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DESCRIPTION OF THE MATURE LARVA  
(HYMENOPTERA: VESPOIDEA)

Studies on the vespoid larvae. II. By SK. Y.

By RONALDO ZUCCHI, SEIKI YAMANE, and SHÔICHI F. SAKAGAMI

*Abstract*

ZUCCHI, R., YAMANE, SK., and SAKAGAMI, S.F. 1976. Preliminary notes on the habits of *Trimeria howardi*, a Neotropical communal masarid wasp, with description of the mature larva (Hymenoptera: Vespoidea). *Ins. matsum. n.s.* 8: 47-57, 1 tab., 2 pls.

*Trimeria howardi* excavates heterodalous nests in soil. The brood cell is excavated, not built in a cavity. An empty cell receives first either an egg or the larval food. Provisioning is successive. Often two or more females are found in the same nests. Most of such nests are tentatively interpreted as communal, but some nests suggest quasisociality. The mature larva is described and compared with that of two other genera. The larva is similar to that of *Pseudomasaris edwardsii*, both with the mandibles feeble, antennae large, and clypeus located above the line connecting the mandibular bases. An unusual number (seven) of antennal sensillae and a remarkably minute atrial opening are characteristic of *Trimeria howardi*.

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## INTRODUCTION

The family Masaridae occupies a peculiar position within the Vespoidea. Except one predaceous genus *Euparagia*, all other genera so far studied provision their nests with pollen and nectar. Thus they are the vespoid counterpart of the bees evolved from the Sphecoidea, though far less successful than the latter in species number, extent of distribution and morpho-functional specialization to melliferous habits. Up to the present the habits of several genera have been recorded as reviewed by Richards (1962), Malyshev (1968), Torchio (1970) and Iwata (1971). But the amount of information is still insufficient to give a precise bionomic perspective of the family. In 1971, two of us (R.Z. & S.F.S.) found nests of *Trimeria howardi* Bertoni 1911 in Ribeirão Preto, State of São Paulo, and started bionomic observations. As the work is still in continuation, here are given only some important findings as a preliminary report, together with the description of the mature larva by Sk. Y.

## BIONOMIC NOTES

Nests are excavated in soil. The main burrow is nearly vertical and about 4 mm wide and 6.0–15.0 cm ( $m$  9.0) deep. The entrance is provided with a neatly built vertical turret (Fig. 9) 1–7 mm in height ( $m$  3.07) and 2.9 mm in inner diameter. A variable number (1–24,  $m$  7.3) of approximately horizontal laterals issue from the main burrow (=heterodalous type by Malyshev, 1935) and the brood cells are excavated at their ends, never built in hollow cavities (=synodalous) as in some *Ceramius* species. Most laterals have an only cell, but rarely two (6.9%) or three (1.1%) cells (=parodalous). Cells are horizontal, elongate oval with the inner walls smooth and polished.

Curiously, the order of oviposition and food provisioning is irregular. There were found three cells each with an egg deposited at the bottom (Fig. 13) and four cells each with a food mass without egg. This might relate to the presence of two or more females in the same nest as referred to below. Provisioning is certainly progressive. There were found some open cells with food and small to medium sized larvae, while no closed cell with such contents. The larval food is made from pollen and nectar, and relatively solid, with an irregular annulation (Figs. 11,12) which probably corresponds to successive foraging trips.

Nests are often reused as proved by the remains of old cells with empty cocoons scattering around the main burrow. The species is possibly bivoltine. Three incipient nests apparently newly excavated, each containing a fresh female, were found on January 19, April 29 and May 5, 1972. But, reflecting the subtropical climate, it is difficult to distinguish the generations clearly. The winter (June to early August) is passed by prepupae.

Often several nests are found side by side, with a distance of 3–4 cm from each other (Fig. 10). The occurrence of two or more females in the same nest, in the other species only once recorded in *Ceramius lichtensteini* (Brauns, 1910, cf. Iwata, 1971), is fairly common in *T. howardi*. Among 30 nests examined, 18 contained a single female. The number of females in other 12 nests were 2♀♀ (7 nests), 3 (1), 4 (3), 7 (1). Further, 8 out of 35 nests contained one male during January to May. Judging from the composition of brood cells, most of these males were not born in the nests concerned but joiners from other nests. By the

parsimonious norm, most nests with two or more females are tentatively interpreted as communal, i.e., each female cares her own brood cell. But there are some nests which suggest more advanced social types, judging from cell composition and adult conditions. Two cases are cited. Nest 4-29-IV: Only one open cell containing a young larva and food mass. No remain of old cells. Two females both with fully developed ovary\*. This nest is regarded as quasisocial (Michener, 1969, 1974) and one female is apparently a joiner from the outside. Nest 4-4-V: One cell with egg and food, several empty cocoons, and seven females. Four females with a fully developed ovary, two heavily worn and with developed ovaries, and one newborn. Apparently the nest was reused. The relation of the first mentioned four females can be interpreted as quasisocial, while the two older females may be either their elder sisters or the females of the last generation. Anyhow, the association is not eusocial, even if containing two successive generations. It is possible but not certain that some ovarially undeveloped females are responsible for the deposition of larval food in a cell before it receives egg as mentioned above. Consequently, the social type of *Trimeria howardi* is regarded as communal, though some nests show quasisociality, despite the species is subsocial, i.e., the larvae are in contact with adult females (cf. Michener, 1969, 1974). The habits described above will be compared elsewhere with those in other genera.

#### DESCRIPTION OF THE MATURE LARVA

The mature larva is described and compared with that of two other species, *Pseudomasaris edwardsii* (Cresson) (melliferous) and *Euparagia scutellaris* Cresson (predaceous), both described by Torchio (1970).

*Head*: Nearly circular in frontal view; integument weakly sclerotized; with mandibular apices, anterior tentorial pits, maxillary palps, galeae, labial palps, salivary lips, especially ventral one, pigmented; setae and sensoria nearly lacking on head capsule; mid-cranial sulcus (*mcs*) weak, visible only at upper portion; vertex (*v*) round, not indented; frons not separated from epicranial area by distinct lines; antennae (*ant*) large and distinctly projecting conically, each with about seven minute sensillae at the center; temporal bands (*tmb*) narrow and weak; anterior tentorial pits (*atp*) located at dorsolateral angles of clypeus (*clp*), large and distinct; postoccipital sulcus (*pos*), hypostomal sulci (*hs*) and pleurostomal sulci (*plst*) well developed; epistomal sulcus (*es*) complete, lateral sides converging dorsally; mid-point of the ventral margin of clypeus nearly at the level of mandibular bases; clypeus broadly emarginate below; labrum (*lm*) distinctly narrower than clypeus, with ventral margin strongly emarginate medially; labrum and palate without distinct sclerotized patch or conical sensillae; mandibles (*md*) somewhat elongate, tridentate, tapered and pigmented apically; outer tooth largest, median tooth smallest and sharply tapered; inner apical surface concaved; abductor apodeme (Fig. 6) much shorter than adductor apodeme (Fig. 7), the latter bearing a rudimentary branch at half distance from the base; maxillae (*mx*) of moderate shape and size; separation of cardo from stipes indistinct; stipes each with maxillary palp (*mplp*) and galea (*ga*), the latter being more developed than the former; salivary opening surrounded by transverse salivary lips (*sl*) located apically on prelabium (*prlb*);

\* In this species, two ovaries seem to develop alternately. Virtually no female had two fully developed ovaries.

salivary lips not serrate apically, simple, ventral lip being more prominent than dorsal one; labial palps (*lplp*) small and less developed than maxillary palps and galeae; prelabium and postlabium (*plb*) of normal shape and size.

*Body*: Nearly white in alcoholized specimens; subcylindrical, strongly decurved; head not hidden, appressed against abdominal sterna; integument without setae, microscopic denticles sparse; intersegmental lines distinct; dorsolateral and lateral tubercles developed; spiracle not elevated above cuticle; atrial opening (*ato*) remarkably small; atrial walls smooth, lacking spines or denticles; primary tracheal opening (*pto*) without spines; diameter of primary tracheal opening distinctly larger than that of atrial opening.

*Comparison with two other species*: The results of the present comparison are synoptically given in Table 1.

Table 1. Morphological comparison of the larvae of three masarid genera.

	<i>Trimeria howardi</i>	<i>Pseudomasaris edwardsii</i>	<i>Euparagia scutellaris</i>
Vertex	round	indented	≠ <i>Trimeria</i>
Mid-cranial sulcus	incomplete	≠ <i>Trimeria</i>	incomplete, but rather developed
Antennae	large; located somewhat high on head; projecting	large; located somewhat high on head; convex	normal; located low on head; slightly produced
Antennal sensillae	about seven	three in a straight line	three in a triangle
Epistomal sulcus	complete	indistinct medially*	≠ <i>Trimeria</i>
Ventral margin of clypeus	medially emarginate; at the level of mandibular bases	≠ <i>Trimeria</i>	medially produced; ventral to the level of mandibular bases
Labrum	narrower than clypeus; not spinulate	wider than clypeus; not spinulate	as wide as clypeus; spinulate
Mandibles	somewhat elongate; with three teeth	somewhat elongate; with two teeth	broadened; with three teeth
Atrial opening	very small; smaller than primary tracheal opening	moderate; larger than primary tracheal opening	≠ <i>Pseudomasaris</i>
Body tubercles	developed	not developed	≠ <i>Trimeria</i>

\* "Distinct centrally" in the original description, but indistinct in the associated figure.

Reflecting the different food habits, two distinct types of larvae are recognized in the masarid wasps, i.e., the Eumenid type (Eumeninae-Vespininae complex by Torchio) represented by *Euparagia* and the Non-Eumenid type (Polistinae-Polybiinae complex by Torchio) involving *Pseudomasaris* and *Trimeria*. The latter type is characterized by the somewhat elongate and feeble mandibles, remarkably developed antennae, and clypeus located above the line connecting the mandibular bases. The mandibles more degenerated than in Eumenidae may relate to the pollenivorous habits. The derived characters common to the three masarid genera are yet not decided. The large antennae could be regarded as a derived character for Masarini, but further comparative studies are necessary. The characters peculiar to *Trimeria* are as follows: 1) antennal sensillae are unusually numerous (seven), whereas in other vespidae groups they are almost always three (e.g. see Reid, 1942); 2) atrial opening of spiracles is

unusually small. It must be mentioned that pollen grains attached to the body were larger than the diameter of atrial opening (Fig. 8). In aculeate larvae, two devices to prevent the invasion of various alien particles in spiracles, diminution of primary tracheal opening (*Euparagia* and *Pseudomasaris*), and development of atrial and collar processes on the inner wall (*Vespa* and *Dolichovespula*, Sk. Yamane, 1976; *Bombus*, Ritcher, 1933), are adopted. The diminution of atrial opening in *Trimeria* may represent a third filtering device.

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**PLATES**

Plate IX

- Fig. 1. Lateral view of mature larva. *sp.* spiracle.
- Fig. 2. Frontal view of head. *dfm.* depression in cranial wall at the origin of the frontal muscle; *lcs.* labro-clypeal suture; *mc.* mandibular corium; other abbreviations in text.
- Fig. 3. Lateral view of head. *ata.* anterior tentorial arm; *dta.* dorsal tentorial arm; other abbreviations in text.
- Figs. 4 & 5. Dorsal and inner views of mandible.
- Fig. 6. Abductor apodeme.
- Fig. 7. Adductor apodeme.
- Fig. 8. Longitudinal section of spiracle, with pollen grains removed from the body. *at.* atrium; other abbreviations in text.

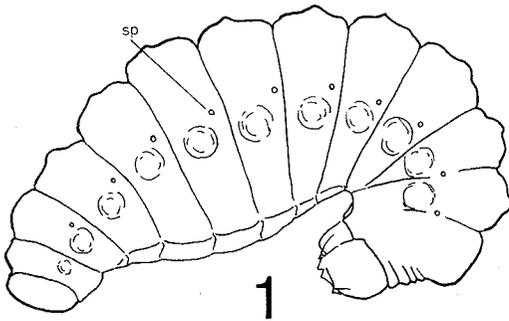
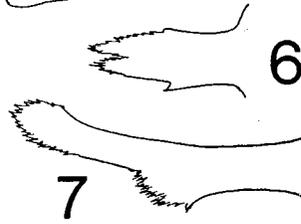
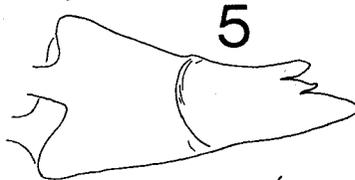
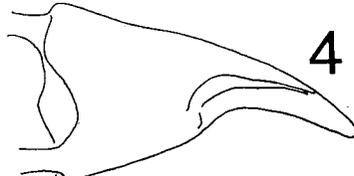
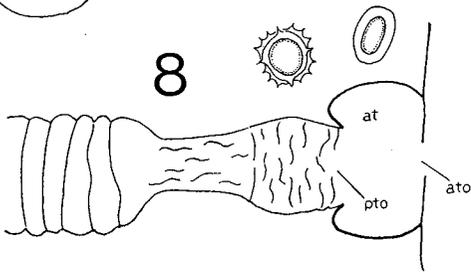
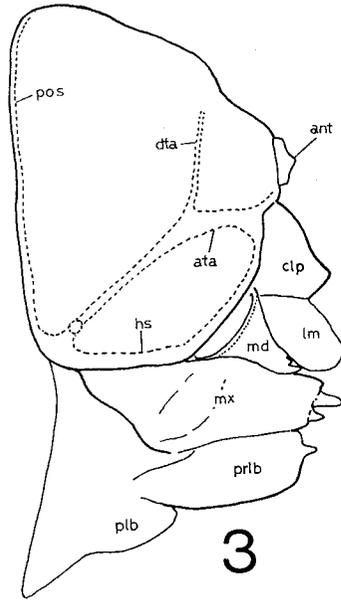
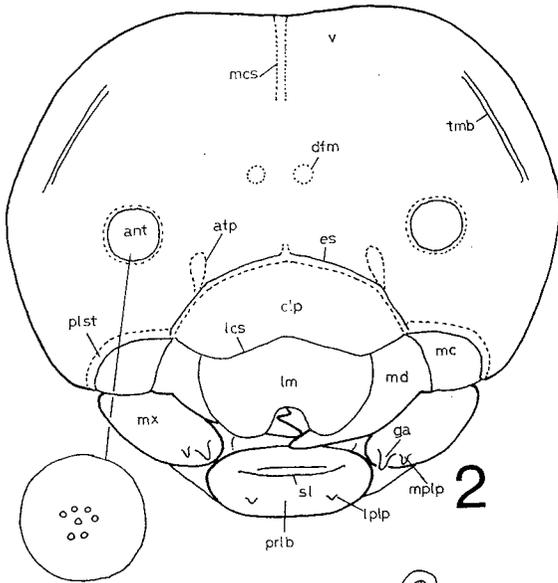


Plate X

- Fig. 9. Female leaving the nest (departure from the turret always from the metasoma).
- Fig. 10. Two nests lying side by side. One female is just leaving the nest.
- Fig. 11. Medium sized larva with food.
- Fig. 12. Cell with food and small larva, and a part of main burrow.
- Fig. 13. Egg deposited in a cell.
- Fig. 14. Cocoons.

