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Mature Larvae of Five Species of the Subgenus *Icariola* of the Genus *Ropalidia* from the Philippines (Hymenoptera, Vespidae)

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Abstract Mature larvae of five Philippine species of the subgenus *Icariola* of the genus *Ropalidia* are described. Species described are *Ropalidia cyathiformis*, *R. fasciata*, *R. gregaria*, *R. horni* and *R. marginata sundaica*. Some of larval characters are briefly discussed.

The Philippine *Ropalidia* consists of twelve species of which five belong to the subgenus *Icarielia* and their ranges are restricted to the archipelago (KOJIMA, 1982a). The remaining seven species belong to the subgenus *Icariola* and are widely distributed in South-East Asia, continental Asia and/or Oceania except for *R. philippinensis* which is restricted to the Philippines. Phylogenetic and biogeographic studies on these wide-spread species may contribute to an understanding of the origin of the *Ropalidia* fauna of the Philippines. No comprehensive work on the taxonomy of the Philippine *Icariola* has, however, been made since VAN DER VECHT (1941, 1962) published the monograph on Indo-Australian *Ropalidia*. Although it has increasingly been realized that larval characters are useful for taxonomic purpose (RICHARDS, 1978a; YAMANE & OKAZAWA, 1981), little is known of the larvae of these *Icariola* species. During the stay in the Philippines in 1980, I collected some nests of *Icariola* except *R. philippinensis* and *R. stigma*. In the present paper, I describe the mature larvae of five species obtained from these nests, and discuss the taxonomic value of some of larval characters.

Ropalidia cyathiformis (FABRICIUS)

(Fig. 1)

Specimens examined: 10 mature larvae, 26 March 1980, Campus of the University of the Philippines at Los Baños, Laguna, Luzon I., J. KOJIMA leg.

Head. Cranium largely brown in color (genae, clypeus and large spots inside temporal bands pale), nearly circular in frontal view; posterior margin weakly concave at the level of antennae; in profile frons somewhat convex anteriorly. Integument moderately sclerotized, weakly granulate; frons with very sparse minute setae. Midcranial sulcus very weak. Frons not separated from the epicranium and clypeus by sutures. Clypeus strongly transverse, weakly emarginate ventrally and defined

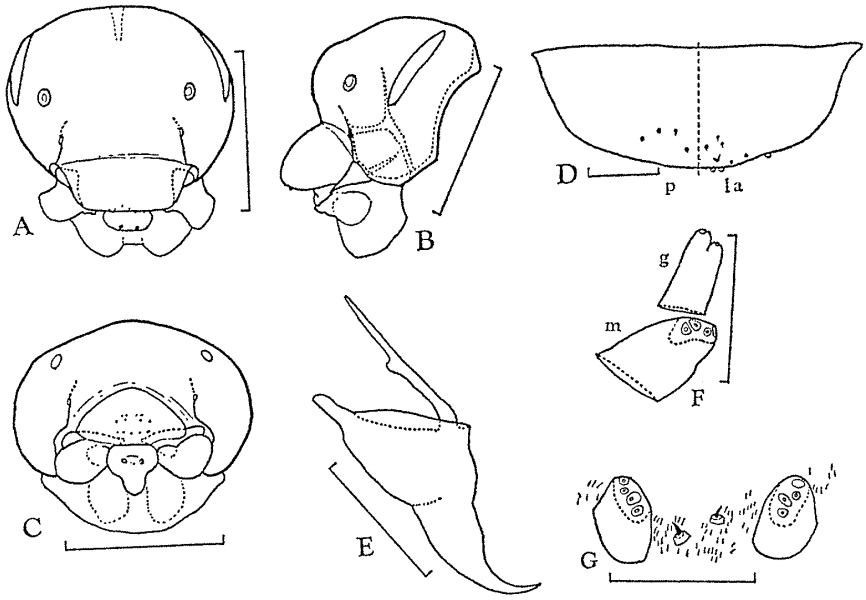

Fig. 1. Head of mature larva of *Ropalidia cyathiformis*. —— A, Head in frontal view; B, head in profile; C, head in ventral view; D, labrum (1a) and palate (p); E, mandible; F, maxillary palp (m) and galea (g); G, labial palps and paired setae. Scale lines: A–C, 1 mm; D, E, 0.2 mm; F, G, 0.1 mm.

laterally by epistomal sulcus. Antenna relatively large, with two or three very small sensillae. Temporal band rather long and relatively wide, reticulate at outer half. Postoccipital and hypostomal sulci developed; pleurostomal sulcus weak; upper portion of epistomal sulcus disappearing. Labrum pale in color, transverse, well developed and strongly swollen anteriorly, not emarginate ventrally, and with several conical sensillae near ventral margin and a few setae; palate with a few setae. Mandible slender, sharply pointed apically, without subsidiary tooth; adductor apodeme long, with a short branch at some distance from base; abductor apodeme short. Maxillary lobe moderately developed, hidden under the produced labrum except the somewhat swollen basal part, with a sclerotized ring at base, with dense microscopic denticles at apex, no setae; maxillary palp with 4 minute sensillae; galea divided into two lobes, each with a quite small sensilla. Prelabium wider above, much narrower below, with microscopic denticles around labial palps; lower half with small punctures; labial palp with 4 minute sensillae; paired setae behind labial palps arising from raised sockets. Postlabium developed, distinctly concave below, without setae or punctures.

Body. Integument not granulate. Venter of thoracic segment I bare, II anteriorly bare, posteriorly with sparse setae and dense microscopic denticles; venter of thoracic segment III and of abdominal segments with sparse setae and densely covered with microscopic denticles, which are rarely contiguous to form rows. Dorsum of thoracic segments and of abdominal segments I and II with sparse setae and dense

microscopic denticles, which are often contiguous to form rows; denticles on the dorsal area of the following segments less often closely set. Limb and wing bud plates distinct at least in stained specimens. First spiracle about twice as large in diameter as the rest; atrium bare.

Ropalidia gregaria (SAUSSURE)

(Fig. 2)

Specimens examined: 12 mature larvae, 18 Apr. 1980, Muñoz, Nueva Ecija, Luzon I., J. KOJIMA leg.

Head. Cranium largely brown in color (lower margin of clypeus, genae and frons extensively pale brown), nearly circular in frontal view, evenly concave posteriorly at the level of antennae. Integument moderately sclerotized, without granules; frons and clypeus with sparse punctures, each puncture with a quite minute seta. Midcranial sulcus very weak. Frons not defined. Clypeus strongly transverse, weakly emarginate ventrally and defined laterally by epistomal sulcus. Antenna large, with three very small sensillae. Temporal band long and wide; outer half reticulate. Postoccipital and hypostomal sulci developed; pleurostomal sulcus

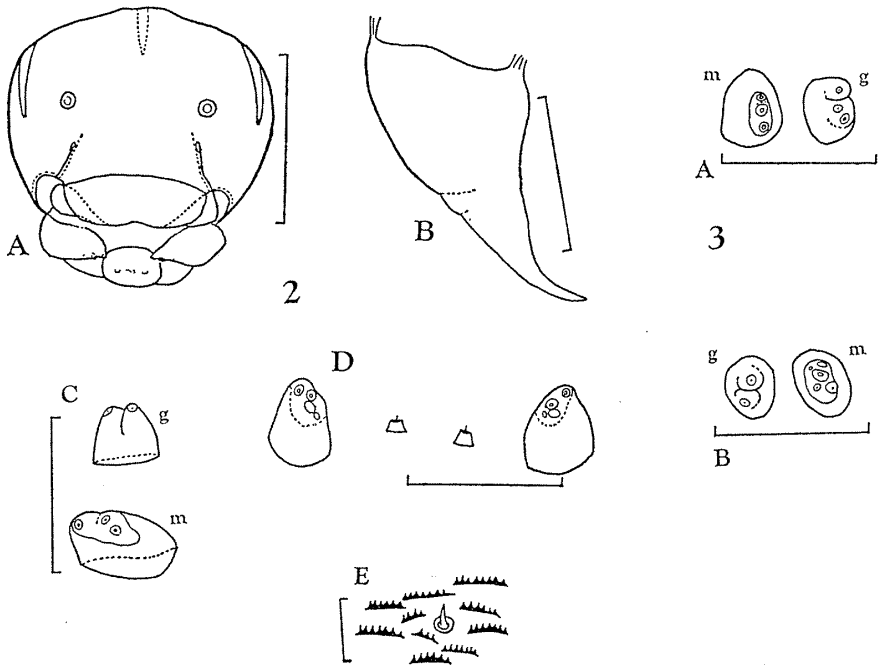

Fig. 2. Mature larva of *Ropalidia gregaria*. —— A, Head in frontal view; B, mandible; C, maxillary palp (m) and galea (g); D, labial palps and paired setae; E, seta and microscopic denticles on venter of thoracic segment III. Scale lines: A, 1 mm; B, 0.2 mm; C, D, 0.1 mm; E, 0.02 mm.

Fig. 3. Maxillary palp (m) and galea (g) of right (A) and left (B) maxillary lobe with abnormal number of sensillae in a mature larva of *Ropalidia fasciata*. Scale lines, 0.1 mm.

very weak; upper portion of epistomal sulcus disappearing. Labrum pale in color, transverse, weakly emarginate ventrally, with several rather large conical sensillae near ventral margin; palate without setae or conical sensillae. Mandible slender, sharply pointed apically, without subsidiary tooth. Maxillary lobe not very developed, with a sclerotized basal ring, without setae; upper margin with microscopic denticles; maxillary palp with 3 or 4 minute sensillae, two of which are situated on the slightly produced half of the palp; galea divided into two lobes, each with a single minute sensilla. Prelabium wide above, somewhat narrower below; lower half with punctures; labial palp with 4 minute sensillae; paired setae arising from distinctly raised sockets. Postlabium moderately developed, weakly concave below, without setae or punctures.

Body. Integument not granulate, with sparse setae and dense microscopic denticles as follows: Venter of thoracic segment I bare; II and III and abdominal segment I with sparse setae and dense microscopic denticles, most of which are contiguous to form rows; setae on the ventral surface of the following segments sparser and microscopic denticles smaller and sometimes contiguous to form rows. Setae and denticles on dorsum of thoracic segments and of abdominal segment I like as those on venter of thoracic segment II; those on venter of abdominal segments II–X as in dorsal area of these segments. Limb and wing bud plates distinct at least in stained specimens. First spiracle about 2.5 times as large in diameter as the rest; atrium bare.

Ropalidia fasciata (FABRICIUS)

(Fig. 3)

Specimens examined: 9 mature larvae, 27 Apr. 1980, Puerto Princesa, Palawan I., J. KOJIMA leg.

No marked differences are discovered between the larvae of *R. fasciata* and *R. gregaria*. One of the examined specimens has abnormal maxillary lobes as follows: right maxillary palp has three minute sensillae, while the left has five; right galea is bilobed and one of the lobes has two sensillae at its top.

Ropalidia horni SONAN

(Fig. 4)

Specimens examined: 10 mature larvae, 25 Apr. 1980, Puerto Princesa Palawan I., J KOJIMA leg.

Head. Cranium extensively brown (large genal spots and the regions inside the temporal bands pale; clypeus whitish yellow), nearly circular in frontal view, in profile posteriorly concave at the level of antennae. Integument moderately sclerotized, weakly granulate, without setae. Midcranial sulcus rather wide and very weak. Frons not defined. Clypeus strongly transverse, not emarginate ventrally; defined laterally by epistomal sulcus. Antenna large, with 2 or 3 very small sensil-

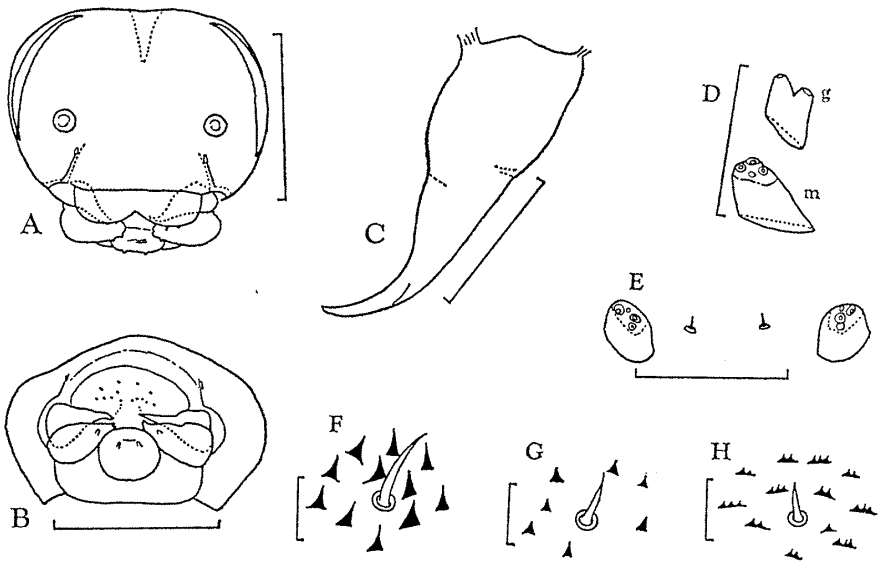

Fig. 4. Mature larva of *Ropalidia horni*. —— A, Head in frontal view; B, head in ventral view; C, mandible; D, maxillary palp (m) and galea (g); E, labial palps and paired setae. F–H, Setae and microscopic denticles on venter of thoracic segment II (F); venter of abdominal segment II (G); dorsum of thoracic segment I (H). Scale lines: A, B, 1 mm; C, 0.2 mm; D, E, 0.1 mm; F–H, 0.02 mm.

lae. Temporal band rather long; outer half to two-thirds reticulate. Postoccipital and hypostomal sulci developed; pleurostomal sulcus weak; upper portion of epistomal sulcus disappearing. Labrum pale in color, transverse, rather strongly emarginate ventrally, with sparse setae and a few small conical sensillae near ventral margin; palate with a few setae. Mandible slender, sharply pointed apically, and with a very reduced, short subsidiary tooth near apex. Maxillary lobe rather well developed, with a sclerotized ring at base, without microscopic denticles or setae; maxillary palp with 4 minute sensillae; galea apically divided into two lobes, each with a minute sensilla. Prelabium subcircular in shape, with sparse punctures at lower half; labial palp similar to maxillary palp in shape, with 4 minute sensillae; paired setae arising from weakly raised sockets. Postlabium small, not concave below, and without setae or punctures.

Body. Integument not granulate. Ventral surface of thoracic segment I with quite sparse setae and without denticles; that of thoracic segments II and III and of abdominal segment I with sparse, relatively large setae and moderately large microscopic denticles; setae and denticles on venter of abdominal segments II–X smaller and sparser. Posterior portion of dorsum of thoracic segment I, whole area of dorsum of thoracic segments II and III, and of abdominal segments I and II with sparse setae and densely covered with microscopic denticles, most of which are contiguous to form rows; denticles on dorsal area of the following segments small, those on abdominal segments III–VII contiguous to form rows while those on VIII–

X not arranged in rows. Limb and wing bud plates distinct at least in stained specimens. First spiracle about twice as large in diameter as the rest; atrium bare.

Ropalidia marginata sundaica VAN DER VECHT

(Fig. 5)

Specimens examined: 9 mature larvae, 15 Apr. 1980, Muñoz, Nueva Ecija, Luzon I., J. KOJIMA leg.

Head. Cranium dark brown except for lower margin of clypeus (pale brown), nearly circular in frontal view, in profile relatively flattened and weakly emarginate posteriorly. Integument rather strongly sclerotized, granulate and with sparse but distinct setae. Midcranial sulcus narrow and rather distinct. Dorsal tentorial pit very weak, but visible. Frons not defined. Clypeus strongly transverse, slightly emarginate ventrally and defined laterally by epistomal sulcus. Antenna moderate in size, with 3 or 4 very small sensillae. Temporal band narrow and rather long;

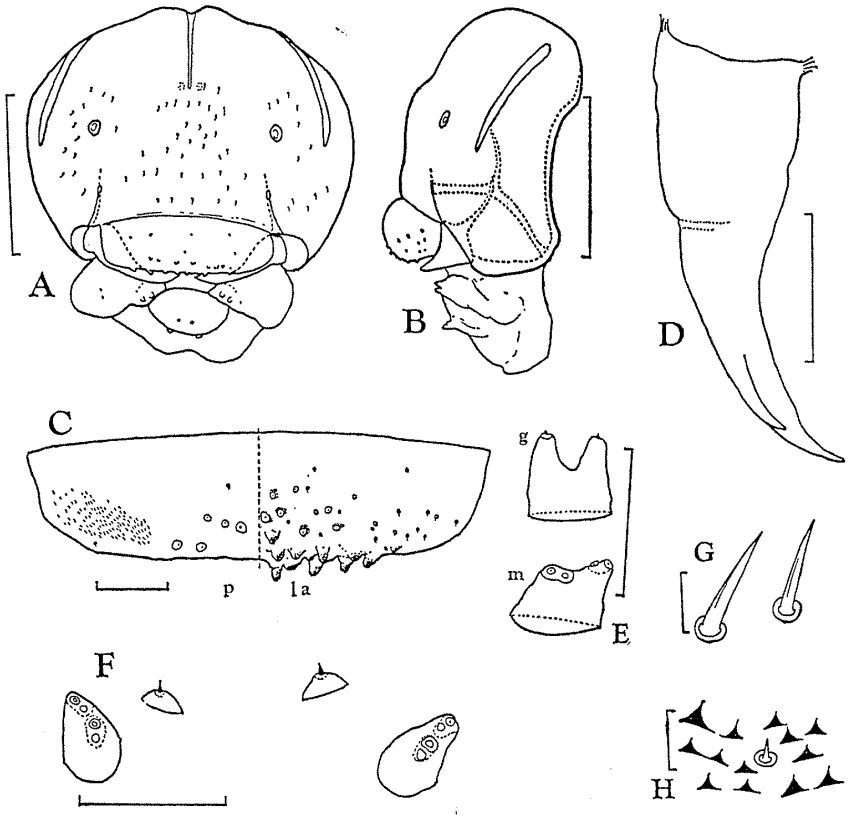

Fig. 5. Mature larva of *Ropalidia marginata sundaica*. —— A, Head in frontal view; B, head in profile; C, labrum (la) and palate (p); D, mandible; E, maxillary palp (m) and galea (g); F, labial palps and paired setae. G, Setae on venter of thoracic segment I; H, seta and microscopic denticles on venter of thoracic segment II. Scale lines: A, B, 1 mm; C, D, 0.2 mm; E, F, 0.1 mm; G, H, 0.02 mm.

outer one-third to half reticulate. Postoccipital and hypostomal sulci developed; pleurostomal sulcus weak; upper portion of epistomal sulcus disappearing. Labrum pale in color, transverse, not emarginate ventrally, with several relatively large conical sensillae near ventral margin and several minute setae in lateral portion; palate with fewer setae and conical sensillae than labrum, laterally with dense microscopic denticles. Mandible slender, sharply pointed apically, with a distinct subsidiary tooth near apex. Maxillary lobe not much developed, with a distinct sclerotized ring at base, apically with microscopic denticles, without setae; maxillary palp with 4 minute sensillae, two of which are situated on the distinctly produced half of the palp; galea divided into two lobes, each with a single minute sensilla. Prelabium subcircular in shape, lower half sparsely punctate; labial palp similar to maxillary palp in shape, with 4 minute sensillae; paired setae short but rather strong, arising from dome-like raised sockets. Postlabium moderately developed, not distinctly concave below, with a few setae and small punctures.

Body. Integument not granulate. Venter of thoracic segment I anteriorly with sparse strong setae, posteriorly bare; II bare in anterior one-third, posteriorly with sparse setae and dense microscopic denticles (several denticles sometimes contiguous to form a row); III with setae and covered with dense denticles as in posterior portion of venter of segment II. Venter of abdominal segments and dorsum of all the body segments with sparse setae and dense microscopic denticles, which are weaker than those on venter of thoracic segments and rarely contiguous to form rows. Limb and wing bud plates distinct at least in stained specimens. First spiracle about twice as large in diameter as the rest; atrium bare.

YAMANE and OKAZAWA (1981) described the mature larva of *R. marginata jucunda* CAMERON from New Guinea and noted that temporal band is not reticulate and all the body seguments have microscopic denticles.

Notes on Larval Characters in *Ropalidia*

YAMANE and OKAZAWA (1981) enumerated and discussed some larval characters which seem to be important in polistine taxonomy and phylogeny, laying stress on two characters in *Ropalidia*, i.e., raised sockets for the paired setae behind labial palps, and contiguous microscopic denticles on body integument. They considered that these characters are regarded as derived ones, and are possibly associating *Ropalidia* with *Belonogaster*. The larvae of all the species studied here show the same states in these characters. Moreover, morphoclines are recognized in these two characters among the five species. The raised socket is relatively weak in *R. horni*, distinct in *cyathiformis*, *gregaria* and *fasciata*, and well developed and somewhat modified (dome-like) in *marginata*. On the other hand, microscopic denticles on body integument are only sometimes contiguous to form rows in *R. marginata*, and more often so in *cyathiformis* and *horni*; and in *gregaria* and *fasciata* nearly all the denticles on thoracic segments are arranged into rows.

YAMANE and OKAZAWA (1981) discussed also nine other structural characters, but did not mention about the color. Coloration of larval head seems, however, to be important when the larval characters are viewed in relation to adult's behavior. KOJIMA (1982b) noted that brownish larval head in an exposed nest of *Ropalidia* helps to make the nest less conspicuous to visual predators by forming a nest uniformly brown in color. The present five species, of which larvae have brownish heads, are known to construct exposed nests (KOJIMA, 1982b; RICHARDS, 1978b; VAN DER VECHT, 1962). On the other hand, larval head of the subgenus *Icarielia* which constructs enclosed nests is whitish yellow (KOJIMA, 1982a). The brownish larval head, being associated with the construction of an exposed nest which is very probably an ancestral behavior, is presumably a primitive condition in the genus *Ropalidia* and may have been selected out in the subgenus *Icarielia* along the evolution of constructing an enveloped nest.

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