

## REDESCRIPTION OF THE PUPA OF *PARYPHOCONUS OLIVEIRAI* LANE (DIPTERA: CERATOPOGONIDAE) FROM BRAZIL<sup>1</sup>

María M. Ronderos,<sup>2</sup> Gustavo R. Spinelli,<sup>2</sup> and Daiane Silveira Carrasco<sup>3</sup>

**ABSTRACT:** The pupa of *Paryphoconus oliveirai* Lane is described from a specimen collected from a sandy bottom of a shallow human disturbed stream near Manaus, Brazil. The pupa of *P. oliveirai* is compared with previous descriptions of the pupa of this species and with the pupae of its congeners, *P. flavidus* (Johannsen), and *P. mayeri* Wirth.

**KEY WORDS:** *Paryphoconus oliveirai*, predaceous midge, pupa, Diptera, Ceratopogonidae, Manaus, Brazil

The predaceous midge genus *Paryphoconus* Enderlein is exclusively Neotropical, and includes medium-sized to large midges (female wing lengths 1.5-7.0 mm). Presently there are 40 species in this genus (Borkent and Spinelli, 2000), and Spinelli and Wirth (1984) provided a key to females of 38 of these. The pupae of only three species have been previously described: *P. flavidus* (Johannsen) (as *P. lanei*) and *P. mayeri* Wirth by Mayer (1959), and *P. oliveirai* Lane by Wirth and Ratanaworabhan (1972). These prior pupal descriptions are very brief and incomplete, and it is almost impossible from them to determine the most relevant structures at even the generic level.

During recent field sampling by DSC in the vicinity of Manaus, Brazil, one pupa of *P. oliveirai* was collected. The purpose of this paper is to redescribe and illustrate the pupa of this species, the first detailed description of a pupa of *Paryphoconus* sp.

### METHODS

A single live pupa of *P. oliveirai* was collected from the sandy bottom of a shallow human disturbed stream (Fig. 1). The sandy sediment was collected with an aquatic net (Fig. 2) and transported to the laboratory with water from the natural environment in a 5 liter plastic container. The pupa was lab reared and the adult eventually emerged and its exoskeleton allowed to harden before preservation in 70% ethanol.

This adult female and its pupal exuvia was slide-mounted in Canada balsam following the technique of Borkent (2000), and examined and measured with a binocular compound microscope. Illustrations were made with pen and ink using an attached camera lucida.

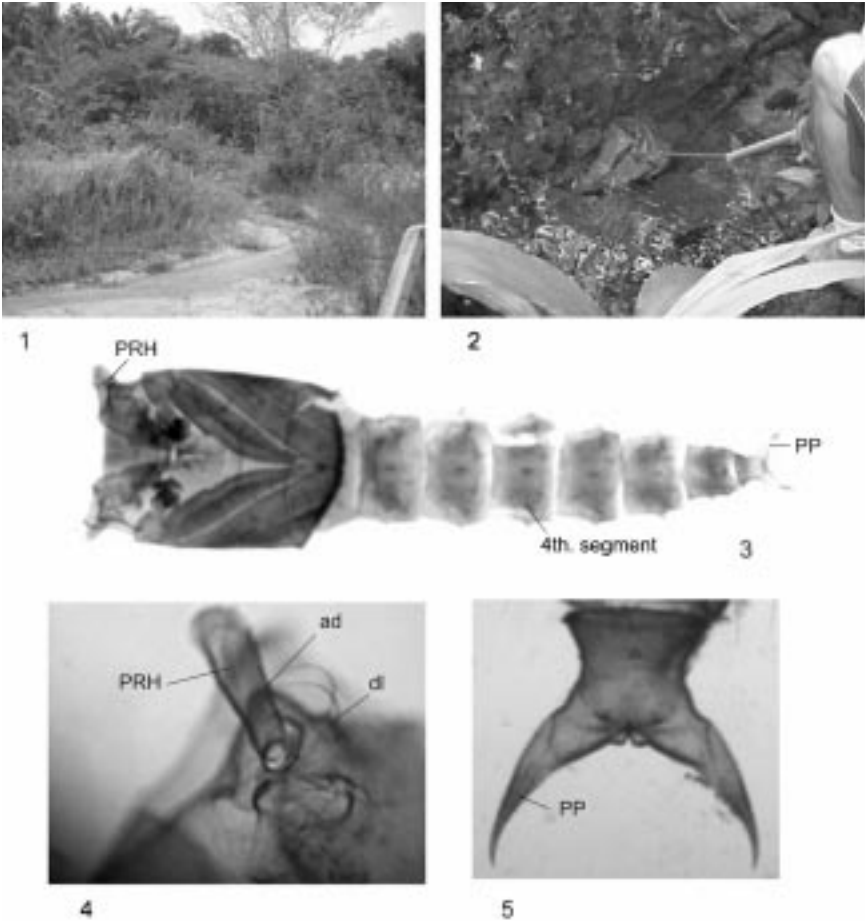
This specimen is deposited in the collection of Invertebrates, Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil (INPA). Photomicrographs

<sup>1</sup> Received on September 13, 2006. Accepted on May 18, 2007.

<sup>2</sup> División Entomología, Museo de La Plata, Paseo del Bosque s/n, 1900 La Plata, Argentina. E-mails (respectively) ronderos@museo.fcnym.unlp.edu.ar; spinelli@museo.fcnym.unlp.edu.ar

<sup>3</sup> Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil. E-mail: daiane.carrasco@bol.com.br

of pupa were taken with a Pentax Optio, Power Shot, S60, digital camera through a Leitz, SM-Lux microscope at 10X and 40X, and the images assembled in Photoshop 7.0. For special terminology of ceratopogonid terminology, see Nevill and Dyce (1994).



Figs. 1-5: *Paryphoconus oliveirai*, female pupa. 1, collecting site; 2, collecting with aquatic net; 3, female pupa; 4, prothoracic respiratory horn (PRH) and anterodorsal (ad) and dorsolateral (dl) tubercles; 5, caudal segment, posterolateral processes (PP).

## SYSTEMATIC ENTOMOLOGY

*Paryphoconus oliveirai* Lane

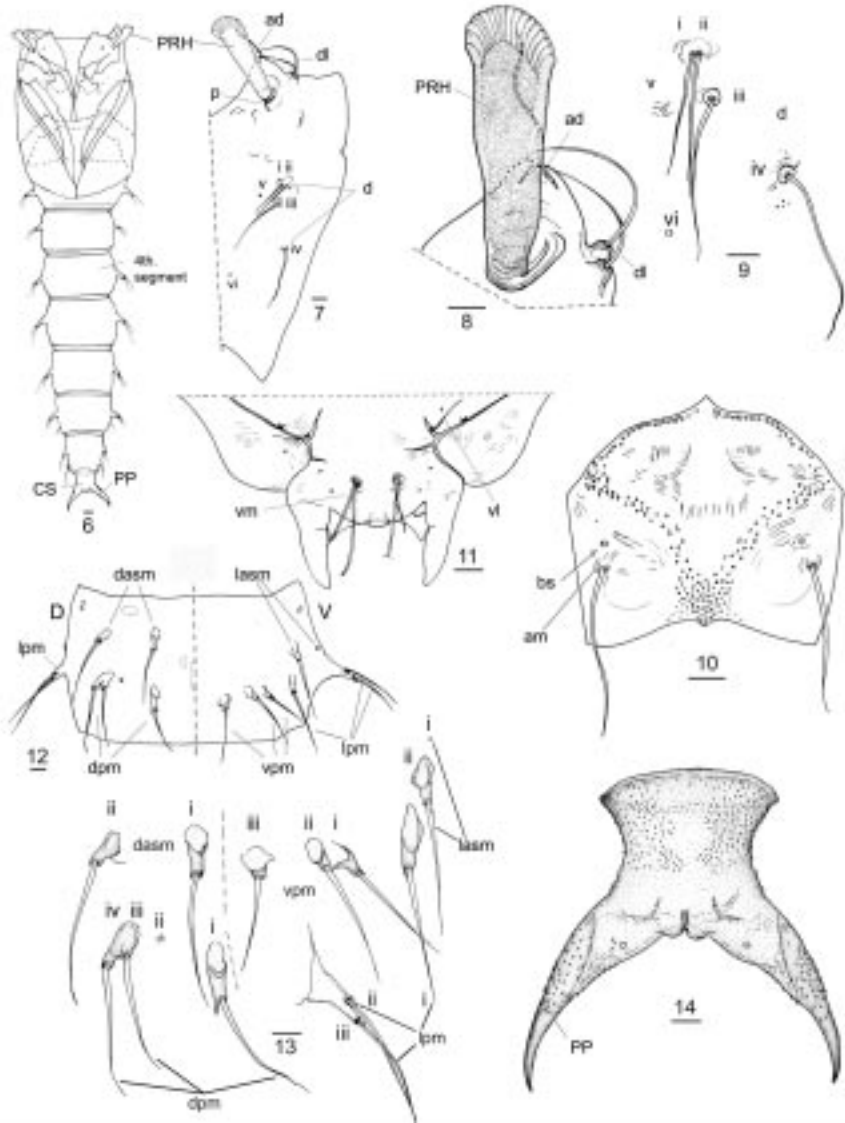
(Figs. 3-14)

*Paryphoconus oliveirai* Lane, 1956: 303 (female; Brazil); Wirth and Ratana-worabhan, 1972: 1374 (female, male, pupa; Brazil); Spinelli and Wirth, 1984: 902 (in key; Colombia record); Borkent and Spinelli, 2000: 66 (in catalog).

**Redescription of female pupa.** Length 6.00 mm. Exuvia dark brown (Figs. 3, 6). Cephalothorax quadrangular, length 2.07 mm, width 1.56 mm; cephalothoracic tubercles (Figs. 7-9) as follows: anterodorsal tubercle (ad) (Figs. 4, 7-8) with one long, thin seta; dorsolateral tubercle (dl) (Figs. 4, 7-8) with two long, thin, subequal setae; dorsal tubercles (d) (Figs. 7, 9): i-iii,v with long, thin seta, iv pore, setae of iii,v slightly longer than setae of i-ii; two stout ventromedian setae (vm) (Fig. 11), one longer than other; apparently one very thin ventrolateral seta (vl) (Fig. 11). Respiratory horn (Figs. 4, 8) 4.57 times longer than broad, length 0.26 mm, surface with reticular cell-like pattern, apex with 18-20 spiracles; pedicel short, stout, length 0.10 mm; P/H 0.38. Operculum (Fig. 10) as long as broad; anterior margin pointed with single row of marginal rounded tubercles; mesal V-shaped band of spicules extending 0.13 mm under the angle of disc, disc mostly smooth; two anteromarginal tubercles (am) with single long seta and basal sensillum present; posterior margin concave with small, rounded, anteromesal tubercles; OL 0.1 mm; OW 0.3 mm; OW/OL 3.0. Abdominal segments with abundant spicules. Fourth abdominal segment (Figs. 3, 12-13) with two dorsal anterosubmarginal tubercles (dasm): i,ii with long, stout, subequal setae; four dorsal posteromarginal tubercles (dpm): i,ii,iv with long, stout, subequal setae, iii pore; three lateral posteromarginal tubercles (lpm): i,ii with long stout setae, sharing stout triangular base, iii with long, stout seta; two lateral anterosubmarginal tubercles (lasm), i pore, ii with long, stout seta; three ventral posteromarginal tubercles (vpm), each with long, stout seta; tubercles with stout, quadrangular base (except lpm i, ii). Caudal segment (Figs. 5-6, 14) length 0.45 mm, width 0.25 mm, lateral margins concave; ventral surface with abundant posteriorly directed spinules, also present on posterolateral processes. Posterolateral processes (PP) stout, curved, divergent, with base broad, apical 1/3 pigmented, tips bare, sharply pointed.

**Distribution.** Brazil (Amazonas, Pará), Colombia.

**Material Examined.** Brazil, Amazonas, Igarapé, Parque das Garças (bacia Mindú) Trecho Tributario, 03°03'41,2"; 59°58'09,0", 14-X-2005, D. Carrasco-J. Oliveira, 1 female (with pupal exuvia) (in slide in Canada balsam, INPA); Brazil, Amazonas, rio Aripuana, Igarapé das Pedras, 18-I-1962, E. J. Fittkau, 1 female, at light (in Museo de La Plata, Argentina, MLP).



Figs. 6-14. *Paryphoconus oliveirai*, female pupa. 6, entire pupa; 7, cephalothorax, dorso-lateral view: prothoracic respiratory horn (PRH), pedicel (P), anterodorsal tubercle (ad), dorsolateral tubercle (dl); 8, prothoracic respiratory horn (PRH), anterodorsal tubercle (ad), dorsolateral tubercles (dl); 9, dorsal tubercles (d); 10, operculum, anteromarginal tubercle (am), basal sensillum (bs); 11, ventral setae: ventrolateral setae (vl), ventromedian setae (vm); 12, 4th abdominal segment; 13, abdominal tubercles of 4th abdominal segment: lateral anterosubmarginal tubercle (lasm); dorsal posteromarginal tubercle (dpm); dorsal anterosubmarginal tubercle (dasm); ventral posteromarginal tubercle (vpm); lateral posteromarginal tubercle (lpm); 14, caudal segment, posterolateral processes (PP). Scale bars: 0.05 mm

**Remarks.** The adult female keys out to *P. oliveirai* in couplet 26 in the key by Spinelli and Wirth (1984). It was also compared with one female examined by Wirth and Ratanaworabhan (1972) as *P. oliveirai*, who briefly described the pupa of this species based on material from the same locality and date. However, their pupa differs from the pupa described herein in having 13 spiracles on the respiratory horn and in the shape of the caudal segment, has subparallel lateral margins and the posterolateral processes are nearly straight, not divergent.

Mayer (1959) described the pupa of *P. mayeri*, which is much smaller (length 4.3 mm) than our pupa of *P. oliveirai*. Also, despite the terminology of the cephalothoracic tubercles is different from the one used in this redescription, Mayer mentioned one ad and three dl tubercles (as a spine devoid of seta and 3 setae at the base of the respiratory organ, respectively) and only one vm seta, which are the most important differences with respect to the pupa of *P. oliveirai*. Mayer (1959) also described the pupa of *P. flavidus* (as *P. lanei*), and stated that it is very similar to the one of *P. mayeri* except for the vm which is represented by a short seta.

#### ACKNOWLEDGMENTS

We would like to acknowledge Dr. William L. Grogan for his critical review of an earlier version of the manuscript. We are also grateful to Drs. Ruth Leila Menezes Ferreira and Neusa Hamada, directors of the Master Thesis of Daiane Carrasco, for their continuous support during this investigation

#### LITERATURE CITED

- Borkent, A. and G. R. Spinelli.** 2000. Catalog of the new World biting midges south of the United States of America (Diptera: Ceratopogonidae). Contributions on Entomology, International 4: 1-107.
- Lane, J.** 1956. On "*Paryphoconus*" and "*Stenoxenus*" (Diptera, Ceratopogonidae). Revista Brasileira de Biologia 16: 299-308.
- Mayer, K.** 1959. Die puppen brasilianischer Heleiden (Diptera). Deutsche Entomologische Zeitschrift 6: 230-233.
- Nevil, H. and A. L. Dyce.** 1994. Afrotropical *Culicoides*: Description and comparison of the pupae of seven species of the *similis* supergroup (Diptera: Ceratopogonidae). Onderstepoort Journal of Veterinary Research 61: 85-106.
- Spinelli, G. R. and W. W. Wirth.** 1984. A review of the Neotropical predaceous midge genus *Parayphoconus* (Diptera: Ceratopogonidae). Proceedings of the Biological Society of Washington 97: 882-908.
- Wirth, W. W. and N. C. Ratanaworabhan.** 1972. A revision of the tribe Stenoxenini (Diptera: Ceratopogonidae). Annals of the Entomological Society of America 65: 1368-1388.