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Agricultural Research Institute, Pusa

Second Hundred Notes on Indian Insects

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PREFACE

THIS Bulletin, in continuation of Bulletin No. 59, contains a second collection of one hundred short notes on Indian Insects, their names, habits, lifehistories and occurrence either in previously unrecorded localities or on new foodplants. As previously explained, such notes are commonly made by workers in all branches of entomology but are only too often buried away in note-books, reports or files, or, if published, are so scattered that in any case they become inaccessible to the ordinary student. To obviate this, such notes, collected to form Bulletins, will be published as material accumulates.

In the present Bulletin, Note 101 is reprinted from the *Quarterly Journal of the Indian Tea Association*, Notes 120, 146, 159, 174 and 191 from the Madras Agricultural Department's *Year-book* for 1917 which was issued "for official use only" and remains unpublished in the technical sense), Notes 154 and 155 from the *Entomological News*, Note 156 from the *Journal of the Asiatic Society of Bengal*, and Note 186 from the *Entomologists' Monthly Magazine*.

Besides the above-mentioned Notes which are here reprinted, Mr. T. V. Ramakrishna Ayyar has contributed Notes 119, 166, 171, 177, 188, 192, 194, 195 and 198; Mr. Y. Ramachandra Rao, Notes 114, 129, 151, 169, 181, and 196; Mr. G. R. Dutt, Notes 105 and 106; and P. Susainathan, Note 175. The remaining Notes have been written by myself, the sources of information being indicated in most cases, those described from Pusa Insectary cage-slips having been reared by Mr. C. C. Ghosh, the Insectary Assistant.

T. BAINBRIGGE FLETCHER,
Imperial Entomologist.

PUSA:
1st December 1918.

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[*Received for publication on 5th December 1918.*]

101. Insect Pests of Tea in North-East India during the season 1916.

A noticeable feature of insect attack in the tea districts of North-East India during the season 1916 was, that while *Helopeltis theivora*, the tea mosquito, though severe, was not more than usually so, and in some cases less so, in districts which suffer from its depredations year after year, it appeared in increased numbers in districts which have usually been considered to be fairly free from attack. This happened, not in one isolated district, but in different and widely separated districts in the areas under tea, the three districts affected being the Eastern Duars, part of the Balisera district (to a less extent) and parts of the Sibsagar district (to a still less extent).

Another feature was the unusual severity of green fly attack in the Central Duars, following, in most cases, severe hail.

The Tea Mosquito.

(*Helopeltis theivora*, Waterh.)

Assam. This pest is reported from the North Bank of the river from the Bishnath district, where it appears to have been about the same as last year, with local fluctuations mostly for the worse. The pest was noticeable on the tea from the end of July or the beginning of August to the end of the season, though in one place it first appeared in June, and the attack was at its height in July and August. In the Mangaldhai district the tea mosquito is never a pest and the report from that district makes no mention of the insect. When the Entomologist was in that district in December, however, he noticed a patch of old tea, of about an acre in extent, in a garden close to the hills, which appeared to be suffering severely from mosquito blight. Investigation showed that the damage was not due to *Helopeltis*, but to the Capsid bug *Disphinctus humeralis*, and it is worthy of record that, while the attack was

extremely local, the bushes affected suffered serious damage identical in all respects with that caused by *Helopeltis*. Reports were not received from the North Lakhimpur or Tezpur districts.

On the South Bank of the river the tea mosquito was not mentioned as an active pest in the reports received, which were from the Lakhimpur and Jorhat districts, but during the season reports were received that it was becoming increasingly active in the Sonari district and in certain parts of the Jorhat district. In the Golaghat district the attack was similar to that in the previous year.

Cachar and Sylhet. In the Happy Valley this pest was worse than last year more especially in the east end of the district, while it was extremely bad in the Hailakandi district. In the Longai-Chargola district the damage, though serious and affecting some 50 per cent. of the total acreage, was hardly so bad as last year, and there was a tendency for the blight to lift in November. An important development in this area, however, was the increase in the damage done on certain gardens in the Balisera Valley.

Darjiling-Terai. The reports from these districts indicate that the severity of the attack was less than last year in the higher level gardens, but similar to last year in the lower level gardens.

Duars. In the Western Duars this pest appears to have held off a little longer than usual, but came down badly later in the season. In the districts further east, however, the attacks were much more severe than usual, and in the extreme eastern districts the pest appeared in sufficient numbers to make it evident that it has at last gained a foothold there, one or two gardens suffering severely.

Green Fly.

(*Empoasca flavescens*, Fab.)

Assam. On the North Bank green fly was again in evidence, being slight in some places, moderately serious in others, the worst months being June and July. There was less than usual in Upper Assam, while moderately bad attacks were experienced in parts of the Sibsagar district.

Cachar and Sylhet. No mention of green fly occurs in the reports from these districts.

Darjiling-Terai. In Darjiling attacks of green fly were slight, and less than last year. May and June were the worst months, but in some places the attack continued into August. This pest does not appear to have attracted attention in the Terai.

Duars. Green fly was particularly bad in the Nagrakata and Dina Toorea districts, following a hail, and reaching its climax in May and June. In other parts of this area the attacks were slight only.

Red Spider.

(*Tetranychus bioculatus*, W. M.)

Assam. Along the North Bank this pest was, on the whole, less serious than in the previous year, and the reports from districts on the South Bank indicate a similar state of affairs.

Cachar and Sylhet. No reports of serious attack, such as were experienced in some places during 1915, were received from these districts, and red spider, though general, appears not to have been particularly serious in the area as a whole.

Darjiling-Terai. In Darjiling this pest was not quite so serious as usual, and was worst in May. At the lower elevations of the Terai the pest was earlier in evidence, and at its worst in April-May, but does not appear to have been particularly serious.

Duars. Here the attack was much as usual, if anything less than last year. In many places, in addition to the usual attack in the early part of the season, the pest was also in evidence in October, November and December.

Red Slug.

(*Heteraxia magnifica*, Butl.)

Assam. At one place in the Bishnath district this pest was serious during 1916, and persisted through the year, but at other places on the North Bank the damage done was negligible. No mention is made of its occurrence on the South Bank.

Cachar and Sylhet. There is no mention of the occurrence of the pest in these districts.

Darjiling-Terai. No mention of Red Slug.

Duars. Red Slug is again reported from the Chulsa district, but in even smaller numbers than last year.

Looper.

(*Biston suppressaria*, Guen.)

Assam. This pest is again reported from the North Bank only, but in much smaller numbers than in 1915. The autumn brood was again the one which did most damage.

FAGGOT AND BAG WORMS.

(*Clania* spp.)

Assam. Slight damage by these pests over restricted areas is reported from districts both on the North and South Banks.

Cachar and Sylhet. No damage reported.

Darjiling-Terai. No damage reported.

Duars. A slight occurrence of these pests is reported in the Chulsa district.

NETTLE GRUBS.

(*Thosea* spp.)

Assam. Local attacks of these pests occurred in parts of the Dibrugarh district, during the latter half of the season, and in one case the attack is reported as serious.

Cachar and Sylhet. No damage reported.

Darjiling-Terai. No damage reported.

Duars. In the Chulsa district a slight attack of these pests occurred in the early part of the season, the caterpillars being less in evidence than in 1915.

THRIPS.

(*Physothrips setirentris*, Bagn., and an undescribed species.)

Darjiling. This pest was again serious in the Darjiling district, the attack being of normal intensity, though slightly less at some places and slightly worse at others. The insects were in evidence from April to October, and at their worst in May and June.

CRICKETS.

(*Brachytrypes achatinus*, Stoll.)

Assam. Damage by these insects in nurseries is reported from both banks of the Brahmaputra.

TERMITES.

(*Termes* (*Odontotermes*) sp.)

Sylhet. These pests are reported as serious in the Balisera Valley.

Other pests reported as having occurred are:—

"Borers" in the Duars.

Cluster Caterpillar (*Andraca bipunctata*, Wlk.) in the Jorhat district.

Tea Seed Bug (*Poecilocoris latus*, Dall.) in Bishnath and the Duars.

Carteria decorella, Mask., a scale insect received from the Chulsa district of the Duars.

(E. A. ANDREWS. *Qrly. Journ. Ind. Tea Assocn.*, Vol. VII, Pt. 3, pp. 75-79.)

102. Bothroponera rufipes.

The range of *Bothroponera rufipes*, Jerd., is given by Bingham (*F. I., Hym.*, II, 96-97, f. 50) as "Himalayas from the Siwaliks to Assam and up to 4,000 feet." When at Abbottabad, in the Hazara District of the N.-W. Frontier Province, in June 1916 I collected a single specimen, so that its distribution must be extended to the western extremity of the Himalayas. We also have specimens from Nepal, sent us by Col. Manners-Smith, V.C., when Resident there.

Bingham notes (*l. c.*) that this species when picked up or disturbed emits a thick white frothy liquid from their mouths with an overpowering smell of formic acid. The Abbottabad specimen, when caught in the forceps, was noted to emit a long mass of white frothy semi-liquid substance from the anal extremity, but no special smell was noticed.

Since writing the above note, I have also taken this species not uncommonly at Shillong, where it occurs singly under stones.

103. Parasites of Pseudàgenia clypeata.

In *Entomological Memoirs*, Vol. IV, No. 4, page 195, mention was made of two parasites of the above-named wasp, but neither of them could be named at that time. They have now been identified as:—

(*i*) *Aphœbantus ceylonicus* (Bombylidæ).

(*ii*) *Gotra longicornis* (Ichneumonidæ; Cryptinæ).

The former has already been referred to in Note No. 47, under the name *Argyramœba ceylonica*.

Gotra longicornis has since been bred from the cells of *Pseudagenia blanda* also.

104. A parasite of Athalia proxima.

In the *Memoirs of the Department of Agriculture in India* (*Entomological Series*), Vol. I, page 369, it is mentioned that two species of Ichneumon flies parasitize the larvæ of the Mustard Sawfly (*Athalia proxima*, Kl.). One of these parasites is shown on Plate XX, figure 10, and this is described by Mr. Morley (*Fauna of India, Hymenoptera*, Vol III, page 331) as *Exacrodus populans*.

105. Hosts of some Indian Ichneumonidae.

This list includes only such species as have actually been bred from known hosts and are represented in the Pusa Collection.

PIMPLINÆ.

(1) *Xanthopimpla immaculata*, Morl.

Bred from—

(*a*) *Cnaphalocrocis medinalis*, Guen. (*Pyralidæ*), Dacca.

(*b*) *Telicota augias*, Linn. (*Hesperiidæ*), Palur, Madras.

In the collection specimens are from the following localities also:—

Bihar, Chapra; Central Provinces, Jubbalpore; South India, Coimbatore.

(2) *Xanthopimpla punctata*, Fb.

‖*ceylonica*, Cam.

Bred from—

(*a*) *Chilo simplex*, Butl. (*Pyralidæ*), Punjab, Lahore.

(*b*) „ „ „ Central Provinces, Betul.

(*c*) *Sphenoptera gossypii* (*Buprestidæ*) Central Provinces, Nagpur.

In the collection specimens are from the following localities also:—

Bihar, Pusa and Chapra; Central Provinces, Bilaspur and Raipur; Bombay, Surat.

(3) *Xanthopimpla nursei*, Cam.

Bred from—

(*a*) *Chilo simplex*, Butl. (*Pyralidæ*), Central Provinces, Nagpur.

(*b*) „ „ „ Bihar, Pusa.

(*c*) *Scirpophaga auriflua*, Z. „ „ Champaran.

(*d*) *Plusia* sp. (*Noctuidæ*), Bombay, Belgaum.

In the collection specimens are from the following localities also:—

Bihar, Chapra; Nilgiris, Naduvatam; Bombay, Surat.

OPHIONINÆ.

(1) *Henicospilus meridarius*, Grav.

Bred from *Euproctis scintillans*, Wlk. (*Lymantriidæ*), Madras, Saidapet.

In the collection specimens are from the following localities also:—

Bihar, Pusa and Chapra; Central Provinces, Balaghat, Nagpur and Hoshangabad; Bombay, Nadiad; Madras, Penukonda.

(5) *Henicospilus atricornis*, Morl.

Bred from *Sylepta derogata*, Fb. (*Pyralidæ*), Central Provinces, Balaghat and Nagpur.

(6) *Charops erythrogaster*, Ashm.

Bred from—

Achæa janata, Linn. } (*Noctuidæ*) Bihar, Pusa.
Ilmelicerta, Dr. }

(7) *Dioctes argentcapitosa*, Cam.

Bred from—

Laphygma exigua, Gn. } (*Noctuidæ*) Central Provinces, Nagpur.
Caradrina exigua, Gn. }

(8) *Dioctes debilis*, Morl.

Bred from—

(*a*) *Sphenarches caffer*, Zell. (*Pterophoridæ*), Central Provinces, Nagpur.

(*b*) *Exelastis atomosa*, Wlsm. (*Pterophoridæ*), Bombay, Surat.

(9) *Dioctes albicalcar*, Morl.

Bred from *Catochrysops cnejus* (*Lycænidæ*), Bihar, Pusa.

(10) *Angitia fenestralis*, Holmg.

Bred from *Plutella maculipennis*, Curt. (*Plutellidæ*) Punjab, Lyallpur.

(11) *Tarytia flaco-orbitalis*, Cam.

Bred from—

(*a*) *Antigastra catalaunalis*, Dup. (*Pyralidæ*) Bihar, Pusa.
(*b*) *Chilo simplex*, Butl. „ „ „
(*c*) *Euzophera perticella*, Rag. „ „ „
(*d*) *Argyroploce paragramma*, Meyr. (*Eucosmidæ*) „

(12) *Pristomerus testaceus*, Morl.

Bred from—

(*a*) *Leucinodes orbonalis*, Gn. (*Pyralidæ*), Central Provinces, Nagpur.
(*b*) „ „ „ Bihar, Pusa.
(*c*) *Euzophera perticella*, Rag. „ Madras, Attur.

In the collection specimens are also from Bihar, Chapra.

(13) *Edrisa pilicornis*, Cam.

Bred from the cocoons of a Microgasterid parasite of *Achæa janata*, Linn., Bihar, Pusa.

CRYPTINÆ.

(14) *Melcha ornatipennis*, Cam.

Bred from *Scirpophaga auriflua*, Zell. (*Pyralidæ*), Bihar, Pusa.

In the collection specimens are also from Bihar, Chapra.

(15) *Gotra longicornis*, Cam.

Bred from—

(*i*) *Pseudogenia blanda*, Guèr.
(*ii*) ,, *clypeata*, Bingh. } (*Pompilidæ*).

(16) *Melcha nursei*, Cam.

Bred from—

(*a*) *Earias fabia*, Stoll. (*Noctuidæ*), Bihar, Pusa.

(*b*) *Plusia orichalcea*, Fb. (*Noctuidæ*), United Provinces, Cawnpore.

ICHNEUMONINÆ.

(17) *Aglaojoppa alecto*, Morl.

Bred from *Parnara mathias*, Fb. (*Hesperiadæ*) Bihar, Pusa.

In the collection specimens are also from Bihar, Chapra.

(18) *Ischnojoppa luteolator*, Fb.

Bred from *Schœnobius bipunctifer*, Wlk. (*Pyralidæ*), Madras, Coimbatore.

In the collection specimens are from the following localities also:—

Bihar, Pusa and Chapra; Bombay, Bassein Fort; Madras, Samalkota.

G. R. DUTT.

106. Edrisa pilicornis.

Edrisa pilicornis, Cam. (Morley, *Fauna of India, Hym.*, Vol. III. p. 521) was originally described by Cameron in *Tijds. Ent.* (1907, p. 112, from specimens collected by Colonel Bingham in Sikkim. In 1912 this species was in evidence at Pusa in castor plots where the plants were badly attacked by the caterpillars of *Achæa janata*, Dr. Later on in the season a number of *Achæa* caterpillars were found to be parasitized by a *Microgasterid* parasite which is figured in the *Memoirs of the Department of Agriculture in India* (*Entl. Series*), Vol. II, No. 4, p. 73, pl. 7, f. 7, but has not yet been identified. While rearing the cocoons of this parasite a number of individuals, male and female, of *Edrisa pilicornis* were noticed inside the cage. Further observations established the fact that *Edrisa pilicornis* is a parasite of the *Microgasterid*, which

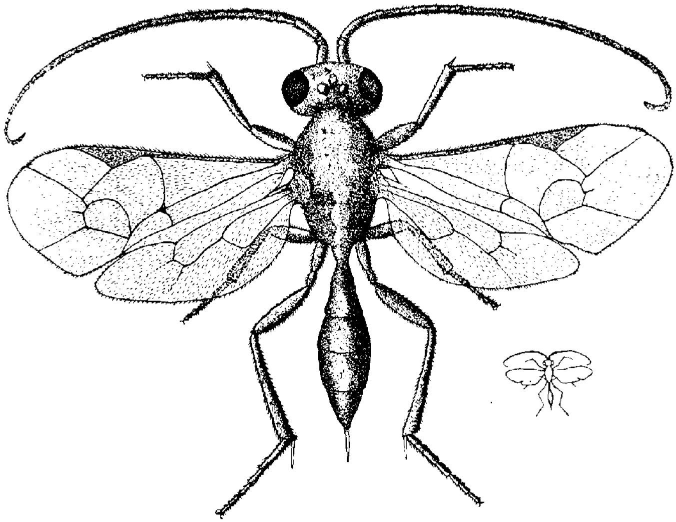


Fig 1. *Edriso pilicornis*, natural size, and magnified × 16.

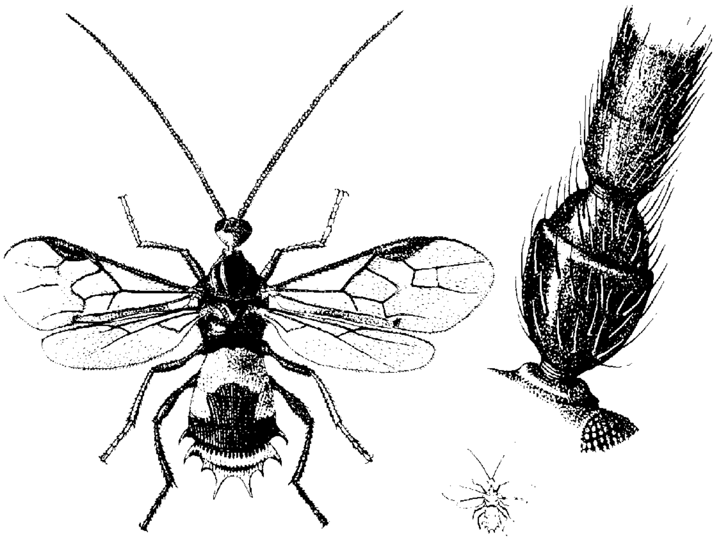


Fig. 2. *Spinaria leucomelaena*, natural size, and magnified × 6.
On right is more highly enlarged view of base of antenna

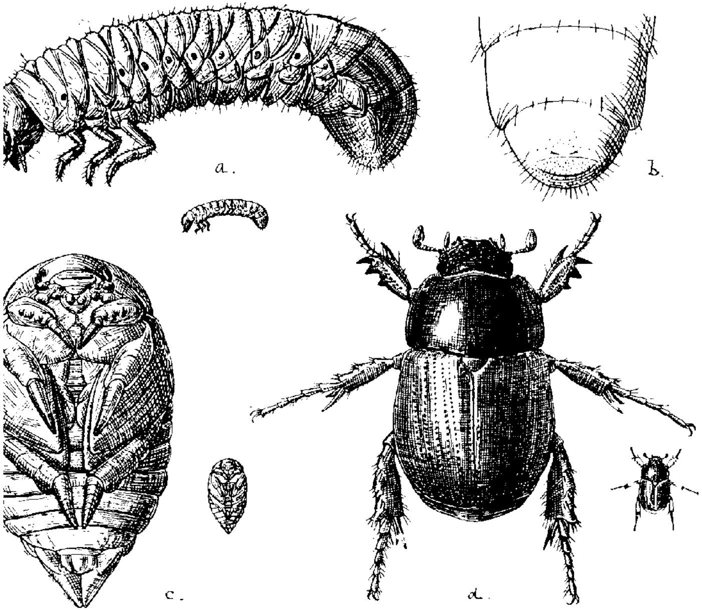


Fig. 3. *Alissonotum piceum.*
a. Larva, natural size, and enlarged (× 1½).
b. Posterior extremity of larva, ventral view, more highly magnified.
c. Pupa, natural size, and enlarged (× 1½).
d. Imago [illegible]

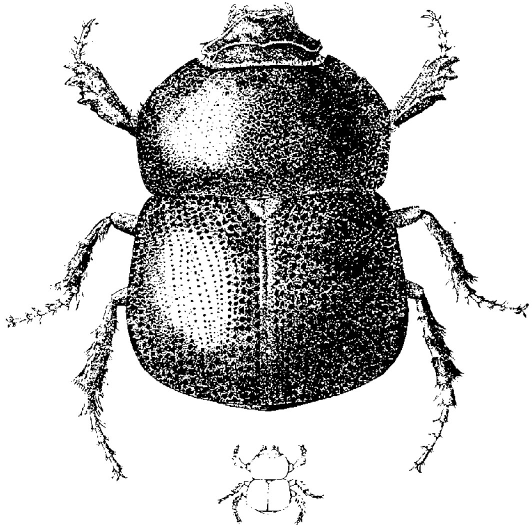


Fig. 1. *Pentodon bengalense* (× 6).
The small outline figure shows the natural size.

is in turn parasitic on the caterpillars of *Achæa janata*. When counts were made it was found that the *Microgasterid* cocoons were heavily parasitized, as many as 72 per cent. of the cocoons yielding *Edrisa*.

G. R. Dutt.

107. Spinaria leucomelaena in Southern India.

During a tour in Coorg in November 1915 two specimens of a species of *Spinaria* were captured at Pollibetta, and these have been identified as *Spinaria leucomelæna*, Westwood [*Tijds. voor Ent.*, XXV, 31, t. 7, f. 2, (1882)], originally described from Siam and not previously recorded from the Indian Region. *Spinaria nigriceps*, Cam. [*Manch. Mem.*, XLI, No. 1, pp. 37-38, t. 3, f. 7 (1897)] was described from Ceylon, but this is readily separated from *leucomelæna* by the black thorax of the latter species. Nothing seems to be known regarding the habits of these curious Braconids.

108. Oxycetonia jucunda in the Palni Hills.

Oxycetonia jucunda is recorded in the Fauna volume (pp. 168-170, ff. 37, 38) from the Himalayan Hill Region, ranging thence to Siberia and Japan. Three specimens taken at Kodaikanal at an elevation of 6,000 feet in the Palni Hills in 1913 (L. V. Newton coll.) have been identified by Mr. Arrow as this species, whose range is thus extended into Southern India. Of the three specimens, one is green, the second is red, and the third belongs to Arrow's variety *a*.

109. Early stages of Alissonotum piceum.

A larva of *Alissonotum piceum* was found at Pusa on 14th May 1917 gnawing into the base of a sugarcane shoot in the field. The shoot showed a "dead-heart" and, on turning over the earth, the larva was found eating into it in the same way as *tiryllolalpa* does. In confinement it bored into a thick piece of cane sett, throwing out dust in the manner of wood-borers. The larva pupated on 25th May and the adult beetle emerged on 3rd June 1917.

Pusa Insectary (Cage-slip 1578).

110. Pentodon bengalense as a cane-pest.

In May 1912 specimens of *Pentodon bengalense*, Arr., were received from Peshawar with a report that they had been found attacking newly-

sprouted sugarcane shoots over an area of eight acres. The accompanying report from the Agricultural Officer, North-West Frontier Province, stated that "the beetle begins tunnelling at the soil surface, about two or three inches distant from the shoot; the tunnel goes to the base of the shoot, where the beetle is usually found nestling beside the injured shoot, or the beetle is frequently found inside the injured shoot which shows a dead-heart, whose base is eaten quite through. Close by each old injured shoot two holes are generally found on the soil surface and it is thought that one of the holes serves for ingress and the other for egress. A pair of the beetles were found coupling near the base of the shoot."

P. bengalense was described by Arrow (*Fauna of India, Dynastinæ*, p. 304, f. 71) from Pusa and Rajmahal, but is probably widely distributed throughout Northern India. Except at Peshawar it has not been noted as a pest. It has been reared at Pusa from larvæ found eating cane shoots in May 1906 and 1909. The larva is about 20 mm. long and 5 mm. broad, flattened, dorsally convex, middle of body narrower than thoracic region, posterior portion of abdomen thicker, almost cylindrical, yellowish-white; head brownish yellow or red-brown.

A larva collected on 20th May 1906 pupated on 24th June and emerged on 3rd July 1906. Another larva, collected on 1st May 1909, pupated on 2nd July and emerged on 12th July 1909.

Pusa Insectary (Cage-slips 357, 768).

111. Anomala bengalensis attacking sugarcane.

Note No. 12 dealt with some larvæ of *Anomala bengalensis* found breeding in leaf-mould at Pusa. In July 1917 larvæ of this beetle were found, both at Pusa and Dacca, underground near roots of sugarcane gnawing into the growing stem from the side and causing the plants to wither. In confinement these larvæ were reared on pieces of sugarcane stem, which were gnawed into from the side. The larva passes the winter in the larval state and pupates about the end of March, the adult beetles emerging in the middle of April. The accompanying figures of larva and imago were drawn from the Dacca specimens referred to above.

Pusa Insectary (Cage-slip 1779).

112. Early stages of Aphodius moestus.

The early stages of *Aphodius moestus* are passed in cattle-dung, either on the ground or collected in the form of cakes for purposes of fuel. So long as the interior of these cakes remains moist, the larvæ are able to live in them. When the dung is lying on the ground, the

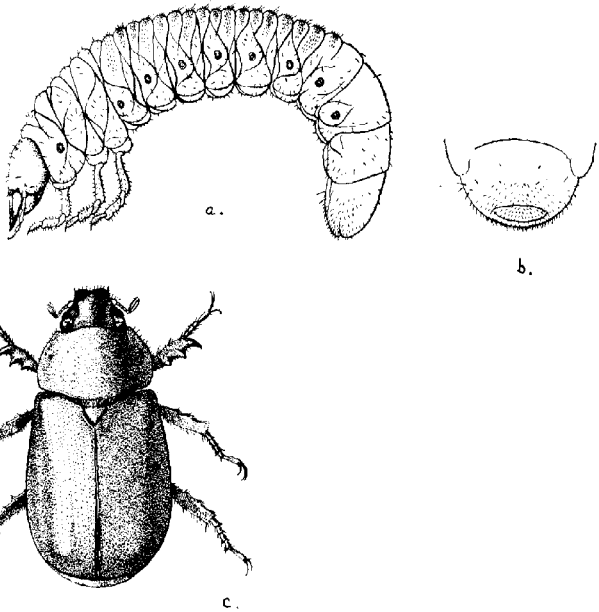


Fig. 5. *Anomala b. agaleasis*.
a, Larva (× 3)
b, Posterior segment of larva, ventral view, more highly magnified.
c, Imago (× 3).

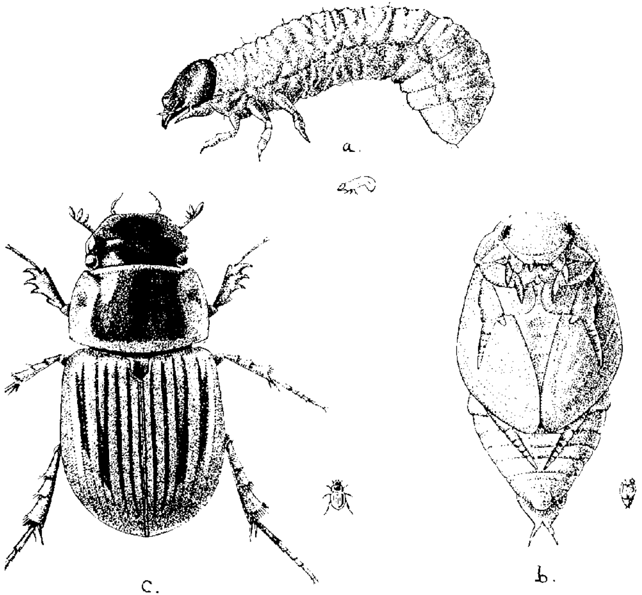


Fig. 6. *Aphodius moestus.*
a, Larva, natural size, and magnified (× 10).
b, Pupa, " " " "
c, Imago. " " " "

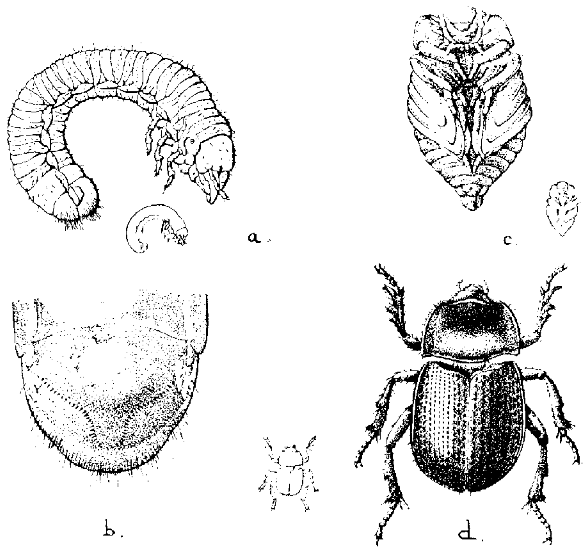


Fig. 7. *Hybosorus orientalis.*
a. Larva (× 4).
b. Under surface of anal segment showing arrangement of spinous hairs.
c. Pupa (× 4).
d. Adult (× 4).
The small outline figures show natural sizes.

larvæ, when full-fed, go down into the soil, excavate an oval space, and pupate there; but in the case of cakes applied to walls, etc., or when the soil is unsuitable, pupation takes place in chambers made in the dung. The life-cycle is short, probably about or less than three weeks.

The full-grown larva is about 8 mm. long and about 2 mm. broad across the anterior and 2·5 mm. across the posterior portion of the body. In general appearance it is much like a young *Anomala* larva and is ventrally incurved, convex dorsally and rather flattened ventrally. Head rounded, dark brown, shining. Three pairs of well-developed pale-yellow legs. No distinct shield on prothorax but a yellow marking present on either side of pronotum. Body much wrinkled, white or pale yellowish-white, the dorsal vessel and visceral contents plainly visible.

The pupa is about 6 mm. long and 3 mm. broad across the wing-covers, ventrally incurved, uniform brownish-yellow, with a pair of long tapering divergent spines on the anal segment. The pupal period is four or five days.

Pusa Insectary (Cage-slips 844, 1545).

113. Early stages of Hybossorus orientalis.

On 6th July 1914 a pupa of *Hybossorus orientalis*, Westw., was found in farmyard manure at Pusa and emerged as an adult on 12th July. On 28th July 1916 three larvæ were similarly found and five more on the following day, and on 15th August 1916 larvæ were also found in cattle droppings on roads and in the pasture areas. The adult beetles emerged between 18th August and 11th September, the pupal period being ten or twelve days.

The full-grown larva is about 20 mm. in extreme length, stoutest across the metathoracic region which is about 5 mm. broad, and tapering slightly anteriorly and more pronouncedly posteriorly, the hinder extremity being about 3 mm. broad. It is of the ordinary Scarabæid form. Head smooth, shining yellow-brown. Body uniformly pale yellow and with a delicate appearance in comparison with such larvæ as those of *Anomala*. Segments subdivided, the subsegments bearing short brown hairs. Anal segment with a transverse indentation and with longish brown hairs on dorsal and posterior areas, ventrally with an obliquely curved row of short spinous hairs, as indicated in figure 7, arising from the anterior margin and reaching median portion of the posterior fold. The spiracles differ from those of *Anomala* and similar larvæ, being unicolorous with the body and scarcely distinguishable. Tarsi of all three pairs of legs well-developed, spinous.

When placed on a flat surface the larva does not walk on its ventral surface, or on its dorsal surface (like *Protaetia* larvæ), but it progresses somewhat obliquely on one side. When disturbed it coils up and, unlike other Scarabæid grubs, the anal extremity is raised over and overlaps the body to some extent.

Pusa Insectary (Cage-slips 1071, 1436).

114. Sthenias grisator.

This beetle was found in rather large numbers at Coimbatore in December 1914 damaging mulberry bushes at the Insectary. Many of the stouter twigs were found to have been deeply girdled all round by these beetles, a little above the base. The girdle ultimately became so deep that the twigs broke at the part attacked and fell to the ground. A careful examination of the twigs revealed the presence of numerous little cuts in the bark made by the beetles. A slight prominence may be noticed in the bark either above or below the slit. This is caused by the presence of an egg thrust in between the bark and the wood by the female beetle. The egg is somewhat cigar-shaped, more pointed towards one end than the other, dull white and very slightly flattened. The grub hatches in about 9 days, and begins at once to bore into the wood of the twig. The grub tunnels into the woody tissue and feeds on it till the twig is reduced to a mass of yellow dust and excreta, wrapped up by the thin cover of the bark. In some places the grub thrusts out through slits in the bark some of the yellow dust and grass which may be found in small heaps on the ground.

The grub when full grown is about 1 inch long. It prepares an elongate chamber in a part of its tunnel and pupates.

The pupal period has not been definitely determined.

The length of its life-history seems to vary a good deal. From larvæ hatching from eggs in January-February 1915 a few beetles emerged in May 1915, some in August-October 1915, and a few in January-March 1916. Some are yet in the larval stage. This is probably due to adverse conditions under confinement. In nature the length of the cycle would be about 4 or 5 months.

Nerium odorum, *Bougainvillea*, *Moringa*, etc., were also attacked.

Y. Ramachandra Rao.

115. Identification of Soy-bean Stem-borer.

The longicorn beetle boring in stems of soy-bean in Bihar, whose life-history has been described by H. L. Dutt in the *Bihar Agricultural*

Journal (Vol. III, pp. 52-56, April 1915), has now been identified as *Napserha bicolor*, Thoms., and this name should be used in any further references. The insect is known to occur in Northern India and Java.

116. A new Weevil Pest from Kulu.

Under date of 5th July 1914 a correspondent at Chawai, Kulu, in the Kangra District of the Punjab forwarded specimens of a weevil which had attacked his orchard, completely defoliating the trees. He wrote :— "The insects first of all appeared on an alder tree (*Alnus nitida* in a zamindar's field adjoining my orchard. After completely defoliating the alder, they attacked peach trees in my orchard. When they had completely eaten away the peaches, they began to attack the apricots and pears. Apples were the last to be touched."

Specimens of the weevil were forwarded to Dr. G. A. K. Marshall, who writes that it represents a new genus and species, which he has called *Emperorrhinus defoliator* and described in *Bull. Ent. Res.*, VI, pp. 366-368, f. 1. (February 1916).

This species also occurs at Kurseong and Darjiling and in the Khasi Hills.

117. An attack on fruit-trees by Emperorrhinus defoliator in Kulu.

Lala Guran Ditta Mal, Forest Ranger, Chawai, Kulu, Kangra District, under date of 23rd July 1917, has given us an interesting account of the occurrence of *Emperorrhinus defoliator*, Mshll., in Kulu in 1917. He writes as follows :—

"Great efforts were made to find out the winter hiding places of the weevils but with no success. So as a precautionary measure all the dry grass in the orchard was burnt down during the month of December 1916. But this did not do any good. On careful observation it was found out that the weevil first of all appeared at the bottom of the valley and slowly but steadily worked its way upwards towards the orchard, defoliating each and every wild pear tree in the way. In addition to the wild pear trees, all other broad-leaved trees and shrubs with soft leaves were eaten away.

"Thus the weevil approached the orchard in the beginning of July 1917, where we were ready to meet it. Spraying with strong doses of lead arsenate was continuously done every morning, using 1 oz. for every 4 gallons. In addition to this, the insects were not allowed to rest at leisure, but were continually disturbed by shaking the trees. In the

night time they were driven off with torches and as soon as they fell down in the pits they were crushed to death with broad wooden sticks. All the shrubs in the vicinity were also cut down and burnt so as not to give them any resting place.

"By 10th July the attack had spread on to seven pear trees. But then it suddenly stopped and the insects began to decrease, until by 20th they had disappeared altogether, only eating away half the leaves of seven pear trees.

"Now the weevils are going up the valley, defoliating each and every wild pear tree which comes in their way. It was noticed that when once the weevils went up, they never came down.

"Although the spraying with lead arsenate was a great check, yet continuous disturbing and burning with torches contributed a great deal in suppressing the pest. They came to know that that orchard was not a safe place for them and thus retreated in grief.

"Another peculiar practice of this pest is that it is only a local pest. It is found only in a limited area about two miles square. A private orchard situated at a distance of about 2½ furlongs from our orchard is not visited at all by the pest. Our orchard appears to be the northern boundary of its area of operation."

118. Early stages of Myllocerus discolor.

Myllocerus discolor, Boh., has been reared on several occasions at Pusa from larvae and pupae found underground at roots of maize, sugarcane, and of a wild *Amaranthus*. The larvae seem to feed on the roots and do a small amount of damage.

The full-grown larva is about 7 mm. long and 3 mm. broad across the thoracic region, whence the body tapers posteriorly, dirty white; head brownish yellow, narrower than prothorax.

Pupation takes place underground with a specially prepared cell. Pupa about 6 mm. long, dirty white. The pupal period is about three weeks.

This weevil has been described and figured in *Fauna of India, Curculionidæ*, Vol. I, pp. 348-350, f. 106, where a list of foodplants of the adult beetle is also given. In the *Planters' Chronicle*, Vol. V, p. 255 (June 1910), this species (presumably var. *variegatus*, Boh.) is stated to do a good deal of damage to the foliage of fruit-trees in the neighbourhood of Ootacamund in January and February, just at the time when the trees are breaking into new leaf.

Pusa Insectary (Cage-slips 356, 1095 and 1622).

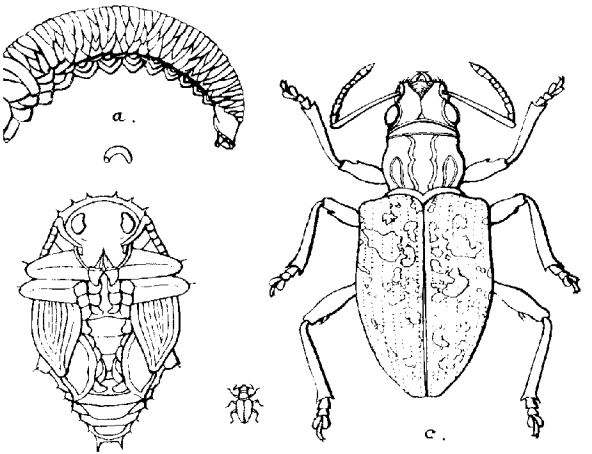


Fig. 8. *Mylloceras discolor.*
a, Larva, natural size, and magnified (×8).
b, Pupa .. .. .. *c*
c, Imago .. .. .. ,,

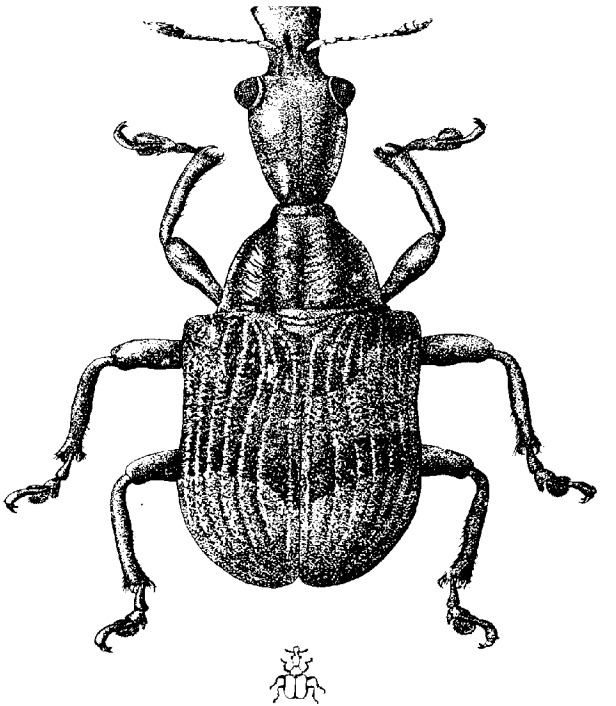


Fig. 9. *Apoderus tranquebaricus* (×12).
The small outline figure shows the natural size.

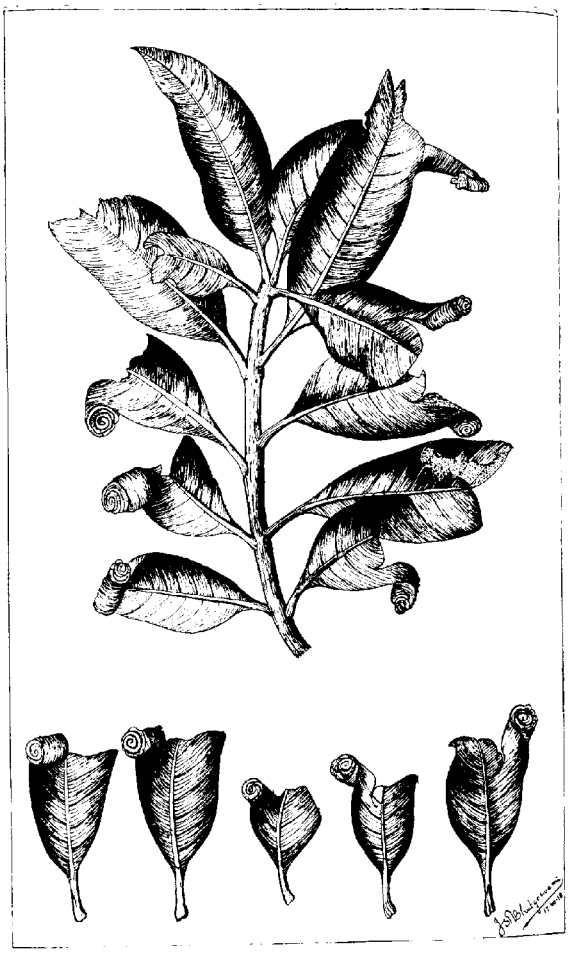


Fig. 10. Mango leaves twisted by *Apoderus tranquebaricus*.

119. Apoderus tranquebaricus as a pest of Mango.

Apoderus tranquebaricus, Fb., is commonly observed as a leaf twister of the common country almond tree (*Terminalia catappa*) in South India. Occasionally however it has been noted on mango. Last December while at Chittoor in connection with the mango hopper spraying campaign I came across this weevil in rather large numbers on mango trees. At this season of the year several trees put out fresh shoots and tender leaves and it is this fresh growth that suffers from the attacks of the beetle. Almost every leaf showed the characteristic twisted knot which in several cases contained a fresh laid egg. Several adult beetles were also found feeding on the tender leaves. Many of these knots were dry and showed holes, apparently those through which the adult had emerged. The insect can however be checked easily when it appears in the pest form by collecting the adults which I found very easy early in the morning when they are found exposed in numbers. The leaf knots can also be picked and destroyed.

(Figure annexed showing damage to mango leaves.)

T. V. Ramakrishna Ayyar.

120. Note on the egg-laying habits of the Agathi weevil.

(*Alcides luba*, Fb.)

This insect feeds on Agathi (*Sesbania*), Cluster beans (*Cyamopsis*) and Indigo in South India. On Agathi it has often been noted as a serious pest in betel vine gardens where this plant is grown as a standard for the vines. The following facts in connection with egg-laying of the insect noted in the course of the investigation of its life-history and habits may be interesting.

Four pairs of the weevils were kept in captivity and daily observations were made as to the egg-laying. Before depositing the eggs, the weevil first makes an incision into the tender shoots of its foodplant and into this excavation an egg is thrust in. Each egg is laid in a separate incision, though several eggs may be laid in the same stem or shoot. The eggs are thus safely deposited inside the plant tissue one after the other.

The presence of an egg inside the succulent stem can be made out by experienced eyes from the peculiar small dirty dark brown spots on the stem surface which denote the place where the puncture was made by the weevil. On close examination, this spot shows a slight depression and the passage made by the weevil can be traced.

The following tabular statement gives an idea of the egg-laying powers of this insect :—

	Cage A* Number of eggs	Cage B* Number of eggs	Cage C* Number of eggs	Cage D* Number of eggs
19th September 1915	1	1	1	...
20th „ „	...	1	3	1
21st „ „	1	...	2	2
22nd „ „	1	...	...	6
23rd „ „	1	3	...	3
24th „ „	4	3	...	3
25th „ „	5	4	...	3
26th „ „	4	5	...	2
27th „ „	1	3	...	...
28th „ „	4	3	...	2
29th „ „	5	2	...	2
30th „ „	2	6	...	2
1st October 1915	3	1	Insects died in C & D	
2nd „ „	4	1		
3rd „ „	4	2		
4th „ „	2	3		
5th „ „	4	1		
6th „ „	2	5		
7th „ „	3	1		
8th „ „	6	2		
9th „ „	2	Female insect found missing.		
10th „ „	2			
11th „ „	2			
12th „ „	3			
13th „ „	...			

* One pair put in cage.

	Cage A* Number of eggs	Cage B* Number of eggs	Cage C* Number of eggs	Cage D* Number of eggs
14th October 1915	2			
15th „ „	2			
16th „ „	...			
17th „ „	2			
18th „ „	1			
19th „ „	2			
20th „ „	3			
21st „ „	...			
22nd „ „	1			
23rd „ „	2			
24th „ „	1			
25th „ „	1			
26th „ „	...			
27th „ „	2			
28th „ „	...			
29th „ „	...			
30th „ „	...			
31st „ „	...			
1st November 1915	Female dead.			
2nd „ „	...			
3rd „ „	...			
4th „ „	...			
5th „ „	...			
6th „ „	...			

* One pair put in cage.

It will be seen from the above that the female in cage A laid in all 55 eggs in the course of 42 days from the 19th September to the 31st October. It died on the 1st November. That in B laid 47 eggs in 20

days from the 19th September, and due to some mishap escaped from the cage on the 9th October. Those in D and C did not continue being although the female in D appeared to be pretty prolific having laid 26 eggs in 11 days.

This habit of the insect in not depositing all its eggs at one time differs from many other insects—especially moths—which lay all their eggs at a time. To this feature must be attributed the presence of the pest in the field in all its stages and at all seasons in the year. It also gives us some idea of the number of progeny the insect is capable of giving rise to, at each generation.

T. V. RAMAKRISHNA AYYAR.

121. Early stages of Ceuthorrhynchus portulacae.

Larvæ of this weevil were found mining leaves of purslane (*Portulaca oleracea*) at Pusa on 24th September 1909 and the following notes on its early stages were made in the Insectary :—

Egg. The egg is about 0·5 mm. long, slightly less than 0·5 mm. broad, oval, ends rounded, brownish yellow, the surface smooth. It is thrust into a small hole gnawed by the female parent in the tissue of a leaf of the foodplant, only one egg being deposited in each hole, although two or even three eggs may be placed in the same leaf. The hole, in which the egg is placed, is made a little obliquely. Eggs laid on 10-11th October hatched on the morning of 13th October. When the young larva emerges it finds itself in the midst of the leaf tissue, on which it commences to feed, leaving entire the two epidermal layers of the leaf.

Larva. The newly-hatched larva is about 1 mm. long, cylindrical, legless, pale brownish-yellow, head dark brownish ; the blackish intestinal contents visible through the skin.

The full-grown larva is about 4 mm. long, cylindrical, legless, the body soft, wrinkled and uniformly yellow ; head black, smaller than prothorax which bears a black, medially-divided plate. The larva remains bent ventrally in its natural attitude. It mines the leaf of the foodplant and, though legless, can progress and, if food becomes deficient, may leave the mine and enter another leaf.

Pupation. When full-grown, the larva leaves its mine and progresses with a creeping movement down to the plant onto the soil, whereon it forms a rounded, thin-walled cocoon about 3 to 3·5 mm. in diameter. The cocoon which is formed of agglutinated earth is brittle, with its inner surface perfectly smooth ; externally it resembles a small fragment of earth. The larva pupates inside this cocoon.

Pupa. The pupa is about 2·5 to 3 mm. long, uniformly yellow, of the usual weevil type.

Life-cycle. The life-cycle is very short: egg, about two to three days; larva, four to five days (to time of forming cocoon; pupa, seven to nine days from formation of cocoon to emergence of adult). The actual time passed in the pupal state is about five days; the larva takes about a day to complete its cocoon and to rest before pupating, and the adult beetle, which is at first yellow and darkens gradually, takes about a day and-a-half to harden before it breaks out of the cocoon.

Adult. The weevil makes short jumps like a Flea-beetle (Halticid). The same habit has been noted in the case of *Centhorrhynchus asperulus*. It eats holes in the leaves of *Portulaca*, frequently leaving uneaten a thin layer of one epidermal surface. It also eats the tissues of the soft stem of *Portulaca*.

This weevil proved to be an undescribed novelty which has been recently described and figured by Dr. Marshall under the name of *Centhorrhynchus portulacae Bull. Ent. Res.*, VI. 368-369, f. 2; Feb. 1916.

122. Life-history of Baris portulacae.

On 1st February 1912 the grubs of a weevil were found at Pusa, boring in the stems of *Portulaca oleracea*, Linn. (vernacular *Lunglai*), and eggs were also found in the stems on this date. On 14th February more grubs were collected but no more eggs were now to be found. The adult beetles emerged as follows:—

5th March, three; 10th March, seven; 20th March, eight; 26th March, three; 29th March, four; 3rd April, three; and 8th April, two.

The eggs are inserted into the stem through a small hole specially gnawed by the parent. The egg is roundish, about 0·6 mm. in diameter, pale yellow, with a soft, thin, membranous shell. The young larva, on hatching, bores into the surrounding succulent tissues of the stem and forms a tunnel longitudinally inside the stem.

The full-grown larva is 3·5 to 4·5 mm. long, of the ordinary legless Curculionid type, tapering towards each end, very pale yellow, with a brownish yellow head. When fullfed, it forms, inside the stem, an entirely-closed, elongate-oval cocoon, which is composed of a black substance which is probably largely excrementitious. The weevil emerges by boring a hole in the stem. (Pusa Insectary.)

This species was described as new and figured by Dr. Marshall in *Bull. Ent. Res.*, VI, 369-370, f. 3 (February 1916).

123. A weevil attacking Water-melons in Bellary.

In April 1908 living weevil grubs were sent in by Y. Ramachandra Rao, Entomological Assistant in Madras, as "badly damaging water-melons on the Hagari Farm" in the Bellary District. The grub enters the melon on the side touching the ground and tunnels inside in the flesh and seeds, filling its gallery with excrement and causing decomposition of the fruit which soon rots or falls off.

The full-grown grub is about 9 mm. in length, sub-cylindrical, tapering considerably towards the head, which is yellow and about 1 to 1·25 mm. in breadth, whilst the abdominal segments are 3 mm. or more broad; the head is round with a faint median vertical furrow, from whose apex a faint white broad linear mark runs on each side to the base of the mandibles, whilst just above the mandibles is also an u-shaped dark mark. The body is soft, legless, and white or yellowish-white, curved concavely ventrally, and convexly dorsally. Spiracles yellowish, of an irregular oval shape with a central yellowish mark: the first pair on the anterior portion of the mesothorax and one pair on each of the first eight abdominal segments. There are a few minute white hairs on the head and body.

Pupation took place within the rotting fruit in an oval brownish cocoon formed of particles of the rotten fruit and of excrement closely stuck together. The pupa is of the usual Curculionid type, about 6-7 mm. in length, uniform white or yellowish-white, with minute scattered white hairs, those on the body arising from slightly tuberculated bases; the beak, legs and wings are folded ventrally, the wings between the second and third pairs of legs.

Beetles which emerged on 18th April died on 10th May in confinement. Length of life-cycle not worked out.

The beetle has been identified as an undescribed novelty by Dr. G. A. K. Marshall, who has named it *Aeythopeus citrulli*. (*Bull. Ent. Res.*, VI, 372-373, f. 5; February 1916).

It also occurs in the Cuddapah District, at Coimbatore, and at Koilpatti in Tinnevelly.

124. A new weevil on Tamarisk at Pusa.

Weevil grubs, in general appearance almost exactly like those of *Hypera medicaginis* and *H. variabilis*, are found commonly on Tamarisk (*Tamarix gallica*, vernacular *Jhau*) at Pusa in February, living openly upon the green twigs which they gnaw.

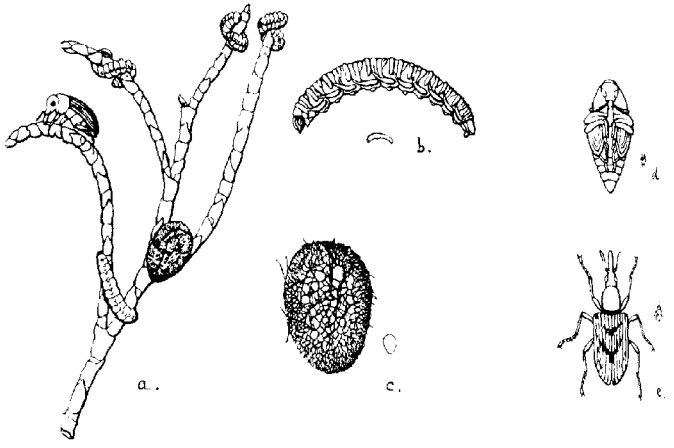


Fig. 11. *Conalus infuscus.*
a. Tamarisk twigs with larvæ, cocoon, and adult weevil (× 3).
b. Larva, natural size, and magnified (× 7).
c. Cocoon. ,, ,, ,, ,,
d. Pupa. ,, ,, ,, ,,
e. Image. ,, ,, ,, ,,

The full-grown grub is about 6 mm. long, semi-cylindrical, the ventral region flattened, the segments distinct and somewhat protuberant laterally and ventrally, the ventral protuberances serving the purpose of legs which are otherwise absent. Segments thirteen in number, including the head, which is black, shiny and smaller than the other segments. The surface of the body including thorax is wrinkled, in colour green, with yellowish-white dorsal and lateral stripes. Locomotion is effected by gripping the twig with one end of the body, whilst the other is raised and moved in the required direction; the free end then grips the twig whilst the other extremity relinquishes its grip and is brought forward.

Pupation takes place in a roundish, brown, silken cocoon, composed of a net-work whose meshes may be quite open or closely matted together. In captivity cocoons were formed on the twigs as well as on the bottom of the cage, but under natural conditions they usually seem to be formed on the twigs.

Three specimens, which formed cocoons on 17th February 1915, pupated on 19th February, assumed imaginal characters on 1st March and emerged from the cocoons on 3rd March. Exact length of life-cycle not known, but the adult beetles are found commonly on tamarisk as late as May.

Specimens of this weevil have been determined as *Coniatus indicus*, by Dr. G. A. K. Marshall who has recently published a description (*Bull. Ent. Res.*, VI, 367-368; February 1916).

125. Athesapeuta oryzae on Paddy.

Stray specimens of this weevil were found on paddy at Coimbatore in 1908, but it is apparently not a pest of this crop. In the Krishna District it has been noted by T. V. Ramakrishna Ayyar as breeding in numbers on a species of fleshy grass—probably a *Cyperus*—growing in the paddy fields, and the same thing has been noticed in Tanjore by Y. Ramachandra Rao.

This weevil proved to be an undescribed novelty and has been named *Athesapeuta oryzae* by Dr. G. A. K. Marshall. (*Bull. Ent. Res.*, VI, 370-371, f. 4; February 1916.)

126. Sagra nigrita as a pest of Lablab.

In October 1909 the accompanying photograph of *Sagra nigrita*, Oliv., was received from Mr. E. Ernest Green, Government Entomologist in Ceylon, with the information that "it breeds in the stems of the

climbing bean (*Dolichos lablab*) and causes large gall-like swellings in the stems."

Sagra nigrita, although only recorded from Ceylon in the *Fauna of India* volume on Chrysomelidæ, occurs in the Plains of India also and is likely to be met with as a pest of *Dolichos*.

127. Early stages of Cryptocephalus sex-signatus.

Larvæ of *Cryptocephalus sex-signatus* were found at Pusa on 10th January 1917 and the beetles emerged during the latter half of June 1917. The soft-bodied larvæ feed on dry, fallen leaves whose edges are nibbled. They are enclosed in a case, which they carry about like Psychid larvæ.

The natural attitude of the larva inside its case is a position in which it is ventrally doubled on itself as shown in figure 13*b*. It measures from head to tip of the doubled portion about 7 mm. and from this tip to the anal extremity about 5 mm. In section it is rounded, the thoracic region being about 3 mm. broad and the doubled portion of the abdomen about 5 mm., the anal extremity tapering. Head flattened, fuscous, concave on anterior surface which is rounded in outline and measures about 2·5 mm. in diameter. Prothorax with a broad fuscous collar-like shield. Body uniform light yellow, its surface wrinkled. Three pairs of long, slender thoracic legs.

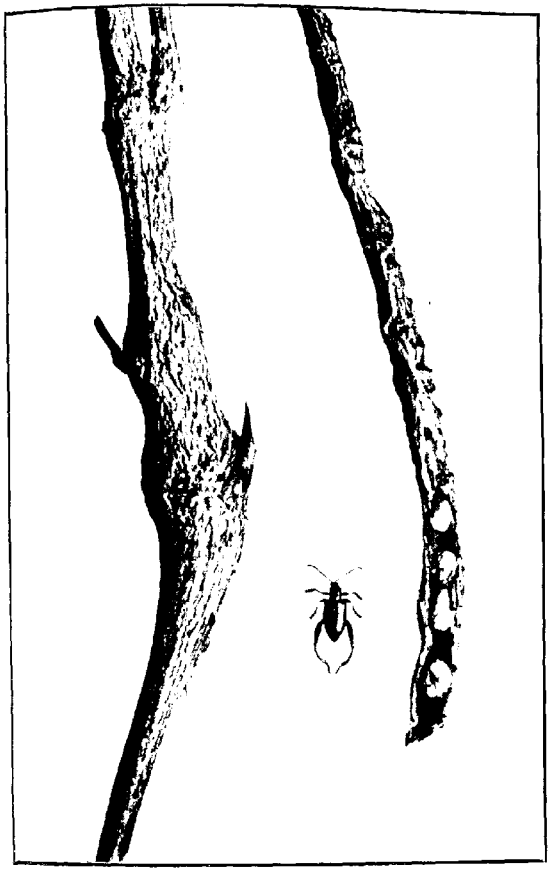
The larval case varies with the size of the enclosed larva and is from 7 to 13 mm. long and from 3·5 to 8 mm. broad, thick-walled, roughened exteriorly, tolerably hard and fuscous or blackish in colour. The case appears to be made of larval excrement, but it is not known how it is enlarged as the grub grows. At one end of the case is an opening which is just plugged by the head of the larva when the latter retreats inside its case; for locomotion the larva thrusts out its head and legs and carries the case about.

Pupation takes place inside the case, whose mouth is plugged in a manner which on casual inspection exactly resembles the way in which it is usually closed by the head of the larva. No exact details of the pupa or pupal stage were therefore noted. The adult beetle emerges from the case by breaking open a portion of its hinder end like a cap.

Pusa Insectary (Cage-slip 1590).

128. Clitea picta as a pest of Bael.

The Bael (*Ægle marmelos*) trees at Pusa are damaged considerably every year in June and July by *Clitea picta*, a Chrysomelid beetle



(From a photo. by E. Ernest Green.)

Fig. 12. *Sagra nigrita*. Stems of *lablab* showing gall-like swellings caused by larvæ and (on right) a stem cut open to show the larvæ. Adult beetle in centre.

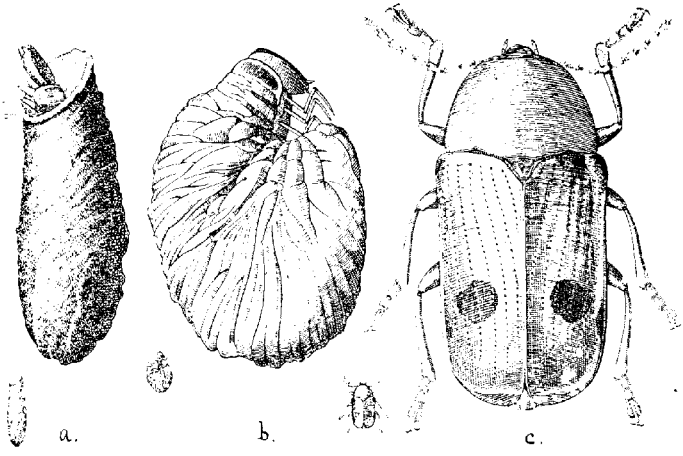


Fig. 13. *Cryptocephalus sexsignatus*.
a, Larva in case, natural size, and magnified (× 1).
b, Larva removed from case, natural size, and magnified (× 1).
c, Insect, natural size, and magnified (× 1).

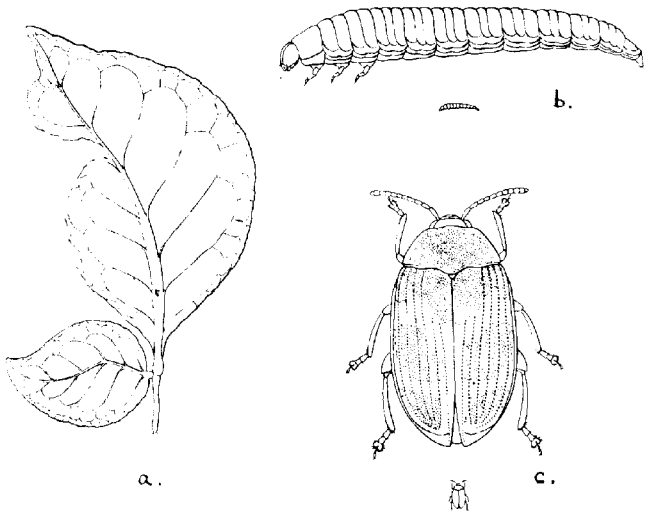


Fig. 14. *Clitea picta.*
a. Bael leaf bored by larva.
b. Larva, natural size, and magnified (×9).
c. Imago " " " "

whose larva burrows in the midribs of leaves, tender shoots, spines, axils of branches and even occasionally in the young setting fruits, whilst the adult beetles eat holes in the leaves which are often badly riddled. Figure 15.

The larva is about 8 mm. long and about 1·5 mm. broad, dorsally convex and ventrally compressed, of a dull-brown or orange-yellow colour, with a flattened brownish head. Prothorax with a brownish shield medially divided. Three pairs of jointed legs. The eighth abdominal segment with a small dark patch above between the spiracles. Anal plate dark, large, somewhat concave above. Anal segment with a pair of ventral fleshy processes, which assist in locomotion. Spiracles rounded, dark-rimmed. Minute scattered hairs on head and body, especially posteriorly. The larva bores longitudinally inside the twigs, etc., the bored parts swelling to some extent and the position of the burrow being marked by a transparent resinous exudation.

Pupation takes place either within the larval burrow or in the soil. In the case of some grubs kept in the Insectary in a glass dish with about an inch of moist earth, when full-fed they left the stems and went down into the earth until they reached the bottom of the dish, where they formed rounded cocoons of earth with a smooth interior. From three grubs which went into the earth on 10th June 1908, one beetle emerged on 15th and two on 16th June.

Pusa Insectary (Cage-slip 712) and notes by C. S. Misra and T. Bainbrigge Fletcher.

129. Bruchus chinensis.

A cosmopolitan insect, it is found all over the world. Its habits have been studied in various parts of the globe, especially in America. In India however it has been noted only in stored produce and has been believed, so far as I am aware, not to attack crops in the field. The only Bruchid noted to be injurious to crops in fields in Madras was *Bruchus theobromæ* which was found attacking red gram (*Cajanus indicus* pods in the fields. It however did not breed in stored produce. In January-February 1915, while examining pulses for pests in the farm I first noticed that pods of green gram, horse gram and cowpea had been attacked by Bruchids. Large numbers of pods were collected and kept under observation. Specimens of *Bruchus chinensis* were reared out from the pods of the following crops: Horse gram (*Dolichos biflorus*, green gram (*Phaseolus mungo*), cowpea (*Vigna catjang*), red gram (*Cajanus indicus*), *Ph. aconitifolius*, cluster bean (*Cyamopsis psoraloides*).

Horse gram and green gram were found to be the main host plants, only small numbers being bred from the others.

The eggs were found laid on the exterior of pods—whether green or mature—the grubs bored their way through the capsules to the seeds. When full grown they pupated in the seeds. The beetles when ready to emerge bit circular holes out of the seed capsule and flew away.

The beetles thrive very well in the stored seeds and may very badly damage the produce unless measures are taken in time. The fact that the pest is ushered into the storeroom along with the produce from the field makes it clear that one must not expect to keep the produce free from pests even if it is stored in insect-proof bins directly from the field. It shows the absolute necessity of previous fumigation before storing the produce. The eggs were found attacked by small yellow Chalcid parasites.

Y. RAMACHANDRA RAO.

130. Early stages of Formicomus coeruleipennis.

The larvæ of of *Formicomus cœruleipennis* have been found at Pusa on several occasions underground in gram and sugarcane fields and under fallen, dry leaves of Nim (*Melia azadirachta*). Little is known of their habits, but they appear to be predaceous, as in one case a pupa of this beetle, left in the same cage as a grub, was partly eaten by the latter.

The full-grown larva is about 5 to 5½ mm. long and about 1 mm. broad, flattened, the sides almost parallel and only slightly converging posteriorly. The head is light yellow or yellowish-brown, the prothorax of about the some colour, the remaining segments creamy or dirty white. The anal segment tapers abruptly and is armed with a pair of short upturned brown-tipped processes. Hairs short and thin. Three pairs of well-developed functional thoracic legs. Locomotion is also assisted by the retractile process below the anal segment.

Pupation takes place in a thick-walled cell made of earth, the pupal period occupying about six days. There are apparently several broods in the year as full-grown grubs were found on 12th March 1916 (emerged 18th April), 16th April 1915 (emerged 1st May) and 12th August 1917 (emerged 20th August).

Pusa Insectary (Cage-slips 1205, 1374 and 1646).

131. Early stages of Gonocephalum elongatum.

Larvæ of *Gonocephalum* (*Opatrum*) *elongatum*, Fb., were found at Pusa in some numbers underground in gram and indigo fields between

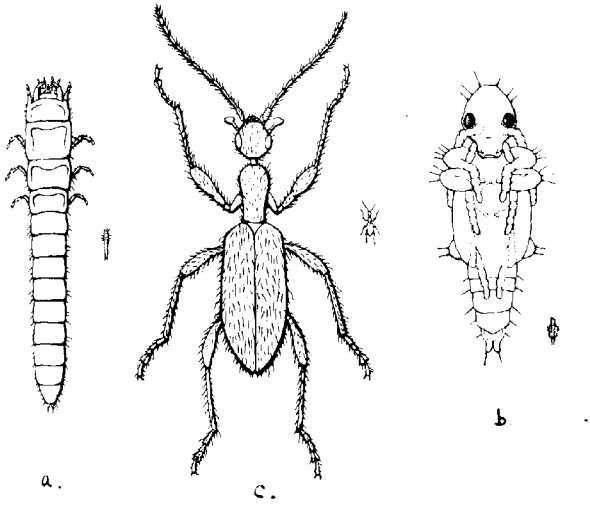


Fig. 16. *Formicomus cæruleipennis*.
a, Larva, natural size, and magnified (× 11).
b, Pupa. ,, ,, ,, ,,
c, Imago. ,, ,, ,, ,,

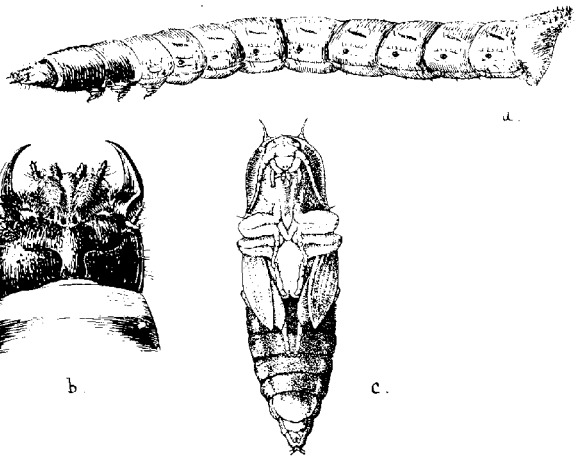


Fig. 17. *Agrypnus fuscipes.*
a. Larva, slightly magnified (× 1½).
b. Mouth parts of larva (× 4).
c. Pupa, slightly magnified (× 1½).

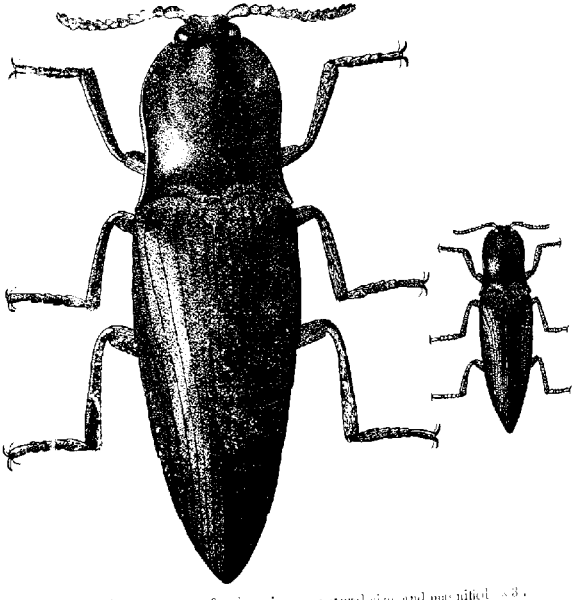


Fig. 18. *Agrypnus fuscipes*, imago, natural size and magnified (× 3).

7th April and 3rd May 1915. In captivity they were found to feed, both by day and by night, on gram roots and on both fresh and dried sweet potato leaves placed on the surface of the soil, under which the larvae hide, only emerging to feed. It seems probable that these larvae eat any living or dead vegetable matter found near or upon the surface of the soil, and that, in their capacity of rootfeeders, they may do some damage when present in large numbers.

The larva is about 24 mm. long and 3 mm. broad across the prothorax, cylindrical, tapering slightly posteriorly, pale yellow, the integument hard and chitinous; head flattened, dull red-brown; prothorax tinged with red-brown; anal segment tapering abruptly posteriorly, its posterior margin slightly upturned and provided with minute brown tubercles surmounted by brown hairs; anal segment beneath with a retractile spically-bifurcated process, which is used in locomotion when it resembles a pair of prolegs.

Pupation takes place underground within thick-walled earthern cells, the pupal period being about nine days in April.

The pupa is about 12 mm. long, elongated, flattened and incurved ventrally, with the wing-sheaths and legs folded on the ventral region, the first seven abdominal segments with a flattened flap-like lateral process; anal segment with a pair of pointed brown-tipped processes.

Pusa Insectary (Cage-slip 1199).

132. Early stages of Agrypnus fuscipes.

In *Indian Insect Life* (page 332, fig. 212) is given a figure, copied from Westwood's *Introduction to Entomology*, of a larva which is described as "possibly that of *Agrypnus fuscipes*." Since the publication of *Indian Insect Life*, the larva of *Agrypnus fuscipes* has been found and reared on several occasions at Pusa and it is evident that, whatever the original of Westwood's figure really was, it bears little resemblance either in general appearance or in details to the true larva of *A. fuscipes*; so that an amended figure and description of this insect is required.

The larva of *Agrypnus fuscipes* lives beneath the surface of the soil and is predaceous on cockchafer grubs as a rule under natural conditions. In confinement it feeds readily on caterpillars, such as *Prodenia litura*, *Utetheisa pulchella*, *Papilio demoleus*, *Bombyx mori*, etc., and lepidopterous pupae and even dead moths, such as *Agrotis ypsilon*, provided that the prey is available on the surface of the ground underneath which it is dragged for consumption, but cockchafer grubs

are much preferred as food. The adult beetle also feeds in confinement on caterpillars and pupæ.

This beetle has not as yet been reared from the egg and it is not known how long it remains in the larval stage under natural conditions, but in confinement a larva which was probably about half-grown in November 1914 did not attain the adult stage until May 1917, so that it seems probable that the normal life-cycle is two or three years, the time being perhaps dependent on abundance of available food. Larvæ may therefore be found throughout the year, but the adults appear to emerge about May-June and may live on until the next hot weather. Thus, two beetles were found at Pusa on 26th November 1915, attracted to a vessel containing palm-juice, and were kept in confinement to try and obtain eggs; one of these died on 27th January and the other on 5th February 1916. The Pusa collection contains a series of specimens taken at Pusa from May to November, four examples taken at Coimbatore from February to November and one specimen found at Samalkota on 13th May 1916.

A larva found on 7th January 1916 moulted on 30th March, prepared to pupate on 15th May, and emerged as an adult on 7th June 1916. A second larva found on 24th May 1915 was then about 60 mm. long and 8 mm. broad; it prepared to pupate on 10th June and pupated on 16th June and the adult emerged on 1st July 1915 and lived in confinement until 11th August 1915, being fed on caterpillars. A third larva, about three-fourths grown, found in the beginning of September 1915, became adult on 1st May 1916. The fourth larva, referred to above, was found at Pusa on 21st November 1914, hiding under some dry earth attached to an exposed mango root. It moulted on 25th April and on 1st May 1915 was about 46 mm. long. On 14th May 1915 it moulted, and was then about 60 mm. long. By 28th June 1915 it was 62·5 mm. long and 6·25 mm. broad, and on 28th July 1915 it moulted again. The next moult observed occurred on 11th July 1916, when the larva was about 62·5 mm. long; it had not increased in size during this year, probably due to starvation. On 20th September 1916 another moult occurred. On 21st February 1917 it was about 75 mm. long. On 21st April 1917 it cleared a space at the bottom of the cage and prepared to pupate, pupated on 1st May and emerged as an adult on 20th May 1917, after a period of over two and a half years in the larval stage.

The general appearance of the larva is shown in the figure. It is broad, flattened, and shining yellow-brown; the head, prothorax and

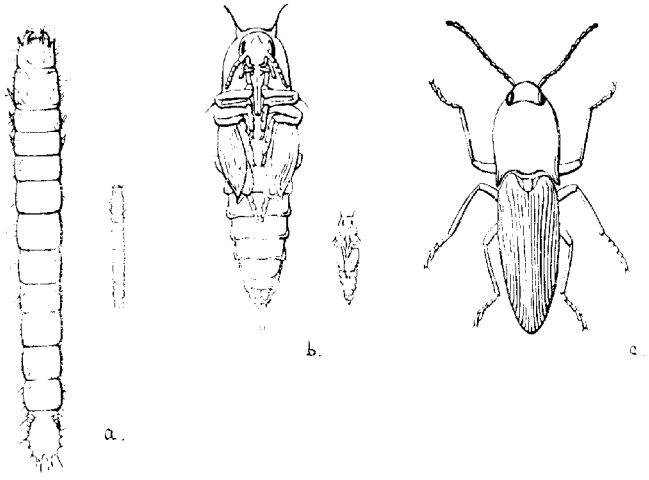


Fig. 19. *Heterodactyles lewis.*
a. Larva, natural size, and magnified ×3.
b. Pupa. „ „ „ „
c. Imago. „ „ „ „

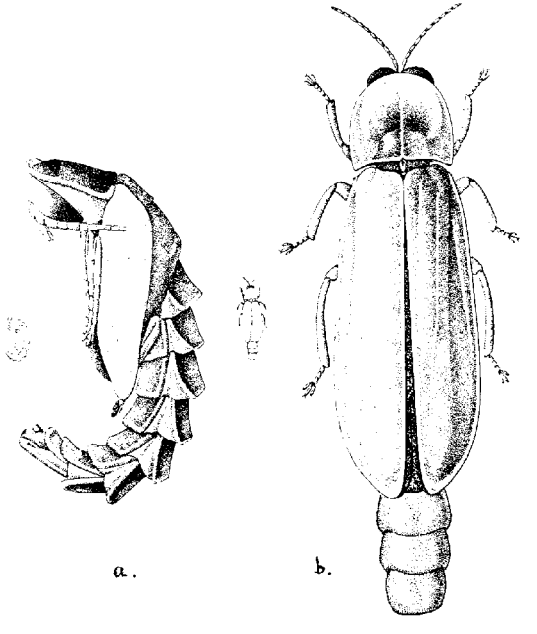


Fig. 20. *Lampyris noctiluca.*
a. Pupa, natural size, and magnified.
b. Insect. „ „ „

anal segment shiny dark brown and the mesothorax and metathorax shiny red-brown.

Pusa Insectary Cage-slips 1245, 1335, 1382, 1400 and 1565.

133. Early stages of Heteroderes lenis.

Larvæ of *Heteroderes lenis*, Cand., have been found at Pusa on several occasions underground in gram and indigo fields and beneath trees. They seem to be predaceous and have been found to eat Scarabæid grubs in confinement. The following dates show the times of emergence :—

Larvæ found	Pupated	Adult emerged
26th February 1914	27th April 1914	3rd May 1914
5th May 1915	11th May 1915	20th May 1915
7th May 1915	25th June 1915	2nd July 1915
26th May 1915	5th July 1915	23rd July 1915

The length of the life-cycle is not known.

The full-grown larva is about 20 mm. long and 2 to 3 mm. broad, flattened, parallel-sided, shiny yellow-brown, lateral regions of body with rather long brown hairs; head flattened, dark red-brown; prothorax red-brown; a yellow space between head and prothorax; mesothorax and metathorax yellow with a brown tinge above; anal segment dark red-brown, flat, concave above, furnished with small black teeth laterally, posterior margin indented medially and produced at either angle into a broad tooth with bifid apex.

The pupa is 12 to 13 mm. long and 3 mm. broad, flattened, and of the usual Elaterid shape, creamy yellow; prothorax with a long spine on anterior and posterior angles.

Pusa Insectary Cage-slips 1047, 1225 and 1260.

134. Early stages of Lampyris marginella.

Two larvæ of *Lampyris marginella*, Hope, were found at Pusa on 19th August 1916 at a depth of about three inches underground. One of these pupated on 18th November and the other on 24th November, and the adult beetles emerged on 7th and 15th December 1916 respectively.

The larva is flattened, about 15 mm. long and 2·25 mm. across the metathorax from which the body tapers in both directions. Antennæ creamy-white. Head black, much smaller than prothorax, into which it is retractile. Segments of body distinct and each partly overlapping the following segment. The dorsal region in each segment resembles a dull black plate divided medially by a yellowish dorsal line running the whole length of the body. The intersegmental soft parts and the lateral and ventral portions of the segments are yellowish in colour. The anal segment with a retractile process which has at its tip a number of retractile rod-like creamy-white processes. There are three pairs of brown thoracic legs and the retractile anal process also helps in locomotion.

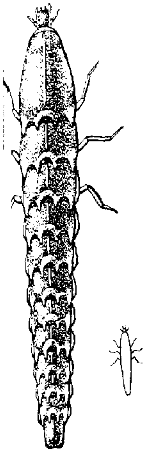
Pupation takes place on the surface of the soil, no special pupal cell being formed. The pupa is flattened, with its abdomen bent ventrally, in colour yellow, the wing-lobes, legs and antennæ free and creamy-white or very pale yellow. The posterior margins of the abdominal segments strongly produced, both dorsally and ventrally, to form small, pale yellow wing-like protuberances.

Pusa Insectary (Cage-slip 1501).

135. Larva of Luciola gorhami.

Luciola gorhami, Rits., is one of the common glow-worms at Pusa. Its larva has been found on several occasions between May and August on the surface of the soil, usually under fallen and rotting leaves. It is very active and seems to shun light. In captivity it has been found to feed on dead Lepismids, but seems to eat little and refused to touch living food. An adult beetle was reared on 10th September 1915 from larvæ collected on 5th August.

The larva is about 20 mm. long and 4 mm. broad across the hinder part of prothorax, whence the body tapers slightly posteriorly and more rapidly anteriorly, flattened, dirty yellow; head flattened, longer than broad, much smaller than prothorax beneath which it is retractile, armed with moderate-sized falcate mandibles; prothorax much elongated, anterior portion narrowed, rounded anteriorly and brownish-yellow; dorsal areas of all thoracic and abdominal segments black and chitinized and (except anal segment) with four stout spines on posterior margin, one pair subdorsal and the other at posterior angles; first to eighth abdominal segments with an additional lateral spine and a lateral fleshy protuberance surmounted by a hair; anal segment black above, with two bunches of small, yellow, cylindrical, retractile, rod-like processes which



[illegible] *L[illegible]a gorhami.* Larva magnified.
[illegible] outline figure shows [illegible]al size.

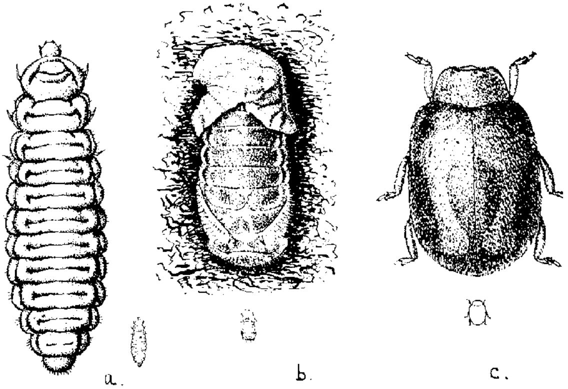


Fig. 22. *Synonycha coeardi.*
a, Larva, natural size, and magnified (× 7).
b, Pupa, " " " " "
c, Imago, " " " " [illegible]

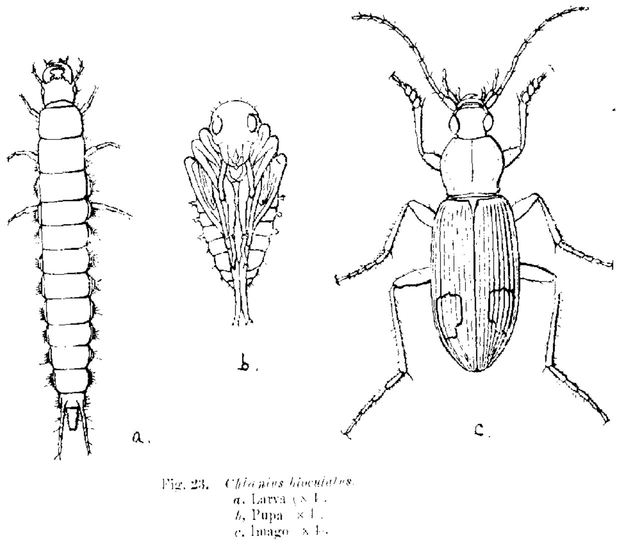


Fig. 23. *Chlaenius bioculatus.*
a, Larva (× 4).
b, Pupa (× 4).
c, Imago (× 4).

assist in locomotion ; outer posterior angles of dorsal areas of metathorax and sixth abdominal segment yellow; lateral and ventral areas dirty yellow with chitinized black spots on ventral surface, these spots bearing hairs; thoracic legs well-developed, yellow.

Pupation takes place within an oval cell formed of agglutinated earth.

Pusa Insectary (Cage-slip 1281).

136. The "Khapra" Grain-beetle in Northern India.

There has been considerable confusion regarding the identity of the Dermestid beetle which is found as a major pest of stored wheat in Northern India. In 1888 specimens were sent to England and were identified as "apparently belonging to a species of *Trogoderma* not previously represented in the British Museum Collection" (*Ind. Mus. Notes*, I, i, p. 61, where this insect is referred to as "*Kapra*"). Apparently the same insect was subsequently referred to in *Indian Insect Pests*, pp. 252-253, under the name *Ethriostoma undulata*, Mots. As noted in Entomological Note No. 37, Mr. Arrow subsequently showed that *Ethriostoma* is a synonym of *Attagenus*, and it was therefore presumed that the Indian grain-pest should be known as *Attagenus undulatus*; in the same note I recorded specimens of *Trogoderma versicolor*, Creutz., from Lyallpur (in stored wheat) on the strength of specimens sent from Pusa and so identified, though with some doubt, by Mr. Arrow.

Mr. Arrow has now examined a large series found in cargoes of wheat imported into England from Karachi and Bombay, and has concluded that the common Indian grain-infesting Dermestid belongs to a hitherto unnamed species, which he has now described as *Trogoderma khapra* in *Ann. Mag. Nat. Hist.*, (8) XIX, 481-482 (June 1917). All references to *Attagenus undulatus* in Messrs. Barnes' and Grove's Memoir (*Dept. Agric. India, Chemical Series*, IV, No. 6 should be corrected to read *Trogoderma khapra*, Arrow, and the record of *T. versicolor* (Entl. Note 37, *b*) should also refer to the same species.

137. Early stages of Sumnius renardi.

Larvæ of *Sumnius renardi* have been observed at Pusa on several occasions preying on *Monophlebus stebbingi octoannulata*, and this is the unnamed Coccinellid beetle referred to in *Entom. Mem.*, II, 7, and figured in *Indian Insect Life*, t. 84, ff, 7-9, where it is referred to (p. 308) under the name of *Aulis restita*, Muls. On 15th March 1916 larvæ were found at Pusa on the trunk of a mango tree infested by

Monophlebus and were reared in the Insectary. The *Sumnius* larva grips a *Monophlebus* nymph with its legs, applies its mouth-parts to any convenient portion of the ventral surface of its prey, gnawing through the skin and feeding on the yellow fluid body-contents; the body of the larva is doubled over onto the back of its victim and, if the latter is large, the larva may be carried about in this posture, feeding all the while. The larvæ pupated on 12th and 15th April and the adult beetles emerged on 21st and 23rd April 1916.

The larva is about 10 mm. long and about 3 mm. broad across the middle of the body, flattened, tapering towards either extremity, segments clearly defined; each body-segment divided into two subsegments and formed into a rounded fold laterally, below these folds with a narrow deep furrow running along the whole length of body, and followed by corresponding folds along the ventral region; colour uniform light brown, rather yellowish ventrally; head small.

Pupation takes place in the usually Coccinellid manner, the larva fixing itself anally to any convenient surface, head downwards, the cast larval skin enveloping the posterior extremity of pupa.

Pusa Insectary (Cage-slip 1356).

138. Early stages of Brumus suturalis.

The early stages of *Brumus suturalis*, Fb., are referred to in *Indian Insect Life*, p. 308. It has been reared at Pusa in July 1908 from larvæ found feeding on *Phenacoccus insolitus* on leaves of *Sida spinosa* and in February 1914 from a larva found in an egg-mass of *Pseudococcus* sp. on cotton. The larvæ are sluggish and, in the case of *Phenacoccus insolitus*, were found feeding on the male puparia by thrusting their heads through one end of the cocoon. The larva is parasitized by a small black Hymenopteron which emerges through holes in the body of the larva which dies before pupation; seven parasites have been reared from a single larva.

The full-grown larva is about 5 mm. long and 2·5 mm. broad across the abdomen, which is the stoutest part of the body, tapering thence anteriorly rather abruptly, dorsal region convex, segments distinct and usually contracted, grey covered with a fine white bloom, head very small, thoracic legs well developed.

Pupation takes place on a leaf amongst the larval prey, the pupa being attacked by its anal extremity. Pupa yellow, almost wholly enclosed within the larval skin which splits longitudinally and exposes only the dorsal region of the pupa. The pupal period in July is about

seven days, of which two days are occupied in hardening the integuments and developing the colours of the adult.

Pusa Insectary (Cage-slip 733).

139. Host of Merismoderus bensoni.

On 3rd September 1916 I found a specimen of the small Paussid beetle, *Merismoderus bensoni*, Westw., being dragged down a wall in my bungalow at Pusa by three workers of *Prenolepis longipes*. At first I took it to be some victim captured by the ants, but it was being carried away from the nest and, when taken from the ants, was quite lively and unhurt. As numerous nests of this ant in and around the bungalow had just been harried by spraying, etc., it is probable that the beetle was being carried off to safety in a new nest.

This beetle was first found by Benson in 1844 and 1845 in the United Provinces, under stones and bricks associated with a black ant. *Prenolepis longipes* nests in such situations and may have been the species referred to. G. R. Dutt has also recorded the finding of *M. bensoni* in a nest of *P. longipes* (*Dept. Agric. India, Entom. Mem.*, IV, 263), so that this ant would seem to be the definite host of this Paussid beetle.

140. Early stages of Chlaenius bioculatus.

Several larvæ of *Chlænius bioculatus*, Chaud., were found at Pusa in July 1914 on sann-hemp plants, feeding on caterpillars of *Utetheisa pulchella*. The larvæ live openly on the plants, walking briskly about and boldly seizing and devouring caterpillars much larger than themselves, their prey being usually caught by the ventral surface by passing the mandibles and head beneath it. Besides *Utetheisa pulchella*, various other caterpillars are eaten and in confinement these larvæ and the adult beetles fed freely on caterpillars of *Prodenia litura*, *Polytela gloriosæ*, *Diacrisia obliqua* and *Antigastra catalaunalis*, whilst the *Chlænius* larvæ will also at times attack and devour one another, but the pupæ of the moths were not touched. *Utetheisa* larvæ were preferred. On an average, each *Chlænius* larva destroyed five, and each *Chlænius* beetle, seven caterpillars every two days.

The full-grown larva is about 12 to 15 mm. long and about 2 to 3 mm. across the middle of the body, tapering towards either end especially posteriorly and flattened in shape. Head quite flat, brownish-yellow with a dark spot on each side near base of mandibles which are much

curved and falcate, their tips considerably overlapping when closed. Antennæ and oral appendages prominent. Thoracic legs well developed, black. Body uniform black, rather shiny. Lateral regions of abdominal segments rather protuberant. Anal segment above with a pair of slender processes about 1·5 mm. long and below with an anal process which assists locomotion.

The larva enters the soil for pupation, making a hole in the earth by cutting and throwing out small pellets of earth with the mandibles. A comparatively large heap of loose earth is thrown up, the mouth of the hole usually remaining open and seldom being closed up. In confinement, the larvæ were sometimes noticed to make similar holes in the soil before they were fully fed and to remain resting near the mouth of the hole, sometimes with their head and part of the thorax protruding; but they were not observed to catch their prey when in this posture, even when caterpillars were induced to walk over the hole. This habit, however, is of interest in comparison with the habit of Cicindelid larvæ.

The period between the entry of the larva into the soil for pupation and the emergence of the adult beetle is usually about seven days, but the actual pupal period is probably four or five days, as the adult rests for about two days inside the cell, after casting off the pupal skin, in order to harden and develop its colour. The life of the adult beetle in confinement was found to be between one and two months.

Pusa Insectary (Cage-slip 1081).

141. Early stages of Chlaenius circumdatus.

A larva of *Chlænius circumdatus*, Brullé, was found underground amongst sugarcane roots at Pusa on 15th August 1917. It pupated on 25th August and the adult beetle emerged on 29th August. It was found together with larvæ of *Mononeyla signata* and of another unidentified Chrysomelid beetle (C. S. 1640) and is predaceous on these larvæ. In confinement it also ate grubs of *Stictaspis ceratitina*.

The larva is about 14 mm. long and 3 mm. across the middle of the abdomen, tapering slightly in both directions from this point, flattened, with distinct segments. Head flat, with long red-brown antennæ and prominent curved jaws whose tips meet. Prothorax longer than other segments. All segments with large dorsal plates, in colour black with a bright yellowish reflection, the prothoracic plate covering the whole segment; plates laterally with short hairs. The sides and ventral region

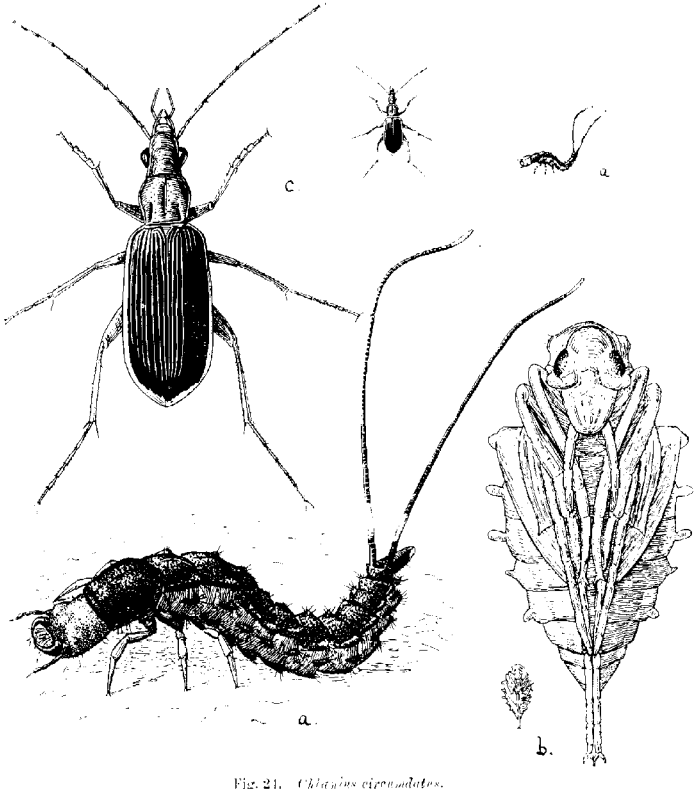


Fig. 21. *Chlaenius circumdatus*.
a, Larva, natural size, and magnified (× 7).
b, Pupa, ...
c, Image, ... (× 1).

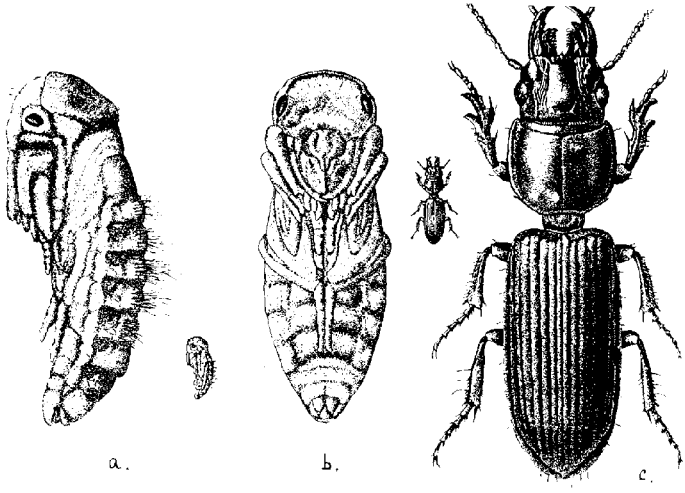


Fig. 25. *Scaritus indus.*
a, Pupa, lateral view, natural size, and magnified (× 5).
b, Pupa, ventral view (× 5).
c, Imago, natural size, and magnified (× 5).

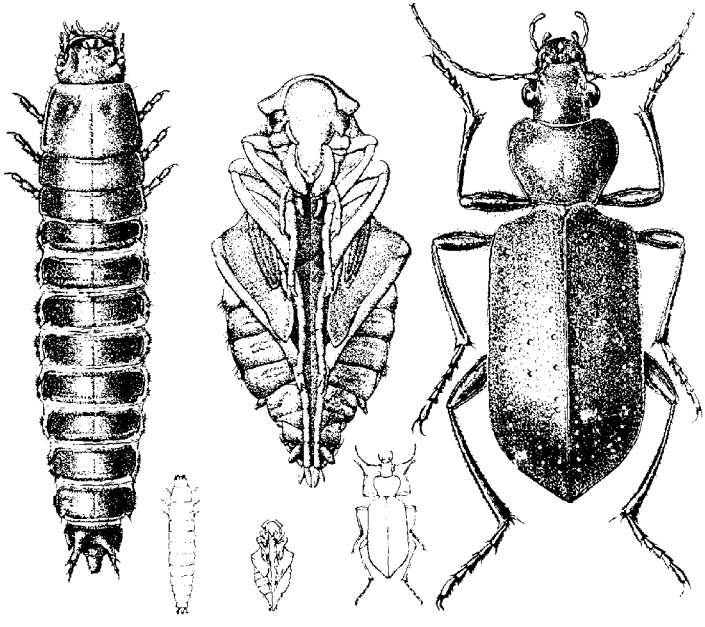


Fig. 26. *Calosoma latum.* Larva, pupa and adult beetle (× 1).
The small outline figures show the natural sizes.

of mesothorax and succeeding segments grey with slight lateral protuberances bearing small black plates from which arise short hairs. Ninth abdominal segment posteriorly with a black anal tube and dorsally with a pair of long (about 9 mm.) slender posteriorly-directed filamentous processes which are black with broad subbasal and apical pale-yellow rings. During locomotion the larva raises its hinder end in the air and, when at rest, the hinder end is raised similarly and the thoracic region is also humped upwards.

Pupation takes place on the surface of the soil without the formation of any special cell.

A second larva, found on 26th August 1917, pupated the next day, the adult beetle emerging on 1st September.

Pusa Insectary (Cage-slip 1665).

142. Chlaenius pictus.

A larva of *Chlænius pictus*, Chaud., was found in a parcel received from Cawnpore on 11th July 1915 and containing pieces of sugarcane in which cane-borer larvae were sent. It is probable that the *Chlænius* grub was predaceous on the borer larvae. It was much like the larva of *Chlænius bioculatus*, Chaud., with a yellow head, shining black back, yellowish-white ventral surface, three pairs of thoracic legs and a pair of slender, black posteriorly-directed processes on the anal segment. It pupated on 19th July and the adult beetle emerged on 22nd July. The beetle was found to eat cane-borer larvae.

Pusa Insectary (Cage-slip 1259).

143. Early stages of Scarites indus.

A Carabid grub, found walking on a road at Pusa on 28th August 1917, pupated on 2nd September and on 9th September emerged as an adult of *Scarites indus*. No detailed description of the larva was made, but it was very similar in appearance to the larva of *Calosoma indica*, but the anal cerci were provided with small joints and with brown hairs arising from these joints as well as from the tips of the cerci.

Pusa Insectary (Cage-slip 1679).

144. Calosoma indica predaceous on caterpillars.

In April 1916 larvae and adults of *Calosoma indica*, Hope, were found commonly at Peshawar in wheat and oat fields infested with

caterpillars of *Cirphis unipuncta*, being found in cracks in the soil or under clods and shooks. Both larvæ and adults were found to feed freely on the *Cirphis* caterpillars. Of the larvæ brought to Pusa one pupated on 9th May and attained the adult stage on 13th May.

In October 1917 many of the *Calosoma* grubs were found at Pusa in a field of *Phaseolus aconitifolius*, preying on caterpillars of *Plusia*, *Remigia* and *Thermesia*. The grubs were active and bold, running briskly about and freely attacking the caterpillars. Fifteen grubs, collected on 7th October, were placed in a cage and all went into the earth but, on searching the cage a week later, only one grub was found alive and it is evident that these larvæ are cannibalistic when confined in close quarters.

The full-grown larva is flattened, about 30 mm. long and about 6 mm. broad, all the segments covered dorsally with a shining black plate, the lateral and ventral areas greyish and membraneous with black plates. Three pairs of well-developed legs are present. Anal segment with an anal tube which helps in locomotion and dorsally with a pair of long single-branched spines, posterior margins of segments produced externally into short spinous processes.

The pupa is white and about 17 mm. long and about 7 mm. broad across the first abdominal segment, the head narrowed anteriorly and the abdomen tapering posteriorly. Head doubled onto ventral surface and body incurved ventrally. Appendages free. This Pusa example pupated on 19th October and the adult emerged on 25th October 1917.

Pusa Insectary (Cage-slips 1386, 1721).

145. Broscus punctatus predaceous on caterpillars.

In February 1914 adult beetles of *Broscus punctatus*, Klug, were found commonly at Pusa under the soil in gram fields infested with larvæ of *Agrotis ypsilon*. Six beetles were collected on 26th February 1914 and were kept under observation in the Insectary, and it was found that these beetles fed freely on larvæ of *Agrotis ypsilon*, *Prodenia litura*, *Pieris brassicæ* and *Chilo simplex*. Under natural conditions of living in the soil, the beetles hunt for the caterpillars of *Agrotis ypsilon* beneath the surface of the soil, chase them to the surface, and there attack and devour their prey, whose internal parts are preferred, the skin being rejected as a rule. Pupæ of *Agrotis ypsilon* were not touched. The number of caterpillars destroyed daily by each beetle is

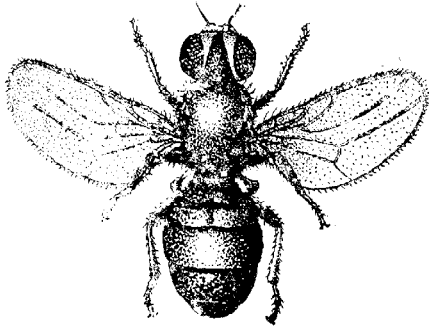


Fig. 27. *Siphunculina funicola*. × 20.

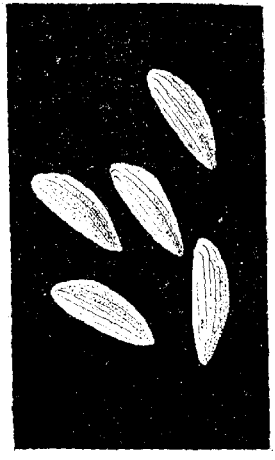


Fig. 28. Eggs of *Siphunculina funicola*. × 50.

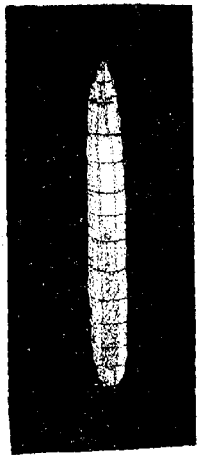


Fig. 29. Young maggot of *Siphunculina funicola*.

comparatively small, one large *Agrotis* or two *Prodenia* larvæ sufficing as a rule, but, on the other hand, the adult life of the beetle is a long one, extending over at least three months, from March to June, so that each individual beetle ends its life with a considerable total destruction of caterpillars to its credit. The early stages are as yet unknown.

Pusa Insectary (Cage-slip 1048).

146. The life-history and habits of "the Eye fly", Siphunculina funicola, De Meij.

Introduction. There are several insects living around us, with which we are very familiar but about many of which our knowledge is very limited. The insect under consideration here, *viz.*, the Eye fly, may be quoted as an example. As a source of annoyance we are as much familiar with the eye fly as we are with the house fly, mosquito or the bed bug. But very little is known or on record regarding the bionomics of this insect, except that at certain months in the year it is found a veritable nuisance to man. And it is only in very recent publications of entomology even a mention of it is made. It is expected, therefore, that the following notes, of course with many lacunæ still to be filled up, might add a little to our knowledge of this very familiar but little known insect.

*The insect.** This troublesome fly is a very small shining black creature resembling the house fly in general structure but much smaller in size than the latter, measuring only 1½ mm. in length (Fig. 27). It is shining black in colour, though on closer examination the eyes and the tarsi of the legs appear reddish brown. The two wings are transparent and iridescent. The insect enjoys a wide distribution all over India. It is also found in Ceylon and Java. It has been found both along the seacoast and in fairly high elevations such as Bangalore, Bellary, etc.

Except during the cold months from November to February this insect is found all through the year; but it is abundant during the

* *Siphonella-Micromacrum*-Becker.

Micromacrum funicola, de Meijere, 1905.

Siphonella funicola, de Meij., 1905.

References.—Lefroy—Indian Insect Life, p. 627.

Fletcher—Some South Indian Insects, p. 355.

Castellani and Chalmers Manual of Tropical Medicine, p. 700.

Green.—Mosquitos and Eye flies (*Spolia Zeylanica*, V. 18, 1908).

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summer months and especially so during the short intervals of warm weather after the South-West Monsoon sets in.

Habits of the insect. As the very name of the insect indicates, the fly has the habit of hovering about our faces and often settling at the corners of the eyes. Being a minute creature it often gets into one's eyes and this is frequently the case with children with unclean faces. It is felt as a veritable nuisance when one is engaged in duties demanding the close attention of the eyes such as reading, writing, etc. The insect appears to have a special liking for the lachrymal secretion and perspiration. It greedily feeds on blood as is often seen by its settling on razor wounds. The fly is also found commonly feeding on open sores, scratches and other wounds. In certain cases the eye fly appears a worse nuisance than the house fly. The latter very rarely troubles our eyes or settles on the face, except perhaps at times when one is asleep, and it is hardly ever found in such places as libraries, laboratories, etc., away from houses. The eye fly on the other hand follows the man to such places and interferes with his work considerably. This is very often felt on some of those still, warm days when there is no breeze. A peculiar habit of this insect and one which might help us in destroying it is its characteristic way of swarming in numbers on slender bits of ropes and strings such as those hanging from roofs, punkha-ropes, etc. The fly prefers old bits of fibre rope or cloth to fresh ones. Such aerial colonies are more commonly found under thatched roofs where numerous fibrous bits are found hanging. These swarms are always found away and protected from the winds. The fly has also been found settling in numbers in drying up *Nim* leaves kept under the roofs of houses. The fibrous bits hanging from sparrows' nests in the roofs of houses also offer a favourable place for these flies to congregate. Once what appeared a dark patch of paint on a rafter high up the roof of a house really happened to be a colony of eye flies—this appeared to be quite a departure from the ordinary habit of settling on ropes, etc. On another occasion I noticed the key of a mahogany microscope box kept in its hole being completely covered with a colony of eye flies. Even a small area of the box surface around the key hole was found occupied by numerous flies. Stray individuals are not uncommonly found hovering about window panes. The fly, as it hovers about, produces a low humming noise, which, though annoying, is not as pronounced as that of its nocturnal cousin—the mosquito.

Life-history. All attempts to discover the natural breeding haunts of the eye fly have so far been unsuccessful. Every kind of available rotting animal and vegetable matter was examined. Kitchen refuse,

Fig. 30. Maggot-like larval stage of *Siphonaulina funicola* (× 30.)

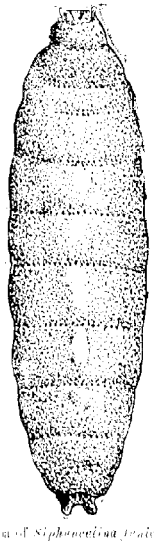

Fig. 31. Pupa of *Siphonaulina funicola* × 30.

refuse from the stables, silo pits and drains were all tried but without success. As the time of the appearance of the insect in numbers corresponds with the fruit season, rotting *nim* and mango fruits were also tried but without any favourable result. Quite accidentally a few eye flies emerged from earth brought in from the Insectary garden to be put into a breeding jar for quite a different purpose. Another time, the flies appeared in the jars in which *Oxya* (a grasshopper) eggs were kept in damp sand. In two cases, among a number of Drosophilids a few eye flies also came out from the rotting fibrous matter in coconut and palmyra trees.

However, it was possible to get an idea of the different stages of the insect and the time occupied by each, by following the development of the insect from eggs which were laid by flies in captivity. In June 1914, I got a number of eye flies clinging to a string and put them into a jar with fresh cow dung. The flies deposited eggs on this material within a short time and grew to maturity in this medium.

Egg. The cream white eggs were laid either singly (Fig. 28), or in groups in the cracks and grooves of the lump of cow dung and often just a little below the surface. Each egg is cigar-shaped and shows under the lens longitudinal striations. One pole of the egg is broader than the other which is more or less pointed. In three days the eggs hatch out into minute maggots.

The maggot. The fresh hatched maggot is a minute transparent white wriggling creature measuring a millimetre in length (Fig. 29). The head end is pointed. On the second day the mouth parts appear dark and the internal organs at the hinder regions show as reddish brown patches through the transparent body wall. The maggot feels the necessity for some moisture as is seen by its torpidity when the cow dung fluid gets evaporated and by its activity when a drop or two of liquid is added. The maggot grows in this medium and assumes its full grown condition in a week's time (Fig. 30). When about to pupate it leaves the liquid medium and approaches the drier portions of the cage such as dry dung or soil and there changes into the pupa.

The pupa. The puparium is reddish brown with the anterior end slightly flattened and with a pair of projections (Fig. 31). The spiracles are found as in the larva; the posterior end has another pair of spiracles. The pupation period occupies a week after which the adult fly emerges.

The following tabular statement might give an idea of the different developmental periods occupied by stages in the different rearings.

Date when eggs were laid	Date of hatching	Date of pupation	Date of emergence of fly	Number of days from egg to adult
8th June 1914	10th June 1914	17th June 1914	23rd June 1914	16
8th June 1914	10th June 1914	18th June 1914	26th June 1914	19
8th June 1914	10th June 1914	19th June 1914	25th June 1914	18
8th June 1914	10th June 1914	19th June 1914	26th June 1914	19
13th June 1914	16th June 1914	...	30th June 1914	18
13th June 1914	17th June 1914	25th June 1914	1st July 1914	18
13th June 1914	17th June 1914	26th June 1914	2nd July 1914	19
20th June 1914	...	29th June 1914	6th July 1914	17

From the above it is evident that the life-history of the eye fly from egg to imago, in captivity at any rate, occupies from sixteen to twenty days. With regard to the longevity of the adult fly under favourable conditions it might live for a week or more. Flies kept in cages fed on sugar have lived ten and twelve days.

Returning again to the breeding haunts of the insect it may be stated that other substances besides cow dung were also tried to get the flies deposit eggs on. Among others were bits of mango fruit, horse dung, rotting fibrous matter from trunks of palmyra tree, vegetable mould, soil from gutters near kitchens, etc. In none of these did the flies lay eggs in captivity.

Some insects of this family—Oscinidæ—are known to breed in plant tissue in different countries while a few are scavengers breeding on decaying vegetable tissue. One insect *Oscinis theæ*[1] is recorded as leaf miner on tea in India. Williston[2] speaks of the larvæ of *Siphunculina* having been bred from the plant *cirsium*.

From these facts it is quite possible that the natural breeding haunts of the eye fly may be some common plant or plants. Further investigations will have to show this to be so or not.

The eye fly as a criminal. There is a good deal of circumstantial evidence to bring the eye fly under the category of disease-carrying insects.

[1] See *Indian Museum Notes.*

[2] See his *North American Diptera*, p. 310.

It is a common sight during the months when the fly is very prevalent to find a number of people suffering from eye complaints. This is especially so in children. The disease "sore eye", very common during the summer months, has been found to spread freely among school children and the eye fly is found visiting such eyes. The cause of eye complaints is often attributed to eating too many mangoes. But it has not yet definitely been proved how far the eye fly plays the part of a carrier of the disease germ. Flies similar to our eye fly, according to various authorities, [1] are said to cause some eye disease in the southern states of America. The eye fly is suspected by Castellani [2] to be a carrier of the Koch-Weeks bacillus which is the cause of severe conjunctivitis. Further investigations in this direction by medical entomologists might reveal the true position of the eye fly as an offender.

Control measures. As in the case of the house flies, mosquitos, etc., the most effective and radical control measure consists in tackling the breeding haunts of this insect, and so long as these remain a mystery we have to content ourselves by resorting to other methods for the present. As stated above, the habit of the insect of congregating in swarms on ropes, etc., in many cases helps us in destroying these colonies easily; with the help of a wide-mouthed jar or a killing bottle, several colonies can be trapped and destroyed. Such swarms can also be burnt with a torch. This is more successfully done early in the morning or late in the evening. Household sanitation and personal cleanliness also keep away this pest to a great extent. According to Castellani the eye fly objects to substances like Odol. Eucalyptus oil rubbed on the coat collar is said to keep away the fly from hovering about our face.

Until our knowledge of the habits and life-history of this insect is considerably advanced we shall have to rely upon such temporary measures of relief.

It may be added in conclusion that there are still several important facts regarding this insect which are quite unknown and which require investigation. Among these are the following:—

(i) The number of broods passed by the eye fly in the year.
(ii) Whether the fly has a resting or hibernating period and if so in what stage, adult or pupa.
(iii) Number of eggs laid by one fly.
(iv) The nocturnal enemies, if any, of this insect.
(v) The natural breeding haunts.

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[1] *See* Kellogg, p. 350. Deane.
[2] *Manual of Tropical Medicine*, p. 700.

(vi) Chemotropic characters of the fly. Experiments with different kinds of chemicals, such as essential oils, etc., to attract the fly.

T. V. RAMAKRISHNA AYYAR.

147 A Fruit-fly in Plantains.

Mr. K. D. Shroff, Entomological Assistant in Burma, has sent us some specimens of *Chætodacus diversus* reared from plantain fruits at Mandalay, and writes as follows :—

"The fruits, in which I found the maggots of this fly, were quite sound from outside and not injured by any animals. Before I came across this pest, I had [? heard] several times that the plantains were also attacked by maggots. I found the pest in a variety locally known as "yakaing nga-pyaw." It is an inferior variety of plantain. In the whole bunch only five or six fruits were found infested. Better varieties of plantain are also said to be attacked, but the pest does not appear to have spread to any appreciable extent like mango and peach flies. If the attacked fruits are peeled, small dark grey spots are found on the pulp, which indicate the presence of maggots working inside the pulp".

This is, I think, the first record of the occurrence of a Fruit-fly in plantains within our limits.

T. BAINBRIGGE FLETCHER.

148. A Fruit-fly attacking Bamboos.

At Pusa in July and August a fairly high proportion of young bamboo shoots is found to be dead and drying up and, on examination, the majority of these dead shoots are found to contain a large number of pinkish-grey maggots of *Stictaspis ceratitina*, which consume the whole interior of the shoot, only the sheaths being left. So far as has been observed, the death of the shoots is due to the attack of these maggots. Attempts were made, by confining adult flies over the growing shoots, to infect them artificially, but no positive infection could be obtained; it is possible that these negative results were due to the fact that the adult flies used for these experiments were all freshly emerged.

Stictaspis striata has also been bred from bamboo at Peradeniya by Green, and it seems probable that the species of this genus are more injurious to young bamboo growth than has been suspected hitherto.

T. BAINBRIGGE FLETCHER.

149. Myiopardalis pardalina.

This Fruit-fly, well-known as a pest of melons in North-Western India, was reared in large numbers from fruit of *Cucumis trigonus* at Pusa in August and September 1915. This is, I think, the first record of its natural occurrence south of the Punjab.

T. BAINBRIGGE FLETCHER.

150. Anoplomus flexuosus.

A single specimen of *Anoplomus flexuosus*, Bezzi (*Mem. Ind. Mus.*, III, 100-102, t. 8, f. 12) was taken, in company with various other flies, on ripe mulberry fruit at Jeolikote, Kumaon, on 10th May 1915.

T. BAINBRIGGE FLETCHER.

151. Early stages of Clitellaria heminopla.

The larvæ of this Stratiomyiid were found at Coimbatore in March 1914, along with grubs of a Monommid, attacking the decaying tissues of the thick bark of the stem of *Moringa pterygosperma* which had been cut down some time back. The maggots, which were of a grey brown colour, were somewhat flattened probably in adaptation to a life under bark. The body tapered to a point anteriorly and terminated in a blunt end posteriorly. The head is lance-head-like and horny and the segments of the body are very clearly marked. When full grown the larvæ choose a safe locality, wherein to pass the pupal stage. The pupa is formed inside the hardened skin of the larva and emerges as a brownish black fly with a faint greyish pubescence parts of the body. The fly has an extraordinary resemblance to some of the smaller bees.

Y. RAMACHANDRA RAO.

152. The Gingelly Gall-fly.

The insect figured under the above name in *Some South Indian Insects*, page 364, figures 224 and 225, has now been named *Asphondylia sesami*, n. sp., by Dr. E. P. Felt, whose description has recently appeared in the "Canadian Entomologist," Vol. XLVIII, pages 31-33 (January 1916).

153. The Cotton-bud Cecidomyiad.

The Cecidomyiad fly figured in *Some South Indian Insects*, pages 363-364, figure 223, as a species of *Contarinia*, has been named *Dasyneura gossypii*, n. sp., by Dr. E. P. Felt, whose description has recently appeared in the "Canadian Entomologist," Vol. XLVIII, pages 29-30 (January 1916).

154. New Indian Gall Midges.

In an endeavour to discover plants in which *Pachydiplosis oryzæ*, Wood-Mason, might breed in the absence of paddy (rice), various grasses bearing deformations similar to those produced by the above named midge were found on three different grasses by Mr. Y. Ramachandra Rao, and a number of flies bred out and submitted for study through Mr. T. V. Ramakrishna, Acting Government Entomologist of the Agricultural College and Research Institute. Several new species obtained are described below, and it is worthy of note that *Orseolia cynodontis*, Kieff. & Mass., was reared not only from *Cynodon dactylon* but is also recorded as issuing in association with *Pseudhormomyia fusicalis* and *Lasioptera fruitans* both characterized below. In addition, females of another species were obtained, and it is probable that further rearings would result in the securing of other gall midges.

Lasioptera fruitans, Felt.

The specimens were received from T. V. Ramakrishna, Acting Government Entomologist, Coimbatore, India, under date of August 4, 1916, accompanied by the statement that they were reared from galls in *Panicum fruitans* along with *Pseudhormomyia fusicalis* described below. The specimens were labelled 3, XII, '15, South India, Coimbatore, from *Panicum fruitans*, Y. R. Rao coll.

Length 1·5 mm. Antennæ extending to the base of the abdomen, sparsely haired, dark brown; 18 segments, the fifth with a length equal to its diameter, the terminal segment narrowly to broadly oval; face with a conspicuous patch of white scales. Palpi yellowish, the first segment irregularly subquadrate, the second with a length nearly twice its diameter, the third a little longer than the second, more slender, and the fourth a little longer and more slender than the third. Mesonotum a shining dark brown. Scutellum dark reddish brown apically, yellowish basally, postscutellum dark brown. Abdomen almost black, with lunate submedian silvery spots on segments 1 to 5, the apex of the terminal segment yellowish. Wings hyaline, costa dark brown, the third vein

uniting with the yellowish costal spot at the distal third; halteres mostly pale yellowish orange; coxæ and femora basally yellowish orange, the distal portion of the femora, tibiæ and tarsi a nearly uniform dark brown. Ovipositor nearly as long as the abdomen, a thick group of moderately stout, hooked spines at the base of the slender, sparsely setose, tapering lobes, the latter with a length nearly three times the width.

Length 1·5 mm. Antennæ dark brown, sparsely haired, extending to the base of the abdomen, the fifth with a length one-fourth greater than its diameter, the terminal segment narrowly oval. Palpi: first segment subquadrate, the second with a length twice its diameter, broader, the third a little longer and more slender and the fourth a little longer and more slender than the third. Colorational characters wanting; claws moderately stout, strongly curved, unidentate, the pulvilli as long as the claws. Genitalia: basal clasp segment rather short, stout; terminal clasp segment long, swollen basally, subacute apically; dorsal plate short, broad, deeply and triangularly emarginate, the lobes narrowly rounded distally; ventral plate long and tapering to the narrowly rounded apex; harpes long, stout, tapering apically, with an irregular quadrate tooth; style long, slender, narrowly rounded distally.
Type Cecid. a2779.

Pseudhormomyia fluviatis, Felt.

The midge described below is provisionally referred to this genus and was received from Mr. T. V. Ramakrishna, Acting Government Entomologist, Coimbatore, India, under date of August 4, 1916. The species is stated by him to be very abundant locally, breeding on *Panicum fluitans*, a common grass in wet land areas, galls being found both in the terminal and the side shoots. The specimens were labelled No. 1, 29, VII, 1916, South India, Coimbatore, from *Panicum fluitans*, Y. R. Rao coll.

Length 3 mm. Antennæ one-half longer than the body, rather thickly haired, yellowish brown; 14 segments, the fifth with the stems approximately equal, each with a length one-half greater than the diameter; the basal enlargement subglobose, the distal pyriform and with a constriction near the middle, each enlargement with a whorl of long, stout setæ, the basal with one and the distal with two circumfili, the loops, moderately long and thick; terminal segment with the basal portion of the stem produced with a length five times its diameter, the distal enlargement shaped like a truncate cone, the length one-half greater than its diameter and apically with an equally long moderately

stout, fulsiform appendage. Palpi: first segment subquadrate, the second narrowly oval, with a length nearly twice its diameter, the third twice the length of the second, slender. Mesonotum purplish brown, the submedian lines sparsely haired. Scutellum and postscutellum yellowish brown. Abdomen rather thickly haired, purplish brown, the genitalia yellowish. Wings hyaline, the third vein uniting with the margin well beyond the apex; halteres yellowish basally, yellowish brown apically; anterior coxæ dark brown, the mid and hind coxæ yellowish brown; legs a nearly uniform yellowish brown, the hind tarsal segments yellowish straw; claws moderately stout, strongly curved, simple, the pulvilli as long as the claws. Genitalia: basal clasp segment moderately stout and unusually long, the length being nearly three times the greater diameter and with an obtuse internal lobe near the basal half; terminal clasp segment stout, slightly curved and with a length about thrice its diameter; dorsal plate nearly divided, the lobes long and tapering to a narrowly rounded apex; ventral plate long, broad, constricted near the distal third and broadly rounded apically; style long, slender.

Length 3 mm. Antennæ nearly as long as the body, sparsely haired, light brown; 14 subcylindrical segments, the fifth with a stem one-fifth the length of the subcylindrical basal enlargement, which latter has a length five times its diameter, a distinct constriction near the basal third, whorls of long, stout setæ basally and subapically and short-looped, circumfili near the basal third and apically, the latter connected by a longitudinal filum; terminal segment reduced, tapering slightly distally, with a length about four times its diameter and apically a short, stout, subfusiform appendage. Palpi: first segment broadly oval, the second a little longer, more slender, and the third more than twice the length of the second and more slender. Mesonotum dark reddish brown, to dark brown, the submedian lines almost naked. Scutellum and postscutellum yellowish brown, the abdomen sparsely haired, reddish brown, the segments narrowly margined posteriorly with yellowish brown, the eighth and ninth mostly yellowish brown. Wings hyaline; halteres mostly yellowish brown. Coxæ yellowish brown, the legs mostly a chestnut brown; claws more slender than in the male. Ovipositor short, stout, the lobes broad, with a length about twice the diameter and tapering slightly to a narrowly rounded apex. Other characters practically as in the opposite sex.

Exuviæ. Length 5·5 mm., mostly light yellowish brown; antennal horns long, narrowly conical; antennal cases extending to the base of the abdomen, the wing cases to the second abdominal segment and the leg

cases of the first, second and third pairs extending to the third, fourth and fifth abdominal segments respectively; the dorsum of each abdominal segment with a transverse, irregular row of stout, chitinous, unidentate spines, the anterior ones approximately half the size of the posterior series.

Type Cecid. a2777.

Pseudhormomyia cornea, Felt.

The midges provisionally referred to this genus were received from T. V. Ramakrishna, Acting Government Entomologist, Coimbatore, India, under date of August 4, 1916, accompanied by the statement that they breed in a grass, *Ischæmum ciliare*, the galls being formed mostly in the side shoots, and labelled No. 4, 2, VIII, '16, South India, Coimbatore, from *Ischæmum ciliare*, Y. R. Rao coll.

Length 2·5 mm. Antennæ nearly as long as the body, sparsely haired, light brown; 14 segments, the fifth having the stems each with a length one-half greater than the diameter, the basal enlargement subglobose, the distal strongly constricted and with a length over twice its diameter; whorls of moderately stout setæ occur upon both enlargements and on the distal two circumfili, the loops being moderately long, stout, and rather numerous. Palpi: first segment irregular, subquadrate, the second irregularly oval, the third more than twice the length of the second, more slender. Mesonotum reddish brown. Scutellum and postscutellum yellowish brown. Abdomen yellowish brown, the genitalia yellowish. Wings hyaline, the third vein uniting with the margin well beyond the apex; halteres yellowish. Legs mostly yellowish brown. Genitalia: basal clasp segment with a length two and one-half times its diameter and a distinct internal lobe near the basal half; terminal clasp segment stout, curved and with a length over twice its diameter; dorsal plate long, broad, deeply and triangularly emarginate, the lobes tapering mostly internally to a narrowly rounded, thickly setose apex; ventral plate long, broadly, thickly setose; posterior margin narrowly rounded; style stout, tapering to a narrowly rounded apex.

Length 3 mm. Antennæ nearly as long as the body, thickly haired, yellowish brown; 14 segments, the fifth with a stem one-third the length of the cylindrical basal enlargement, which latter has a length about four times its diameter; low circumfili occur at the basal third and apically; terminal segment with the basal part subcylindric and having a length four times its diameter; apically there is an irregular, fusiform appendage about half the length of the basal portion. Palpi:

first segment irregularly quadrate, the second as long as the first and the third twice the length of the second, slender. Mesonotum dark reddish, the submedian lines sparsely haired. Scutellum and postscutellum dark yellowish brown. Abdomen rather thickly haired, pale reddish, the terminal segments and ovipositor mostly yellowish; halteres mostly pale straw; coxæ and legs mostly dark straw; claws moderately slender, strongly curved, simple, the pulvilli as long as the claws. Ovipositor short, moderately stout, the lobes sparsely haired, narrowly oval and with a length two and one-half times the width.

Type Cecid. a2778.

(E. P. Felt; *Entl News*, XXVIII, pp. 73-76; Feb. 1917.)

155. Indian Gall Midges.

The writer has been privileged, through the courtesy of Mr. Ramakrishna Ayyar of South India, to study two small collections of gall midges reared or obtained from the vicinity of various grasses. In addition to data given in a preceding paper,* we would record the rearing of the rice or paddy gall midge, *Pachydiplosis oryzæ*, Wood-Mason, from *Panicum stagninum*, and the capture of adults, referable with very little question to this species, in light traps. The specimens taken in early October, 1916, were heavy with eggs. *Pseudharmomyia flavidula*, Felt, was reared, in addition to foodplants previously recorded, from *Panicum punctatum*, and both this species and the closely related *P. cornea* are here referred to *Dyodiplosis*, Rubs. Below we describe one new species and all the stages of a very interesting midge, the adults previously being unknown and tentatively referred to *Oligotrophus*, Latr.

Harmomyia ischæmi, Kieff.

1910 Kieffer, J. J., *Royal Botanic Gardens, Kew, Bull.* No. 3, p. 71, *Oligotrophus*.

Adults and specimens of the gall of this insect, provisionally referred to *Harmomyia*, were received from Mr. T. V. Ramakrishna, Coimbatore, S. India, under date of November 9, 1916, accompanied by a statement that the insects were reared from a gall on *Ischæmum pilosum* and were very likely identical with the species described from the larva and gall by Dr. Kieffer as *Oligotrophus ischæmi*, which latter is probable though not certain. The larva described by Dr. Kieffer, of this species, is evidently a young stage, since the large size of the midges preclude their developing from such a small full-grown larva.

* Ent. News, XXVIII, 73-76.

Gall. Length 11 to 18 cm., diameter 3 to 4 mm. This is a reddish, cylindrical tube pointed at the apex and sheathed at the base by scale-like leaves. The interior is hollow for practically its whole length and emergence is through a small hole near the tip (characters in part from L. A. Boodle, p. 70, *l.c.*).

Egg. Length 0·2 mm., ovate, cylindrical, whitish and apparently produced in great numbers, since several hundred were found in a vial containing a portion of a gall and one dilapidated female.

Larva. It is probable, as stated above, that the whitish larva described by Dr. Kieffer, *l.c.*, p. 71, is a very young stage or does not belong to this species. A free translation of Dr. Kieffer's description follows:

Larva white, length 2 mm., smooth, the spiny warts very fine and situated on the ventral part of the last two thoracic segments and all of the abdominal segments. The papillæ are all simple, save the eight terminal ones, which are provided with very short, scarcely distinct hairs; the pleural and sternal papillæ are equally large; the mesial pleural papillæ arranged in groups of three; the anterior, ventral and posterior papillæ small and hardly apparent. Antennal segment rounded, deeply emarginate in the middle, dorsally with spare granulations on the anterior portion, the posterior part nearly smooth; breastbone yellow, large, sessile, as long as large and with two triangular teeth which have a length twice the width of the base and are separated by a broadly rounded emargination.

Exarium ♂. Length 5 mm., moderately stout, yellowish transparent, the thoracic horns slender, slightly curved, nearly cylindrical and with a length about five times the diameter. Antennal cases probably extending to the base of the abdomen and with triangular basal processes with a length about three times the diameter of the base and thickened apically; the wing cases reaching to the tip of the second abdominal segment, and the leg cases to the fifth or sixth abdominal segments; the dorsum of the latter slightly chitinized and with an irregular series of three or four transverse rows of chitinous spines.

♂. Length 3·5 mm. Antennæ about as long as the body, thickly haired, yellowish brown; 14 segments, the fifth almost trinodose, the stems with a length 1¼ and 1½ times their diameters, respectively; basal enlargement subglobose, with a sparse subbasal whorl of stout setæ and a subapical circumfilum, the loops numerous, with a length about half the diameter of the enlargement and forming an almost double row, the latter being true of the middle and distal fili; terminal

segment somewhat produced, the basal portion of the stem with a length about twice its diameter, the distal enlargement subcylindric and with a length nearly three times its diameter, and apically a large, fusiform appendage, a rudimentary segment.

Palpi; first segment irregularly ovoid, the second a little longer and stouter, the third more than twice the length of the second and tapering uniformly from a somewhat swollen base. Eyes holoptic.

Mesonotum dark reddish brown. Scutellum concolorous, postscutellum dark reddish brown. Abdomen dark yellowish brown, somewhat variable, the genitalia yellowish; the terminal clasp segment fuscous apically.

Wings subhyaline, brownish, shorter than the body, the third vein, uniting with the margin well beyond the apex, the fifth vein joining the posterior margin at the distal fourth, its branch beyond the basal half; halteres yellowish basally, brownish yellow apically.

Coxæ reddish brown; legs mostly yellowish brown, the tarsi somewhat darker.

Genitalia; basal clasp segment short, broad, swollen basally; terminal clasp segment moderately long, nearly straight; dorsal plate short, broad, deeply and narrowly emarginate, the lobes narrowly rounded; ventral plate a little longer, broad, broadly rounded apically.

♀. Length 5 mm. Antennæ probably three-fourths the lengh of the body, sparsely haired, dark brown; 14 segments, the fifth with a stem one-fourth the length of the subcylindric basal enlargement, which latter has a length about four times its diameter and low, looped circumfili near the basal third and subapically.

Palpi; first segment irregular, the second a little longer, subquadrate, the third more than twice the length of the second, slender and nearly uniform in diameter.

Mesonotum dark brownish black, the submedian lines sparsely haired. Scutellum and postscutellum concolorous, the former with a few golden hairs apically. Abdomen shining dark brownish black, sparsely clothed with short hairs.

Wings slightly fuscous and only about two-thirds the length of the abdomen, the third vein uniting with the margin just beyond the apex of the wing, the fifth with the indistinct anterior branch joining the posterior margin at the distal fourth and the posterior branch beyond the basal half; halteres yellowish orange basally, fuscous subapically.

Coxæ and legs a nearly uniform dark brown; claws moderately stout, strongly curved subapically, simple; pulvilli nearly as long as the claws.

Ovipositor short, the lobes irregularly oval, with a length about one-half greater than the width and rather thickly setose

Type Cecid. a 2781.

Dyodiplosis andropogonis, Felt.

The species described below was received from Mr. T. V. Ramakrishna, Acting Government Entomologist, Agricultural College and Research Institute, Coimbatore, South India, under date of November 9, 1916, accompanied by a statement to the effect that the midges were reared from galls in a common perennial grass, *Andropogon annulatus*, at Adoni, Bellary District, September 23, 1916, and labelled Y. R. Rao coll. These insects are similar to, though quite distinct from, *Pseudharmomyia flurialis*, Felt, and *P. coracea*, Felt, both received earlier from the same correspondent. These last two species are congeneric with the one to be characterized and now referred to the genus *Dyodiplosis*.

♂. Length 2 mm. Antennæ one-half longer than the body, thickly haired, yellowish brown; 14 segments, the stems with a length one and one-fourth and two and one-half times their diameters, respectively, the distal enlargement with a length one and three-fourths greater than its diameter and only slightly constricted near the basal third as compared with *D. flurialis*. The circumfili are fine and moderately long; terminal segment produced, the basal portion of the stem with a length three times its diameter, the distal enlargement cylindric, with a length fully three times its diameter and apically a moderately stout, rather long, conical process.

Palpi; first segment short, irregular, with a length about one-half greater than its diameter, the second a little longer and broader, the third about as long as the two preceding, more slender.

Mesonotum purplish brown, the submedian lines and posterior median areas yellowish. Scutellum and postscutellum mostly pale yellowish. Abdomen sparsely haired, a variable dark brown basally, yellowish brown apically.

Wings hyaline; halteres yellowish basally, light brown apically.

Legs mostly a pale straw.

Genitalia; basal clasp segment moderately long, stout; terminal clasp segment distinctly swollen basally, tapering; dorsal plate deeply and triangularly emarginate, the divergent lobes narrowly rounded;

ventral plate long, broad, subtruncate apically, the posterior border slightly and roundly emarginate; style a little longer than the ventral plate.

♀. Length 3 mm. Antennæ nearly as long as the body, sparsely haired, dark reddish brown; 14 segments, the fifth with a stem one-third the length of the cylindric basal enlargement, which latter has a length about four times its diameter and sparse whorls of stout setæ subbasally and apically; terminal segment hardly produced, the enlargement with a length three and one-half times its diameter and apically a rather broad subconical process.

Abdomen sparsely haired, mostly dark reddish brown, the seventh segment and the lobes of the ovipositor yellowish brown; halteres yellowish basally, reddish brown apically; claws long, rather slender, strongly curved apically, the pulvilli a little shorter than the claws.

Ovipositor short, tapering, the lobes with a length over twice the width and tapering irregularly to a narrowly rounded, setose apex. Otherwise as in the male.

Type Cecid. a 2782.

(E. P. Felt; *Entoml. News*, XXVIII, pages 369-372; Oct. 1917.)

156. Notes on some South Indian Cecidomyiads causing galls in grasses.

Paddy is subject to a peculiar disease known in the Tamil tracts as "Anaikombu" (Elephant-tusk or "Thandeethu" (the bearing of earless stalks), in the Telugu districts as "Kodu" and "Koyyala Tegulu" (stick disease), as "Kané" in Canarese (S. Canara District), and in popular English as "silver-shoots." This malady is characterized by the formation in the young plant of a long hollow shoot, carrying, when fresh, a rudimentary leaf at the tip. This out-growth is formed at the expense of the normal development of the bud culminating in the formation of the ear-head, and is, therefore, a distinct source of loss to the ryot. Till about two years ago, the silver-shoot on paddy was a puzzle and was either ascribed to the action of fungi or bacteria, or attributed to that ultimate refuge of a scientist in despair—a constitutional disease. It was only in 1914 when good specimens were received from Pudukottah from one of the ex-students of the Agricultural College, Coimbatore, that the real nature of the disease became apparent.

The silver-shoot is in fact a gall caused by a gall-insect. A small reddish fly belonging to the Family Cecidomyiidæ—identified as

Pachydiplosis oryzæ by Dr. E. P. Felt of the New York State Museum, Albany—is the specific cause of the malformation. This fly lays elongate-oval reddish eggs measuring half a millimetre in length on the hairs of the ligules, or on the lower surface of the basal parts of leaves, and rarely, also, on their upper surface, especially in young tillers. The tiny young larvæ creep down between the leaf-sheaths till they reach the growing point of the apical of the side buds. On entering the interior of the buds, they seem to lacerate their tender tissues and feed on their nutritious juices. Whether by actual feeding or by continual irritation, an oval chamber is formed around the maggot in the tissues of the growing point. Further normal apical growth being stopped, all the nutrition is directed to the walls of this chamber, which elongates like a normal internode. By the time the out-growth begins to be visible, the maggot will generally have turned into a pupa and in about six days will be ready to emerge as a fly. When about to transform, the pupa, with the help of the dorsal spines of its abdominal segments, wriggles up the hollow tube, and, boring a hole at the tip with its frontal spines, partially projects out. The adult now emerges, and flies away, leaving the empty pupal skin at the tip of the hollow shoots. This disease is found in paddy generally only in the rainy season and is altogether rare in the dry season crop. As, even in places where paddy is not raised in the dry season, the fly re-appears on paddy with the advent of the rains, it is evident it cannot depend solely on paddy and must have an alternate foodplant, presumably some perennial wild grass, wherein it tides over the dry weather. With the object of finding out such host-plants a scrutinizing search was made among the various grasses in the wet land area of the Central Farm and was attended with rather remarkable results. Never was the paradox that "a man may keep his eyes wide open and yet not see" more truly illustrated. *Panicum flavum* is a very common grass in the wet land area at Coimbatore growing abundantly on the field *bunds* and along the banks of channels. Throughout the year except in February and March, a gall-midge breeds in this grass causing gall-formations in profusion. 20 to 30 galls sometimes having been found to occur on one single plant. Yet this common-grass did not draw my notice, till by chance one day I tumbled on it in the course of my search for the egg-masses of *Oxya velox*. Again, no grass is more familiarly known or more abundant than *Cynodon dactylon*—"Hariali." This is also attacked by a Cecidomyiad fly which affects the tips of shoots and causes the formation of a body of the shape of a miniature pine-apple. This object is in reality a collective gall from which later on 3 to 8 and sometimes 12 or more hollow shoots appear, each giving rise to a

fly. These conspicuous objects were not taken notice of and, if at all they were, they were believed to be caused by fungi.

These are instances of how one is apt to overlook very obvious things and one may well imagine Nature crying out in extreme pity—like Aunt Betsey Trotwood in "David Copperfield"—"Blind, Blind, Blind."

At Coimbatore, after very careful search, three grasses were, in the first instance, found to exhibit such formations. They were:—

(1) *Panicum flavitans.*
(2) *Cynodon dactylon.*
(3) *Ischæmum ciliare.*

Quite recently, in November 1916, these formations were noted also in the following three grasses at Coimbatore, *viz.*:—

(4) *Andropogon schœnanthus.*
(5) „ *pertusus.*
(6) *Aplvda varia.*

When galls were first noted on some of these grasses, in the excitement of the discovery, I had the temerity to congratulate myself on having found out the host-plants of the paddy gall-fly, but on comparing freshly-bred specimens of all these gall-flies side by side, I was forced to the conclusion that I had to do with several different species altogether, each confining itself to its own particular foodplant. Many of these gall-flies have been sent to Professor E. P. Felt for accurate determination.

Between July and October 1916, I had opportunities of visiting the Government farm at Palur, S. Arcot District, several places in the Bellary and Kurnool districts, and Samalkota and Anakapalle in the Northern Circars. As leisure and opportunities allowed, I continued my search for gall formations among the wild grasses in these various localities. The results were rather surprising. Instead of the formation of the "silver-shoot" on paddy being an isolated and extraordinay phenomenon, it became evident that it was one of common occurrence in many grasses.

The following grasses were noted to be subject to the attack of gall-flies. As the time needed for collecting them in sufficient quantities was not at my disposal, and breeding appliances were not at hand, the gall-midges could not be reared out in all cases. Again the degree of parasitization of the galls was so high that the chances of rearing the flies were considerably minimized. It would be very interesting if future worker in this line would try and breed out the flies from each grass and have their identity established.

EXPLANATION OF FIG. 32.

1. The picture on the left shows three galls in *Panicum fluitans*; the one on the right, two similar formations in *Apluda varia*. In the latter, the grey object dimly seen at the angle of the leaf axis on the shaded background at the top represents the empty pupal skin sticking out from the tip of the hollow gall.
2. Compound galls in various stages of formation in *Cynodon dactylon*.
3. Galls in *Andropogon pertusus*. They are not distinct in the photographs, but their positions are indicated by the cross-marks.
4. Shows a single shoot with the central gall in *Andropogon pertusus*. The pale object seen feebly projecting from the shoot on the shaded background is the pupal skin.

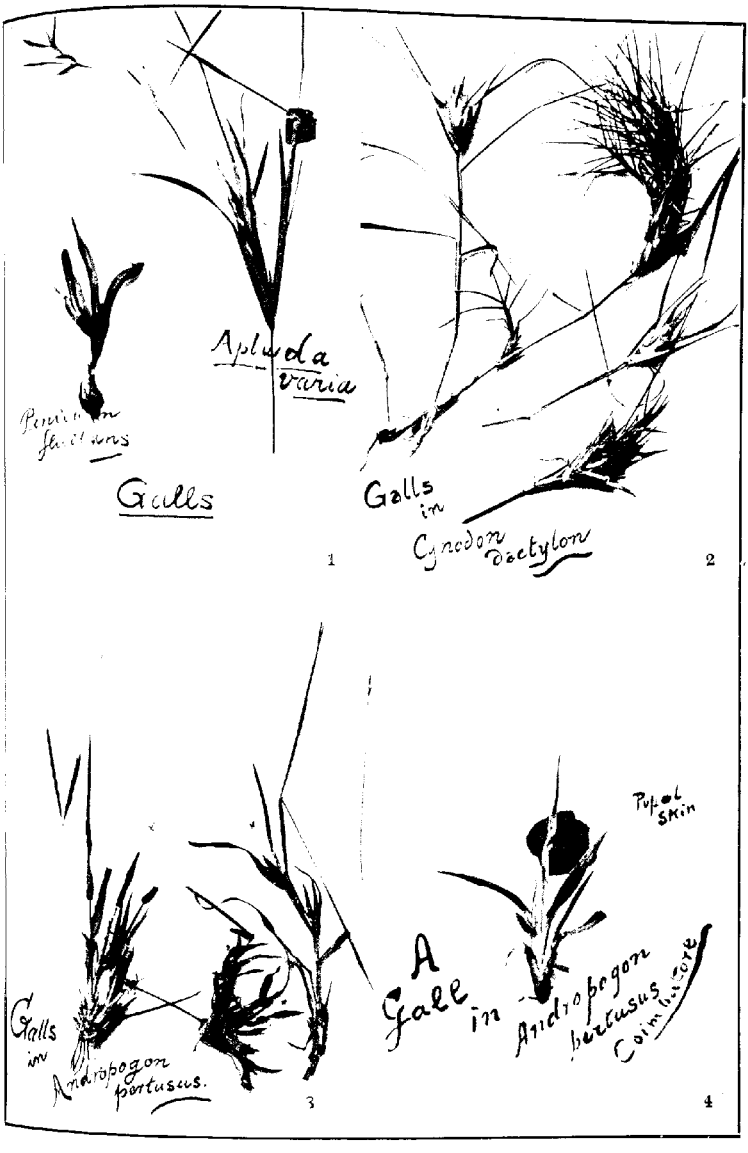


Fig. 32. Cecidomyiad galls in grasses.

1. *Panicum flaitans*, Retz. This grass is semi-aquatic and is found growing on field *bunds* in wet lands on the banks of canals, in the beds of streams and in shallow tanks. It has so far been noted by me only in Coimbatore and Bellary districts and in Bangalore. Galls have been found on this grass at Coimbatore and in the following places in the Bellary District, *viz.*, Hadagalli, Kottur, Sirugnppa and Yemmiganur. The flies reared at Coimbatore and in the Bellary District were identical.

The life-history of this fly* has been fully studied by me. The female scatters its 300 to 350 eggs singly along the pronounced grooves of the upper surface of the leaves. The eggs are elongate-oval, half a millimetre long, and slightly reddish in colour. They hatch in about three days into tiny active maggots, which crawl by instinct down the leaf and, insinuating themselves between the leaf-sheath and the stem, creep down until they reach the growing tips of either the apical or the side buds. Each bud is occupied only by a single maggot. The shoot begins to show a swelling in about a week or two and the typical hollow shoot emerges in two or three weeks. Though hatching at one time out of the same batch of eggs, the maggots that enter the apical buds complete their development more quickly at least a week earlier than those affecting the axillary ones; and invariably the apical galls are much larger in size than the axillary ones. The full-grown maggot is of pale brown colour and possesses a well-marked breast-plate, the anterior ends of which are prolonged into two pointed horns. The freshly formed pupa is milk-white, but later turns bright-pink. The adult emerges in six days. The female is pale brown and possesses a huge reddish abdomen bulged with eggs, while the male is somewhat darker and more slender in form. Most of the eggs are laid during the first night. The male flies seem to go for a drink, soon after emergence, while the females do not display any such thirst.

2. *Panicum paucifolium*. A grass very nearly allied to *P. flaitans* but more thoroughly aquatic. It was collected by me at Samalkota, Godavari District, and showed profuse gall-formations. The fly reared out was identical with *Dyadiplosis fluviatis* reared from *P. flaitans*. The flies reared from galls of *P. paucifolium* freely laid eggs on *P. flaitans* at Coimbatore. The maggots that hatched out indwed typical gall-formations in *P. flaitans* and flies emerged normally from them.

3. *Cynodon dactylon*. As already noted, a collective gall is formed in this grass, from which 2 to 12 hollow shoots may emerge. Such galls

*Through the courtesy of the Ag. Government Entomologist, Coimbatore, information has been received that this fly has been identified by Prof. Felt as *Dyadiplosis* (*Pseudhormomyia*) *fluviatis*.

were noted on this grass at Coimbatore, Palur (S. Arcot District), Samalkota (Godavari District), and Anakapalle (Vizagapatam District). The fly which has been identified as *Orseolia cynodontis*, Kief. and Mass., is smaller, comparatively more thick-set and darker than *Dyodiplosis fluvialis*. The life-history of this fly has also been studied by me. The eggs are elongate, reddish and about one-third of a millimetre long and are laid in batches of 3 to 20 along the under and rarely also on the upper surface of the top leaves of a shoot. The maggots hatch out in three days and, creeping between the leaf-sheaths, reach the rudiments of the apical and axillary buds of the shoot. Owing to the irritation caused by the maggots, several of the side-buds of the shoot begin to develop their galls simultaneously, so that the tip of the shoot bulges out gradually and assumes the pine-apple form. When mature, the hollow shoots appear at the tip and the flies emerge later on. The time taken by the fly to develop into the adult from the egg is about three to six weeks.

4. *Ischaemum ciliare.* This is also a common grass at Coimbatore in the wet lands. The galls found on this grass are smaller and shorter than those on *P. fluitans* and are developed usually from the axillary buds towards the base of the plant. Flies have been reared and are quite distinct; the wings being more distinctly smoky and the body much darker than in the other species of Coimbatore. It has been named by Felt as *Dyodiplosis (Pseudhormomyia) coraea*, n. sp.

Similar galls were also noted at Samalkota in an allied grass(?).

5. *Panicum stagninum*—an aquatic plant common at Samalkota and Coimbatore along canals, in shallow tanks and along water channels in the wet lands. At Samalkota, in October 1916, silver-shoots were noted in profusion on this grass. Large quantities of this grass were collected and taken to Coimbatore for rearing, but as the galls were heavily parasitized, only small numbers of flies could be reared out. These flies resembled *Pachydiplosis oryzæ* in almost all characters, and have been forwarded to Professor Felt for exact identification.[1] As sufficiently large numbers of flies could not be reared out actual breeding experiments to find whether flies from *P. stagninum* would breed on paddy could not be undertaken and their identity could not, therefore, be solved in a direct manner.

At Samalkota the eggs of this fly were found laid as in paddy, either on the hairs of the rudimentary ligules, or on the leaves or leaf-stalks in the neighbourhood of the ligular region. The silver-shoots were also

[1] The flies have been found identical with *Pachydiplosis oryzæ* from paddy by Prof. Felt.

similarly very long. Though abundant at Coimbatore, this grass has not shown any gall formations there.

6. *Paspalum scrobiculatum* (wild variety—known in Telugu as Neeti-Arika—is semi-aquatic and is found on *bunds* in paddy fields and along canal banks. At Samalkota, this grass exhibited long silver-shoots, but as the parasitization was severe flies could not be reared out. At Coimbatore and in the Bellary District this grass did not exhibit galls.

7. *Andropogon annulatus*. This grass is very common along roads in black soils in the Bellary District; being perennial, it forms fairly large clumps. On close examination a good many of the clumps showed, in September 1916, long and slender galls among the fresh shoots emerging from the root-stock. Four specimens of the flies[1] were reared from these galls. Similar formations were noted also at Samalkota on this grass.

8. *Andropogon schœnanthus*. At Pattikonda, Kurnool District, old but genuine galls were noted on side-shoots high up on the stems of this grass. In November 1916, numerous examples of gall-formations in this grass were noted at Coimbatore. It is usually found growing abundantly among prickly pear bushes and in open pasture ground. The galls may appear high up on the plant in the side-shoots or may emerge directly from the root-stock. Flies have been reared. The female fly is comparatively large in size and pale pinkish-brown in colour.

9. *Andropogon pertusus*. This grass is extremely common in the pasture grounds of the Central Farm, Coimbatore. On careful examination, small-sized galls were found in small numbers on these plants. The fly, which has been reared out, resembles the gall-fly on *Andropogon schœnanthus* in general appearance, but is smaller in size.

10. *Aplada varia*. This is a slender red-stemmed, tall-growing grass commonly found among prickly pear bushes and along the banks of water-courses and canals. Galls were first noted in this grass at Samalkota in October 1916, but flies could not be reared. In November, galls were found abundantly on this grass at Coimbatore. They are slender, elongate structures of violet-brown colour and generally covered with a whitish bloom. The tip is surmounted usually by an undeveloped leaf. In some cases flower buds in the ear-heads were found transformed into galls. The fly is slightly smaller, slenderer, and darker than the one reared from *A. schœnanthus*. These galls were also found at the foot of the Nilgiris at Kallar.

[1] The flies have been named by Prof. Felt as *Dyodiplosis andropogonis*.

11-13. *Iseilema* spp. A few galls were noted on *Iseilema anthephoroides* at Pattikonda, Kurnool District, in September 1916. Flies not reared. Old galls were noted at Samalkota on *Iseilema laxum*. At Palur, S. Arcot District, a few galls were found on a grass very like *Iseilema*, but which could not be identified on account of the inflorescence not having been found. Two flies were reared, of which one has been sent for identification.

14. *Ophiurus corymbosus*. A tall erect grass with brittle stems, growing in thick clumps in moist depressions at Pattikonda, Kurnool District. Galls were found in side shoots arising from the collar region and sometimes higher up the stem. Young shoots coming up from the underground stems were also infested and showed specially thick and stout formations. Flies were not reared.

15. *Oryza sativa* (wild paddy). This was found growing luxuriantly in depressions along the railway line at Samalkota. Silver-shoots were common, but flies could not be reared out owing to heavy parasitization.

16. *Ischæmum pilosum*. The road from Adoni to Sirugappa traverses a vast stretch of undulating black soil country. The fields of indifferent cultivators in these black soils are generally infested with "Kundara gaddi" (Telugu)—*Ischæmum pilosum*—a grass with a system of spreading under-ground stems—proving as bad a weed as "Hariali" (*Cynodon*) or Nutgrass (*Cyperus*). Here and there in the midst of large patches of this grass, stiff, stout shoots of bright pink colour 4 to 6 inches long, were noted in September 1916 standing out from the surface of the ground. They ended bluntly, and in most of them the empty pupal skin of a fly was borne at the tip, from which circumstance their true nature was easily recognized. These are in all probability the very galls described by Mr. L. A. Boodle in *Kew Bulletin* No. 3 of 1910 in an article on "Galls on an Indian Grass." The galls described therein were reported to have been collected by Mr. Talbot, a Forest Officer at Poona. From the material then available, *viz.*, the pupal skins and specimens of young larvæ, Professor Kieffer described the fly *as *Oligotrophus ischæmi*, n. sp. I am not aware if the adult flies have been reared and described. In September, 1916, while examining the galls, I had the rare luck of securing two freshly emerged female specimens and one of the male. Two more were also reared out from galls. The females are rather large, black flies with an immense abdomen and short piceous wings. The males are also black but much smaller. The females were, on account of their wings being short, unable to fly. Eggs

* Prof. Felt has identified it as *Hormomyia ischæmi*, Kief.

were readily laid in tubes and hatched in three days. This fly seems to breed only in the rains, and how it passes the long dry season in these arid plains is a mystery. Possibly the young larvæ remain quiescent in the nascent buds underground and develop when the latter shoot out after the rains.

The above grasses are the only ones in which I have noted these gall-formations, but I am sure the number will be doubled or even trebled if the subject be systematically taken up and worked out.

There are some general factors governing these gall flies even in the matter of parasitization. The parasites attacking the gall maggots may be divided into two distinct classes: (1) A group, the members of which parasitize the grown-up maggot or the pupa. The mother parasite seeks the gall and inserts its eggs inside with its ovipositor, the grubs that hatch out attack and feed on the maggot or the pupa which is usually previously paralysed by the mother wasp. Coming under this group are several parasites belonging to two or three families of the super-family Chalcidoidea. (2) A second group which parasitizes the eggs. The parasites coming under this group are Proctotrupids. The adult wasp hunts out the eggs of the Cecidomyiad and deposits one or more eggs into each egg. The egg thus parasitized hatches normally into a maggot which searches for and enters the terminal buds of shoots and therein feeds and grows.

In the case of one of the parasites, *Platygaster oryzæ*, several eggs seem to be deposited in a single Cecidomyiad egg, and when the gall maggot becomes full-grown the parasite larvæ 20 to 30 in number also grow up feeding on the internal tissues of the host. Ultimately the maggot is reduced to an empty bag, inside which the parasite larvæ spin tiny oval cocoons and pupate. *Platygaster oryzæ* is a black species common in galls on paddy, *Panicum*, etc., in most of the paddy areas. In the Bellary and Kurnool districts a yellow brown species of *Platygaster* was common in the galls of various grasses such as *Ischæmum*, *Ophiurus*, *Andropogon*, etc.

In the case of a third Proctotrupid only a single egg is apparently laid in each Cecidomyiad egg. The parasite larva kills the maggot when about half-grown, shoves off its excrement and the remnants of the internal tissues of the host into a corner of the hollow skin and pupates inside in a cocoon. This Proctotrupid is a black species about twice as large as *Platygaster*.

The above notes are mainly the result of stray observations made when opportunities occurred, and are confessedly imperfect in a good

many details, and I shall be amply repaid if this paper would induce workers to take interest in this obscure group and fill up the many lacunæ that are at present perceptible in our knowledge of galls on Indian grasses.

[Y Ramachandra Rao; *Journal and Proceedings, Asiatic Society of Bengal (New Series)*, Vol. XIII, No. 5, 1917.]

157. Early stages of Plecia fulvicollis.

About three hundred fly maggots were found at Pusa on 4th October 1915, congregated together on the earth at the base of a Gular tree (*Ficus glomerata*). They were moving slowly in a body and appeared like a moving lump of earth.

When placed on earth in the Insectary they burrowed in at once and the adult flies emerged on 13th-15th October and proved to be *Plecia fulvicollis*, Fb., which is described in Brunetti's "Fauna" volume on Diptera Nematocera (pp. 163-164, t. 12, ff. 12, 15). The appearance of the larvæ, pupæ and adult flies is shown in the figures. (Pusa Insectary.)

158. New Indian Mosquitos.

In the *Bulletin of Entomological Research*, Vol. VI, Part 4 (February 1916), Mr. F. W. Edwards has described two new mosquitos from India. They are:—

(1) *Ochlerotatus oreophilus* (p. 357), from Gharia in the Murree Hills. This is perhaps most nearly allied to *O. pulchricenter*, Giles, also from the Himalayan region.

(2) *Culex nilgiricus* (pp. 358-359, fig. of male genitalia), from Utakamand (Outacamund) in the Nilgiri Hills in December.

The occurrence of *Culex mimeticus*, Noé, at Utakamand is also noted in this paper.

159. Adisura atkinsoni.

Hampson's description. "Head, thorax, and forewing ochreous; the last with a greyish tinge, the costal and outer areas pinkish; the orbicular and reniform stigmata represented by indistinct dark patches; an indistinct postmedial series of specks. Abdomen and hindwing straw-yellow, the latter with the outer area more or less broadly and completely suffused with fuscous. Underside usually with the reniform prominently black."

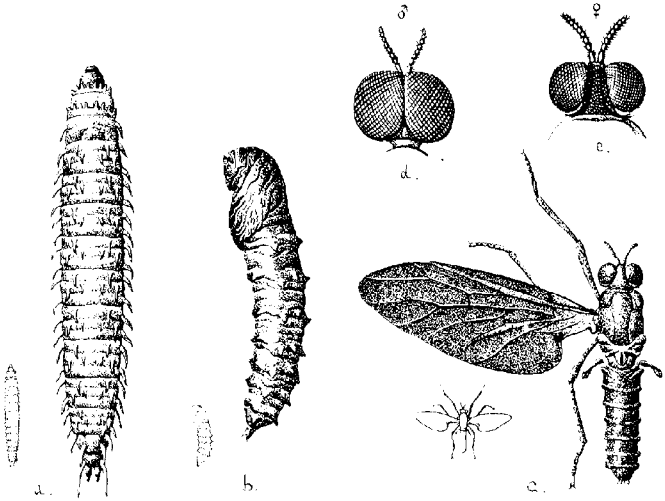


Fig. 33. *Plecia fulvicollis.*

a, Larva, natural size and magnified (× 4).
b, Pupa " " " "
c, Imago " " " "
d, Head of male imago (× 11).
e, Head of female imago (× 11).

According to Hampson, its distribution has been noted to be Sikkim, Nagas, Karachi, throughout Bombay and Madras Presidencies and Ceylon.

It has been noted as a pest of *Dolichos lablab* almost throughout the Madras Presidency. In addition to *lablab* it attacks red gram to a small extent.

Eggs. The beautiful opalescent white spherical eggs are laid singly either on the pods or on the flower buds. Each egg is about $\frac{1}{2}$ mm. in diameter and is attached by a slightly flattened base to the pod by a gummy secretion. At the distal end there is a depression from which numerous longitudinal ribs radiate out towards the proximal face. The egg is beautifully sculptured.

The eggs turn a dull pale brown on the second day and an orange brown on the third. They seem to hatch in three days.

Caterpillar. The young caterpillar is about 2 mm. long, elongate and slender; light green. The head is shiny black and the prothoracic shield dark brown. The meso- and meta-thoracic segments carry a transverse row of small black tubercles disposed in two rows. The anal segment is dark-brown and bears a large chitinous plate; legs and prolegs are normal.

Soon after hatching the young caterpillar devours the eggshell. It then bites its way through to an interior of the pod and proceeds to feed on the tender seed.

In about 24 hours, the caterpillar may be noticed to have assumed a greenish yellow or light yellowish orange colour; at the same time a dorso-median streak of light orange as well as lateral stripes of the same colour is observable.

The *first moult* is undergone in about two days after hatching. *The larva of the second instar* is 5 mm. long, stouter, pale green with light orange stripes. The head is light brown, the prothoracic shield also light brown, but with dark dots carrying setæ.

A dorso-median orange streak on trunk and a lateral stripe of similar colour enclosing the row of spiracles.

Two days later the *second moult* is undergone.

The third instar larva is about 10 mm. in length.

Head is light brown, prothoracic shield is also light brown and carries a pair of dorso-lateral grey streaks which are continuous with the greyish streak on the trunk extending to the hind end of the body.

Trunk: light green: middorsally there is a dark-green streak bounded on each side by a greyish green stripe.

Laterally is to be found a rather interrupted faint orange stripe bounded below by a rather pronounced grey longitudinal streak. Ventral surface dark green : prolegs dark-brown.

Tubercles are not very prominent.

The *third moult* is undergone within the next 48 hours.

The fourth instar larva is 11-13 mm. in length. Head light green; the prothoracic shield large, flat, shiny, light green with a few warts carrying setæ and marked by a faint dark brown dorso-median and a pair of dorso-lateral grey stripes. It partially covers the head somewhat like a hood.

Trunk : dorsally greyish green with a dark-green median stripe. Laterally and ventrally dark-green with a greyish orange stripe extending along the side from prothorax to hind end. The spiracles which are oval and brown edged are to be found near the upper edge of the stripe.

On the eighth abdominal segment, the lateral dark green stripe bulges out dorsally and tends to meet its fellow of the other side.

Legs and pro-legs light green.

The fourth moult occurs two days later.

The caterpillar measures 20 mm.; stouter; light green with darker markings.

Head, light yellowish green and shiny.

Prothoracic shield, shiny darker brown with a conspicuous grey streak on each side.

Trunk light green with a darker dorso-median streak. Dorso-laterally a faint dark brown stripe which generally breaks up into a series of conspicuous oblique brown patches of which the one on the eighth abdominal segment is the largest and almost meets its fellow over the back.

Laterally, below the above the stripe is a pale grey green stripe in the upper part of which the line of spiracles is situate. Each spiracle is surrounded by a patch of orange brown. Hairs are short and inconspicuous.

A full grown caterpillar may measure about 25 mm. This caterpillar may be easily distinguished from *Chloridea obsoleta* which also feeds on *lablab* and red gram, by its comparatively smoother skin and its habit of entering bodily into the pods. It is capable of doing much damage, a single caterpillar being capable of attacking several pods in succession. In about four to six days after the fourth moult, the caterpillar deserts the pod for the soil, prepares an oval, earthen chamber underground, and pupates. The pupa is about 18 mm. long, somewhat

thickset, red brown and of the normal Noctuid shape. The moth may emerge in about eleven days after pupation.

Life-cycle.

Egg laid on	Egg hatched on	I M	II M	III M	IV M	Pupated on	Moth emerged on
	1915	1915	1915	1915	1915	1915	1915
1. ?	26—27 Jan.	28—29 Jan.	30 Jan. 1 p. m.	1 Feb. 8 a. m.	3 Apl.	8 Feb. 10 a. m.	19—20 Feb.
2. Probably laid on 3. 11—12 Jan. 1915.	14—15 Jan.	16—17 Jan.	18—19 Jan.	20—21 Jan.	22—23 Jan.	28—29 Jan.	8—9 Feb.
4. Probably laid on 11—12 Jan. 1915.	14—15 Jan.	16—17 Jan.	18—19 Jan.	19—20 Jan.	22—23 Jan.	28—29 Jan.	8—9 Feb.
5. ?	13—14 Jan.	15—16 Jan.	18—19 Jan.	20—21 Jan.	22—23 Jan.	28—29 Jan.	8—9 Feb.
6. Probably laid on	28—29 Jan.	31 Jan. 1 Feb.	2 Feb. 3 p. m.	3—4 Feb.	5—6 Feb.	9—10 Feb.	20—21 Feb.

Out of a number of caterpillars collected on 21st January 1914 most pupated by the 28th January 1914. Of these only about a dozen moths emerged between the 8th and 14th February. The rest of the pupæ remained alive in the soil at the bottom of the cage throughout the period from February to November and emerged one by one between the 30th October 1914 and the 16th December 1914. This clearly shows that the moth is one that breeds only in the cold season—presumably following the habits of *lathyrus* and red gram which produce pods only in the cold weather.

Parasites. The caterpillar is kept in check by a yellowish Bracon *Rhogas* ?. As many as 10 or 12 are found attacking the same caterpillar and construct their whitish oval cocoons in the interior of the pods. This Bracon is itself attacked by a black Chalcid hyperparasite.

Y. RAMACHANDRA RAO.

160. Further Note on Adisura atkinsoni.

A caterpillar of *Adisura atkinsoni* was found at Pusa on 3rd May 1912 on *Blumea* sp. leaves by A. Mujtaba and was at first supposed to be a larva of *Heliothis obsoleta* from its general appearance. It was

about 10 mm. long, tapering slightly posteriorly, in colour yellowish-green with a mid-dorsal and lateral dark longitudinal line, the whole body covered with thick scale-like hairs. There were also longer hairs, some black-tipped and others white. The larva pupated on 4th May and the moth emerged on 13th May 1912.

A. Mustaba. (Cage-slip 88.)

161. Early stages of Polytela orientalis.

Several caterpillars of *Polytela orientalis* were found on 1st May 1916 walking over sparse grass over almost bare rocks at Cherat, North-West Frontier Province. The caterpillar is brick-red at either extremity, white on first six and anterior half of seventh abdominal segments and banded with black as shown in the figure. The larvæ pupated in mud cells and two moths emerged at Pusa on 1st July 1916, whilst two other pupæ lay over and emerged on 30th June 1917.

This moth has been recorded from Aden and the Nilgiris, and I have seen a specimen from Bellary. It has not been noted from Northern India before so far as I know. Sir George Hampson gives the food-plant as *Pupercularia*.

T. Bainbrigge Fletcher.

162. Early stages of Eublemma dimidialis.

Eublemma dimidialis, Fb. *heterhoda*, Wlk. has been reared at Pusa in June 1911 from pods, and in August 1917 from flower-buds, flowers and pods of *urang*, *Phaseolus aconitifolius*, to which crop this insect may at times do serious damage, usually in association with other lepidopterous larvæ, such as those of *Catochrysops cnejus*, *Encosmia melanaula* and *Anarsia ephippias*. The larva bores into the flower-buds, flowers and seed-pods and eats out their contents. It lives in concealment, in the case of flowers tying them together with silk and living within the tied mass and, in the case of pods, entering them by gnawing a hole near the base of the pod and devouring the seeds inside, the hole being covered with a loose silken network on which the frass is extended and collects.

The full-grown larva is about 18 to 20 mm. long and 3 mm. broad across the fifth abdominal segment, tapering thence slightly to either extremity, cylindrical, segments distinct, pale greenish-yellow, the dorsal vessel showing through the skin as a broad dark stripe; head shiny dark-brown, almost black; prothorax pinkish or reddish, with a large shield which is concolorous with head, divided medially and rounded posteriorly; other segments with large brownish patches disposed to form

EXPLANATION OF FIGS. 34 AND 35.

Fig. 34 *Polytela orentalis.*

a, Larva, natural size, and magnified (× 3).
b, Pupa, „ „ „ „
c, Imago, „ „ „ „

Fig. 35. ***Eublemma dimidialis.***

a, Larva, natural size, and magnified (× 5).
b, Pupa, „ „ „ „
c, Details of anal extremity of pupa, posterior view.
d, Imago, resting position, natural size, and magnified (× 5).
e, Imago, natural size, and magnified (× 5).

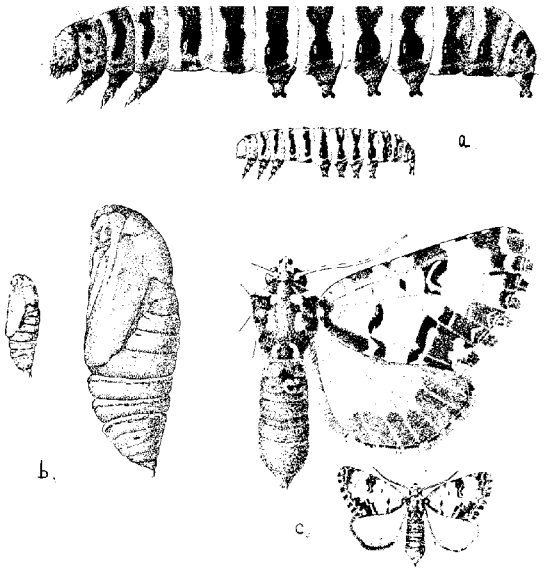
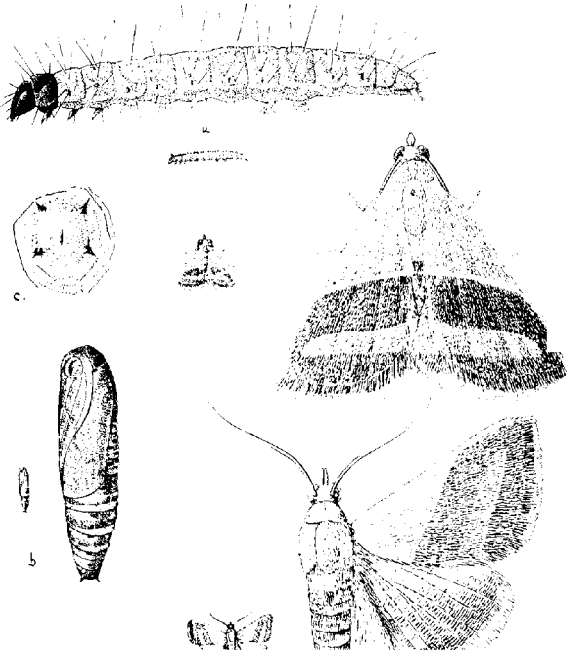


Fig. 31. *Polyptila orientalis*.



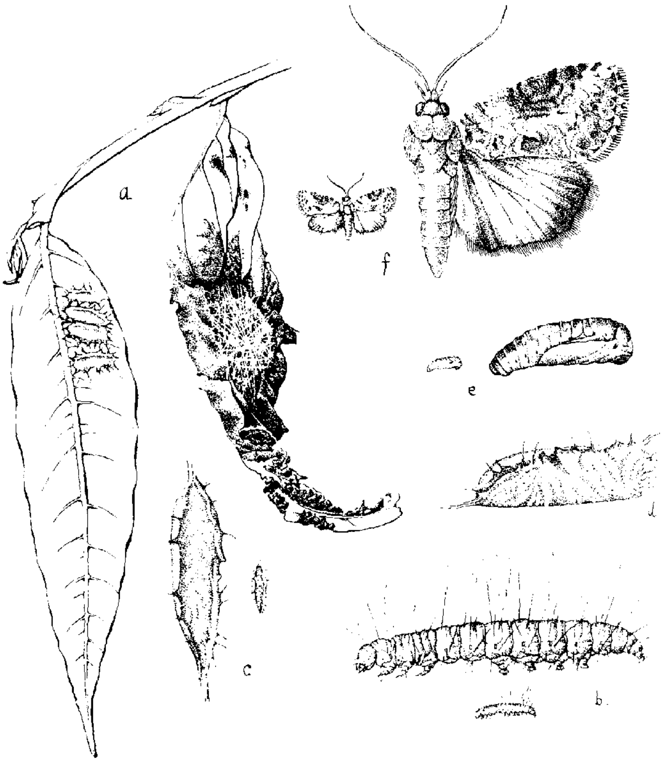


Fig. 36. *Symitha nolalella.*

a. Spray of *Lagerstroemia flos-reginae*, showing one leaf spun up and eaten by larva, and on another leaf four cocoons.

b. Larva, natural size, and magnified (× 4).

c. Cocoon, dorsal view, natural size, and magnified (× 4).

d. „ lateral view (× 4).

e. Pupa, natural size, and magnified (× 4).

f. Imago, „ „ „ „

three interrupted faint lateral stripes; primary hairs very long; spiracles oval, brown; legs blackish; first and second pairs of prolegs absent.

Pupation takes place with an elongated oval silken cocoon formed in any convenient shelter, *e.g.*, amongst flowers, within a rolled leaf, or between two pods. The pupal period is about seven to eleven days. The pupa is not extruded from the cocoon on emergence.

The pupa is about 9 mm. long, moderately stout, brown, anal extremity blunt and rounded at apex and provided with four hook-like processes arranged subapically at almost regular intervals.

Pusa Insectary (Cage-slips 901, 1649).

163. Figures of early stages of Symitha nolalella.

In July 1917 larvæ of *Symitha nolalella*, Wlk., were found at Pusa damaging *Lagerstroemia flos-reginæ* by spinning together and eating the leaves. The figures show the stages in sufficient detail but no descriptions of them appear to have been made.

Pusa Insectary (Cage-slip 1624).

164. Early stages of Giaura sceptica.

Giaura (*Clethara*) *sceptica*, Swinh., has been recorded as a sporadic minor pest of soy-bean *Glycine hispida* and velvet bean at Surat and Pusa, the larva rolling or tying the leaves, especially the lower leaves, and eating holes in them.

The larva is about 15 mm. long and 2·5 mm. broad across the posterior portion of the body, which tapers very slightly anteriorly, cylindrical, yellowish green, segments distinct, skin on intersegmental regions slightly folded and giving the appearance of a yellowish band, all segments with a network of whitish markings; prolegs equally developed. Before pupation the larva turns reddish or coppery-brown with faint whitish lateral markings which combine along the subdorsal region to form a stripe.

Pupation takes place either on a leaf within a silken cocoon much like that of *Earias fabia* or underground in earthern cells. The pupal period is eight to ten days.

The pupa is 9 to 10 mm. long and 4 mm. across thoracic region, thence gradually tapering posteriorly, both extremities rounded, brown, darker dorsally, with a coating of white bloom all over; anal segment with a ring of short posteriorly-directed spines.

Pusa Insectary (Cage-slip 1659).

165. Protective device in pupa of Eligma narcissus.

Eligma narcissus is abundant at Coimbatore and the larvæ often defoliate small trees of *Ailanthus excelsa* in November and December. When full-fed, they pupate on the stem of this tree, the pupa being enclosed in a long boat-shaped cocoon of greyish silk which exactly matches the colour of the bark. These cocoons are often grouped in masses on the stems, the larvæ apparently preferring to pupate more or less gregariously.

When disturbed, the enclosed pupa is able to make a loud rattling sound which is evidently of protective value and would probably serve to daunt any small vertebrate enemy attacking the cocoon. On examination of the pupa and cocoon it is seen that this sound is produced by the friction produced by rapid vibration of the anal extremity of the pupa against several strong longitudinal ridges of silk towards the anal extremity of the cocoon, so placed that these ridges are opposite to and are acted on by a series of short longitudinal chitinous ridges on the dorsal surface of the anal segment of the pupa. It will be noted from the figures given here that the three posterior segments of the pupa are considerably reduced in size in comparison with the preceding segments, and this reduction admits of a very considerable amount of lateral movement when these posterior segments are vibrated laterally, thus bringing the pupal ridges into strong contact with the silken ridges on the inner surface of the cocoon.

T. Bainbrigge Fletcher.

166. A new foodplant of the Castor Semilooper, Achaea janata.

Achæa janata (*Ophiusa melicerta*), which is often a serious pest of castor all over South India, has so far been noted to feed commonly on castor, pomegranate and *Euphorbia pilulifera*. It has also been noted as feeding on *Sapium sebiferum* and tea in Dehra Dun (*Indian Museum Notes*, Vol. III, 3, page 3). Very recently, however, Mr. Latham, the District Forest Officer of Salem, in forwarding specimens of this insect has remarked that he noted the larva feeding on *Albizzia amara* in October 1914 in the Salem District. I think there is no record of this foodplant and is therefore worth noting.

T. V. Ramakrishna Ayyar.

167. Early stages of Rivula bioculalis.

Larvæ of *Rivula bioculalis*, Mo., have been found at Pusa feeding on *Punicum* sp., but not hitherto in injurious numbers. The larvæ are

EXPLANATION OF FIGS. 37 AND 38.

Fig. 37. ***Ginura sceptica.***

a, Larva, natural size, and magnified (× 5).
b, Cocoon, " " " "
c, Pupa. " " "
d, Imago, " " " "

Fig. 38. ***Eligma narcissus.***

a. Pupa, after emergence of imago. (× 4).
b. Cocoon, interior surface, (× 2).
c, Portion of interior surface of cocoon, more highly magnified, to show details of silk ridges, (× 8).
d, Anal segment of pupa, more highly magnified, to show stridulating apparatus. (× 16).

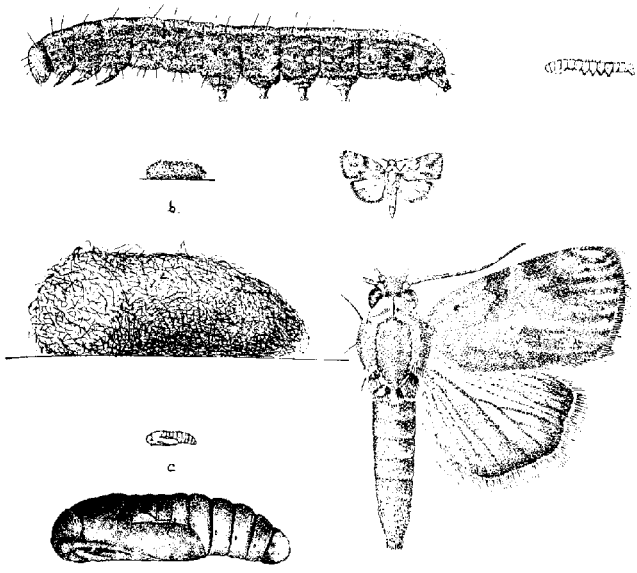
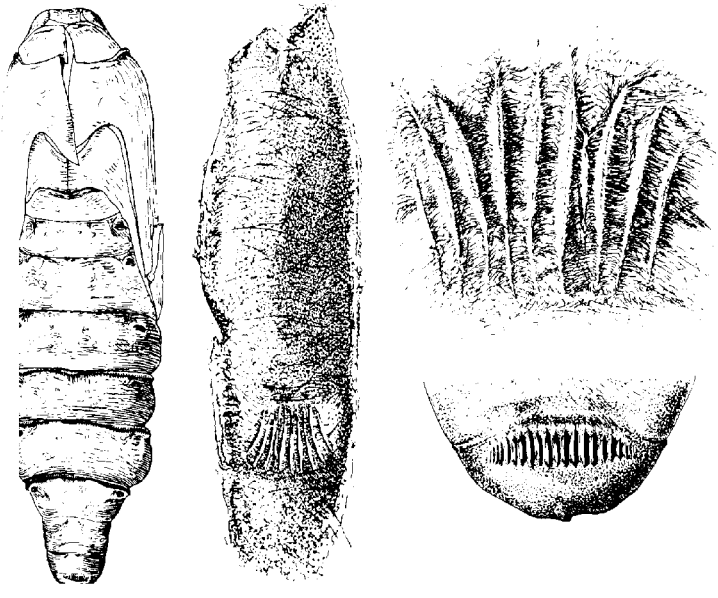


Fig. 37. *Orgyia antiqua.*



found on the leaves, which are eaten from the edge inwards. Larvæ found on 15th August 1917 pupated on 18th and 22nd August, the moths emerging on 22nd and 29th August 1917.

The larva, when about 12 mm. long, is about 1·75 mm. broad, cylindrical, tapering very slightly towards either extremity, green with an interrupted white subdorsal stripe, the dorsal vessel showing through the skin as a dark green stripe; head larger than following segments, rounded, pale-yellow with a greenish tinge and minutely speckled with grey, the grey specks arranged in groups; primary hairs long; prolegs slender, equally developed. The full-grown larva measures about 17 mm.

Pupation takes place on a *Panicum* blade, which is slightly rolled, in a flimsy open cocoon formed by a few transverse silken threads.

The pupa is about 13 mm. long, cylindrical; head rounded, remainder of body tapering posteriorly almost to a point; cremastral hooks entangled in silken cocoon.

Pusa Insectary (Cage-slip 1650).

168. Larva of Lyncestis amphix.

Figure 306 on page 446 of *Indian Insect Life* represents a larva described as that of an *Euscotia* sp. and on page 447 this is referred to as an "apparently undescribed species or variety" of Cucullianæ. This species has now been identified as *Lyncestis amphix*, Cr. (*Faun. Ind., Moths*, II, 479, f. 267) and the necessary corrections should be made.

169. Ophideres ancilla and Ophideres materna.

The caterpillars of *Ophideres ancilla* were found at Coimbatore in November 1914 feeding on the leaves of *Achyranthes aspera*—a common amaranth weed at Coimbatore. They are semiloopers of large size—nearly 2½ in. in length. In coloration they are a beautiful velvety black with blue specks and with 2 pairs of conspicuous eyelike markings in white and blue on the 3rd and 4th abdominal segments and a pair of large yellow patches on the second segment. There are only four pairs of prolegs—the first pair being absent. A dorsal protuberance is present on the last abdominal segment. The pupa is large and thickset with a dorso-median keel in the thoracic region. It is dark brown with a remarkable golden sheen all over. The abdominal segments are coarsely pitted.

The moth emerged on the 13th day after pupation.

The moth has the forewings brown with an elongate median green patch and the hindwings orange with a crescent-shaped marking and a submarginal patch of black colour.

The caterpillars of *Ophideres materna* were observed feeding on a wild convolvulus creeper in the Farm at Coimbatore in October-November 1914 and 1915. They were of a light grey brown colour with a soft velvety look. There were numerous yellow, orange and blue speckles distributed over the body. Only two pairs of ocelli were present—located on the third and fourth abdominal segments. The ocelli had the iris partly yellow and partly orange and the pupil blue. The first pair of prolegs is absent as in *ancilla*: a dorsal protuberance on the anal segment. When disturbed the caterpillar doubles up the anterior half of its body and lifts up the hinder part so as to form an irregular S in outline. In this posture the body rests wholly on the first three pairs of prolegs, and the ocelli are brought into prominence. *Ophideres ancilla* has similar habits.

The pupa is thickset and large, nearly one inch in length, dark reddish brown, smooth but without any particular golden lustre as in *ancilla*. The thorax is smooth without any keel. The abdominal segments are also smooth and very finely and minutely pitted.

The moth emerged in 14 days. Forewings greyish green with numerous striæ of brown colour. A silvery Y-shaped mark along the middle of the wing. Hindwing orange with a round black spot and a marginal black band.

Y. Ramachandra Rao

170. Ophideres cajeta a distinct species.

In the *Fauna of India. Moths.* Volume II, page 560, Sir George Hampson sinks *Phalæna cajeta*, Cramer, as a synonym of *O. fullonica*, Linn., although Moore, in his monograph on the Ophiderinæ of the Indian Region (*Trans. Zool. Soc.*, XI, 67) had treated *cajeta* as distinct from *fullonica*. Examination of Moore's description and figures of *cajeta*, in conjunction with a series consisting of one male and six females from South Malabar, sent from the Forest Institute at Dehra Dun for identification, leave no doubt in my mind as to the distinctness of *cajeta* as a species. It is uniformly smaller than *fullonica*; the outer margin of the forewing in *cajeta* ♂ is straighter, whilst in *fullonica* ♂ this shows a tendency towards slight crenulation; and in the female the forewing in *cajeta* is of a much more uniform mottled brown without the strong contrasts seen in *fullonica*.

T. Bainbrigge Fletcher.

171. An alternative foodplant of Hyblaea puera.

In September-October last we had a plague of caterpillars of the Noctuid *Hyblæa puera*, Cr., on the Agricultural College Farm, Coimbatore. The plant that suffered most was *Millingtonia*. There are a number of these young trees in various parts of the estate and not one escaped from a serious attack; and those plants that shared in the damage, though to a smaller extent, were *Bignonia megapotanica*, and *Vitex negundo*, L. Hole in his interesting paper on this insect p. 685, Vol. XV, *Bombay Journal* mentions teak, *Millingtonia* and Bignoniaceæ as foodplants, and has not mentioned anything regarding *Vitex negundo*, L., which is one of the Verbenaceæ. This is apparently an alternate foodplant of the pest not recorded till now; regular hand-picking of the folded leaves containing the larva and spraying with lead arsenate checked the pest. It may also be stated here that a number of Tachinid flies were reared out as parasites from *Hyblæa* larva. This fact of the existence of a dipterous natural enemy has not been noted by Hole among the enemies he has mentioned in the above paper.

T. V. Ramakrishna Ayyar.

172. Early stages of Rhyncolaba acteus.

A caterpillar of *Rhyncolaba acteus* was found at Pusa on 6th August 1917 eating leaves of *Pythonessa walliehii*. It spun up on 11th and pupated on 12th August and the moth emerged on 25th August.

The fullgrown larva is about 75 mm. long when fully extended and about 10 mm. broad across the abdominal region, cylindrical, the thoracic region tapering anteriorly. The general colour is green, the sides with white markings amongst which are eight one thoracic and seven abdominal upwardly sloping broad white stripes which, in the case of those on the abdominal segments, pass over the spiracles and at their upper ends about the subdorsal region are marked off as elongated oval spots. A large subdorsal ocellus on the anterior part of the first abdominal segment and partially encroaching on to the meta-thorax. Caudal horn short, stout, reddish, with down-curved tip. Spiracles whitish.

Pupation takes place in a slight cocoon formed under a leaf by a large-meshed silk network. Before pupation the colour of the larva changes to grey with dark patches, the oval spots turning pinkish or brick-reddish. The pupa measures 50 mm. in length from the upper part of the loop of the proboscis to the tip of the anal extremity and 46 mm. from head to tail, and is about 11 mm. broad across the

broadest portion of the abdomen. The proboscis is contained in an antero-ventral prolongation of the head, which gradually narrows and then, turning downwards and then inwards, forms a large loop thickened again towards its apex which is embedded in the surface of the prothoracic region. The anal segment is deeply concave ventrally and its dorsal surface is produced posteriorly very considerably. In colour the pupa is a dull dirty brown, the dorsal surface darker and the ventral surface of the abdomen with large whitish patches.

Pusa Insectary (Cage-slip 1655).

173. Life-history of Taragama siva.

Ovum. The egg (figures 40*a*, *b*) is almost spherical and measures 1·5 to 1·7 mm. in diameter from base to apex and 1·3 to 1·5 mm. in diameter transversely. The shell is thick, smooth, tough and moderately hard. The micropylar area is dull brown, broadly bordered with yellowish-white, and this is again surrounded by a broad dull brown band irregularly indented on its lower edge; the remainder of the surface is of a dirty yellowish-white speckled with brown. The eggs are laid horizontally in clusters or in irregular rows, the moth moving as they are deposited. Eggs laid on 17th and 18th May 1914, hatched on 24th and 25th May, the young larva gnawing away the micropylar area and the surrounding portion of the egg-shell and emerging through the hole so produced; after emergence it usually eats the greater part of the empty shell before wandering away in search of plant food.

Larva. First instar.—The newly-hatched larva (figure 40*c*) is about 5 mm. long, dorso-ventrally compressed and slightly tapering posteriorly. Head shining black, about 1 mm. across, without any hairs. Prothorax on each side with a yellow, fleshy protuberance bearing long white hairs, dorsal intervening portion dull black. Mesothorax and metathorax each with a transversely-elongated dorsal black patch. All segments from mesothorax to eighth abdominal bear on each side a flattened, fleshy, pale-yellow protuberance bearing a tuft of long white hairs. The abdominal segments are transversely wrinkled, rather dirty-whitish in colour, their interstices showing as fine black lines. The anterior trapezoidal tubercles on all segments from mesothorax to ninth abdominal are large yellow protuberances bearing tufts of long white hairs. The posterior trapezoidal tubercles are small protuberances similarly bearing tufts of long white hairs. Some of these hairs are about 5 mm. long and their presence gives the larva a hairy

EXPLANATION OF FIGS. 39 AND 40.

Fig. 39. *Rhyncolaba actevs.*

a, Larva, slightly magnified (× 1½).
b, Pupa, „ „ „
c, Imago. „ „ „

Fig. 40. *Taragama siva.*

a, Eggs as laid on twig.
b, Egg, natural size, and enlarged (× 6).
c, Newly-hatched larva, natural size, and enlarged (× 6).
d and *e*, Full-grown larva, natural size.
f, Cocoon, natural size.
g, Pupa, natural size.
h, Male moth, natural size.
i, Male moth, in resting attitude.
j, Female moth, natural size.
k, Female moth, in resting attitude.

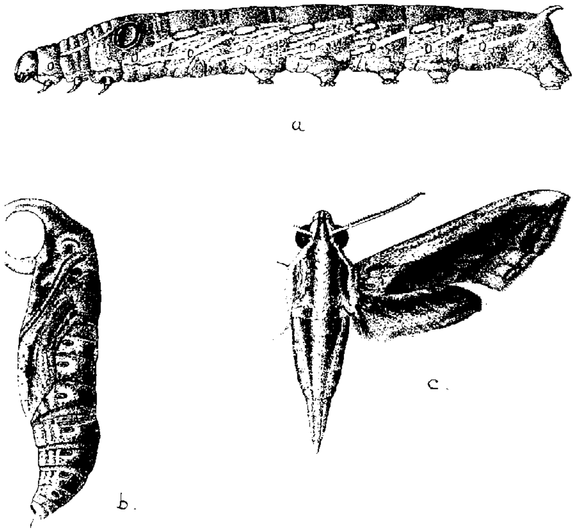
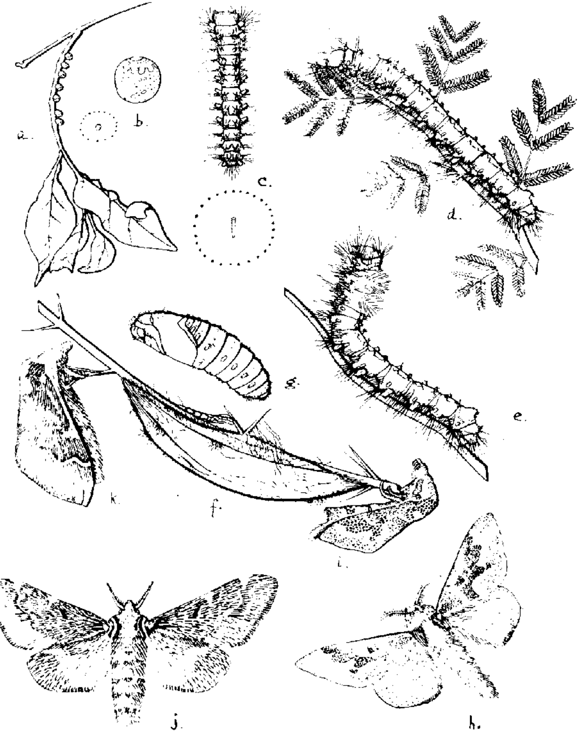


Fig. 30. *Rhyncolaba acteus.*



appearance. The surface of the segments does not possess tufts of hairs but there are single hairs on the primary tubercles. The ventral surface and legs black, prolegs pale yellow.

Second instar.—After the first moult the larva is about 9 mm. long. The head and back of prothorax are dark grey and covered with minute white hairs, the general colour of the body being light grey. The dorsal regions of mesothorax, metathorax, and first, seventh and eighth abdominal segments are black, these blackish areas on metathorax and seventh abdominal segments coalescing with those on the next succeeding segments respectively. The mesothorax and metathorax each bear posteriorly a transverse reddish-yellow ridge having in its middle a few short yellow hair-like processes with their tops flattened. The anterior trapezoidal tubercles on mesothorax and metathorax and first and eighth abdominal segments are black, those on prothorax and ninth abdominal are grey, and the remainder reddish yellow. All tubercles bear a few long black hairs and not regular tufts. The lateral processes each bear a long black hair and also numerous whitish hairs. The dorsal surface also bears numerous whitish hairs but these are more prominent on the lateral regions of the body.

Before the second moult the larva covers a portion of the stem of its foodplant with a layer of shining silvery-white silk, and rests on this pad with its prolegs entangled in the fibres. The skin is not thrown off posteriorly in a crumpled mass but the larva walks forward out of it as from a case, the head covering being cast off separately. The cast skin is partially or wholly devoured.

Third instar.—After the second moult, the larva is about 15 mm. long and in general appearance resembles the previous instar. The black markings on meso- and meta-thorax do not ordinarily show when the larva is at rest, being enclosed and hidden in transverse folds when open and expose them when the larva moves. The black markings on seventh and eighth abdominal segments in the second instar have almost disappeared in the third, giving place to grey.

Fourth instar.—After the third moult the larva is about 25 mm. long and is little changed in general appearance. The posterior trapezoidal tubercles on first to seventh abdominal segments have become larger and are now red in colour. The anterior trapezoidals are also enlarged, that on the eighth abdominal segment being larger than the others.

Fifth instar.—After the fourth moult the larva is about 40 mm. long. Head grey, covered with grey hairs. Colour of back greyish-brown

with scattered indistinct violet spots. Anterior and posterior trapezoidals red. The tufts of grey hairs on lateral processes are denser.

The full-grown larva (figure 40*d*) is about 50 (male) to 70 mm. (female long, moderately stout, cylindrical, tapering slightly posteriorly. When disturbed it assumes a terrifying attitude (figure 40*e*) by raising the head and thorax and displaying two tufts of short black hairs on the meso- and meta-thorax; just bordering the posterior edge of the mesothoracic fold there is also a tuft of short flat-topped violet hairs and in a similar position on the metathorax a similar but larger tuft of white hairs: in the resting position these tufts are hidden inside the transverse folds.

Pupation. When fully fed the larva prepares on a twig of the foodplant an elongated cocoon tapering toward each extremity (figure 40*f*). The cocoon is composed of brown silk into which larval hairs are interwoven and is about 35 to 45 mm. in length and 15 to 20 mm. in diameter. The last larval skin is thrust off posteriorly in a shrunken mass which lies close to the anal extremity of the pupa, the moth emerging through a slit at the anterior extremity of the cocoon, the empty pupa-case remaining inside the cocoon to which it is attached by its reddish cremastral hooks.

The pupa (figure 40*g*) is about 25 to 30 mm. long by 8 mm. in diameter, cylindrical, bluntly rounded at each extremity, dark brown with short brown hairs.

Life-cycle. The life-cycles of two individuals (both males) are shown below:—

Dates	No. 1	No. 2
Egg laid	17-18th May	17-18th May.
Egg hatched	24th May	24th May.
First moult	28th May	28th May.
Second ,,	31st May	31st May.
Third ,,	4th June	4th June.
Fourth ,,	9th June	10th June.
Formed cocoon	22nd June	21st June.
Moth emerged	3rd July	2nd July.

Foodplants. At Pusa this insect has been reared on *Tamarix gallica*, *Murraya exotica*, *Polyalthia longifolia*, rose, *Acacia arabica*, and *Zizyphus jujuba*. Of these the last two are probably the most common foodplants.

[Pusa Insectary. Cage-slips Nos. 369 and 650 and unnumbered cage-slips, dated 15th March 1910 and 17th May 1914.]

174. A new pest of the Coconut palm on the West Coast.

In December last, a communication was received regarding damage done to coconut trees by some insects in some sea-side villages in the Cochin State from the Superintendent of Agriculture of that State. Following close on this information a report was also received through the local Revenue officials from certain cultivators in the Ponnani taluq of the Malabar District describing a similar attack of a coconut pest. The localities from which these reports were received are so adjacent to each other that no doubt was entertained as to whether the pest was the same or not in both the places. Before samples of insects were received for examination, it was assumed from the information contained in the above reports regarding the nature of the damage done, that the pest might be *Paraxa lepida*, Cram., an insect previously noted as attacking coconut and palmyra trees. This presumption was also strengthened by the fact that *Paraxa lepida* was found doing serious damage to coconut trees in almost the same locality in Cochin eight years ago. When, however, the specimens of insects were received, it was found that the pest under consideration was quite a different one from the one previously noted, though both belong to the same group and possess the same habits.

The early reports having come late, as usual, and as it was not possible to visit the locality and make the necessary investigations, the work was postponed pending further reports. As expected, a report of a second outbreak was received from the same locality in the Ponnani taluq. The place was then visited, the local conditions were studied and some live material was brought to Coimbatore to follow the life-history of the insect in captivity. The following is a brief account of the investigations made so far in connection with this insect.

Distribution, Previous history and nature of damage. So far in South Malabar, the insect has not been found to enjoy a wide distribution as a pest. It was found confined to a small tract of land in the backwaters adjoining the sea coast and on both occasions when we had reports of this pest, they were received from this particular tract—Vadanapalle amsom in the Ponnani taluq. The local coconut cultivators

appear to know the insect; it has been noted during previous years on the coconut tree, on a very insignificant scale, nibbling the leaf tips here and there, but it was only during the last season when the insect multiplied and assumed pest proportions that it attracted the serious attention of the cultivators. The first outbreak was noted in December 1915 and the second one followed in February, and in both these cases the infestation was in the same place.

The injury done to the trees by the pest consisted in the foliage being eaten up by hundreds of these small fleshy wormlike creatures. Numbers of them remain feeding gregariously on the green epidermis of the leaves and in bad cases the coconut fronds are actually skeletonized. It has been found that the maturer leaves are affected more, while the tender portions do not suffer so much. The tree stem is immune. As between old and young trees the latter appear to be more or less free from attack. The effect of a bad attack on a tree is that the affected fronds dry up and drop down, and gradually the tree becomes very weak and suffers considerably in outturn.

The pest, its classification and description. The insect under consideration is a moth of the family Limacodidæ. The characteristic features of the members of this family are easily made out from the peculiar fleshy slug-like appearance of the larvæ of the great majority of them. This feature has given them the popular name of "slug caterpillars" and "gelatine grubs". It is this immature stage of the insect—the slug caterpillar—that is directly responsible for the damage done to coconut trees. As it is difficult to correctly identify the insect from the larval stage, except in very well-known cases, adults were bred out in captivity from the few specimens received with the earlier reports. The Imperial Entomologist to whom specimens were forwarded identified the insect as *Contheyla rotunda*, Hmp. (Fig. 41*a*, *b*). The only previous record of this insect is by Sir George Hampson in his paper on the Moths of India, page 196, Volume XVI of the *Journal of the Bombay Natural History Society* in the year 1905. It is there described as a new species and as found in Karwar, North Kanara. The following is his description of the moth: "Grey brown. Forewing with slight dark irroration, a series of black points from costa beyond middle excurved to vein six, then becoming sub-terminal. Hindwing slightly darker. Cilia of both wings yellowish at base. Wing expanse 16 mm. in the male and 20 mm. in the female."

Thus it will be seen that this is the first record of the insect *as a pest*.

Life-history. Though the main points in the life-history of the insect have been noted, it was not possible to study the various points in detail

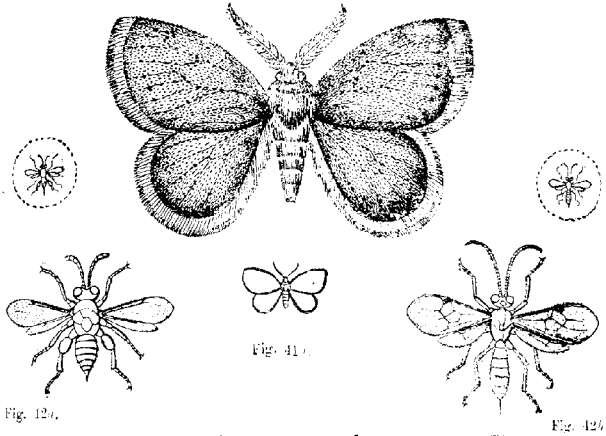


Fig. 42a.

Fig. 41a.

Fig. 42b.

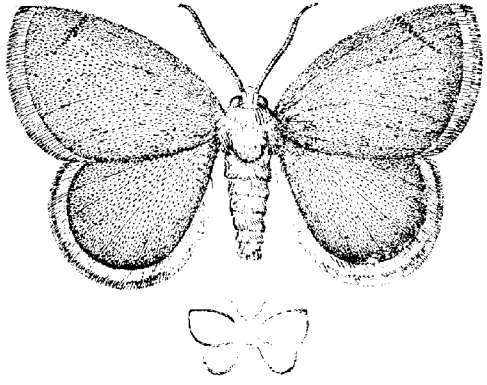


Fig. 41b.

Fig. 41a. *Cantheyla rotunda*, male moth (magnified and natural size).
" 41b. " " female " " " " "
" 42a. Chalcid parasite of *Cantheyla rotunda* moth (natural and magnified).
" 42b. Braconid parasite of *Cantheyla rotunda* moth (natural and magnified).

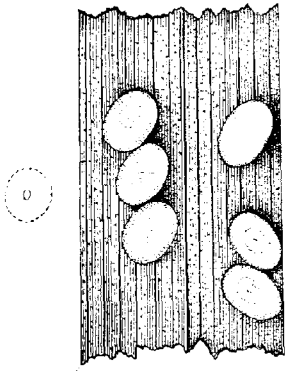


Fig. 44.

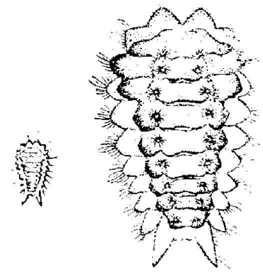


Fig. 45.

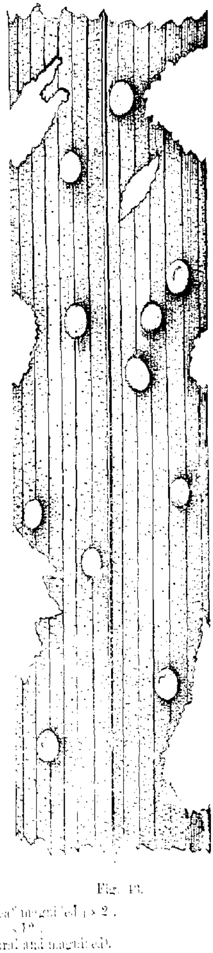


Fig. 43.

Fig. 43. Eggs of *Contheyla rotunda* on palm leaf magnified (× 2).
„ 44. „ „ „ magnified (× 10).
„ 45. Caterpillar of *Contheyla rotunda* (natural and magnified).

during the past season. The following points have been followed so far:—

Each parent insect is capable of laying from 50 to 170 eggs. These insects are minute spherical, flattish objects resembling scales and laid in groups on the leaf surface (Fig. 43). Each is about a millimetre across the poles and has a shining, transparent, colourless, jelly-like consistency. When the hatching time approaches the embryo inside the egg is seen through the transparent egg shell. In about four days the egg hatches and the tiny larva ¾ to 1 mm. in length is soft and fleshy—quite characteristic of Limacodid larvae. It is pale brown in colour with a number of greyish processes. These latter are disposed along the lateral edges of the body and along the median dorsal region. The head is kept concealed underneath the prothorax. The young larva feeds on the leaf by scraping the epidermis. As the larva feeds and passes moults, it grows in size and the processes become fleshy protuberances, each with a central long spine with a circlet of shorter ones around. The larvae are very slow moving in habit; they do not feel happy when they are mechanically transferred to fresh leaves in captivity; due to this many of them died before reaching maturity. The full-fed larva when about to pupate constructs a small, hard, oval, dirty brown, shell-like cocoon about 1 mm. across and then changes into the chrysalis inside the cocoon. At the end of the pupation period the moth emerges out of it. The male is smaller than the female though in other respects the differences are not so clear. A generation from egg to adult roughly takes about a month and a half.

Number of broods in the year. That two reports were received from the same place, one following the other, has clearly proved that there are at least two generations passed by the pest in the year. One in December-January and the other in February-March. What the pest does during the rest of the year, how it passes its life, whether it has a resting or hibernating period, etc., are all points which remain to be investigated.

Other host plants. So far, no other plant has yet been found on which the insect is found to breed. It is not unlikely that other palms might serve as alternate foodplants.

Natural enemies. Two hymenopterous parasites have been found to be prasitic on this insect. One is a dark stout built small Chalcid and

the other a slender delicate brown Braconid wasp. These attack the larvæ and lay eggs inside their bodies, and these grubs hatching out of these eggs feed on the body of the slug caterpillar and gradually kill the latter. In this way these wasps play some part as natural enemies to this pest.

Control measures. The easiest and most practicable method of checking the pest is the one which the local cultivators practise though it is done without any system. This consists in the burning off of the affected foliage. When the depredations of the insect are noted on a small scale early in the season, the systematic method of cutting away the affected fronds and burning them will prevent the multiplication of the pest during the next generation and the pest will gradually be checked.

Spraying with a stomach poison like lead arsenate was only found effective in the case of young trees which are not very tall. On the whole spraying will be found impracticable against this pest which generally attacks old trees and the fairly ripe foliage which are difficult to operate satisfactorily with a spray pump.

The pest can also be destroyed while in the cocoon stage, as these shell-like objects are clearly seen on the attacked fronds, which can be easily cut and burnt.

It might be possible to check the pest in other, and perhaps easier, ways when more is known of the insect. The following important points which still require investigation might give several clues to tackle the pest in the future :—

(*i*) The exact number of broods in the year.
(*ii*) Other alternate foodplants, if any.
(*iii*) Natural enemies other than those noted already.
(*iv*) Effect of weather changes.
(*v*) The habits of the adult insect which might help us to gauge the facilities for the distribution of the pest.

It is hoped that as opportunities offer, further investigations with this insect will be pushed on. The attached diagrams will give some idea of the different stages of the insect.

T. V. Ramakrishna Ayyar.

175. Breeding notes on Papilio polytes.

A pair of *Papilio polytes*, Linn., "in cop" was taken on the 24th November 1915, resting on a twig of *Toddalia aculeata*, a Rutaceous plant in the vicinity of the wetlands of the Central Farm, Coimbatore. The ♀

was of the *polytes* form, a mimetic of *P. aristolochiæ*. This fertilized ♀ laid 37 eggs within 24 hours after copulation, later on 9 eggs; she succumbed in the morning of the 26th.

The egg was rounded, yellow, elastic, sometimes dotted with pale orange, laid singly, preferably on tender shoots, but also on twigs and older leaves. From the time of oviposition, no radical change in the colour of the egg was noted, until just before hatching when a black v-shaped mark was visible through a transparent shell.

Most of the eggs had hatched by the 29th morning. It was observed that the just-hatched caterpillars turned round and ate up the empty egg-shells partly. The larva measured 3·5 mm. sometime after hatching.

By the 1st December 1915 only 27 caterpillars were surviving and by the 28th only eleven. This large percentage of mortality was mostly due to the difficulty in obtaining the *Toddalia* leaves. These caterpillars would not feed on lime or sour lime leaves.

The first pupa was got by the end of December. The pupæ varied considerably in colour; some were ashy brown, others green and others grey

Altogether only ten butterflies emerged. Six black-and-yellow males, three ♀ *polytes* form, mimetics of *Papilio aristolochiæ*, and only one ♀ *romulus* form, mimetic of *P. hector*. No *cyrus* form of ♀, similar to the ♂ emerged.

P. SUBRAMANYAM.—31-III-1916.

176. Further Note on Papilio polytes.

Several attempts have been made at Pusa to rear continuous broods of *Papilio polytes* to note the relative occurrence of the polymorphic forms of the female, but various difficulties have hitherto prevented successful rearing for more than two generations and those only on a small scale. What is really required is continuous rearing of successive broods on a large scale, but for this special arrangements, in a locality more suitable than Pusa, are necessary. The following is a brief account of one experiment made at Pusa.

A female of the *polytes* form was captured at Pusa on 1st August 1917 and kept for eggs. The male parent was unknown but the female was fertilized and laid 65 eggs on the two following days. The eggs began to hatch on 5th August and the larvæ were fed on *Murraya koenigii*. Two larvæ pupated on 17th, twelve on 18th, twenty-five on 19th and three on 20th August, all the pupæ being green. Of the

forty-two pupæ obtained, forty emerged as follows:—

Date	Male normal (*polytes*)	Male (*cyrus*)	Female (*cyrus*)	Female (*polytes*)	Total
25th August	...	1	...	...	1
26th August	3	5	1	3	12
27th August	6	...	2	4	12
28th August	1	...	1	6	8
29th August	2	...	...	1	3
30th August	...	...	...	2	2
31st August	...	...	1	1	2
Total .	12	6	5	17	40

From this F_1 brood several attempts were made to obtain eggs but, although pairing took place in several cases and eggs were laid, in all except the following case the eggs failed to hatch.

A female of *polytes* form was confined with a male of *cyrus* form, both being from the above F_1 brood, on 26th August 1917 with a branch of *Murraya koenigii*. Pairing was not observed in this case but on the morning of 28th August nine eggs were laid, and by the morning of 30th August nineteen eggs in all had been laid. The male died on 29th August and the female on the next day. The eggs began to hatch on the morning of 31st August, and of the larvæ four pupated on 11th, four on 12th, and four on 14th September. Of the 12 pupæ, eleven were green and one greenish mixed with straw-brown. The resultant butterflies emerged as follows:—

Date	Male normal (*polytes*)	Male (*cyrus*)	Female (*cyrus*)	Female (*polytes*)	Total
20th September . . .	3	...	...	...	3
21st September . . .	2	...	...	...	2
22nd September . . .	1	...	...	2	3
25th September . . .	...	...	...	2	2
Total .	6	...	...	4	10

T. Bainbrigge Fletcher.

177. Parata alexis as a pest.

Pongamia glabra is a common South Indian tree, being met with in numbers, especially in the upland tracts of the Mysore plateau. Though it is not a tree of great economic importance there are some ways in which the tree is made use of; oil is extracted out of the seeds and the foliage is used largely as green manure for wet lands. This tree has not been noted to suffer from the attacks of any insect pest seriously. But recently (in November 1914) at the Coimbatore Agricultural College Farm some young trees were found very badly attacked by the larvæ of the butterfly *Parata alexis*, Fabr. Though there are previous records of this butterfly larva feeding on this plant—especially by writers like Davidson Bell and Aitken in the *Bombay Journal*—I do not think that such serious attacks are common. Almost every leaf on the trees was folded up and contained a larva, and badly attacked trees were actually stripped of foliage and skeletonized.

The larva, which is stout in build with a spherical head separated from the trunk by a distinct constriction, appears more like the caterpillar of a moth than that of a butterfly. Each larva folds the leaf, bringing the lateral halves of it together and constructing a sort of flattish tube. From inside this structure it feeds on the leaf tissue. A full-grown caterpillar measures 35 mm. There is a good deal of variation in colour. The pupa is also found inside the tube; even this resembles a moth pupa. It is naked and smeared over with a scanty white powdery bloom. The body is fixed by the tail-end; but in addition to this there is a slender silk loop enclosing the middle portion of the trunk. The pupation period lasts from 9 to 10 days.

T. V. Ramakrishna Ayyar.

178. Synonymy of Polyocha saccharella and Anerastia ablutella.

Polyocha saccharella, Ddgn. *B. J.*, XVI, 405, 1905, whose larva bores in the roots and shoots of sugarcane, has already been shown to be identical with *Polyocha depressella*, Swinh., of the *Fauna of India, Moths*, Vol. IV, p. 63, which has been removed from the genus *Polyocha* and is referred to as *Papua depressella* in the *Proceedings of the Second Entomological Meeting* (1917), pp. 141, 145 and 182. In his recent "Classification of the Pyralidæ, subfamily Hypsotropinæ" (*Proc. Zool. Soc.*, 1918, 55-131) Sir George Hampson sinks *Papua*, Rag., as a synonym of *Emmalocera*, Rag. [Nouv. Gen. p. 38 (1888); type *leucocinctella*], so that this insect now stands on our lists as *Emmalocera* (*Papua*) *depressella*, Swinh. (*saccharella*, Ddgn.).

In this paper also the species hitherto known as *Anerastia ablutella*, Zell., is placed in the new genus *Raphimetopus*, Hmpsn. (*P.Z.S.*, 1918, 78; type *spinifrontella*), and *Anerastia bimaculella*, Rag., of the *Fauna* volume, is sunk as a synonym of *ablutella*. The distribution of *R. ablutella* is very wide, being given as the Mediterranean region, throughout Africa, Persia, Japan, Kashmir, Punjab and Madras.

T. Bainbrigge Fletcher.

179. Early stages of Pilocrocis barcalis.

A larva of *Pilocrocis barcalis* was found on 20th November 1914 hidden inside two superimposed leaves of *Cassia fistula* which had been fastened together with silk. The epidermis and mesophyll substance of the leaves had been mostly eaten, the eaten portions turning brown. The larva formed a cocoon on 21st November and the moth emerged on 18th December.

Pusa Insectary (Cage-slip 1143).

180. Early stages of Crocidophora ptyophora.

Larvæ of *Crocidophora ptyophora*, Hmpsn., were found at Pusa in January 1916 inside rolled green leaves of a newly-planted bamboo clump. In some cases several leaves had been rolled up and tied together by white, silken threads applied here and there, the whole bundle of rolled leaves making a cylindrical case of which the innermost leaf or leaves had been partially eaten by the contained larva. Pupation takes place, inside a longitudinally rolled bamboo leaf, in a silken cocoon covered with a thick layer of yellowish dry chewed-up leaf-fibre. From larvæ obtained between 3rd and 26th January moths emerged from 21st March to 15th May. The larvæ seem to rest inside the cocoons, before pupation, for a period which may extend to over two months.

Pusa Insectary (Cage-slip 1347).

181. Early stages of Monoschalis virescens.

The brightly coloured larvæ of *Monoschalis virescens* were collected by Sub-Assistant D. Ponniah from the foot of the Marudamalai Hills seven miles west of the Farm, Coimbatore. They feed on the leaves and burrow into the fleshy stems of *Vitis quadrangularis*. They were about 13 mm. long, stout, rather flattened and somewhat hairy. The caterpillar is dull brick-red with paired black and white patches

EXPLANATION OF FIGS. 46 AND 47.

Fig. 46. *Pilocrocis barealis.*

a, Leaf of *Cassia fistula* rolled and eaten by larva.
b, Larva, natural size and magnified (× 3).
c, Pupa, „ „ „ „
d, Imago, „ „ „ „

Fig. 47. *Crocidophora ptyophora.*

a, Bamboo leaf rolled by larva.
b, Larva, natural size and magnified (× 4).
c, Cocoon, „ „ „ (× 2).
d, Imago, „ „ „ (× 4).

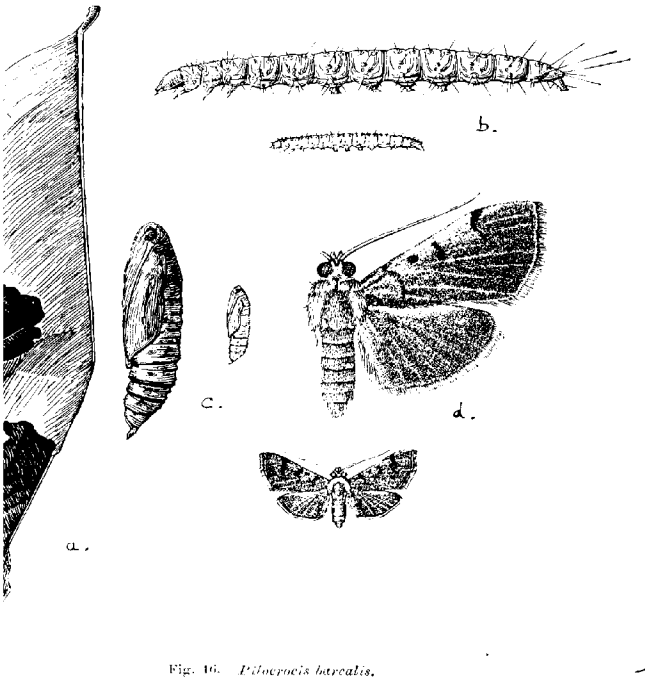


Fig. 16. *Pilocrocis lunalis.*

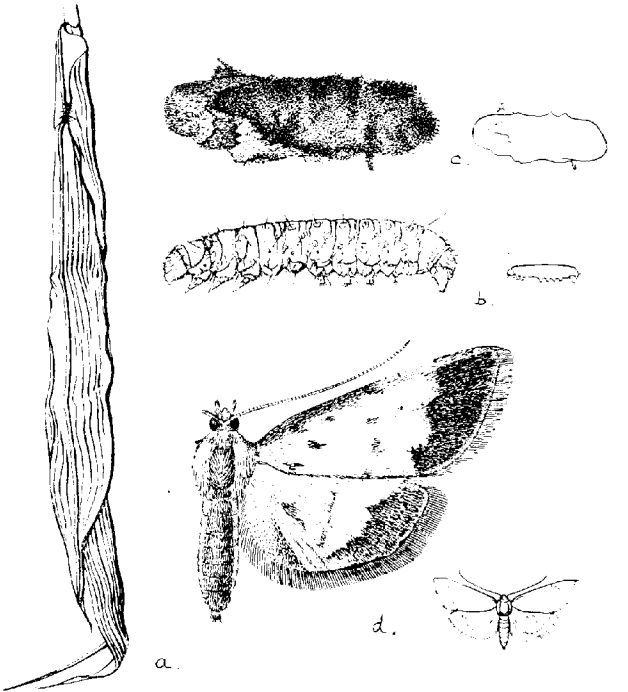


Fig. 17. *Crocidophora ptyophora.*

dorsally. The head is dark brown normally hidden under the hood-like prothoracic segment. The prothoracic shield is shiny brown with a faint white mid-dorsal line. The mesothorax is reddish and somewhat bulged. The metathorax is also reddish with a pair of small dark patches on dorsum. The number of legs and prolegs is normal. All the segments of the abdomen, except the second, fourth and fifth (which carry a pair of large black patches instead), bear dorsally a pair each of prominent bright whitish patches. Laterally there are two series of fleshy prominences, bearing greyish hairs one (small) above and the other (larger) below the line of spiracles.

When full fed they constructed their cocoons between folds of the leaves. The cocoon is held in position by a loose mesh-work of silk intermixed with a white meal-like material. It is thin, brownish in colour but very tough and fits well into the hollow of the leaf fold. The pupa is soft and pale. The abdominal segments are pale pinkish, while the head, thorax and wing rudiments are bright yellow. Hairs are absent.

They emerge in about a week into pale pretty little moths with a Syntomid-like appearance. The body and the wings are blue black with a faint metallic lustre. The abdomen is crossed by a dull red band about the middle. The antennæ are pectinate.

V. RAMACHANDRA RAO.

182. Larva of Thyrassia subcordata.

Larvæ of *Thyrassia subcordata*, Wlk., were found at Pusa on 7th August 1915 on *Vitis trifolia*, eating the leaves, buds, flowers and fruit, and the following description was made:—

About 12 mm. long by 3 mm. broad, slightly flattened. Head shining black, much smaller than prothorax into which it can be retracted. Prothoracic shield large, shining black, divided medially; anterior edge of prothorax white. All segments distinctly defined, 13 divided into two distinct subsegments. Colour yellow, paler ventrally, but the ground-colour is concealed dorsally by the development of the setigerous tubercles which are blackish-brown and bear tufts of long hairs arranged in the form of rosettes. The position of these tubercles is as follows:—subdorsal considerably extended lateral on 3 to 12; supraspiracular on 3 to 12; spiracular on 3 and 4; subspiracular on 5 to 12; just above base of legs on 3 to 6 and 11. The prothorax carries a spot

just above the base of the leg and the four abdominal prolegs have also a basal spot. The mesothoracic warts are small whilst those on the metathorax are conjoined. The subdorsal and supraspiracular warts are conjoined on the abdominal segments, as are also those on the posterior anal subsegment. The subdorsal warts on 5, 7, 10 and 11 are white, thinly margined with black; these white spots are very prominent on the back of the larva. All prolegs present and equally developed.

The larvæ commenced to pupate on 15th August, forming a well-woven and matted cocoon of brown silk amongst leaves or inside a folded leaf. Pupa normal, compressed dorso-ventrally; it wriggles out to some extent through one end of the cocoon prior to emergence of the adult. The first moths appeared on 21st August.

Thyrassia subcordata is described and figured in the "Fauna" volume (Moths, I, p. 238, f. 154), where it is recorded from the Plains of N. India, S. India and Ceylon, but apparently the larva has not been described or figured previously.

In Java the larva of *Thyrassia procumbens*, Snell., is known and also feeds on *Vitis trifolia*. It is described and figured by Piepers and Snellen [*Tijds. voor Entom.*, XLV, p. 228, t. 13, f. 12 (1902)] and appears very similar to that of *T. subcordata*.

183. Pterophoridae from Coorg.

Amongst a general collection of insects made in Coorg whilst on tour in October-November 1915 were specimens of the following *Pterophoridæ*:—

(1) *Buckleria zeroles*, Meyr.—Pollibetta; one specimen. The larva feeds on *Gynandropsis* in Ceylon.

(2) *Buckleria wahlbergi*, Z.—Mercara, Pollibetta; common. The larva must feed on some common plant, but is not known as yet.

(3) *Sphenarches caffer*, Z.—Pollibetta; common.

(4) *Oxyptilus epidictes*, Meyr.—Pollibetta; common. The larva feeds on *Biophytum*, which was growing commonly in localities where the moths were found.

(5) *Deuterocopus ritsemæ*, Wlsm.—Pollibetta; one specimen. This species is known from New Guinea to Assam and Ceylon but has not previously been recorded from Southern India.

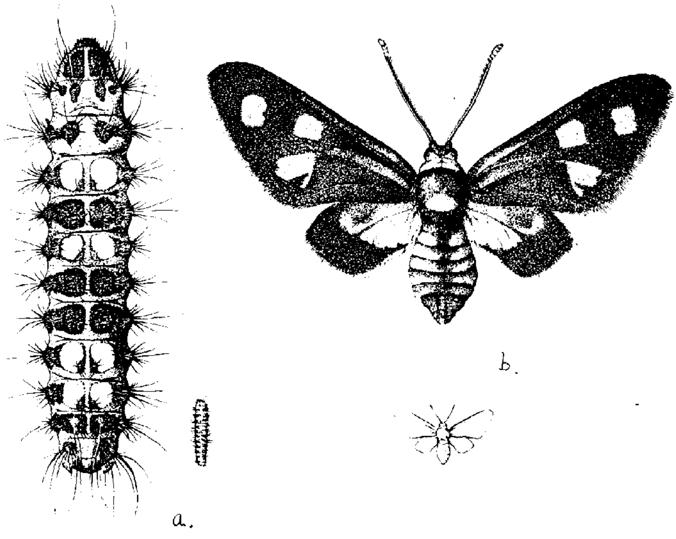


Fig. 48. *Thyrassia* [illegible]
a. Larva, natural size and magnified (×7).
b. Imago, „ „ „ (×5).

(6) *Deuterocopus planeta*, Meyr.—Pollibetta; three specimens. Originally described from Coorg and Assam.

(7) *Platyptilia brachymorpha*, Meyr.—Pollibetta; several. Widely distributed throughout India and Ceylon.

(8) *Platyptilia pusillidactyla*, Wlk.—Common everywhere in Coorg, the larva feeding in flowers of *Lantana*, whose output of seed is thereby reduced to a considerable extent.

(9) *Exelastis liophanes*, Meyr.—Virajpet; one. Probably common. The larva feeds on *Oxalis*.

(10) *Alucita melanopoda*, Fletcher.—Mercara; one. Originally described from Ceylon and the Khasi Hills. Not previously recorded from Southern India.

(11) *Stegnodactyla concursa*, Wlsm.—Pollibetta; one. Previously only known from Ceylon, but I have found it at Belgaum also. The larva feeds between the unexpanded young leaves of *Argyreia*.

184. Pterophorus monodactylus in India.

Three specimens, collected at Parachinar, Kurram Valley, North-West Frontier Province, in September 1917, by Ahmad Mujtaba, seem referable to *Pterophorus monodactylus*, Linn. We also have a single specimen from Mansehra, Hazara District, North-West Frontier Province (A. Mujtaba coll.; September 1917), which is not in good enough condition for exact determination, but which is probably the same species. *P. monodactylus* is widely distributed throughout the Holarctic Region but has not been recorded from within Indian limits hitherto.

185. Synonymy of Eucosma critica.

In Note No. 76 I published a record of a new pest of Arhar under the name of *Laspeyresia trichocrossa*, Meyr. MS. On examination of further material Mr. Meyrick concluded that this was identical with the species described by him from North Coorg under the name *Eucosma indicra* and, in reply to a note that this was the species hitherto standing in the Pusa Collection under the name of *Exelis critica*, he writes (*in litt.*, 27th October 1916):—"Your reference to *critica*, Meyr., has caused me to examine my (poor) specimens of this, and I find you are quite correct in your identification of it; I therefore (I regret to say) provided it with three names, and *trichocrossa* must drop. The species is variable and troublesome in markings; but in the male sex the black hairs of hindwings seem to be a quite peculiar character, and ought

to have ensured recognition. The reference to *Eucelis* was one cause of overlooking it, as that genus has been sunk; if however it were maintained as distinct from *Eucosma* (the distinguishing character is the nearly parallel vein 5 of hindwings), *critica* would be correctly referable to it."

The synonymy will therefore be :—

Eucosma critica, Meyr.

Eucelis critica, Meyr., B. J. XVI 587 (1905)[1]; Lefroy, Ind. Ins. Pests, p. 143[2], Ind. Ins. Life, p. 530 t. 55 (1909)[3]; Fletcher, S. Ind. Ins. p. 450 t. 39 (1914)[4].

Eucosma ludiera, Meyr., B. J. XXI 867 (1912)[5].

Eucosma trichocrossa, Meyr., Exot. Micr. I. 563-564 (1916)[6].

Laspeyresia trichocrossa, Fletcher, Pusa Bull. 59, p. 38, Note 76 (1916)[7].

Localities:—Surat[1]—North Coorg[3]—Pusa[6]—South India (Plains)[7].

186. Two new Indian Species of Cosmopteryx.

The two following species have been recently bred from the larvæ in the offices of the Indian Imperial Entomologist, and are of interest; their full lifehistory will be published by Mr. Fletcher. The perfect insects need very accurate discrimination.

Cosmopteryx phæogastra, Meyrick.

♂ ♀ 7-8 mm. Head dark bronzy-grey, with fine white lines on crown and above eyes, face bronzy-whitish. Palpi white lined with black. Antennæ black lined with white, four apical joints white, then three black, one white, one black, one white, one black, three white with dark bases. Thorax bronzy-blackish with white central line posteriorly. Abdomen uniform dark grey. Forewings narrow-lanceolate, apex produced, acute; blackish; a fine white subcostal line from base to $\frac{1}{4}$, diverging from costa posteriorly, and short median and subdorsal lines beneath posterior portion of this, widely remote from base and band, subdorsal rather posterior; costal edge shortly white before band; a broad pale ochreous-yellow post-median transverse band, edged by slender irregular golden-metallic fasciæ, first nearly direct or slightly outwards-oblique, followed above middle by a black dot,

second slightly inwards-oblique from costa, preceded by small indistinct blackish dot beneath costa, interrupted in middle by a short pale yellow projection, whence a white line runs along termen to apex: cilia grey, with a whitish spot beyond band, and a fine white bar at apex. Hindwings dark grey; cilia grey.

Bihar, Pusa, bred in July from larvæ mining blotches in leaves of bean (*Fletcher*). Extremely like *liggrades*, but distinguished by uniform dark grey (not yellowish-mixed) abdomen, and pale ochreous-yellow (not orange-yellow) band of forewings.

Cosmopteryx bambusæ, Meyrick.

♂ ♀ 8-10 mm. Head and thorax dark fuscous with three very fine white lines, face pale silvery-bronze. Palpi white lined with black. Antennæ black lined with white, three or four apical joints white, then four black, one white, one black, two white, two black, three white. Abdomen grey, in ♂ bronzy-shining. Forewings very narrow-lanceolate, apex long-caudate; dark fuscous, apical area beyond band grey; a very fine white subcostal line from base to beyond ½, diverging from costa posteriorly, and extremely fine median and subdorsal moderate lines, median not nearly reaching base or band, subdorsal posterior, approaching band; costal edge shortly white before band; a broad pale ochreous-yellow postmedian transverse band, margined by narrow pale golden-metallic fasciæ, first slightly outwards-oblique, followed by a black dot above middle and enlarged on lower half into an unusually raised round spot projecting posteriorly, second somewhat inwards-oblique from costa, interrupted above middle by a pale yellow projection, whence a white line runs along termen to apex: cilia light grey, with whitish spot on costa beyond band. Hindwings grey: cilia light grey.

Bihar, Pusa, bred in October from larvæ mining blotches in leaves of bamboo (*Fletcher*). Nearest *spiculata*, but the median line of basal area does not nearly reach base as in that species; the apical area much lighter than ground-colour is a noticeable feature, but is apparent though less marked in *spiculata* also: in the allied *manipularis* the apical area is concolorous with the basal. A pupa-case sent very little discomposed by the emergence of imago through a small slit shows only two abdominal segments free, the rest fixed, wing-cases reaching to end of penultimate segment.

[E. Meyrick in *Entom. Mo. Mag.*, LIII, pp. 257-258, Nov. 1917.]

187. Melasina taprobana in India.

Melasina taprobana was described, under the name *Alavona taprobana*, from Ceylon in Moore's *Lepidoptera of Ceylon*, Vol. III, p. 503, t. 208, ff. 7, 8 (1887). It has not hitherto been recorded from India but the Pusa collection contains a specimen, identified by Mr. Meyrick and collected at Tanjore in March 1913.

188. Two Pentatomids swarming on Pongamia glabra.

In January last I came across numbers of the tree *Pongamia glabra*, pretty old trees, growing as avenue trees on both sides of a trunk road in South Malabar literally covered—stem, trunks and shoots—with thousands of the Pentatomid bug *Cyclopelta siccifolia*, Westw., which has till now been noted on *Erythrina* in pepper and betel-vine gardens on the West Coast.

Very recently, a few days ago I found the same phenomenon, but in this case though the tree was the same the bug happened to be the common *lablab* Pentatomid *Coptosoma cribraria*, Fb. Every shoot and tender trunk was covered up by myriads of this insect. I have also found this insect exhibiting this habit on *Sesbania* (*Agathi*) plants.

T. V. Ramakrishna Ayyar.

189. Occurrence of Ochrophara montana in swarms.

In July 1917 Mr. R. D. Anstead sent in some specimens of *Ochrophara montana*, Dist., which he had received from Mr. C. H. Browne, Sallebile Estate, Kadur District, Mysore State, who wrote as follows:—"I am situated on the western, or monsoon, side of a big hill. Last Sunday (1st July) I climbed it, and on crossing the top I found the whole hill one mass of these insects, every tuft of grass held thousands, if not millions of them; as we walked along they rose in clouds. Eventually I got into the top of my Yelliemudloo coffee and from a short distance it appeared to have suffered from a cyclone, the shade trees (*Grevillea robusta*) had their branches bent or broken and lying about all over the place. On getting near I found it was due to the leaves and branches being laden with these insects. When I tell you that branches thicker than my arm, which would have supported a man without breaking, were snapped off, you will form some idea of the number there were hanging on to it. The coffee was also covered but to a less degree. It was a most remarkable sight and I regret I had not a camera with me. You will notice that there were none on the

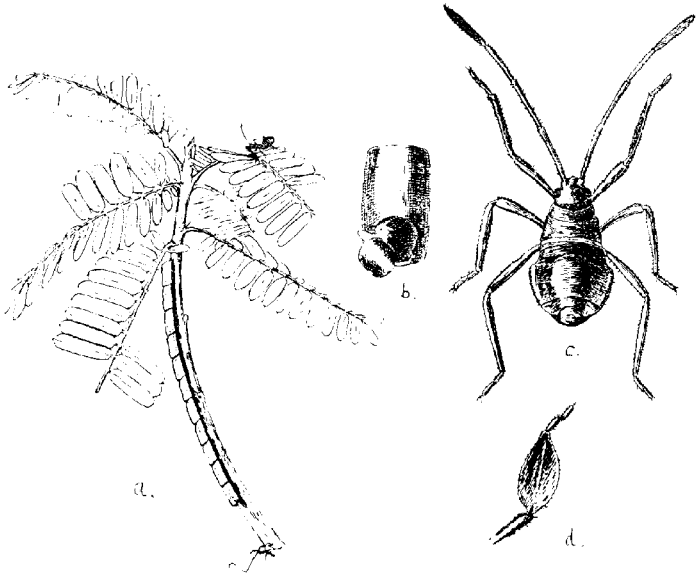


Fig. 43. *Acanthocoris glaviana*.
a, Seed twig, showing eggs deposited on stem and a young nymph on a leaf, slightly enlarged (× 1½).
b, Egg-shell after emergence of young nymph (× 8).
c, Nymph in second instar, magnified.
d, Fore-tibia of nymph in second instar, more highly magnified.

weather side of the hill and beyond damage done by their weight they seem to have no evil designs on vegetation."

This Pentatomid bug seems to occur fairly often in large swarms. We once had it sent in under rather similar circumstances by Mr. Graham, from Hallery Estate, near Mercara, Coorg, and when I was at Pollibetta in May 1914, I saw a similar occurrence on some trees near there.

Some light as to the cause of the sporadic occurrence of *O. montana* in such large numbers is given by the following remark by Mr. W. L. Distant (*Fauna of India, Rhynchota*, Vol. 1, p. 147 :—"Mr. L. de Nicéville forwarded to me specimens for identification and wrote:—"In Chanda (Central Provinces) reported to be doing immense damage over 1,200 square miles of country to the bamboo-seed crop. As is generally known, the bamboo but seldom flowers, and when it does—often after a famine—the seed is a valuable food for the starving people." Mr. E. P. Stebbing, Forest Entomologist to the Government of India, has given the same report and forwarded specimens. He identifies the bamboo as *Dendrocalamus strictus*." Mr. Browne says nothing in his letter *supra* about the flowering of bamboos in the Kadur District, but they had certainly flowered in Coorg just previous to my visit in 1914. So it appears probable that the occasional seeding of bamboos provides favourable conditions for the breeding of these bugs which, on the exhaustion of the bamboo seeds, move upwards in search of more food and thus congregate into large swarms on hill-tops and tall trees.

As Mr. Distant remarks *loc. cit.*, this species is structurally remarkable in having the pronotal angles either obtusely rounded or provided with a short acute forwardly-directed spine, which in some specimens is on one angle only. This character is well represented in the series in the Pusa Collection from Mysore and Coorg.

Ochrophara montana is recorded by Distant from the Naga Hills, Chanda, and Burma from Bhamo to Tavoy. The Pusa Collection contains examples from Mysore, Coorg and Assam.

T. BAINBRIGGE FLETCHER.

190. Early stages of Anoplocnemis phasiana.

Anoplocnemis phasiana is widely distributed in India and occurs on many plants, among which have been noted brinjal, indigo, *Cajanus indicus*, *Phaseolus mungo*, *Andropogon Sorghum*, *Erythrina indica* and *E. lithosperma*. It has been noted in small numbers on indigo at

Cawnpore and is often a serious pest of *Erythrina* in Southern India and Ceylon.

An adult pair, found at Pusa on indigo on 13th June 1917, was confined with a plant of *Sesbania aegyptiaca*, on which the female was observed to feed and on which she deposited eggs, thirty-seven eggs being deposited in all, and these were laid in long rows, all the eggs in the row lying lengthwise and touching one another at their ends. The egg is about 2·5 mm. long by 1·5 mm. broad, a transverse section being ∩-shaped, the flat side in contact with object to which the egg is attached, the ends truncated and flat; surface smooth, brown, coated with white powder. The young nymph hatches out by pushing open a circular, lid-like portion of the shell on the upper surface near one end of the egg. Eggs laid on 21st June hatched on 27th June and the first moult occurred on 30th June.

The newly-hatched nymphs are black and cluster together, resembling *Camponotus* ants. After the first moult the fore-tibia becomes much enlarged and flattened and the young bug then looks much like a young Mantid.

Pusa Insectary (Cage-slip 1596).

191. Notes on the Life-history of Megacoelum stramineum.

Megacoelum stramineum, Walk. (*Capsus* Cat. Het. VI., p. 120 (1873). Distant; Fauna of British India, Vol. II, Rhynchota Heteroptera, p.428 (Figs. 50 and 51).

Megacoelum stramineum, Walk., is described in the *Fauna of British India* as follows: –

Pale ochraceous, corium with a slight virescent tinge; eyes and apex of scutellum piceous; apical area of posterior femora testaceous; membrane pale hyaline; head with a distinct central longitudinal sulcation; antennæ with the first and second joints luteous, remainder fuscous; head pronotum and scutellum very finely ochraceously pilose; tibi longly setose.

Length 7 to 8 millim.

The localities are given as North Bengal, Kangra valley and Ceylon (Pundaluoya). It is common in Madras Presidency and presumably all over India. It occurs as a pest of *Andropogon Sorghum* Cholam in the Madras Presidency. It appears to affect chiefly the ripening grain in which its eggs are laid and on which it feeds. By these

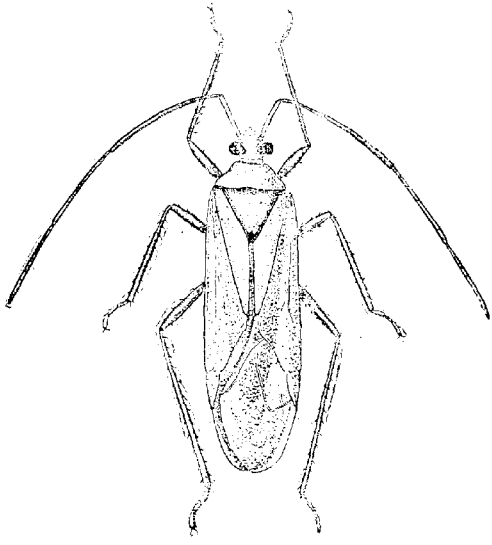
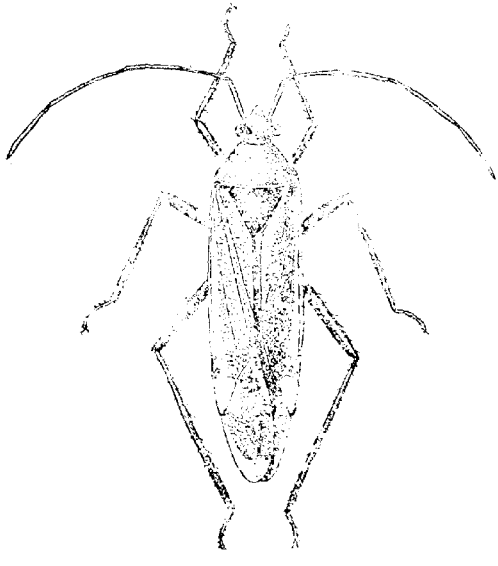


Fig. 50. — *Hesperotinus stramineum*, adult male.



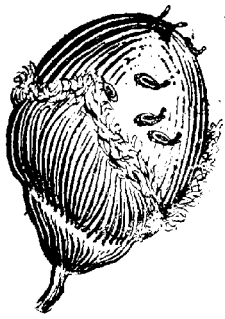


Fig. 52. Eggs on grain of *Sorghum* tops alone seen).

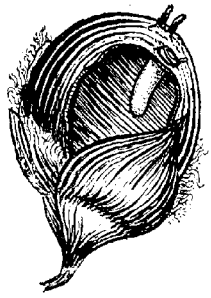


Fig. 53. One complete egg (grain cut open to show the whole egg).

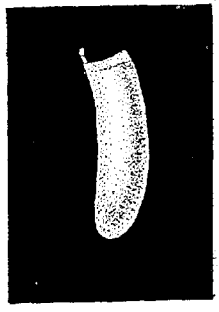
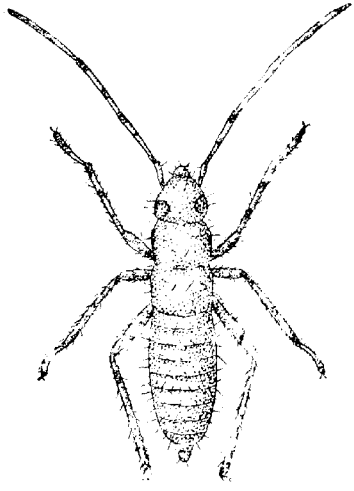


Fig. 54. Egg magnified (×20).



habits it supplements the destructive work of *Calocoris angustatus* with which it is nearly always found but which damages the immature and unfertilized florets.

Once identified the eggs are easily found and very characteristic. They are laid in the grain when in the "milk" stage, sometimes as many as fifteen being laid on one grain, in captivity, but in the field not more than one have been found in one grain (Fig. 53).

They are pushed into the grain by means of the short powerful ovipositor and only the top projects from the surface of the grain. Through this end the nymphs emerge, the top of the egg opening like a trap door.

The nymphs attain maturity in ten to eleven days, moulting five times in the process.

The adults are prolific egg-layers, as many as 199 eggs having been recorded as laid by one female.

The eggs are laid in the ripening grains. They are elongated, slightly curved, and provided with a conspicuous white ridge or collar, part of of which is prolonged to form an erect "Tag" or "Handle."

Nearly the whole of the egg is pushed into the grain, only a small portion and the collar projecting above the surface. In cross section the eggs are elliptical. The colour is purely white. Hatching usually takes place in six or seven days. Very little trouble was experienced in hatching eggs in the Insectary. It was not necessary to take any special precautions to ensure the correct amount of moisture or heat.

The number of eggs laid by a single female appears to be between 150 and 200. Egg records taken in four cases were as below:

1st case . . .	199
2nd case . . .	156
3rd case . . .	156
4th case . . .	2 females let in the same cage laid between them 277 eggs between 7th and 25th of July. It should however be noted here that one of the insects died on 16th, and after that 95 eggs were laid by the survivor between 17th and 25th July.

The eggs hatch in 5 to 6 days.

The nymphs of the first instar have the body a uniformly green colour. The antennæ are banded with seven bands of reddish purple. Round the eyes are reddish spots which extend backwards along the sides of the thorax (Fig. 55).

There are three reddish brown bands on the femora and slight banding is visible on the tibiæ. The most distal tarsal joint is black and

the first dark. The proboscis reaches back to the last pair of coxæ. The length of the nymphs in this instar is between 1·5 and 1·75 mm. The duration of this stage is between 2 and 2½ days after which period the first moult takes place.

After this event very little change is to be noted save that the banding of the legs is fainter than in the first instar.

Two days later the second moult occurs (Fig. 56). The leg banding can still be seen. The first tarsal joint is pale brown in colour as is the distal up of the tibiæ in the case of forelegs and black in the case of the last pair. The antennæ are banded as before. The wing pads are slightly indicated.

The third moult is passed through two days later. The body is covered with short black setæ. The first joint of the antennæ is grey brown and covered with black hair. The other joints of the antennæ are still banded and have the ultimate and penultimate joints dark at their distal end. The legs are greyish brown, setose and the last tarsal joint is black. The hindmost femora are faintly banded with red. The wing pads are more distinct than in the last instar and reach to the second abdominal segment. This stage lasts for two days.

The fourth moult then takes place, after which it is seen that all traces of banding have passed from the legs. The penultimate joint of the antennæ is dark at the tip and the last joint almost entirely dark. The wing pads now reach to the fourth abdominal segment. The antennæ are pale brown and the last tarsal joint dark. The stripes about the eyes are represented by two lines of reddish dots. The legs are pale green in colour, rather deeper on the femora. Two black dots are to be seen at the posterior edge of the metanotum.

At the fifth moult the adult form is attained.

Eggs laid	Time of hatching of eggs	First moult	Second moult	Third moult
1	2	3	4	5
5th to 6th March	12th to 13th Mar.	15th Mar. 4 P. M.	16th to 17th Mar.	19th Mar.
Ditto	Ditto	15th Mar. 9 A. M.	Ditto	18th Mar.
6th to 7th March	13th to 14th Mar.	16th to 17th Mar.	17th to 18th Mar.	19th to 20th Mar.
.....	15th to 16th Mar.	17th to 18th Mar.	19th to 20th Mar.	21st to 22nd Mar.
.....	16th to 17th Mar.	19th Mar.	20th to 21st Mar.	22nd to 23rd Mar.

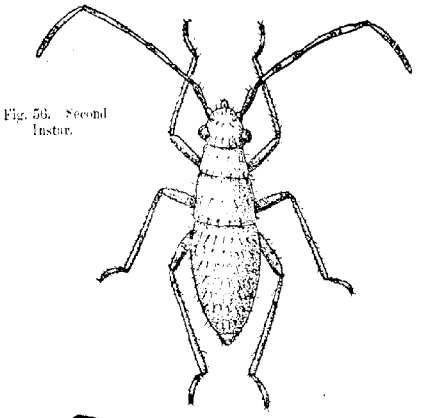


Fig. 56. Second Instar.

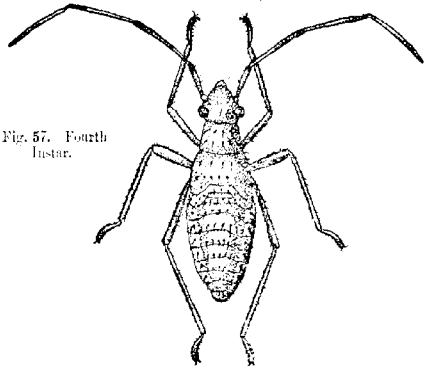


Fig. 57. Fourth Instar.

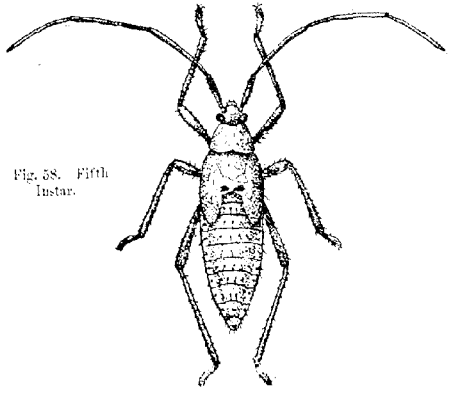


Fig. 58. Fifth Instar.

Eggs laid—contd.	Fourth moult	Fifth moult	Remarks
	6	7	8
5th to 6th March . .	21st Mar. .	24th Mar.	♀
Ditto . .	19th to 20th Mar.	23rd Mar. .	♂
6th to 7th March . .	21st to 22nd Mar.	24th to 25th Mar.	♀
.....	24th Mar. .	26th to 27th Mar.	Died in act of fifth moult.
.....	23rd to 24th Mar.	25th to 26th Mar.	♂

The amount of damage done by *Megaselia straminea* is not so great as in the case of *Calocoris*. At the same time it must considerably hinder the proper ripening of the grain. No effective methods have yet been devised for destroying or checking it, and with the exception of an Acarid found in one case badly infesting an adult female, no natural enemies have been found.

Megaselia is found chiefly as a pest of rain-fed *cholam* which is harvested in January-February. It does not appear in any numbers in the irrigated *cholam* grown under wells during the hot weather. It has been found hiding in the central leaf whorl in young *cholam* and *cumbu* and has also been observed on various other crops such as groundnut and gingelly.

E. Ballard.

192. A natural enemy of the mango hopper.

Very recently while in Bangalore I visited a few mango gardens in the city just to have an idea of the extent of mango hopper attack this year. While examining some badly infested trees I came across numbers of the nymphs and adults of a Reduviid bug, a species of *Isyndus* (probably *I. heros*, Fabr.) (See *F. B. I., Rhynchota*, II, p. 376) ; watching a few of these for some time I found the bug attacking the Jassid and acting as a predator. The nymphs are beautifully coloured in shades of scarlet blue black and white ; the regions occupied by the two rudimentary tegmina showing a conspicuous white multiplication mark. Though this bug does not play a very prominent part as an efficient natural check on such a serious pest as the mango hopper, it will be interesting to note which

are the natural enemies of the latter. I have not seen this insect either in Chittoor or Salem though hoppers abound in these two well-known mango tracts.

T. V. RAMAKRISHNA AYYAR.

193. Aleyrodidae on Citrus plants

Since listing the Indian species of Aleyrodidae (Note 98), some new species, found on *Citrus* plants, have been added in a paper entitled "Aleyrodidae or White Flies attacking the Orange, with descriptions of three new species of economic importance", by A. L. Quaintance and A. C. Baker (*Journ. Agricl. Res.*, VI, pp. 458-472, figs. and tabs.).

Aleurocanthus citriperdus, Q. & B., was found at Peradeniya on an unknown tree and on *Citrus* at Lahore and in Java. It is probably widely distributed in India "and is regarded as of considerable economic importance."

Aleurocanthus woglumi, Ashby, is common and widely distributed on orange in India and Ceylon and has also been found in the Philippines and has been introduced into Jamaica, Cuba and the Bahamas.

Aleurocanthus spiniferus, Quaint., was found on *Citrus* in Java and Macao.

Aleurolobus marlatti, Quaint., has been found on *Citrus* at Lahore and in Japan, also on *Morus* at Lahore and on *Ficus* at Peradeniya, and in Java on an unknown tree.

Bemisia giffardi, Kot., was found on an unknown tree at Lahore. It is abundant on *Citrus* in Hawaii, where it has probably been introduced.

Dialeurodes citri, Ashm., is widely distributed in India, Ceylon, China, Japan, etc., and has been introduced into Florida, Illinois and California.

Dialeurodes citrifolii, Morgan, a noxious species in the Southern United States, has not yet been noted in India or Ceylon, but is considered to be almost surely oriental.

A later "Contribution to our knowledge of the White Flies of the Subfamily Aleyrodinae (Aleyrodidae)" has also been published in *Proc. U. S. Nat. Mus., Washington*, Vol. LI, pp. 335-445, 16 tabs., and may contain further information on Indian species but copies of this paper have not yet come to hand.

T. BAINBRIGGE FLETCHER.

194. Notes on new and unrecorded species of Indian Coccidae.

At the fifth session of the Indian Science Congress held at Lahore I submitted a paper on "Some South Indian Coccidae of Economic Importance" wherein I listed some species which from their food habits appear to be of some importance from an economic point of view. My studies with this group of insects was continued during the past year, and of the 127 species which I have so far been able to verify definitely out of my collected material, 17 appear to be species quite new to science and the rest are those, which though not new to science, have not been recorded from India till I found them. In all 56 species are noted in this paper.

I have in this paper attempted to list these forms adding just what little notes I have on each. The paper is necessarily incomplete, as new and unrecorded forms are still being found. It is, however, submitted solely with the idea of getting into touch with other workers in the same field, if any, inviting their remarks and thus help to bring up our knowledge of these little known insects to a more or less complete and up-to-date condition. I am indebted to Professor Newstead, F. R. S., and Mr. E. E. Green, F.E.S., for kindly determining my material submitted to them. The descriptions of all the new species have not yet been published. Those of one or two which have recently appeared have been inserted in this paper.

1. Monophlebus tamarindus, Green.

Locality. Samalkotta, Godavari District. *Habitat.* On garden crotons (June). The adult ash-coloured females are strongly built and $\frac{1}{3}$" in length; they are found in numbers on the tender shoots.

2. Walkeriana pertinax, Newst.

Locality. Bangalore (June). *Habitat.* Wild plant. Only one adult female got. A number of larvae were found under the scale. This species was first described by Professor Newstead in the *Proceedings of the Zoological Society*, 1900, from specimens collected in Africa.

3. Orthezia insignis, Dougl.

Locality. Bangalore (November). *Habitat.* On *Lantana*. These were found only on a few plants on which the insect was artificially reared; the original specimens were accidentally found on a coffee plantation in the Nilgiris. This is the well-known *Lantana* bug of Ceylon and other countries.

4. Anomalococcus indicus, Green.

Locality. Coimbatore. *Habitat. Acacia arabica* (Babul tree), almost all through the year. Young trees when badly infested suffer a good deal. The common black ant (*Camponotus*) visits the scales in numbers. The adult insect is spherical and has a pale whitish colour; the young ones are flattish and of a pale yellowish colour. A Noctuid caterpillar (*Eublemma scitula*) is commonly found preying on the scale.

5. Eriococcus araucariæ, Mask.

Locality. Lal Bagh gardens, Bangalore, 3,000 feet. *Habitat.* On the shoots of a conifer; found as a white mass; badly infested shoots get a black sooty colour.

6. Eriococcus lagerstromiæ, Kuwana.

Locality. Courtallum, Tinnevelly District. *Habitat.* On a species of *Dalbergia*.

7. Carococcus bryoides, Mask.

Locality. Madras. *Habitat.* On *Hibiscus rosa-sinensis*.

8. Asterolecanium miliaris, var. *longum*, Green.

Locality. Coimbatore. *Habitat.* On the leaves of ordinary bamboo, almost all through the year; the scales are green and elongate. Does not produce any serious damage. First described by Green from Ceylon.

9. Pseudococcus corymbatus, Green MS.

Locality. Malabar, Coimbatore and Godavari districts. *Habitat.* On tender shoots of jak tree, on cotton and on *Citrus* plants. Colonies of this mealy bug cover the plant shoots in thick cottony masses. Numerous ants visit the colonies.

10. Pseudococcus crotonis, Green. (*nom. nud.*)

Locality. Coimbatore and Vizagapatam districts.

Habitat. On shoots of *Adenophyllum*, on fruit stalks of pomegranate and on stem and crevices in stem of the banyan tree.

11. Phenacoccus mangiferæ, Green.

Locality. Coimbatore and Vizagapatam. *Habitat.* On mango leaves and shoots of *Echitis*.

12. Phenacoccus ballardi, Green MS.

Locality. Coimbatore and South Kanara, *Habitat.* I found this form on mango and on a wild plant. The following is the description of this new form by Professor Newstead :—

"*Female adult.* Dorsum, in dried example, covered with a felted mass of white secretion, completely obscuring the segmentation; margin with a conspicuous fringe of extremely long, white appendages, which are shortest in front; those arising from the cephallic margin about three times the length of the felted dorsal area. Length, inclusive of the fringe, 10 mm.

"Form after maceration in potash, slightly elongate ovate. Antennæ of nine segments, the articulation of the third and fourth less pronounced than the rest. Eyes small, but prominent. Legs slender, longer than the antennæ; tarsal digitules simple bristels; those of the claw very long and dilated; two strong apical spines on all the tarsi, margin with a complete series of inconspicuous spines tubercles, the spines short and truncate; between them and surrounding them a number of large circular pores; two or three long hairs accompany each of the abdominal groups of spines. Anal lobes similar to the marginal ones. Anal ring with six hairs. Integument with a few minute scattered spines and small circular pores, the latter most numerous on the terminal abdominal segments. Length of macerated specimens, 1·7-2·0 mm.

"*Female, second stage.* The marginal appendages similar in their arrangement to those in *Pseudococcus* (*Dactylopius*) *longispinus*, Targ., but they are much longer and arranged radically: posterior pair longest. Form, after maceration, elongate. Antennæ of six or seven segments. Marginal series of spinose tubercles not so clearly defined as in the adult. Integument with numerous minute spines; and there are two or three very long hairs arising from near the anal spinose lobes.

"Very like *P. iceryoides*, Green. (*Mem. Dept. Agr., India*, II, page 26), in having a conspicuous fringe of white filaments; but in Green's species the ♀ has a fringe of short, stout, conical spines which extend into broad clusters on the abdominal segments; whereas in *P. gracilis* the spines are truncate and their arrangement similar to those in *P. insolitus*, Green (*i.e.*), but in the latter spines tubercles are present also on the dorsum.

"South India, Coimbatore, on mango (10th Feb. 1914); South Canara District, on an unnamed plant (September, 1913). (T. V. Ramakrishna per E. Ballard.)"

13. Phenacoccus ornatus, Green MS.

Locality. Courtallum, Tinnevelly District. *Habitat.* On a wild creeper. A very beautiful delicate white insect found in numbers on the host plant.

14. Antonina maritima, Green.

Locality. Coimbatore. *Habitat.* Found attached to the underground roots of grass (*Cynodon* sp.).

15. Pulvinaria maxima, Green.

Locality. Coimbatore. *Habitat.* Very common on Nim (*Melia*) trees, doing often considerable damage to them. The leathery adults and the long white ovisacs are prominently seen in numbers on badly infested plants. Found recently on mulberry shrubs and cotton also. The species was first described by Green, from Javanese specimens found on *Erythrina*, in the *Entomologist's Monthly Magazine*, 1904. It promises to become a pretty bad pest.

16. Pulvinaria thespesiæ, Green.

Locality. Coringa, Godavari District, and Papanasam, Tanjore District. *Habitat.* On the Portia tree (*Thespesia populnea*). Very similar to *P. maxima*, Gr., in almost all characters. Green described the insect for the first time in Ceylon from specimens found on the same foodplant.

17. Inglisia chelaioides, Green.

Locality. Coimbatore. *Habitat.* On *Parkinsonia aculeata*. The insects are liable to be mistaken for the thorns of this plant unless carefully examined. The adults are very pretty looking insects with the glassy conical test. First noted in Ceylon from a single example on *Gelonium lanceolatum*. I have recently sent good material of this to Mr. Green, who described it first.

18. Lecanium hesperidum, L.

Locality. Madilagam, South Malabar, and Mandapetta, Godavari.

Habitat. On coconut leaf and *Citrus* shoots. This is a well known scale in the New World and affects a variety of plants. Is perhaps an introduced form.

19. Lecanium longulum, Douglas.

Locality. Mandapetta, Godavari District. *Habitat.* On stem of red gram plants. Green has noted this on *Acacia, Albizzia, Loranthus*, etc., in Ceylon.

20. Lecanium ramakrishnæ, Green MS.

Locality. Kothapetta, Godavari District. *Habitat.* On distal shoots of *Ficus bengalensis*. The scales have a bluish black colour.

21. Lecanium signiferum, Green.

Locality. Golgonda (Vizagapatam District). *Habitat.* On plantain leaf. Previous record from Ceylon.

22. Lecanium adersi, Newst.

Locality. Coimbatore. *Habitat.* On mango leaves. Professor Newstead has very recently described this for the first time from African specimens on mango. The following is the description :—

"*Female adult.* Very flat, irregularly ovate, and narrowed in front. Colour varying from chocolate-brown to brownish buff. Antennæ of six or seven segments; in the latter the fourth is much the longest; in some examples the articulation of the third with the fourth is very faintly indicated or entirely absent. Legs long and slender, especially the middle and hind pairs. Stigmatic clefts invaginated; stigmatic spines stout, bluntly pointed and of varying lengths; there are from twenty to twenty-two of these organs. Marginal spines falciform and finely serrated on one side. Anal lobes with the base exceedingly short, and the outer edge very long and strongly curved or arched. Anal cleft about one-fifth the length of the body. Derm cells minute and very widely separated; there are similar organs grouped together just in front of the anal orifice.

"Length. 4·75—5·0 mm.

"Closely allied to *Lecanium bicruciatum*, Green, from which it differs chiefly in the multiplication of the stigmatic spines."

23. Lecanium tessellatum, Sign.

Locality. Coimbatore (April). *Habitat.* On *Calophyllum* leaves. The scales are reddish brown, flattish and oval in shape.

24. Lecanium acutissimum, Green.

Locality. Coimbatore. *Habitat.* On coconut leaf and very rarely on mango leaf also.

25. *Lecanium discrepans*, Green.

Locality. Palacole, Godavari District, January. *Habitat.* On mango leaf—covered over by webs of a species of ant.

26. *Lecanium ophiorrhizæ*, Green.

Locality. Patti Konda, Kurnool District.
Habitat. On *Diospyros chloroxylon.*

27. *Chionaspis caricosa*, Green.

Locality. Sidapur, Coorg (May). *Habitat.* On pepper stem. The name of this species is changed by Cooley to *Phenacaspis caricosa.*

28. *Chionaspis nilgirica*, Green MS.

Locality. Ootacamund, Nilgiris, 7,500 feet. *Habitat.* On *Loranthus.*

29. *Chionaspis spiculata*, Green MS.

Locality. Chanthanathode, Western Ghats, 1,500 feet.
Habitat. On bamboo leaves.

30. *Chionaspis acuminata*, Green.

Locality. Coimbatore, Tinnevelly and Western Ghats.
Habitat. On tamarind leaves and *Erodia.*

31. *Diaspis permutans*, Green.

Locality. Western Ghats, 800 feet.
Habitat. On *Erodia.*

32. *Diaspis rosæ*, Bouché.

Locality. Bangalore (March). *Habitat.* On a wild plant and also on mango leaves.

33. *Diaspis mangiferæ*, Green.

Locality. Alamanda, Vizagapatam District. *Habitat.* On mango leaf. I am not quite sure whether this has not been recorded before from India.

34. *Hemichionaspis draconæ*, Cooley.

Locality. Vadanapalle, South Malabar (October). *Habitat.* On areca palm.

35. Hemichionaspis chionaspiformis, Newst.

Locality. Coimbatore. *Habitat.* On wild indigo. Previously recorded from Africa.

36. Fiorinia plana, Green MS.

Locality. Coimbatore and Tinnevelly District. *Habitat.* On leaves of *Elæodendron glaucum*. The infested leaves present an ashy grey appearance.

37. Aspidiotus cydoniæ, Comst.

Locality. Bangalore and Coimbatore. *Habitat.* On shoots, stem and fruits of grape, fig and pear plants. Very probably introduced with nursery stock from Australia.

38. Aspidiotus tamarindus, Green MS.

Locality. Coimbatore. *Habitat.* On tamarind leaves and fruits. Very closely allied to *A. hederæ*, Vall. Found in company with *A. orientalis* and *Hemichionaspis minor*, Mak.

39. Aspidiotus pseudocamelliæ, Green MS.

Locality. Ittige, Bellary District (October). *Habitat.* On *Capparis*.

40. Aspidiotus cyanophylli, Sign.

Locality. Nilgiris, 2,000 feet. *Habitat.* Ceara rubber and plantain leaves.

41. Aspidiotus ficalbiiformis, Green

Locality. Vadanapalle, South Malabar (October), and Coconada, Godavari (June). *Habitat.* On *Lecanium coccinea*, *Mimusops elengi*, and mango.

42. Odonaspis penicillata, Green.

Locality. Coimbatore. *Habitat.* On nodes of bamboo covered over by the hairs and scales of the plant.

43. Odonaspis simplex, Green.

Locality. Coimbatore. *Habitat.* On bamboo stem.

44. Gymnaspis ficus, Green MS.

Locality. Kollegal, Coimbatore 1,600 feet (May). *Habitat.* On leaves of *Ficus retusa*. The infested leaves appear rough and pale, the scales appearing as patches of minute dots.

45. Gymnaspis ramakrishnæ, Green MS.

Locality. Courtallam, Tinnevelly district. *Habitat.* On *Hemigyrosa* leaves.

46. Lepidesaphes (Mytilaspis) meliæ, Green MS.

Locality. Coimbatore. *Habitat.* On stem and shoots of Nim (*Melia*) tree.

47. Mytilaspis beckii, Newst.

Locality. Trivandrum. *Habitat.* On pepper leaf.

48. Mytilaspis retusus, Green MS.

Locality. Dodabetta, Nilgiris, 8,000 feet (October). *Habitat.* On leaves of *Litsea whitiana*.

49. Mytilaspis pallida, Green.

Locality. Ramachandrapur, Godavari District (January). *Habitat.* On guava leaf—very few found.

50. Parlatoria proteus, Curtis.

Locality. Bangalore, 3,000 feet. *Habitat.* On orchids, *Vanda* and *Bellatulum*.

51. Parlatoria orientalis, Newstead MS.

Locality. Coimbatore. *Habitat.* On a wild bush.

52. Parlatoria mangiferæ, Marlatt.

Locality. Cocanada, Godavari District (January). *Habitat.* Inner surface of palmyra leaf-sheaths.

53. Parlatoria artocarpi, Green MS.

Locality. Chandanathode, Wynaad, 1,500 feet.
Habitat. On jak leaves.

54. Parlatoria papillosa, Green MS.

Locality. Palghat, S. Malabar.
Habitat. On jak leaf.

55. Pyrogymnaspis indica, Green MS.

Locality. Quilon, Travancore. *Habitat*. On leaves of *Veteria indica*.

56. Aonidia tentaculata, Green MS.

Locality. Quilon, Travancore. *Habitat*. On leaves of *Vateria indica*.

T. V. RAMAKRISHNA AYYAR.

195. An unrecorded foodplant of Chionaspis vitis.

While in camp at Kollegal, Coimbatore District, in September my attention was drawn to a few mango trees exhibiting prominent white and pale yellowish patches on the leaves. Some of the leaves were completely covered with this patch and were drying up, while others though retaining the natural leaf colour had smaller patches on the surface. On closer examination it was found to be an infestation of colonies of a species of scale insect. Mr. E. E. Green, to whom I forwarded specimens, kindly identified the insect as *Chionaspis vitis*, Green. The insect has so far been recorded only as attacking *Vitis lanceolaria* and allied species, *Loranthus sp.* and *Elæagnus latifolia*. The presence of the pest on mango has not been recorded before. It is likely that the pest may become important as I found several trees in Bangalore also infested with this scale. It is not unlikely that the pest distributed itself from *Loranthus* which is very commonly found as parasitic on mango trees.

T. V. RAMAKRISHNA AYYAR.

196. Pseudococcus (Ripersia) sacchari.

In Tanjore and probably various other adjoining districts of the Madras Presidency, paddy is subject to a specific disease known in Tamil as *Soorai Noru*. The crop shows small patches of stunted and somewhat fading plants. At the time of harvest such plants become very conspicuous, as they continue to stand erect while the rest of the crop becomes lodged, owing to the weight of the ears.

The mealy bug is found in all stages between the stalks and the leaf-sheath and later on at harvest time is specially noticeable between the stalk of the earhead and the sheathing leaf or as in many cases, where the earhead is smothered, around the earhead within the leaf-sheath. The mature female is elongate, more or less cylindrical, somewhat purplish and scantily covered with meal. Males were reared out and were delicate little objects of purplish colour. The adult female lays hundreds of small oval eggs. The active young larvæ which hatch out walk up the stem and insinuate themselves into the space between the young stalk and the sheath and grow sucking the plant-sap. The places where the bugs have been at work turn dark brown in colour. The normal growth of the earhead is checked. The grains do not develop properly and if they do, they are of an unhealthy dark brown colour. It was reported that they tasted bitter and if present in good grain they spoilt the flavour of the food when cooked.

Drought was reported to favour the development of the disease.

Certain Chalcids, a species of *Scymnus*, and an Agromyzid fly were found attacking this mealy bug at Manganallur.

Y. Ramachandra Rao.

197. Thrips as a Paddy Pest.

In *Bull. Entom. Research*, Vol. VI, Part 4, pp. 353-355 (February 1916), Mr. C. B. Williams describes as new and figures an Indian Thrips under the name *Thrips (Baynallia) oryzæ*. These specimens were obtained on very young paddy at Madurantakam, S. India, in May, but the species also occurs at Coimbatore in August and is probably more widely distributed. It usually attacks quite young seedlings and may do considerable damage, the affected plants turning yellowish, as if scorched.

As regards control measures, in the case of irrigated paddy (which seems to be most often attacked) a little kerosine oil may be run into the seed-bed with the irrigation stream, to form a slight film on the water-surface, and the plants then dipped under this by dragging a rope or bamboo across the bed.

T. Bainbrigge Fletcher.

198. Paddy Thrips.

In different parts of the Madras Presidency young paddy—chiefly the seedlings in broadcasted fields—suffers from the attacks of *Thrips (Baynallia) oryzæ*, Williams. It was found doing some serious damage

to paddy crops in the Madurantakam taluq, Chingleput District, in May 1915. The paddy seedlings which are badly attacked appear from a distance as though gradually drying up for want of water ; this is due to the sickly pale colour assumed by the tender shoots when they are infested with the pest. The insect is a very minute creature and found in numbers, generally inside the young shoots. It is found in all stages inside these leafrolls. Numerous shining eggs, yellowish white larvæ and the dark brown adults are all found together. The larvæ and the adults by their action on the leaf tissue produce a spotted appearance to the leaf which makes the cultivators often call this disease by names meaning small-pox. During the early stages of the infestation it is found that female insects preponderate in number. The insect was identified by C. B. Williams of the John Innes Institution, Merton, Surrey (*Bulletin of Entomological Research*, February 1916, p. 353). According to him this appears to be the first species to be recorded for the mainland of India of the genus *Thrips*.

T. V. Ramakrishna Ayyar.

199. Fabrician Types of Indian Odonata.

In the June 1917 number of *Ann. Mag. N. H.* there is an article (pp. 441-450) by H. Campion "on Fabricius' Types of Odonata in the British Museum (Nat. Hist.)," in which the following Indian species are referred to :—

(1) *Rhyothemis variegata*, Linn. = *Libellula arria*, Drury = *L. indica*, Fb., Spec. Ins., I, p. 521, no. 8 (1781). The Indian form *Rhyothemis variegata variegata* is smaller than the Chinese form *R. variegata arria*.

(2) *Neurothemis tullia*, Drury = *Libellula equestris*, Fb., Spec. Ins., I, p. 523, no. 20 (1781), erroneously described as from Africa.

(3) *Crocothemis servilia*, Drury = *Libellula ferruginata*, Fb., Spec. Ins., I, p. 521, no. 11 (1781), erroneously described as from Cape of Good Hope.

(4) *Sapho ciliata*, Feb., Spec. Ins., I, p. 528, no. 3 [*Agrion*], described from Coromandel, is really from Sierra Leone.

(5) *Mecistogaster lineatis*, Fb. (1776). The type of this cannot now be traced and in its absence it is impossible to say precisely what Fabricius' *Agrion lineatis* may be. It was described from India from material in the possession of Dr. Fothergill.

200. Pseudagrion rubriceps in the Khasi Hills.

Pseudagrion rubriceps was originally described by Selys from Java in *Bull. Acad. Belg.* (2), XLII, 510 (1876), and its female was described by the same author in *Ann. Mus. Genova* (2), X, 515-516 (1891), the range of distribution of the species being given as Java, Burma and India. Laidlaw (*Rec. Ind. Mus.*, XIII, 24 (1916), f. 2) has lately recorded it from Calcutta and Major F. C. Fraser has taken it at Poona.*

At the end of October and beginning of November 1918, I found this species in small numbers along the shores of the Ward Lake at Shillong, where its occurrence was curiously limited to two non-contiguous parts of the shore of the lake. In life this is a very handsome species, the blue abdominal markings of the male being very vivid and the orange frontal portion of the head very conspicuous, especially when this dragonfly hovers on the wing facing the observer. The flight is swift and when disturbed the insect often hovers motionless in one place over the water or even darts backwards in a straight line. The male grasps the female around the neck and flies with her in the usual Cœnagrionid manner. A female, grasped by the male, was observed ovipositing on a half-submerged twig which was floating freely on the water.

T. Bainbrigge Fletcher.

* Since this Note was sent to press I have also found it at Nagpur in December 1918. [T.B.F.]

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