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Morphology of the last instar larvae of *Prionyx thomae* (Fabricius, 1775) and *P. fervens* (Linnaeus, 1758)

(Hymenoptera, Sphecidae)

Sandor Christiano Buys

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The last instar larvae of the grasshopper-hunting solitary wasps *Prionyx thomae* (Fabricius, 1775) and *P. fervens* (Linnaeus, 1758) are described based on specimens collected in southeastern Brazil. The morphology was studied using both optical and scanning electronic microscope. Some remarkable characters found in the last instar larvae of the genus are discussed.

Sandor Christiano Buys, Laboratório de Biodiversidade Entomológica, Instituto Oswaldo Cruz, Fundação Oswaldo Cruz, Avenida Brasil 4.365, Pavilhão Mourisco, sala 201, Manguinhos, 21.045-900, Rio de Janeiro, RJ, Brazil;
e-mails: sbuys@biologia.ufrj.br; sandor.buys@gmail.com

Introduction

The genus *Prionyx* is cosmopolitan in distribution (Bohart & Menke 1976) and currently includes 59 species (Pulawski 2011) of solitary wasps, which dig unicellular nests in the ground and usually hunt on acridid grasshoppers (Orthoptera: Acrididae) to provision their offspring (Bohart & Menke 1976). The last instar larvae of four species of *Prionyx* were described, namely: *P. atratus* (Lepeletier de Saint Fargeau, 1845) (Evans & Lin 1956, Evans 1959), *P. kirbii* (Vander Linden, 1827) (Polidori et al. 2006), *P. thomae* (Fabricius, 1775) (Evans & Lin 1956) and *P. viduatus* (Christ, 1791) (Tsuneki & Iida 1969). Aspects of the larval behaviour and development of *P. atratus* were provided by Evans (1958) and of *P. thomae* and *P. fervens* by Buys (2006, 2009). In the present paper the morphology of the last instar larvae of *P. thomae* and *P. fervens* (Linnaeus, 1758) are described, including characters not previously observed in the genus; some remarkable characters are discussed.

Material and methods

This study is based on larvae obtained in the laboratory from eggs collected in natural nests during behavioural studies (see Buys 2006, 2009); three prey specimens bearing eggs of *P. thomae* were collected in the Restinga de Barra de Maricá (Rio de Janeiro, RJ, southeastern Brazil) and one prey bearing egg of *P. fervens* was collected in the National Park of Restinga de Jurubatiba (Macaé, RJ, southeastern Brazil). The adult females associated with the studied nests were identified using the revisionary paper by Willink (1951) and by comparison with specimens deposited in the collection of the Museu Nacional – Universidade Federal do Rio de Janeiro. The larvae were killed and preserved in ethanol (80 %). The head and the entire body of the larvae were separately heated in KOH (10 %) for about 15 minutes to remove the soft tissues. One specimen of *P. thomae* was prepared for examination in a JEOL 5310 scanning electronic microscope, following the usual techniques. The measurements of the larvae were taken using a light microscope. The number of punctures and setae on the genal areas respectively on the left side and on the right side of the head were put in the description separated by a slash. The width of the setae was measured at the base. In the descriptions, the thoracic and abdominal segments were prefixed by T and A respectively and

numbered antero-posteriorly. Since the bodies of the larvae are somewhat curved, they were put in a straight line to be measured. The examined larvae were deposited in the entomological collections of the Instituto Oswaldo Cruz, Rio de Janeiro, RJ, Brazil, and the associated adults were deposited in the entomological collection of the Museu Nacional – Universidade Federal do Rio de Janeiro.

Results

Prionyx thomae (Fabricius)

Last instar larva

Figs 1-5

Head capsule. Maximum width 910 μm . Coronal line well developed. Cephalic rugosity absent. Parietal bands light brown. Antennal orbits unpigmented; ovoid, maximum diameter about 60 μm ; with three eccentric sensillae. Frontal and antennal concavities shallow, unpigmented, clypeal concavity indistinct. Coronal area with about 20 punctures (5–6 μm in diameter) and five setae (3–6 μm long); frontal area with punctures and a few scattered setae; genal areas with 18/19 punctures and rare setae; clypeal area with 15 punctures (5–6 μm in diameter) and 10 setae (5–7 μm long). Anterior tentorial arms unpigmented; pleurostoma and hypostoma brown.

Mouthparts. Maximum width of the labrum 470 μm ; with about 60 punctures (4–6 μm in diameter), 12 setae (5–7 μm long) and 15 basiconic sensilla on each lateral portion. Epipharynx with spines (up to 15 μm long and up to 3 μm wide) on lateral, marginal and median portions; sensorial areas with brown spots and 6 basiconic sensilla (8 μm in diameter); an intumesced marginal band brown, thicker in the median portion, with about 15 sensilla. Mandibles 450 μm long; with 4 apical teeth; basal portion with punctures (3 μm in diameter); setae absent. Maxillae with about 7 setae (6–10 μm long) on the lateral portion near to the apex; apical portion lightly brown, maxillary palpi brown, with 87 μm long and 65 μm wide; galeae about 125 μm long and 67 μm wide. Maximum width of the labium 450 μm ; without spines or papillae on dorsal portion; with about 20 setae (9–13 μm long) and scattered basiconic sensilla; dark dots on the lateral portions; labial palpi 63 μm long and 40 μm wide.

Body. Abdomen yellow, thorax reddish brown (the colour is due to internal structures; the integument is unpigmented). Thorax and segment AI approximately cylindrical; abdomen distinctly dorsoventrally flattened. Length about 1.2 cm; width: thorax and segment AI=2–2.5 mm, segments AII–AVII=3.5 mm, segments AVIII–AX only

a few narrower than AII–AVII. Dorsal annulets few distinct, without prominent portions. Pleural lobes indistinct on thorax and reduced in the segment AI, well developed on the segments AII–AIX laterally joined forming a continuous band. Granules of uric acid visible externally in the segments AII–AIX, more scarce in the segment AIX. Integument with a few areas with spines (up to 7 μm long); setae rare and isolated (about 8 μm long). Spiracular depressions distinct; spiracles ornamented with small polygonous of the same size; diameter: TII=63 μm , TIII=70 μm , AI–AVIII=80 μm .

Prionyx fervens (Linnaeus)

Last instar larva

Figs 6-7

Head capsule. Maximum width 17 mm. Coronal line well developed. Cephalic rugosity absent. Parietal bands brown (about 600 μm long). Antennal orbits light brown; ovoid, about 90 μm in maximum diameter; with three eccentric sensillae. Frontal and antennal concavities shallow, unpigmented; clypeal concavity indistinct. Coronal area with 16 punctures (diameter about 5 μm) and three setae; frontal area with punctures and a few scattered setae; genal area with 26/25 punctures (diameter about 5 μm) and 2/2 setae (about 10 μm long and 1 μm wide); clypeal area slightly bilobed, divided into superior and inferior portions: superior portion rugose portion with 30 punctures (7–10 μm in diameter) and 16 setae (8–12 μm long and up to 1.5 μm wide), inferior portion smooth and without punctures or setae. Anterior tentorial arms unpigmented; pleurostoma brown on the superior inferior margin; hypostoma unpigmented.

Mouthparts. Maximum width of the labrum 920 μm ; with about 45 punctures and 32 setae; about 10 basiconic sensillae on each lateral portion. Epipharynx with spines (up to 35 μm) on the lateral, marginal and median portions; sensorial areas with brown portions, with 5 basiconic sensillae; margin with a pigmented intumesced marginal band thicker in the median portion, with 25 basiconic sensillae. Mandibles with three teeth, apparently because of the lacking of the fourth (basal) mandibular tooth; basal portion with 6 punctures (10 μm in maximum diameter); setae absent. Maxillae with a brown band on dorsal portion; maxillary palpi brown, 88 μm long and 80 μm wide, with 3 basiconic sensillae and a conical sensillae; galea 105 μm long and 55 μm wide, with two basiconic sensillae; spines on the lacinial area curved, with 10 μm in maximum length. Labium brown on the superior margin; 820 μm in maximum



Figs 1-4. Last instar larva of *Prionyx thomae* (scanning electronic microscopy). 1. Integument of the body; 2. antennal orbits; 3. epipharynx; 4. oral portion (La = lacinial area).

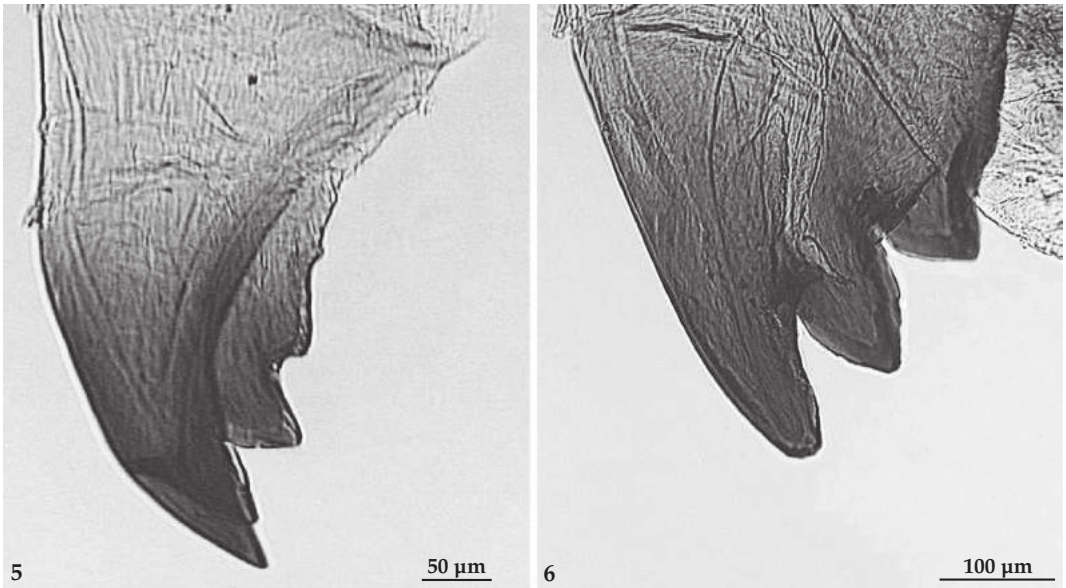


Fig. 5. Apical portion of the mandible of the last instar larva of *P. thomae*, lateral view.
 Fig. 6. Apical portion of the mandible of the last instar larva of *P. fervens*, lateral view.

width; lateral areas pigmented, with small spines; central portion with two areas with very small spines; margin with about 20 setae (12–15 μm long) and several small sensillae; labial palpi 75 μm long and 58 μm wide.

Body. Shape and colour as in *P. thomae*. Length 3.4 cm; segment TI 5.5 mm wide, segment TII and TIII gradually anteriorly, segment AI 7 mm wide, segments AIV–AVII 10 mm wide, segments AVIII–AX a few more tapered. Diameter of the spiracles: TII–TIII and AI=140 μm; AII–AX=about 170 μm; spiracular depressions well developed.

Discussion

Remarkable characters herein observed in the last instar larvae of *P. thomae* and *P. fervens* are commented as follows: (1) Clypeal area bilobed and divided into a superior and an inferior portion, as observed in the larva of *P. fervens*, has not been recorded in other species of *Prionyx*. (2) Mandible with three apical teeth is a notorious distinguishable feature of the last instar larva of *P. fervens*. Among known sphecid larvae, only larvae of the genus *Podalonia* Spinola have been appointed as having only three apical teeth (Evans & Lin 1956). Besides, some species of *Ammophila* have the fourth teeth strongly reduced or subdivided into small denticles (Evans & Lin 1956). (3) The structure of the spines observed

in the integument of *P. thomae* is remarkable in arising from expanded rounded bases, as also observed in larvae of other species of *Prionyx* (Evans & Lin 1956, Polidori et al. 2006). Evans & Lin (1956) put this feature as exclusive of *Prionyx* in their key to genera of Sphecidae based on larvae. But afterwards Evans (1959) retracted his position and mentioned have been observed similar spines in other sphecids; however, he did not name the species. The structure of the spines on the integument has not been finely described in papers on morphology of sphecid larvae; but since the structure of these spines in *Prionyx* seems to be somewhat different of those observed in closely related species (personal observation), it seems to be of taxonomic importance and should be evaluated after further morphological studies on other sphecid larvae. (4) Body distinctively slender anteriorly, as a neck-like portion, was observed in both species of the present study. Evans & Lin (1956) observed a similar feature in the specimens of *Prionyx* they studied. Buys (2009) observed that the neck-like portion of the last instar larva of *P. thomae* remains immerse in the prey body during the development and when the larva completes the feeding phase and exits from the prey body, this portion is very active and able of free movement; on the other hand, the rest of the body have quite limited movements. Similar observations were made on *P. fervens* (Buys 2006), suggesting that it can be a common feature in the genus. Evans & Lin (1956) reported that the

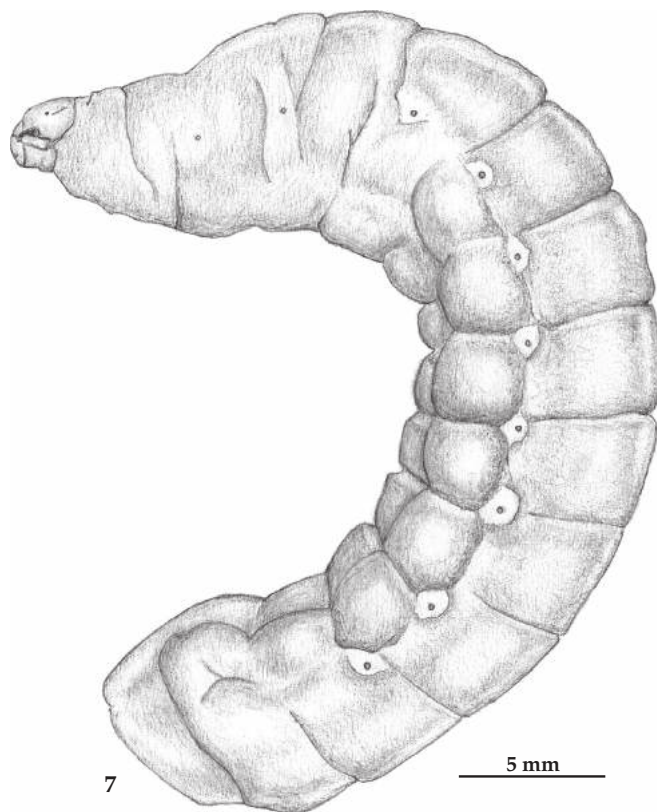


Fig. 7. Last instar larva of *Prionyx fervens*. Body, lateral view.

larva of *Palmodes dimidiatus* [as *P. daggy* (Murray)] is also slender in the anterior portion; among sphecid larvae, this feature was observed only in these two genera, that joined with *Chilosphex* compose the presumably monophyletic tribe Prionychni (Ohl 1996, Pulawski 2011). (5) Intense yellow and reddish brown body colour is a striking feature in both of the species studied, but that has been rarely reported in larvae of Sphecidae. One problem with using colour as larval character in sphecids is that colours must be described from living or freshly killed specimens, which is often not possible. Anyway, fresh larvae of species of several sphecids have been examined (Buys 2004) and similar intense yellow colour was observed only in larvae of *Sceliphron*, reddish colour was not observed in any species other than those of *Prionyx*. Ontogenetic changing of colouration in larvae of *P. thomae* and *P. fervens* were described by Buys (2006, 2009). (6) Apparently spiracular depressions are somewhat variable among larvae, at least in part, in function of the methods of death and preservation. Anyway, after observing several specimens of various genera of Sphecidae (e.g. Buys

2004), it seems that there is a tendency of larvae of Sphecinae bear spiracular depressions more sharply defined than those of Sceliphrinae. (7) Spiracles ornamented with small polygonous of about the same size were observed in both of the studied species, similarly to the illustrated by Evans and Lin (1956) and Tsuneki & Iida (1969) respectively in *P. thomae* and *P. viduatus* and described by Polidori et al. (2006) in *P. kirbii*. Different forms of ornamentation have been observed in other sphecid genera (e.g. Evans & Lin 1956, Tsuneki & Iida 1969).

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