongly thickened and compressed. Wings with only two conspicuous nervures, and a denser costal area. Halter strap-shaped (pl. i, fig. 6), with a stout blunt hook at extremity, and a

large hyaline spot on costa. The glandular patch on dorsum of abdomen (pl. i, fig. 7) is divided into three contiguous plates or lobes, the anterior lobe situated on a backward extension of the 7th and the two posterior lobes on the 8th segment. Each lobe contains a number of closely packed polygonal cells, with an elongate pore in the centre of each cell communicating with a well-defined sublying tubular gland. Notal plates with numerous spiniform hairs, a transverse series of similar hairs on each of the abdominal sternites and some small hairs on the abdominal tergites. Genital sheath with numerous translucent pores; intromittent organ terminating in a stout falcate point. Total length (exclusive of antennae) 2.5 mm.

It appears (*vide* notes by the collector of the material) that the males pass through a nymphal encysted stage similar to that of the females: but I have, at present, been unable to identify the male cyst.

Adult female reddish, inclining to brick-red in newly emerged examples, but afterwards darkening to purplish brown. The body, after fertilization, becomes more or less covered with white mealy powder and loose wooly secretion. When boiled in potash, the female gives out a deep carmine stain. Body broadly oval; slightly narrower in front; convex above. Margins of abdominal segments slightly prominent.

Dorsum (pl. i, fig. 8) with a series of ill-defined chitinous plates on the lateral area of all the abdominal segments (except the 1st and the terminal), and a transverse median plate on the penultimate and antepenultimate segments. Each of these plates bears a series of stout conical papilliform spines, directed forwards; a semilunar series of similar spines on the terminal segment; a small group on the subdorsal area of each abdominal segment; and other backwardly directed groups on the lateral and subdorsal areas of the metathoracic and 1st abdominal segments. The polygonal character of the chitinous areas (described in my previous paper) is not so noticeable in fully matured examples. Immediately anterior to each group of spines are some hairs and series of circular pores. There are similar hairs and pores on the median and lateral areas of the remaining segments. Six small spiracles open dorsally on each side of the abdomen, situated—probably—at the intersegmental areas. There is a gap in the series, between the first and second of these spiracles, but the missing organ is found to be present on the ventral surface. There are, consequently, 7 abdominal spiracles on each side, 6 of which open on the dorsum and 1 on the venter. It is noticeable that, in *M. mediterraneus*, of the six pairs of abdominal spiracles, the uppermost of the series is ventral, while the remainder assume a lateral position.

Venter (pl. i, fig. 9) with a curved series of spines on each side of the terminal segment; a median transverse series on each of the first seven abdominal segments, and a smaller subdorsal series on each side of 2nd to 8th segments; those on the anterior segments containing one or two spines only, those on the 6th to 8th segments

with from five to ten. The spines on the first five segments are more slender and sharply pointed (pl. ii, fig. 15), those on the remaining segments being blunt and papilliform—like the dorsal spines (pl. ii, fig. 16). There are fine hairs and small circular ceriferous pores on the median and submarginal areas. Each hair springs from a conical pit (pl. ii, fig. 15). In my earlier description (vol. vii, part i), drawn up from an imperfect mount of an immature example, the median series of spines were erroneously stated to be dorsal.

There is no trace of buccal apparatus, or of eyes.

Antenna (pl. ii, fig. 10) 7-jointed; the basal joint broadest, the apical joint narrowest and ovoid: all the joints (except the first) with an apical series of stout spiniform hairs.

Anterior limb (pl. ii, fig. 11) large and stout; femur with some longish stout hairs on the side and inner margin; tibia approximately quadrate; tarsus and claw in one piece, stout, strongly falcate, grooved—near the tip—on the inner edge, several stout hairs near the base, probably representing the unguis digitules. Second and third limbs smaller but well developed (pl. ii, fig. 12); tibia elongate; tarsus distinct; claw slender, falcate, swollen at base.

The four thoracic spiracles open on the ventral surface, behind the bases of the first and second limbs respectively. They are large and conspicuous. The opening of each spiracle (pl. ii, fig. 13) is circular consisting of a broad flat chitinous ring, with strongly defined outer margin; within the central cavity is the opening into the trachea and four circular ceriferous pores. Four minute pores are present, close to the outer border of the chitinous ring. The seven pairs of abdominal spiracles, one of which opens on the venter and the remainder on the dorsum, are much smaller. The external aperture is subquadrate (pl. ii, fig. 14) and leads into a thickened chitinous chamber which is connected with paired tracheal vessels. In the mouth of the external opening are four circular ceriferous pores.

Both the anal and the genital apertures open on the venter. The former is small and surrounded by a rather dense chitinous ring. The genital orifice is transversely elongate, and appears to be situated at the junction of the terminal with the penultimate segment.

Dimensions variable, some individuals being more than double the size of others. A corresponding variation is found in the dimension of the limbs. The smallest adult females that I have seen measure 1.5 mm. by 1.15 mm., and the largest 4 mm. by 3 mm.

Female nymph pale yellow, sometimes orange yellow or reddish; subglobular; without limbs or external appendages of any kind. Derm minutely pustular or cellular (*vide* vol. vii, part i, No. 5, p. 74, text figure 1). Internal rostral apparatus (consisting of tentorium and setae) strongly developed in some individuals, but weak in others; the condition probably dependent upon the stage of development of the nymph. On each side of the

rostrum is a truncate conical tubercle (pl. ii, fig. 17), with a deep central pit from which springs a stout bristle: this presumably represents the nymphal antenna. The anus is small but densely chitinous, and the future genital orifice is indicated by a transverse scar (pl. ii, fig. 18). On each side, about midway between the genital scar and the anal aperture, is a circular glandular disc (pl. ii, fig. 19). There are eight pairs of spiracles, all of approximately the same size. Four (2 pairs) of these open on the ventral surface of the thorax; the remainder are disposed near the lateral margin of the abdomen. In one example I find 7 abdominal spiracles on one side and 6 on the other. The structure of abdominal and thoracic spiracles is identical, the former being distinguished solely by their position and by the presence—on one side—of three minute pores which are absent in the abdominal spiracles. Similar pores are associated with the thoracic spiracles of the adult female. The stigmatic aperture opens into a broad cylindrical chamber, at the base of which is a group of prominent ceriferous glands. This is followed by a smaller (? valvular) chitinous chamber communicating with the tracheal vessels (pl. ii, fig. 20).

Nymphal cyst globular or broadly ovoid, smaller examples sometimes irregular in form; smooth; consisting of very thin and brittle nacre; transparent and colourless, or slightly yellowish; the pale golden or honey-yellow appearance being due to the colour of the contained nymph. Empty cysts assume an opaque whitish tint, with a slight pearly lustre, due to decomposition and the presence of air between the lamellae. The cysts 'd,' described on page 71 of my previous paper (loc. cit.), and shown on plate iii, figs. 12, 13, undoubtedly belong to this species and not to *M. indica*. The cysts that I have seen vary in diameter from 1 to 2.5 mm., but much larger cysts must occur, to produce the larger females that I have received.

Living females, placed on fine soil, deposited numerous eggs, amongst a mass of loose woolly secretion. The eggs (pl. ii, fig. 21) are very elongate and narrow; very pale yellow; approximately three times as long as broad,—0.57 by 0.2 mm. These eggs proved infertile and I have been unable to obtain young larvae.

Since my earlier and very imperfect description, I have received ample material of this interesting species, both from Mr. Coleman and from Mr. Fletcher. The former informs me that his specimens were collected by his Assistant at "Honnali, in the Shimoga District, Mysore State, about 120 miles north-west of Bangalore." They are reported to have been found "while digging for egg-pods (of the Jola Grasshopper) in a broad bund at Honnali. They were fairly numerous and were obtained from 5 to 7 inches beneath the soil. The males were also enclosed in shells but emerged soon after excavating, and were observed copulating towards the evening." They are said to have been associated with 'hariali' grass (*Cynodon dactylon*).

Mr. Fletcher's specimens were obtained in the Bellary District, Madras Presidency (on the Mysore frontier), by one of his

Assistants (Mr. Y. Ramachandra Rao), who reports that they were found "while digging the ground for the egg masses of the 'Deccan Grasshopper.' This form was found in all soils—black and red, but seems to be more abundant in clayey soils." He notes that adult males and females were emerging early in June, at which time the cysts "were somewhat reddish in colour." Earlier in the year (in February) the cysts were of a "yellow colour with a pearl-like lustre," and were found, when broken, to contain nothing but a milky fluid.

*Margarodes papillosus* must be very closely allied to *M. mediterraneus* of Silvestri (described very fully in the "Bulletino della Società Entomologica Italiana," xxxviii, 1906, p. 140 *et seq.*). It differs principally in the colour of the adult female, which is creamy white or straw-coloured in the Mediterranean, and brick-red or purplish red in the Indian species. The disposition of the spines is approximately the same in both species, but they appear to be more numerous and more strongly developed in the Indian form. I am, unfortunately, not in a position to compare the larval characters, which are quite peculiar in *M. mediterraneus*. Silvestri states that his species has 8 pairs of spiracles, against the 9 pairs found in *papillosus*. It is interesting to note that, in both species, one of the abdominal spiracles is placed on the venter.

#### ***Margarodes niger*, Green.**

(Pl. iii, figs. 22–35; pl. iv, figs. 36–45.)

Male not known.

Adult female (pl. iii, fig. 22) oblong oval, slightly narrower in front; subglobose. Colour creamy white, thickly covered with pale reddish brown, very fine but shaggy hair, which is denser and of a deeper colour on the thoracic area. Claws dark brown.

Antenna (pl. iii, fig. 23) 6-jointed; weakly chitinized; all the joints short (broader than long); basal joint largest, the remainder gradually diminishing in size to the extremity; two or three long fine hairs and a few spines at apex of 6th joint, a transverse series of slender truncate spines on 2nd to 5th joints, several long fine hairs on the side of the 2nd and 3rd joints, and a transverse series of similar hairs on the 1st joint.

Anterior limb (pl. iii, fig. 24) large and stout, the claw (pl. iii, fig. 25), which includes the tarsal joint, densely chitinous, of a peculiar form that is quite unlike that of any other known species of *Margarodes*. It is strongly curved in two directions, both the inner face and the apical margin being concave. It has almost the appearance of being chelate, but the opposing points (the outermost of which is longer and more sharply pointed) cannot be approximated. Tibia represented by a small triangular joint between the claw and the femur, with a group of minute pores on its outer face. Femur with some long fine hairs on the disc of the inner face and near the apex of the outer face. Mid and hind

limbs small, short and stout (pl. iii, fig. 26). Coxa comparatively large. Tarsus small, fused with tibia but distinct from claw which is sunk into the apex of the tarsus like the fang of a tooth. The claw itself (pl. iii, fig. 27) is long and slender, strongly falcate. There appears to be a tubular channel from the tip of the claw to its base, communicating with an oval cyst which occupies the greater part of the tarsus. The whole limb clothed with very long slender hairs.

There are four large thoracic spiracles, and eight pairs of small abdominal spiracles. The thoracic spiracles are placed on the venter, in the interspaces between the legs. The external aperture of each is horseshoe-shaped (pl. iii, fig. 28), with a densely chitinous rim, opening into a chamber the sides and floor of which are studded with circular ceriferous pores. A densely chitinous paraphysis, with a broadly expanded extremity, runs inwards from the external stigmata. The abdominal spiracles, though properly belonging to the dorsum, have assumed a ventral aspect owing to the expansion of the dorsal area which overlaps the comparatively narrow venter. The anterior spiracle on each side is shifted outwards until it assumes an almost directly lateral aspect. The external aperture of an abdominal spiracle (pl. iii, fig. 29) has a dense chitinous rim, with a tooth-like projection on its upper and lower edges. There is an irregular ring of ceriferous pores just within the opening.

The anus (pl. iii, fig. 30) is represented by a lunate chitinous bar, within the thickness of which there is a very narrow linear opening.

The derm—both of the dorsum and venter—is studded with small circular multilocular ceriferous pores (pl. iii, fig. 31).

Size very variable. The smallest example in my series measures 3.75 by 3.25 mm., while the largest is 11 by 8 mm.

The nymphs apparently undergo several stages, but I have been unable to determine their exact number. The final stage (which discloses the adult insect) is in the form of a globular or subglobular cyst, of an opaque black colour and dense texture. The cysts are apparently naked, consisting of the hardened cuticle of the nymph, with fragmentary and inconspicuous patches of very thin nacre. They vary greatly in size, those from the Bellary district (pl. iii, fig. 32), with a diameter of 7 to 8 mm., averaging four times the size of those received from the Shimoga district (pl. iii, fig. 33) which range from 3.5 to 5 mm. in diameter. Some of the latter are more irregular in shape, showing a prominence on one side, which probably represents the original point of attachment.

In my earlier observations (loc. cit.) upon this species, it was noted that "after boiling in caustic potash, the black derm becomes partially decolorized and separates into two layers. The outer layer swells and becomes rugulose, but still retains its pustular structure. The inner layer is minutely granular." The later examples, under similar treatment, did not exhibit this

separation into two layers. The outer rugulose pustular layer was not observed. Possibly this may be a temporary phase in the development of the insect. The cleared cysts of these later specimens display a minutely granular but not pustular cuticle. The development of the tentorium varies considerably, being very weakly developed in some, but strongly chitinized in other examples. There is a distinct anal aperture, surrounded by a horseshoe-shaped area of denser derm and, immediately in front of it, are three small translucent cicatrices. The stigmata (pl. iii, fig. 34) are well developed, there being 9 on each side, of which 7 are abdominal and 2 thoracic. They are all of the same size and structure, but the thoracic spiracles are more centrally disposed. There are also 3 (sometimes 5) median series of ill-defined circular glandular plates. The rudimentary antennae are represented by a pair of chitinous tubercles, each bearing two stout curved bristles (pl. iii, fig. 35). These cysts, when exposed in a glass jar, developed a series of white waxy filaments emanating from the stigmata (both thoracic and abdominal), proving that the spiracles remain functional throughout the encysted stage.

Earlier stages of the nymph were found to be attached to the rhizomes of *Cynodon*, partially surrounded by white mealy secretion, in which condition they resemble examples of *Antonina indica*. These were of an irregular rounded form; with a dense opaque black cuticle. The anal aperture and stigmata are of the same form and structure as those found in the final nymphal stage; but these cysts were of very much smaller size, having a greater diameter of not more than 2 mm. On clearing these small cysts, they were found to contain what I suppose to be an intermediate nymphal stage, of an oval form, with a short, pliant and almost colourless cuticle. This intermediate stage (pl. iv, fig. 36) displays a conspicuous series of 9 spiracles on each side, of which 7 are abdominal and open onto the dorso-lateral area, while the remaining two pairs are considerably larger and open onto the venter of the thorax. The mouth parts are well developed, the labium usually displaced to a position anterior to the tentorium. The antennal tubercles (pl. iv, fig. 37) are rudimentary, with a deep central pit from which spring two stout curved bristles. The thoracic spiracles (pl. iv, fig. 38) consist of a broad cylindrical outer chamber, with thickened rim, the base of the chamber studded with small circular translucent pores. Near the base of each thoracic spiracle, on its outer side, is an elongate rugose plate with a few minute pores. The abdominal spiracles are of similar structure but of a considerably smaller size; and they have no rugose plates in association with them. The anal aperture (pl. iv, fig. 39) is surrounded by a sharply defined densely chitinous horseshoe-shaped plate which bears numerous short hairs. There are, on the venter, five longitudinal series of small circular glandular pits; the median series containing 8 (the two uppermost being paired), and the remaining four series each containing 6 of these pits. Each pit consists of several concentric rings (pl. iv, fig. 40), with a

central granular plate at its base. The insect, in this stage, measures 2.5 by 2 mm.

What appears to be a still earlier stage has been observed. It differs from that shown at figure 36 in its smaller size (1.25 by 0.75 mm.), and in the presence of only two series of glandular pits on the venter. It is possible that both of these intermediate forms may be stages in the early development of the male insect, which has not yet been identified.

Newly hatched larva (pl. iv, fig. 41) oblong oval, with a transverse row of stout hairs on each segment. Posterior extremity of body with two very long fine setae, as long as the body of the insect. Rostral apparatus with the labium displaced forwards to a position immediately in front of the tentorium. Antenna (pl. iv, fig. 42) 6-jointed; 1st joint stout, approximately as broad as long, equal in length to 2nd and 3rd together; 2nd joint narrow, cylindrical, longer than broad; 3rd, 4th and 5th short, widest medially; 6th as broad as but longer than 1st, the apex obliquely truncate; hairs disposed as in the figure. Anterior limb very stout; tibia and tarsus fused together to form a stout curved claw. Median and posterior limbs long and slender; with two distinct small joints, presumably representing a divided trochanter, as in certain parasitic Hymenoptera, between the coxa and the femur (pl. iv, fig. 43). Foot (pl. iv, fig. 44) with a long, slender, pointed, almost straight claw, more than three-quarters the length of the tarsus. There are four relatively large thoracic spiracles; abdominal spiracles minute, 7 on each side, the 7th almost obsolete. Length of body, 1 mm.

A single unhatched egg (pl. iv, fig. 45), found amongst a crowd of young larvae, measures 1 mm. by 0.43 mm. This egg contained a fully developed embryo.

The present examples of *M niger* were received from the same localities that produced the fresh material of *M. papillosus*, viz., from Honnali, Shimoga district, Mysore State (*L. C. Coleman*); and from the Bellary district, Madras Presidency (*T Bainbrigg Fletcher*). In both instances they appear to have been found at the roots of *Cynodon dactylon*, and early stages of the insect were found to be actually attached to the rhizomes of this grass. They were also found at the roots of 'Red Gram.' Mr. Fletcher's Assistant (Mr. Y Ramachandra Rao) supplies the following particulars:--'The peculiar globular egg-like bodies were met with at a depth varying from  $\frac{1}{2}$  to 3 inches in the soil

.. This form occurred mostly in red soils. The majority of the specimens were perfectly globular, but some had depressions and irregularities on their surface. There was much variation in size; the biggest measured 8 mm. in diameter, while the smallest were less than 2 mm. The shell is very hard in encysted forms, but is soft, tender and purplish brown in colour when the scale is immature. Fresh and carefully collected specimens showed at one spot (the anterior end of the insect) the vestiges of a mouth with two long delicate hairs arising from it. These break off when the shell hardens. .. Towards the end of February and in March,



some of these bodies hatched into stout, soft, hairy, grub-like creatures. (These are the adult females. Specimens kept in my laboratory have continued to hatch out, at irregular intervals, through the past year. E. E. G.). Egg-masses of this Ground Pearl were observed in the soil at a depth of 2-3 inches. The cells in which the eggs were found were long-oval, lined inside with a coating of mealy wax. Hundreds of eggs were found filling up the interior of each cell. The dead mother scale—shriveled and rotten—was to be found at one pole of the cell. When about to hatch it (the egg) assumes a pinkish colour. The just hatched larvae are somewhat flattened, with bright red eyes.’

On the strength of Mr. Rao’s careful observations, and having regard to the strong development of the rostral apparatus observed in some of my examples, as well as to the great increase in size that takes place during the nymphal development, my previously expressed opinion (*loc. cit.*, p. 67) that the larva of *Margarodes* “must take in a sufficient store of nutriment to sustain it during the succeeding nymphal and imaginal stages,” must be modified so far as the nymph is concerned.

Our knowledge of the two species just described is not yet complete. Of *M. papillosus* the larva still remains to be observed. Judging by the close resemblance of the adult female to that of *M. mediterraneus*, I anticipate that the larva, when discovered, will be found to possess but a single pair of legs, and that its antennae will be only 3-jointed. Of *M. niger* the male is still unknown. And the serial development of the insect, from the larva to the final stage of the nymph, requires elucidation—in both species. These problems can be solved only by observation on the spot where the insects occur in life.

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