

## Description of Larva and redescription of Pupa and Adult of *Palpomyia guarani* (Diptera: Ceratopogonidae)

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■ **ABSTRACT.** The larva of *Palpomyia guarani* Lane, 1946 is described and illustrated by using a phase-contrast and Scanning Electron Microscope, and pupa and adult redescribed by using a phase-contrast stereoscope. Immatures were collected breeding in a tree hole in Bella Vista, Paraguay. Larvae have character states typical of carnivorous larvae. The species is compared with its similar congener *Palpomyia columbiana* Kieffer, and this record constitutes the first one from Paraguay.

**KEY WORDS.** Larva. Pupa. Adult. *Palpomyia guarani*. SEM. Paraguay.

■ **RESUMEN.** Descripción de la larva y redescrición de pupa y adulto de *Palpomyia guarani* (Diptera: Ceratopogonidae). Se describe e ilustra la larva de *Palpomyia guarani* Lane, 1946 utilizando Microscopio de Contraste de Fase y Microscopio Electrónico de Barrido. Se redesciben pupa y adulto usando Microscopio de Contraste de Fase. Los estados inmaduros fueron capturados en Bella Vista, Paraguay, en hueco de árbol, donde se desarrollan. La larva presenta características típicas de larvas carnívoras. La especie se cita por primera vez para Paraguay, y es comparada con su similar cogenérica *Palpomyia columbiana* Kieffer.

**PALABRAS CLAVE.** Larva. Pupa. Adulto. *Palpomyia guarani*. MEB. Paraguay.

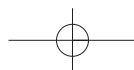
### INTRODUCTION

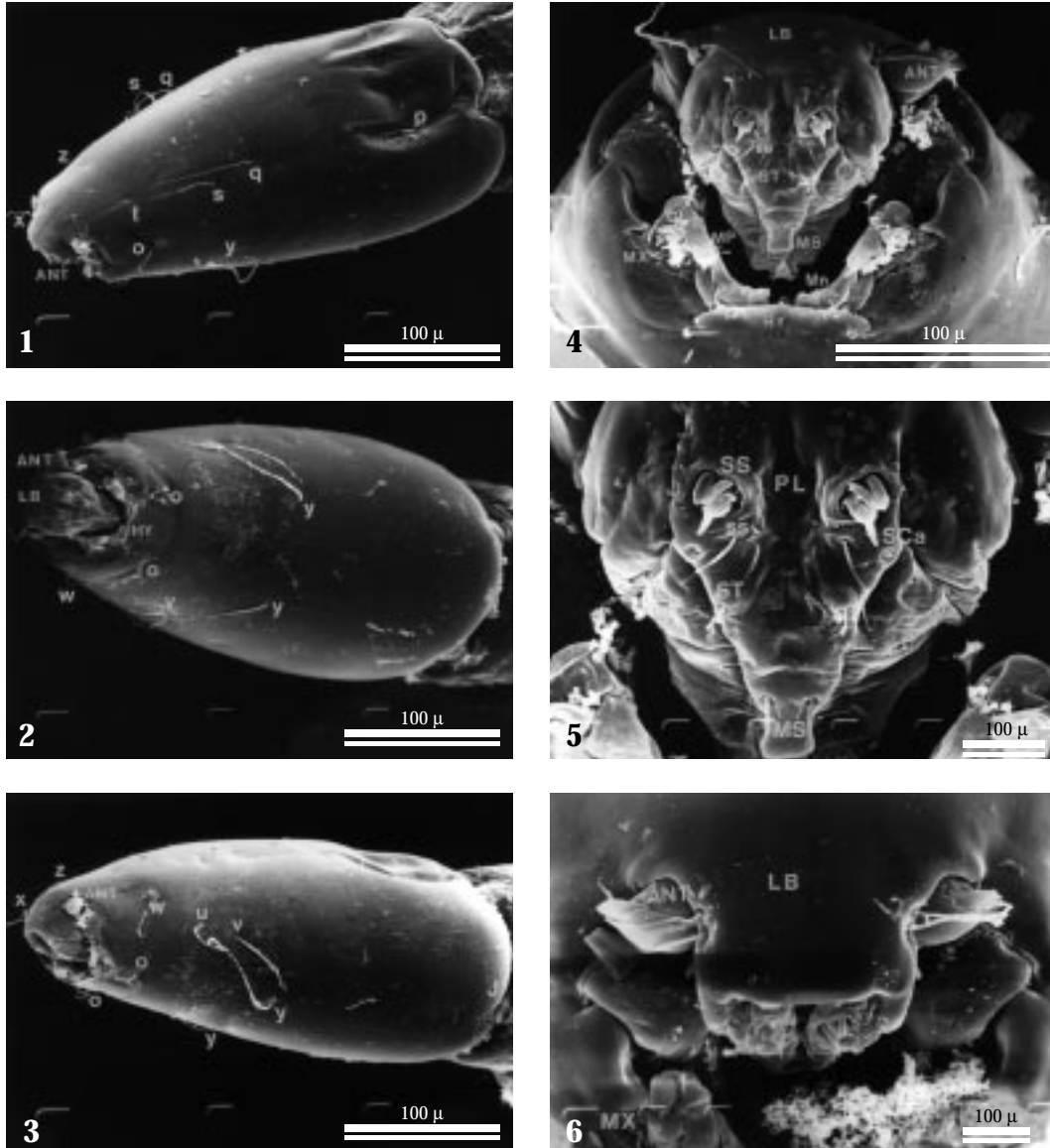
The cosmopolitan genus *Palpomyia* Meigen, 1818 includes predaceous midges that are relatively common inhabitants of aquatic and semiaquatic environments (Grogan & Wirth, 1979). Borkent & Wirth (1997), in their world catalog of Ceratopogonidae, listed 234 extant species, of which 75 inhabit the New World. The immature stages of the majority of the species remain unknown, i.e., from the 48 species listed by Borkent & Spinelli (2000) from the Neotropical region, only the larva of one species and the pupae of six are described: *Palpomyia armatipes* Wirth (larva and pupa, in Grogan & Wirth, 1979), *Palpomyia guarani* Lane (pupa, in Lane, 1946), *Palpomyia lacustris* Lane, Forattini & Rabello (pupa, in Lane *et al.*, 1955), *Palpomyia linsleyi* Wirth (pupa, in Grogan & Wirth, 1979), *Palpomyia subaspera*

(Coquillett) (pupa, in Grogan & Wirth, 1979), and *Palpomyia wirthi* Lane, Forattini & Rabello (pupa, in Lane *et al.*, 1955).

*Palpomyia guarani* was originally described by Lane (1946) based on male and female adults and pupa, being the descriptions and illustrations, especially those of the pupa, very incomplete. Subsequently the species has never been mentioned again in the literature except in reference to its original description and/or type-series (Wirth, 1974; Borkent & Wirth, 1997; Borkent & Spinelli, 2000; Felipe-Bauer & de Oliveira, 2001).

During a development of a collecting program of ceratopogonids in the area influenced by the Yacyreta dam lake, in the Parana river between Argentina and Paraguay, we found immatures of *P.*





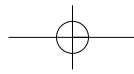
**Figs. 1-3:** *Palpomyia guarani* Lane, larva. 1. head capsule (laterodorsal view), chaetotaxy; 2. head capsule (ventral view), chaetotaxy; 3. head capsule (lateroventral view), chaetotaxy. (ANT) antennae; (LB) labrum; (HY) hypostoma; (x) parantennal setae; (t) prefrontal setae; (z) frontal pits; (s) anterior perifrontal setae; (q) postfrontal setae; (w) anterolateral setae; (u) mesolateral setae; (v) posterolateral setae; (p) posterior perifrontal setae; (o) parahypostomal setae; (y) ventral setae.

**Figs. 4-6:** *Palpomyia guarani* Lane, larva. 4-5 head capsule (anteroventral view); 6. head capsule (anterodorsal view). (ANT) antennae; (LB) labrum; (PL) palatum; (Sca) sensilla campaniformia; (SS) sensilla styloconicum; (ST) sensilla trichodeum; (MS) messors; (MP) maxillary palpus; (MX) maxilla; (HY) hypostoma; (GL) galeolacinia; (Mn) mandible.

*guarani* breeding in a tree hole. The purpose of this paper is to describe the larva and to redescribe the adult and pupa of this species by using Scanning Electron Microscope (SEM), phase-contrast stereoscope and binocular microscope.

#### MATERIALS AND METHODS

Larvae were collected by using suction pipetae in tree holes and carried to the laboratory in tubes containing water from their natural environment.



They were observed daily for recording pupal development. For the observation of larvae with phase-contrast microscope at oil immersion, they were slide-mounted in Canada balsam, placed with their ventral side upward to facilitate examination of the epipharynx within the head capsule. Pupae and adults were slide-mounted in Canada balsam, and examined, measured and drawn using binocular microscope with camera lucida. The pinned paratypes in the Entomological collection of the Instituto Oswaldo Cruz, Rio de Janeiro, Brazil were examined using stereomicroscope.

Larvae were also examined using Scanning Electron Microscope (SEM) at the Museo de La Plata (JOEL T 100). For that purpose, larvae were prepared following the technique of Ronderos *et al.* (2000). Terminology follows Huerta *et al.* (2001) for larvae and pupae, and Downes & Wirth (1981) for adults.

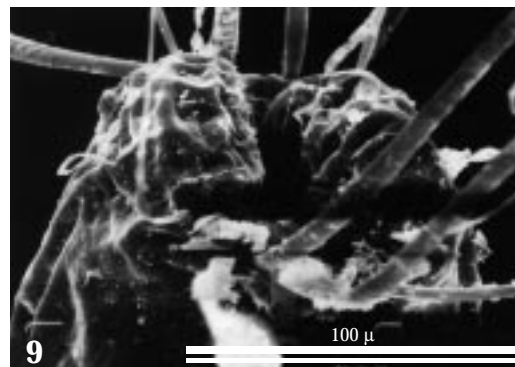
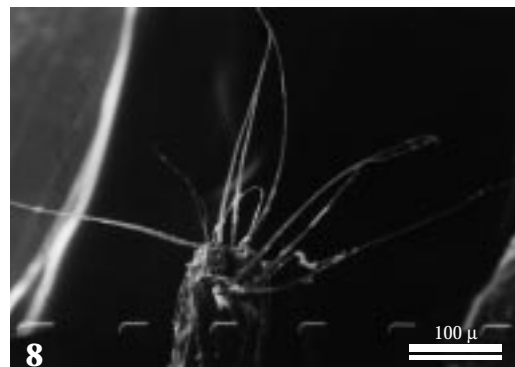
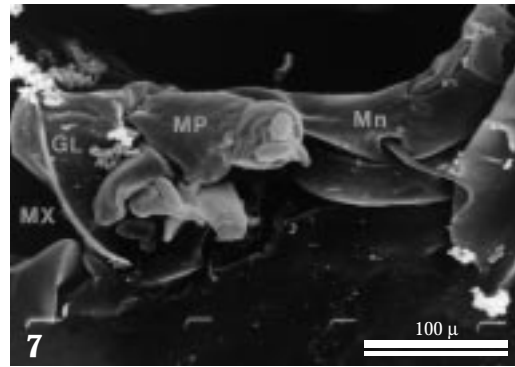
The following measurements and ratios of larvae were taken and/or calculated: head length (HL), head width (HW), subgenal width (SGW), head ratio (HR=HL/HW), mandible length (ML), mandible width (MW), distance between the tips of the lateral arms of the epipharynx (LAW), width of the individual dorsal comb sclerites of epipharynx (DCW), subgenal ratio (SGR=HW/SGW). The following measurements for pupae were taken and/or calculated: total length, operculum length (OL), operculum width (OW), pedicel length, respiratory horn length, pedicel/horn ratio (P/H), operculum length ratio (OW/OL), caudal segment length, caudal segment width.

The studied specimens are deposited in the collection of the Museo de La Plata, Argentina. Paratypes, deposited in the collection do Instituto Oswaldo Cruz, Rio de Janeiro, Brazil, were also examined.

## RESULTS

### *Palpomyia guarani* Lane, 1946 (Figs. 1-26)

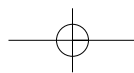
*Palpomyia guarani* Lane, 1946: 221 (female, male, pupa; Brazil); Wirth, 1974: 54 (in Neotropical catalog); Borkent & Wirth, 1997: 132 (in World catalog); Borkent & Spinelli, 2000: 63 (in Neotropical catalog); Felipe-Bauer & de Oliveira, 2001: 1115 (in list of types IOC).

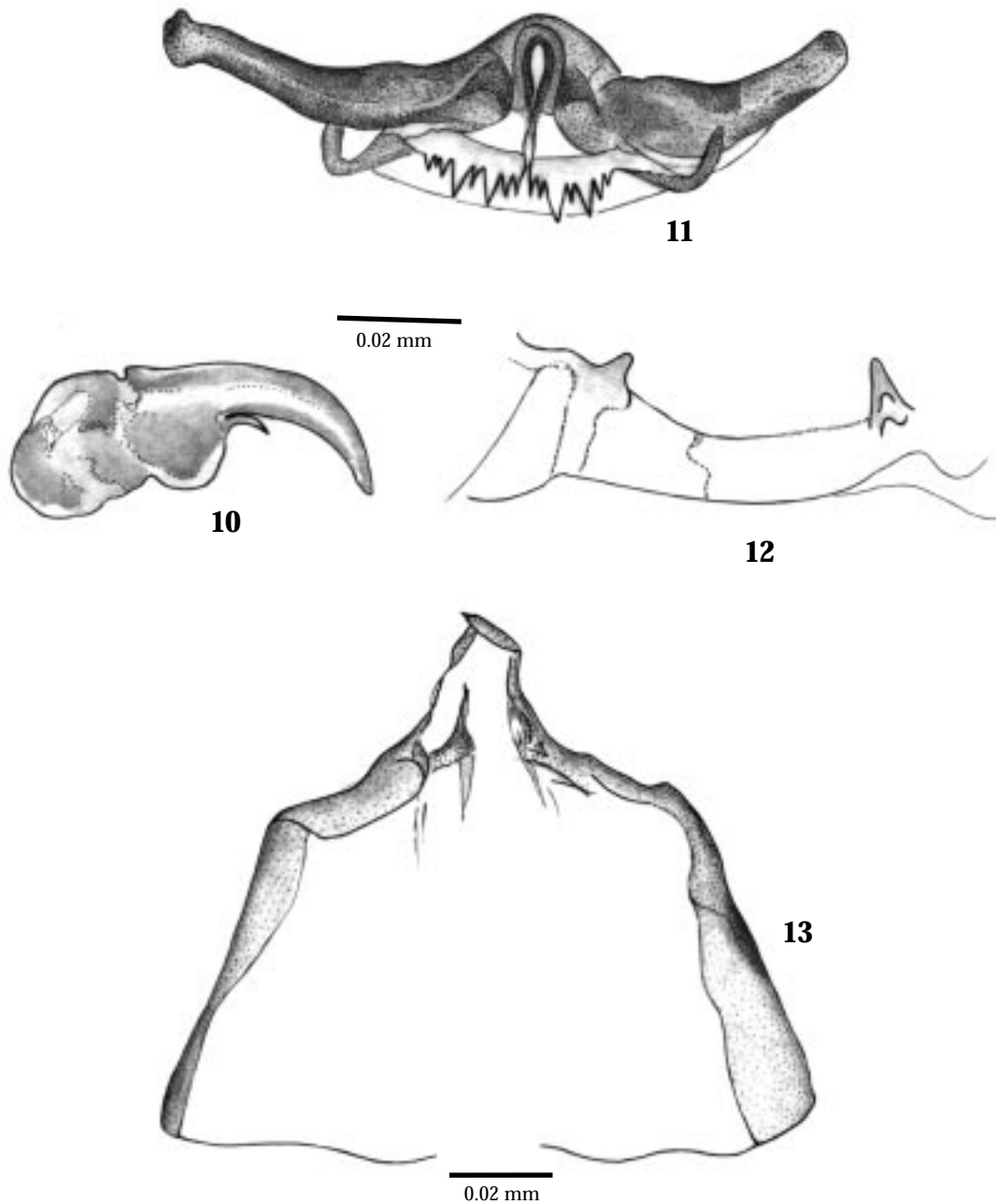
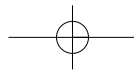


**Figs. 7-9:** *Palpomyia guarani* Lane, larva. 7. (MX) maxilla; (GL) galeolacinia; (MP) maxillary palpus; (Mn) mandible; 8. caudal segment; 9. insertion of setae of caudal segment.

### Description of fourth instar larva (Figs. 1-13).

Exuvia pale brown. Head capsule (Figs. 1-3) three times longer than broad, apex slightly bent ventrally, chaetotaxy as figured; HL 0.30 (0.32-0.30, n=3) mm; HW 0.21 (0.22-0.20, n=3); SGW 0.11 (n=3); HR 1.43 (1.50-1.36, n=3); SGR 1.93 (2.00-1.80, n=3). Labrum (Figs. 2, 4, 6, LB) not extending beyond hypostoma, longer than wide, with anterolateral sensilla styloconicum; palatum (Fig. 5, PL) with sensillae styloconicum, campaniformia

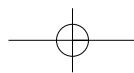


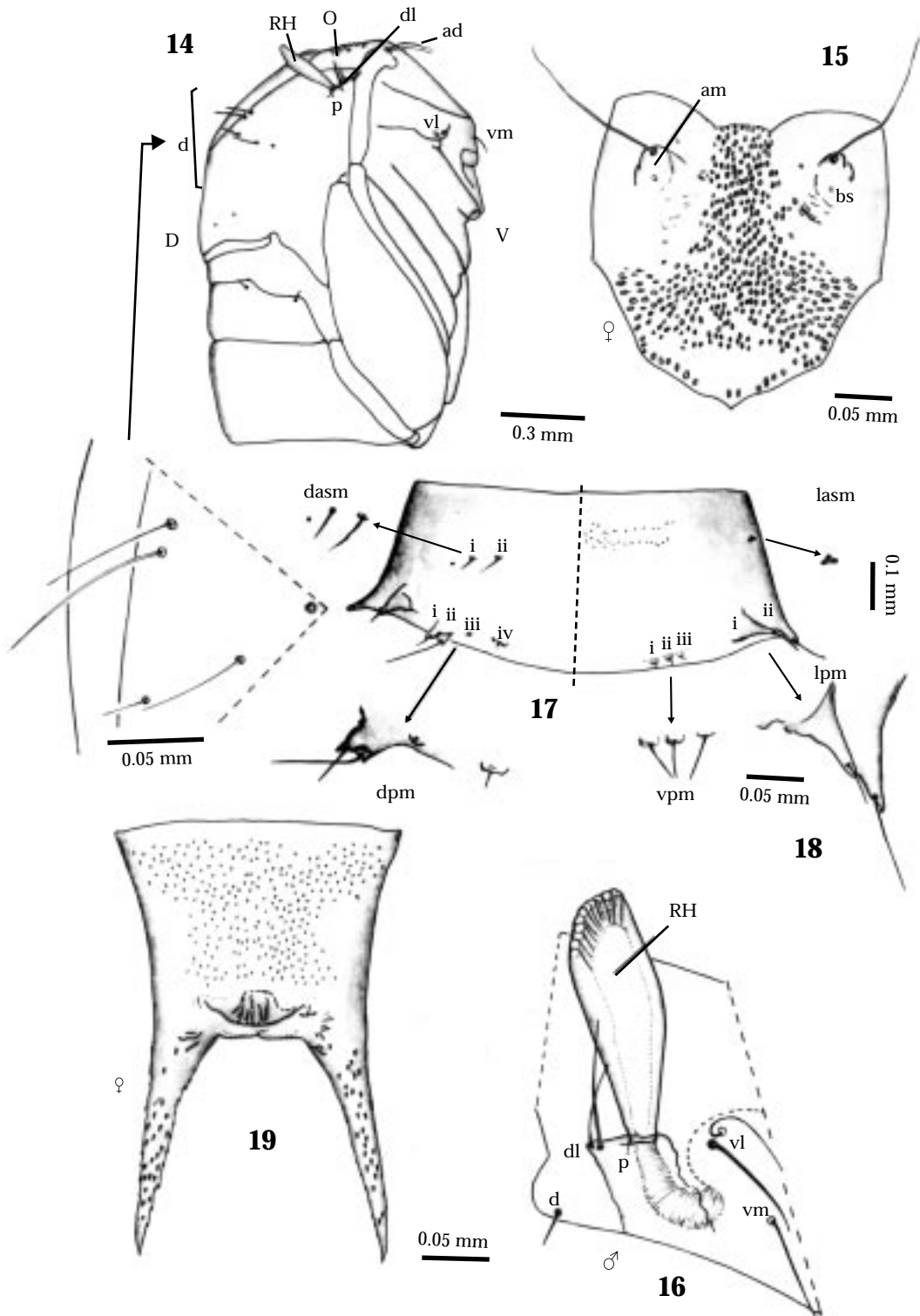
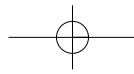


**Figs. 10-13:** *Palpomyia guarani* Lane, larva. 10. mandible; 11. epipharynx; 12. hypostoma; 13. hypopharynx (scale = 0.02 mm).

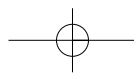
and trichodeum. Messors (Figs. 4-5) thin, gently sclerotized, away from mandibles. Maxilla (Figs. 4, 6-7, MX) with long, cylindrical palpus with three subapical papillae (Figs. 4, 7); galeolacinia (Figs. 4, 7, GL) with upper papilla long, flat, bundle of three stout lower papillae, stout setae thin, long. Mandible (Figs. 4, 7, 10, Mn) hooked, with one strong pointed curved tooth, basal minute

one, mandibular pit present, one strong setae in surface, ML 0.04 (n=3) mm; MW 0.01 (n=3) mm. Hypostoma (Figs. 2, 4, 12, HY) finely toothed, medial portion lightly sharp-pointed. Labium small, subtriangular, apex broad. Epipharynx (Fig. 11) gently massive; single comb with a row of 3-4 lanceolate, stout, pointed teeth interrupted by 8-9 shorter ones; small, curved auxiliary sclerites





**Figs. 14-19:** *Palpomyia guarani* Lane, pupa. 14. cephalothorax (lateral view); 15. operculum; 16. respiratory horn; 17. 4<sup>th</sup> abdominal segment; 18. tubercles of 4<sup>th</sup> abdominal segment; 19. female caudal segment (ventral view); (P) pedicel; (RH) respiratory horn; (O) operculum; (ad) anterodorsal tubercle; (vl) ventrolateral setae; (vm) ventro-median setae; (dl) dorsolateral tubercle; (d) dorsal tubercles.



near lateral arms; LAW 0.09 (0.10-0.09, n=3)mm; dorsal comb sclerite wide, semicircular in outer line; DCW 0.03 (0.04-0.03, n=3) mm. Hypopharynx (Fig. 13) long, thin, arms slender.

Thoracic coloration uniformly pale yellowish. Caudal segment (Figs. 8-9) with four pairs of long, stout, caudal setae, two pairs of thinner ones.

#### Redescription of pupa (Figs. 14-19)

*Female.* Length 3.63 (3.93-3.39, n=5) mm. Exuvia pale brown. Cephalotorax tubercles (Figs. 14, 16) as follows: anterodorsal tubercle (ad) with two long, subequal, thin setae; dorsolateral tubercle (dl) with two long, subequal setae, one stout, one thin; dorsal tubercles (d) i, ii, iv with long thin seta, iii with long stouter seta, v pore; ventral setae: vm with one very thin seta, vl with two setae, one thin, one very thin. Respiratory horn (Figs. 14, 16) 2.5 times longer than broad, surface bare, apex with 10-12 spiracles; pedicel stout, length 0.04 (0.05-0.03, n=5) mm; length respiratory horn 0.18 (0.19-0.17, n=6) mm; P/H 0.21 (0.27-0.17, n=5). Operculum (Figs. 14-15) 0.5 as long as greatest width, disc covered with small rounded tubercles; posterior margin pointed; two anteromarginal tubercles (am) bearing single long seta, basal sensillum present; OL 0.09 (0.11-0.08, n=4) mm, OW 0.20 (0.21-0.19, n=4) mm, OW/OL 2.08 (2.60-1.80, n=4). Abdominal segments with scattered small spinules. Fourth abdominal segment (Figs. 17-18) with two dorsal anterosubmarginal tubercles (dasm), i with thin seta, ii with stouter seta; four dorsal posteromarginal tubercles (dpm), i,ii on single stout base, i with short, thin seta, ii with long, stout seta, iii pore, iv with minute seta; three ventral posteromarginal tubercles (vpm) with base rounded, seta thin; two lateral posteromarginal tubercles (lpm) with base broad, i with short, thin seta, ii with long, stouter seta; one lateral anterosubmarginal tubercle (lasm) without seta. Caudal segment (Fig.19) length 0.32 (0.39-0.33, n=6) mm, width 0.18 (0.21-0.15, n=6) mm, dorsal surface with abundant posteriorly directed spinules, also present on posterolateral processes.

*Male.* Length 3.48 mm. Respiratory horn 0.18 mm; pedicel 0.10 mm; P/H 0.55; OL: 0.10 mm, OW 0.20 mm. Caudal segment length 0.31 mm, width 0.19 mm.

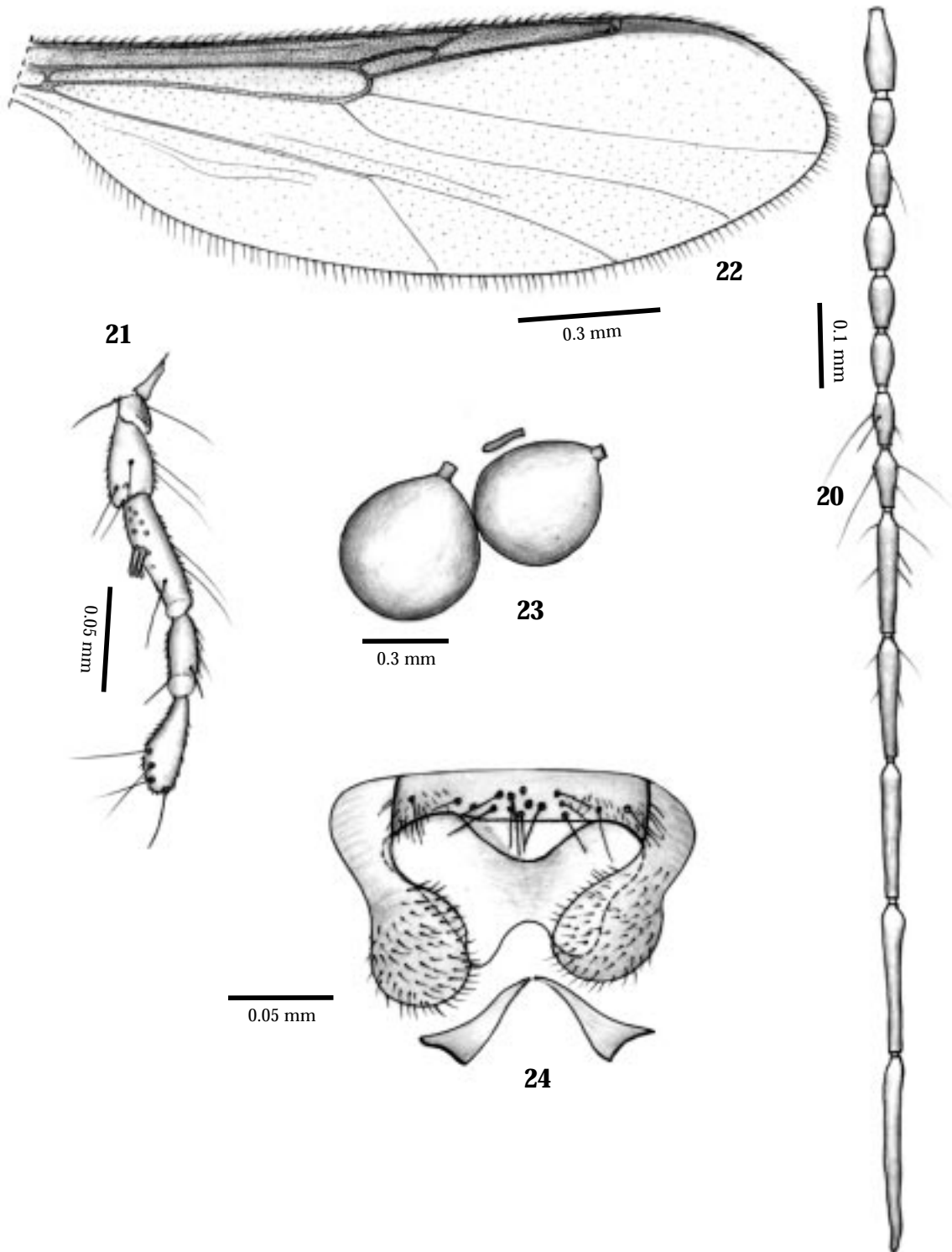
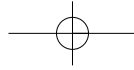
#### Redescription of adult (Figs. 20-26)

*Female* (Figs. 20-24).

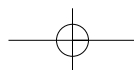
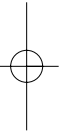
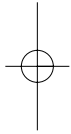
Head. Dark brown, clypeus slightly paler. Eyes bare, separated by distance equal to diameter of 2.5 ommatidia. Clypeus with 13-15 slender setae. Antenna (Fig. 20) with flagellomeres brown, narrow bases only slightly paler; scape without setae; AR 1.47 (1.56-1.35). Palpus (Fig. 21) elongated; third segment with few scattered sensilla; PR 3.05 (3.22-2.75, n=4). Mandible with 10-12 stout teeth. Thorax. Uniformly dark brown. Scutum with anterior tubercle; three prealar strong setae; double row of three dorsocentral setae. Scutellum with four setae. Legs yellow except coxa, trochanter, femur, basal half of tibia of hind leg dark brown; fore femur swollen, with 10-12 spines; tarsomeres 3-5 in all legs slightly infuscated; fifth tarsomeres unarmed; hind tarsal ratio 2.50 (2.60-2.30, n=4); claws small, with small basal inner tooth. Wing (Fig. 22) membrane slightly infuscated, anterior veins brown; wing length 1.70 (1.74-1.62, n=4) mm, width 0.55 (0.57-0.54, n=4)mm, CR 0.71 (0.72-0.70, n=4). Halter dark brown. Abdomen. Brown, no trace of gland rods. Sternite 8 (Fig. 24) with anterior portion rectangular, greatly broader than long; posterior portion hyaline, anterolateral margins rounded, heavily sclerotized; two large, prominent setose lobes arising from anterior margin. Sternite 9 (Fig. 24) divided, each arm with slender anteriorly directed portion and broader laterally directed portion. Sternite 10 pale yellowish, with five pairs of large setae; cerci stout. Two rounded, slightly unequal spermathecae with short necks, diameter 0.050 and 0.046 mm, plus rudimentary third (Fig. 23).

*Male.* Similar to female with usual sexual differences. Wing length 1.32 mm; width 0.42 mm; CR 0.52.

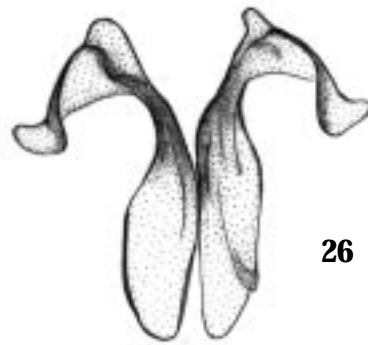
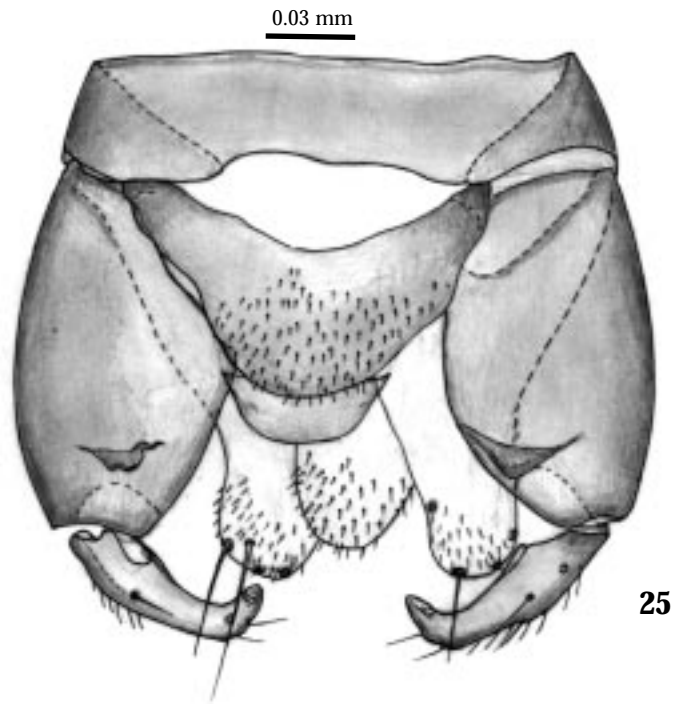
Genitalia (Figs. 25-26). Sternite 9 0.25 times longer than broad, with shallow, irregular posteromedial excavation, ventral surface smooth; tergite 9 tapering distally, cerci lightly sclerotized, bluntly rounded, each one with four setae. Sternite 10 rounded, pilose. Gonocoxite stout, nearly twice as long as broad with setose mesoventral lobe; gonostylus 0.6 times the length of gonocoxite, curved distally, tapering to stout, pointed tip. Aedeagus stout, heavily sclerotized, 1.4 times broader than long; basal arms very short, recurved; basal arch extending 0.25 of total length; distal portion tapering to stout rounded tip; underlying membrane spiculate, with broad rounded tip extending to 0.8 of total length. Parameres (Fig.



**Figs. 20-24:** *Palpomyia guarani* Lane, adult female. 20. antenna; 21. palpus; 22. wing; 23. spermathecae; 24. genital sclerotization.







**Figs. 25-26:** *Palpomyia guarani* Lane, adult male. 25. genitalia (parameres removed); 26. parameres.

26) divided, each with conspicuous, doubly recurved basal arm; stem curved, deeply sclerotized; distal portion stout, nearly straight, tip blunt.

**Distribution.** Brazil (São Paulo, Rio de Janeiro, Espírito Santo), Paraguay (Itapua).

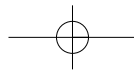
**Specimens examined.** PARAGUAY, Itapua, Bella Vista, 8-XI-2000, G. Spinelli, 1 male, 4 females (reared in laboratory), 3 larvae, 1 pupal exuvia male, 6 pupal exuviae female.

For SEM: same locality, 4 larvae.

This is the first record of *P. guarani* from Paraguay. All the above mentioned specimens were collected in a single, shallow, one meter height tree hole of approximately 5 cm long and 3 cm width.

Paratypes (pinned): BRAZIL, Espírito Santo, São Joao, 6-V-1940, L. Whitman, from bambu, 3 females with pupal exuvia (IOC 360, 361, 362); Brazil, Rio de Janeiro, Distrito Federal, Rio de Janeiro Silvestre, 2-II-1940, L. Whitman, from tree





hole, 1 female (IOC 363); Brazil, São Paulo, Horto Forestal, V-1944, J. Lamosa, 1 female with pupal exuvia (IOC 364)

### DISCUSSION

As it was pointed out by Lane (1946) *P. guarani* is very similar to the colombian species *Palpomyia columbiana* Kieffer, from which it can be distinguished at the adult stage by the apical fifth of hind femur yellowish and hind tibia dark brown almost to apex in *P. columbiana*. These differences are itself not very significant, and perhaps *P. guarani* is a junior synonym of *P. columbiana*. Unfortunately this presumption could not be corroborated, because the type of *P. columbiana*, deposited in the Musée National Hongrois de Budapest, was destroyed by a bombing during the occupation of Hungary by the soviets in 1956.

The specimens studied were determined as *Palpomyia guarani* based on the comparison with the original description, as well as with part of the type-series deposited in the Instituto Oswaldo Cruz. We attempted to study the holotype of this species, deposited in the Faculdade da Saude Publica da Universidade de São Paulo, but unfortunately it is lost (Maria Anice Sallum, pers. comm.).

The larvae of *P. guarani* are prognathous, exhibiting an elongate, narrow head, mandible hooked with a single strong tooth, epipharynx gently massive and hypostoma finely toothed, which are character states typical of carnivorous larvae (Thomsen, 1937; Mullen & Hribar, 1988). Apparently, this is the only species of *Palpomyia* of the world known to breed in tree holes, where microfauna such as copepods were very abundant.

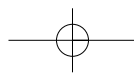
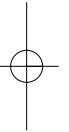
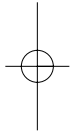
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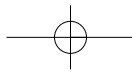
We would like to acknowledge María Felipe-Bauer and the authorities of the Instituto Oswaldo Cruz for facilities during the recent visit of one of us (MMR) to the Instituto Oswaldo Cruz, where paratypes of *P. guarani* were studied. Our gratitude also to Maria Anice Sallum from the Coleção Entomológica, Faculdade da Saúde Pública da Universidade de São Paulo, for the information

on the holotype of *P. guarani*.

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