A NEW CHALCID-FLY PARASITIC ON THE AUSTRALIAN BULL-DOG ANT.*

By CHARLES T. BRUES.

Several decades ago, Professor August Forel† found in cocoons of the large Australian bull-dog ant, *Myrmecia forficata* Fabr., two specimens of a fine Eucharid. He recognized them as parasites of the ant larvæ and sent them to the English hymenopterist, Peter Cameron, who described them as *Eucharis myrmiciæ*.‡ This was the first record of a Eucharid parasite of an ant, although several other genera have been reared subsequently from other ants and it seems likely that all of the Eucharidæ are ant-parasites.

Very recently Dr. R. J. Tillyard, of Hornsby, New South Wales, bred from a cocoon of *Myrmecia gulosa* another Eucharid which he sent to Prof. W. M. Wheeler, who has published accounts of the habits of Orasema and several other genera.§

The species reared by Dr. Tillyard is quite distinct from *Eucharis myrmiciæ*, although I suspect that both may belong to the same genus. Cameron's species is undoubtedly not an Eucharis as that genus is at present restricted and it may perhaps be a Psilogaster to which I believe the new species is referable. Psilogaster was first proposed for an Egyptian species by Blanchard and recently another one from Abyssinia has been more carefully described and figured by Reichensperger+ as *P. fraudulentus*. In addition to these, Dr. Wm. M. Mann tells me that he has a new species which he hopes soon to describe, taken by him in the Solomon Islands. The Abyssinian form occurs with *Pheidole megacephala*. Both of the African species have 11-jointed antennæ as does a Tasmanian Eucharid described by Walker as *Psilogaster pallipes*. Recently Girault has added one from Australia with 10-jointed antennæ, and has proposed the genus *Parapsilogaster* for another with 12-jointed antennæ. Since it is a difficult matter to say

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† Am. Soc. Ent. Belgique, Vol. 20, p. 8. (1890).

‡ Mem. & Proc. Manchester Lit. & Philos. Soc., Vol. 4, p. 187. (1891).

§ Bull. American Mus. Nat. Hist., Vol. 23, pp. 1–93 (1907).

+ Zool. Jahrb. Abth. f. Syst., Vol. 53, pp. 185–218. (1913).

whether the apical part of the antenna ("club") consists of one, two or three separate joints, descriptions without figures may be misleading on this point. The species bred by Dr. Tillyard from Myrmecia differs considerably from *P. fraudulentus* in both the adult and pupa and as they occur with such different ants they may quite likely prove to be generically distinct. In accordance with the large size of Myrmecia, it is more than twice the size of the Abyssinian parasite of Pheidole and by reason of its striking color pattern may be very readily recognized.

Psilogaster fasciiventris sp. nov.

Imago. (Plate I, Fig. 2). ♀ Length 7.5 mm. Head and thorax greenish bronze, less greenish and with purple reflections on the propodeum; abdomen piceous, with transverse yellowish bands, orange yellow on the second segment and lighter yellow on the following segments; band of second segment narrowly interrupted on the median line and curving forward on the sides to near the apex of the petiole, separated by its own width from the apical margin of the segment; those of the following segments of similar form, but not interrupted medially, that of the fifth widened medially and angularly extended forward; petiole black with a purple cast; antennæ ferruginous, scape lighter; mandibles light brown; coxæ black, the front ones bronzed; femora fulvous; tibiæ and tarsi pale yellow, last tarsal joint black at apex; wings hyaline at base, brown elsewhere, more deeply so anteriorly near the middle. Head much narrower than the thorax, fully three times as broad as thick; posterior margin slightly concave; face below the antennæ transversely striate, the striæ continuing over the cheeks and upward behind the eyes and across the occiput; occipital margin raised; ocelli in a nearly straight line, the posterior ones nearly as far from one another as from the eye-margin; antennal basin transversely striated; eyes bare; malar space nearly as long as the eye; antennæ 11-jointed, scape twice as long as thick; pedicel very short; first flagellar joint as long as the scape and pedicel together, over three times as long as broad; following joints growing shorter, the seventh and eighth less than twice as long as thick; apical one longer. Thorax above coarsely rugose-reticulate; parapsidal grooves impressed only on posterior half; scutellum without distinct

median furrow or depression; separated from the post scutellum by a shallow groove, the two together acutely convex at apex, but without teeth or projections. Propodeum flattened and elevated medially, the sides of the central part convexly elevated at the sides, lateral to this with a deep groove extending to the hind coxa separating the lateral part which is acutely convex above near the root of the hind wing. Pleuræ sculptured like the mesonotum. Petiole of abdomen as long as the slope of the propodeum; second segment twice as long as the third and fourth together; following very short, not visible from above; apical margins of the second and third segments deeply excised medially. Tarsal claws simple. Submarginal vein thickened on its apical third; marginal half as long as the submarginal and fully four times as long as the short, stout, nearly perpendicular stigmal vein; postmarginal extending about half-way to tip of wing, but gradually evanescent at tip.

Type from Hornsby, New South Wales, in the writer's collection, bred from cocoon of *Myrmecia gulosa* by Dr. R. J. Tillyard.

Male. A pupa (Plate II, Fig. 2) shows twelve distinctly separate antennal joints and is, I suspect a male, and the apical joints are longer, more slender and of approximately equal length. In the female, if the lengthened and constricted 11th joint were regarded as two joints, the apical one would be much shorter than the penultimate.

Planidium, or First Larval Stage.

There are no specimens of this instar, but the cast skin of one was found still attached to the mature larva described below. This exuvium was firmly attached to the under surface of the thorax just behind the head and I have been able to remove it almost intact. When mounted in balsam it gives some idea of the structure of the planidium which proves to be very similar to that of *Perilampus* as described by Smith.*

Compared with Smith's figure (1912, p. 46, fig. 26 d), of the engorged planidium it appears to have eleven sclerites behind the head, while Perilampus has twelve. The apical plates are very small, however, and quite likely the number is the same in both genera. The head is separated from the

* Bull. U. S. Dept. Agric., Bur. Ent., Tech. Ser. No. 19, pt. IV, pp. 33-69 (1912) and Psyche, Vol. 24, pp. 63-68. (1917).

rest of the dorsal integument in the cast skin, showing that ecdysis must be accomplished by the formation of a dorsal rent behind the head. The thoracic and abdominal plates, except the last three are widely separated by the enormously distended membrane, so that they appear as widely separated bars like those of a much swollen termite queen. The first or prothoracic plate is broader than the others and crescentic, being deeply emarginate in front. The three following are narrower and but slightly curved; the following become gradually smaller to the minute apical one. At each side of each plate is a more or less triangular, paler extension, separated by a fine clear line; these probably represent pleural plates; they are similar to those of Perilampus in having the tip prolonged into a long bristle-shaped point, but the posterior edge bears several short teeth instead of bristles. Between the plates and on the ventral surface, the membrane bears some bristly hairs as in Perilampus, but the arrangement of these cannot be made out clearly in the specimen. I find no trace of the caudal bristles present in Perilampus, but these may easily have been lost in ecdysis.

Larva. Full-grown, length 12 mm. There is a single larva, evidently full-grown and ready to molt into the pupal condition as the appendages of the pupa are to be seen through the skin. The body is rather stout (Plate I, Fig. 1) nearly straight and broadest near the posterior end. At the anterior end there is a large vesicular swelling which extends ventrally, behind it on the ventral side lies another smaller swelling which evidently represents the head and mouthparts, although no definite structures can be made out. Dorsally, and to a less degree on the sides and below, the surface of the body is undulating, indicating eleven segments, including the anterior vesicle previously referred to. Of these segments the three anterior ones (thoracic) are larger than the basal abdominal ones, although the last several abdominal segments increase in size till the sixth is the largest body segment; beyond the segments become rapidly smaller and bent down ventrally; finally at the apex on the ventral side of the body is a minute tubercle which evidently is a twelfth segment. The surface of the whole body is clothed with minute, colorless, sparsely placed hairs which undoubtedly function as exudate organs.

Pupa. (Plate II, Figs 1, 2, 3). Length 15 mm. Elongate and slender, with the abdomen not noticeably swollen and not curved downward, the whole body with vesicular swellings. The head is bent under the thorax so as to be scarcely visible from above, but its projections extend forward as a central bifurcate, transversely wrinkled papilla and another one at each side projecting forward and outward. The mesonotum bears a small rounded tubercle at each side of the anterior edge, an acute one near each tegula and a widely separated pair of sub-acute ones on the disc before the scutellum; otherwise the integument is simple except for a raised, longitudinally wrinkled area between the anterior pair of tubercles. There are no tubercles above the propodeum and petiole like those figured by Reichensperger (*loc. cit.*) for *P. fraudulentus.*

Abdomen narrowly oval, broadest near the anterior end, composed of five apparent large segments and a short apical one, followed by a portion which appears to be retractile and composed of several fleshy segments, terminated by a polliciform projection. Dorsally the five large segments are separated by sharply elevated transverse ridges, each interrupted narrowly along the median line. At the median end each is elevated as a tooth, again as a more conspicuous and longer tooth at the lateral end, which is well down on the side of the body; midway between there is another tooth. Between the large teeth, especially near the dorsal line, there are more or less distinct minute denticulations. The ridges between all segments are very nearly of the same size, except that the lateral tooth-like projections of the first are much larger. The ventral surface is clearly separated by a slight ridge and groove just inside the intersegmental teeth and is less convex than the dorsal surface; only the second to fifth transverse ridges are clearly indicated; they are continuous and much less conspicuous than the dorsal ones; the first is faintly visible and bears an anteriorly directed tooth at its middle. Seen from below, the dorsal surface of the short sixth segment extends further down than the other, leaving only a narrow ventral part which is conically elevated; in addition the apex of the fifth ventral segment bears a pair of closely approximated tubercles at apex; following retractile segments without distinctly separated dorsal and ventral surfaces.

Described from one perfect and several damaged specimens

The very great similarity of the planidium stage of Psilo-
aster to that of Perilampus is extremely interesting and sug-
sts a close affinity between the Eucharidæ and Perilampidæ
s has already been pointed out by Smith from a comparison
f the planidia of Perilampus and Orasema. In fact, this stage
f *Psilogaster fasciiventris* is almost as close to that of *Perilampus*
valinus as the latter is to "Perilampus, species a" figured
y Smith. In this case it may of course be possible that
species a" is not a true Perilampus as Smith did not succeed
n rearing the adult. The host relations are very different
n the case of the two families so far as is known; all bred
Eucharids have been found to be parasites of ants while Peri-
ampus has been bred from a diverse series of hosts, including
Lepidoptera, Coleoptera, Neuroptera and some parasitic
Hymenoptera and Diptera.

The later larval and especially the pupal stages are much
more highly modified in the Eucharids than in Perilampus,
although in the larvæ there seems to be much diversity in this
respect. In the case of the larva, that of Psilogaster is com-
paratively simple, without conspicuous exudate organs, although
it is well supplied with minute surface hairs which no doubt
function as secretory organs of this type. Orasema possesses
numerous, highly developed exudate tubercles arranged seg-
mentally on both the thorax and abdomen. On the other hand,
Perilampus shows similar conspicuous tubercles and projections,
although it seems improbable in view of the host relations in
this case that these can function as true exudate organs. In
the pupa, that of Perilampus is simpler, although with small
intersegmented ridges on the abdomen. In Orasema the pupa
exhibits well developed transverse welts between the abdominal
segments as well as some on the head. The climax appears in
Psilogaster where the exudate organs are extremely large and
elaborate as described in the present account.

There would seem to be two possible reasons for the presence
of the highly developed exudate-like organs on the Perilampus
larva. It might be that Perilampus is derived from Euchari-
like ancestors in which these organs actually functioned for
the elaboration of an exudate, but this seems highly improbable
in view of the much more specialized habits and structure of the
Eucharidæ. On the other hand, it may be that the integu-
mental modifications of Perilampus really do function as exudate

organs. But if such were the case it seems impossible to point out any way in which they might bear any relation to the host. It is of course possible that neither of the foregoing suppositions is true, and that the apparent exudatoria or blood spaces between the body and integument are simply adaptations to assist in ecdysis. Such can hardly be the case however, as they do not exist in other parasitic Hymenoptera with habits similar to those of Perilampus and in which ecdysis must be undergone under the same conditions.

None of these suppositions seems adequately to explain the structure of the Perilampus larva and pupa, and unless the exudatoria are functionless their presence must be due to some other cause. It is barely possible that they may bear a relation to the host other than those enumerated above.

It is known that the larvæ or many if not all externally feeding parasitic Hymenoptera secrete a salivary liquid which is injected into the host. This contains digestive enzymes which act upon the tissues to induce extra-intestinal digestion and a consequent liquefaction of the food material which is then more readily ingested. In ants at least, as has been pointed out by Wheeler (1918) there are undoubtedly cases where such secretions have both a digestive and exudatorial function. With this in mind it is possible that the secretion which is actually produced on the surface of the body of the Perilampus larva (*vide* Smith 1912, p. 50) may have a digestive function. With this hypothesis there is one difficulty; only a small part of this secretion could possibly enter the wound caused by the feeding larva in the host.

Of all these conflicting suppositions none appears satisfactorily to explain the conditions as they occur in Perilampus, and it is perhaps more likely that the exudatoria may have been present in the common ancestors of both Perilampidæ and Eucharidæ. If such be true, they have persisted in both families and have in the Eucharidæ assumed a secondary function as their exudates have proved to be attractive to the ants upon which they are parasitic. We may then believe that they were originally either secretory or excretory organs, or those assisting in some way in the process of ecdysis

Tubercular excrescences of somewhat similar appearance are to be seen in many larval insects of very diverse groups, *e. g.*, in many caterpillars, in certain parasitic beetles, in one

genus of bees (Allodape) and in some ants. In connection with some of these, Professor Wheeler has suggested to me that they may be of assistance in eliminating the large amounts of water ingested by rapidly growing insect larvæ. Quite recently Roubaud* has figured (p. 15) larvæ of the remarkable Rhipiphorid beetle *Macrosiagon ferruginea* which are external parasites of the wasp, Synagris. In these larvæ the body is covered with tubercles much like those of Psilogaster and Perilampus. Roubaud also found in the larva of a Braconid parasite occurring in the nests of Rhynchium, transverse welts of apparently similar nature (*l. c.*, p. 35, Fig. 14). In this case the Braconid larvæ (*Allodorus major*) feed not upon the wasp larvæ, but upon one of the caterpillars used for provisioning the nest. They develop at an unusually rapid rate, and on this account may easily require additional facilities for excreting water, particularly as they possess a closed alimentary tract and must excrete all excess water through the skin. The habits of a somewhat closely related genus of Braconidæ, Chelonus, have been described by Pierce and Holloway in America.† This species is an internal parasite and undergoes a much slower development, the larva requiring about three weeks to mature. These writers do not describe the larva, but it seems probable that they are not tuberculate, as such a peculiarity would undoubtedly have been mentioned. It seems probable, therefore, that at least one form related to Allodorus, but developing more slowly, lacks the welts present in Allodorus. This would appear to lend color to the suggestion made above, that the welted or tuberculated integument may function in excreting excess water.

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* Ann. Sci. Nat. Zool. 1916 Recherches biologiques sur les guêpes solitaires et sociales d' Afrique.

† Notes on the Biology of *Chelonus texanus* Cress., Journ. Econ. Entom., Vol. 5, pp. 425–428. (1912).

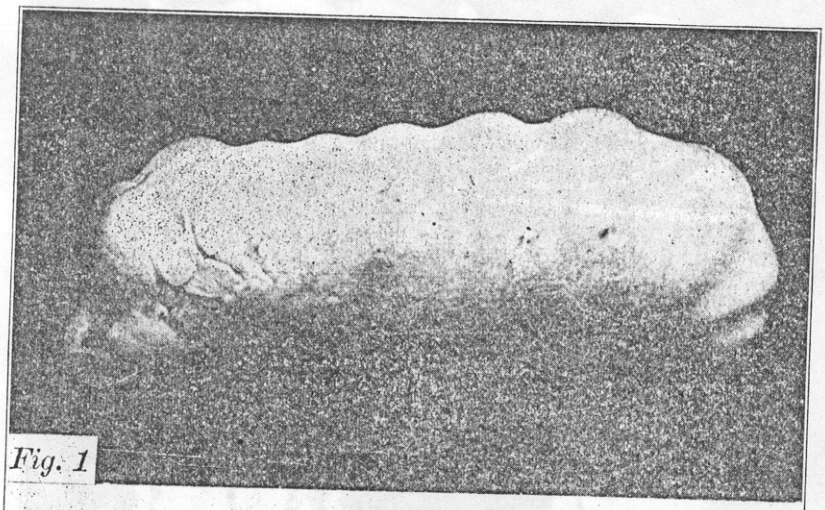

Fig. 1

Fig. 2

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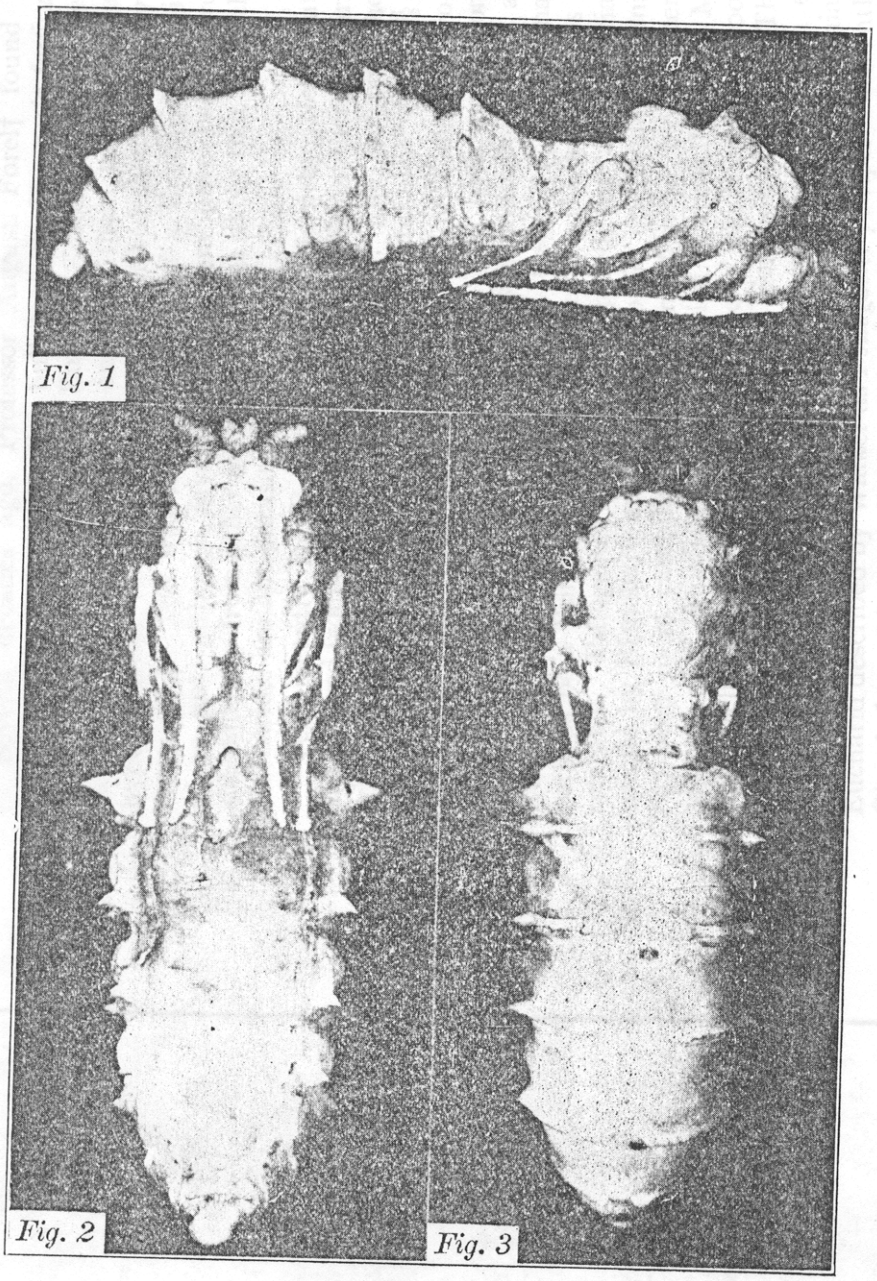

Fig. 1

Fig. 2

Fig. 3

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