

## Two new species of *Baetodes* Needham & Murphy (Ephemeroptera: Baetidae) from Brazil

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### Abstract

*Baetodes santatereza*, new species, and *B. liviae*, new species, are described based on nymphs collected from São Paulo, and Paraná states, Brazil. They both possess one gill on each coxa and tubercles on metanotum and abdominal segments 1 – 9. Besides these characteristics, they can be distinguished from the other known species of the genus by the following combination of characters: *B. santatereza*, **n. sp.**, glossae with two bladelike setae, one pectinate and one nonpectinate, and dorsal edge of femora with five to seven clavate setae, nearly one half the length of long, fine setae; *B. liviae*, **n. sp.**, glossae with one pectinate bladelike setae, dorsal edge of femora often with 6 to 8 clavate setae, nearly the length of long fine setae, besides body color pattern and body length.

**Key words:** Aquatic insects, taxonomy, Neotropics, nymphs

### Resumo

*Baetodes santatereza*, nova espécie, e *B. liviae*, nova espécie, são descritas baseadas em ninfas coletadas nos estados de São Paulo e Paraná, Brasil. Ambas espécies possuem uma brânquia em cada coxa e metanoto e segmentos abdominais 1 – 9 com tubérculos dorsais. Além dessas características, elas podem ser diferenciadas das demais espécies do gênero pela seguinte combinação de caracteres: *B. santatereza*, **n. sp.**, glossas com duas cerdas em forma de lâmina, uma pectinada e a outra não e superfície dorsal dos fêmures com cinco a sete cerdas clavadas, medindo a metade do comprimento das cerdas longas e finas; *B. liviae*, **n. sp.**, glossas com uma cerda em forma de lâmina, pectinada, e superfície dorsal dos fêmures frequentemente com 6 a 8 cerdas clavadas, tão longas quanto às cerdas longas e finas, além do padrão de coloração e tamanho corporal.

**Palavras-chave:** Insetos aquáticos, taxonomia, Neotrópico, ninfas

### Introduction

The genus *Baetodes* Needham & Murphy (Ephemeroptera: Baetidae) was described to include two species from Rio de Janeiro, Brazil: *B. serratus* Needham & Murphy, and another unnamed species, *Baetodes* nymph No. 1 (Needham & Murphy 1924). Since then, several other species were described, from Argentina to Arizona, and to date *Baetodes* is one of the most species-rich genera of mayflies in the Neotropics (Nieto 2004).

Despite these facts, the knowledge regarding *Baetodes* in Brazil has not changed much since that work of Needham & Murphy (1924). Only two other species were described from the country, *B. itatiayanus* Demou-

lin, also from Rio de Janeiro State, and *B. sancticatarinae* Mayo from Santa Catarina (Demoulin 1955; Mayo 1972). Traver (1944) also reported *B. serratus* from the State of Minas Gerais, while two other undetermined species were recorded from São Paulo and Mato Grosso States (Salles *et al.* 2003, 2004).

During works at the Ecological Station of Ribeirão Preto-Santa Tereza Forest, an important conservation area and one of the last remnants of Atlantic forest in Ribeirão Preto, São Paulo State, and at Morretes, Paraná State, two new species of *Baetodes* were found. The aim of this paper is to describe these two new species of *Baetodes*. The material is housed at the Museum of Zoology (MZSP), Universidade de São Paulo, São Paulo, Brazil.

## Results

### *Baetodes santatereza* Salles & Polegatto, n. sp.

(Figs. 1 – 13)

*Nymph.* Body length: 2.75mm; cerci: 3.3mm; terminal filament: 0.3mm. General coloration brownish.

*Head.* Coloration brownish, with whitish area between ocelli and compound eyes, and a whitish longitudinal band between median ocellus and anterior margin of head. Compound eyes black; turbinate portion orange brown. Antennae light brown. Labrum (Fig. 2) not expanded laterally, dorsal surface of each side of midline with a row of six setae; four setae near midline, alternating one long, one short, and two long setae near lateral margin. Hypopharynx as in Figure 3, apex of lingua broadly pointed. Mandibles as in Figs. 4 – 5. Maxillae (Fig. 6) medially with three setae. Labium (Fig. 7), with glossae shorter than paraglossae, and with two blade-like setae, the medial nonpectinate and the lateral pectinate, and five fine setae in lateral margin; paraglossae with one slightly pectinate hard seta among various fine pectinate setae.

*Thorax.* Coloration brownish; pronotum eventually with dark longitudinal bands on lateral margins and along midline; pleura and sterna yellowish white. Pronotum with posterior margin slightly elevated (Fig. 13). Metanotum with tubercle (Fig. 13). Legs (Figs. 1, 8 – 9) light brown with whitish spot at the base and apex of all femora; dorsal edge of femora with five to seven clavate setae, nearly one half the length of long, fine setae (Figs. 8, 9). Tarsal claws (Fig. 10) with six to seven denticles, the basal three denticles small and truncate, the apical three or four denticles pointed and increasing in length. One gill on each coxa (Fig. 8).

*Abdomen.* Coloration dark brown (Fig. 1), except terga 10 light brown; terga 6 – 9 with brown spot near midline; sterna yellowish white, with lateral margins of segments 1 – 9 suffused with brown. Segments 1 – 9 with median blunt dorsal tubercle, and fine long setae (Figs. 11, 13); posterior ¼ of terga covered with minute spines (Fig. 11). Gills oblong, whitish translucent with tracheation weakly pigmented (Fig. 12). Caudal filaments yellowish white.

**Adults:** unknown

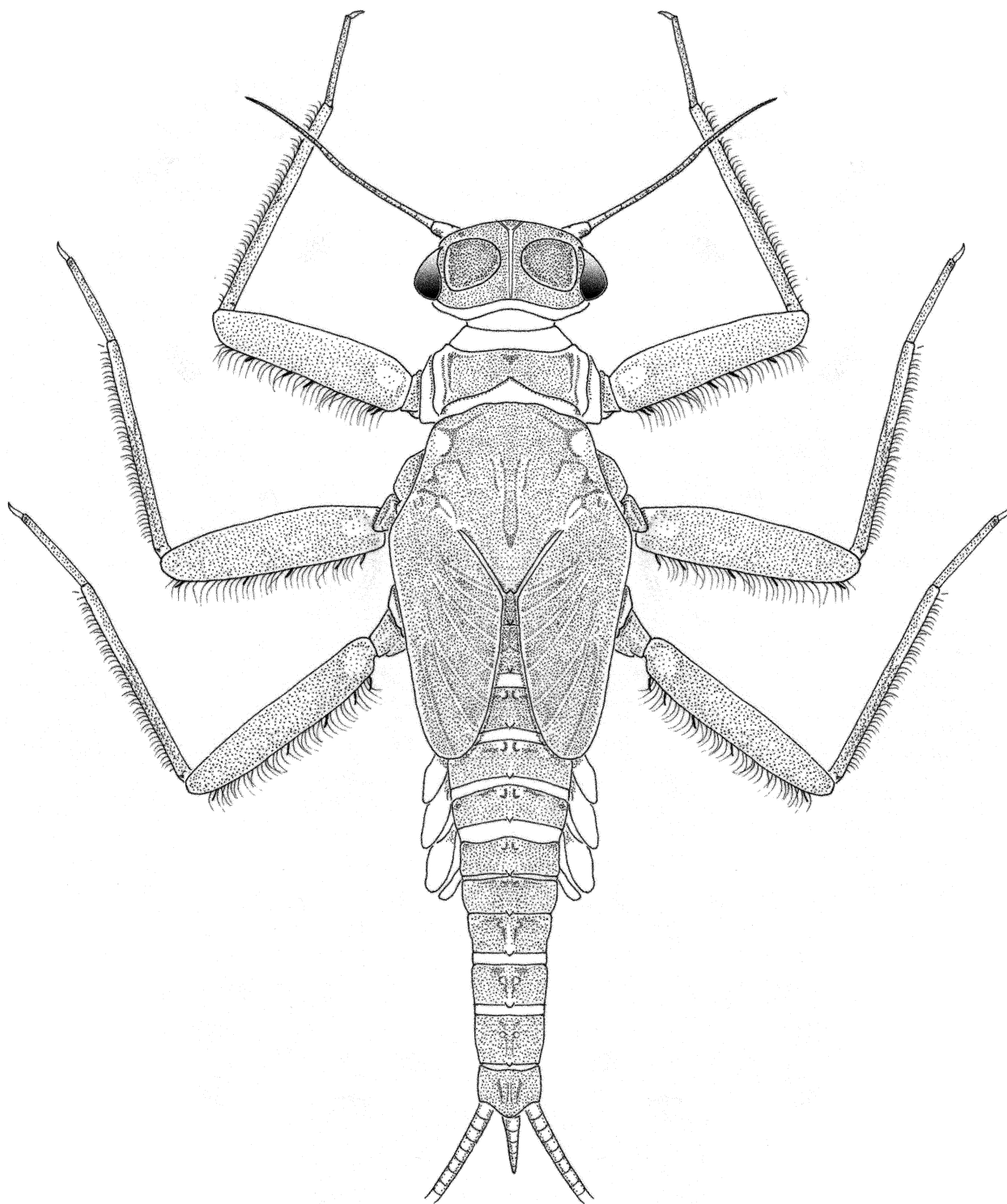
**Etymology:** after Santa Tereza, former name of the Ecological Station where the new species was found.

**Material examined:** Holotype. Male nymph. Brazil, São Paulo State, Ribeirão Preto, Ecological Station of Ribeirão Preto-Santa Tereza Forest (STF), Boa Vista Stream, 01.X.2004, C.M. Polegatto, Cristina Perin, Diego Barione, Camila M. Silva, Jeanne M. J. Amaral. Paratypes. 10 nymphs, same data as holotype, except two nymphs collected in 04.X.2004.

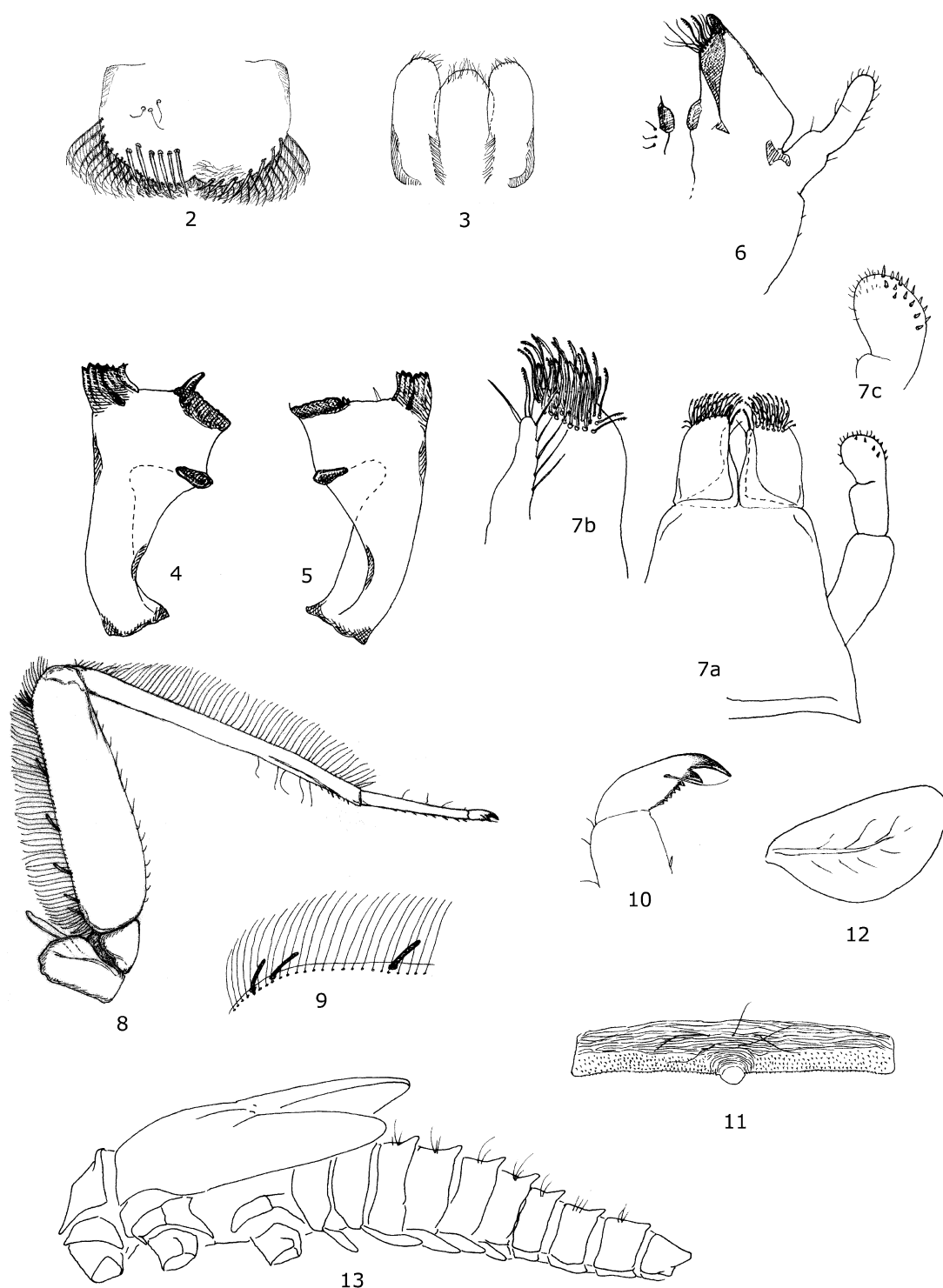
**Diagnosis:** *Baetodes santatereza*, n. sp., can be distinguished from the other known species of the genus by the following combination of characters: 1) small body size; 2) glossae with two bladelike setae, the medial nonpectinate and the lateral pectinate, paraglossa without nonpectinate blade-like (Fig. 7a,b); 3) dorsal edge of femora with five to seven clavate setae, nearly one half the length of long, fine setae (Fig. 8 – 9); 4) one gill on each coxae (Fig. 8); 5) metanotum and abdominal segments 1 – 9 with dorsal tubercles (Fig. 13).

**Biology:** Nymphs of *B. santatereza*, n. sp., were collected in Ribeirão Preto, State of São Paulo, in a third order stream in an Atlantic forest fragment, the Ecological Station of Ribeirão Preto - Santa Tereza Forest

(STF). They were found living in small rapids provided by stones with ca. 50 cm, although some nymphs were also found inhabiting deep stones in riffle areas. In rapids the nymphs were more abundant at the end of the rainy season to the beginning of the dry/cold months, decreasing in the following months. The following measures were taken during the samples: water temperature 20.3°C in July to 22.4° in the first warm months; pH is 6.2 – 6.9.



**FIGURE 1.** *Baetodes santatereza*, **n. sp.**; General habitus of nymph.



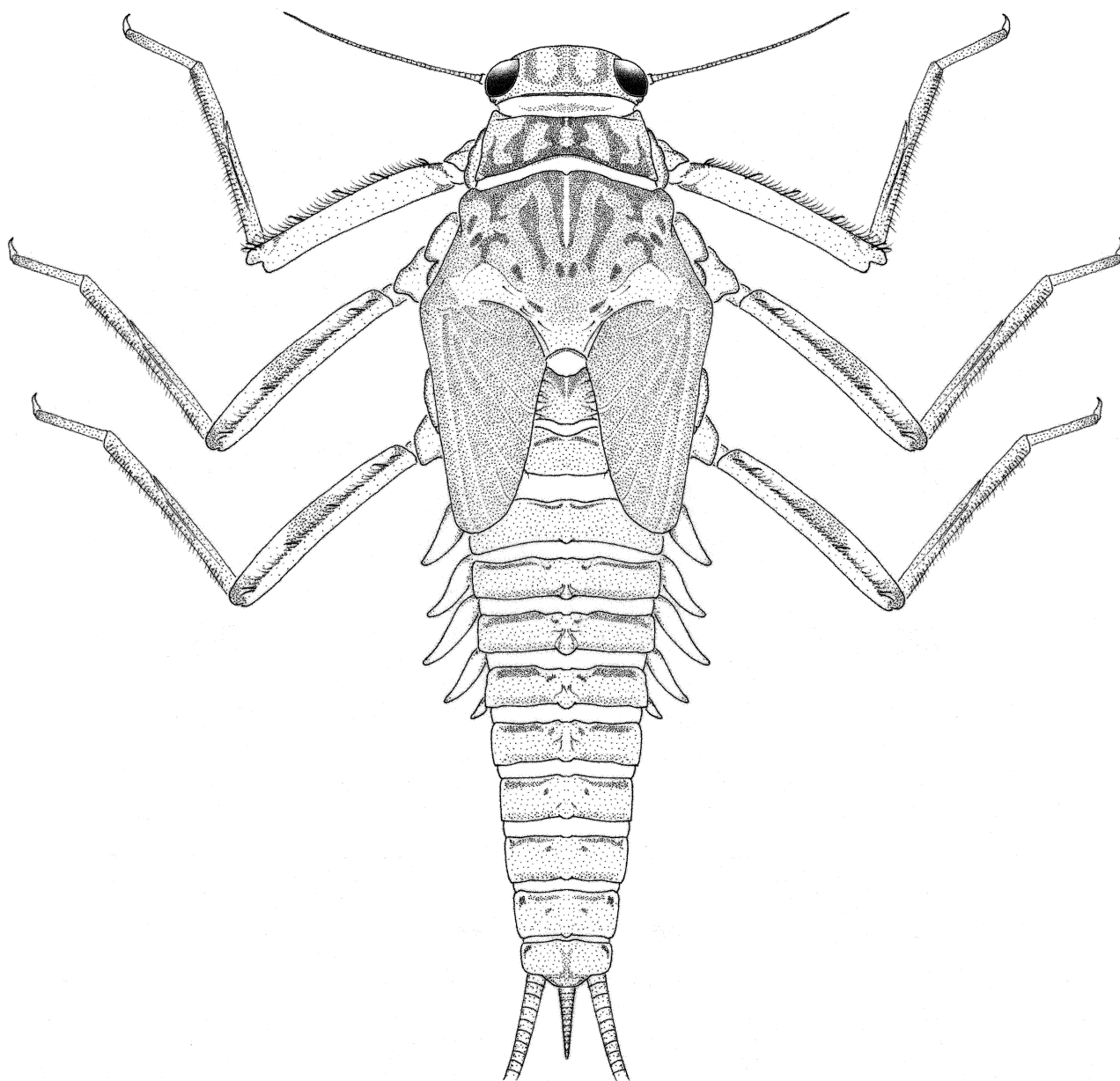
**FIGURES 2–13.** *Baetodes santatereza*, **n. sp.**, nymph; 2, labrum. 3, hypopharynx. 4, left mandible. 5, right mandible. 6, maxilla. 7, labium (a, left, dorsal view, right, ventral view; b, detail of glossa; c, detail of segment 3 of palp). 8, foreleg. 9, detail of dorsal edge of femora. 10, tarsal claw. 11, tergum 4. 12, gill. 13, lateral view of nymph.

The STF is located in a large agricultural area, with sugarcane as the chief crop, where most of the forests were destroyed in the last decades. Although the canopy is abundant over the stream, depositional material is common due the reduction or absence of parts of the riparian vegetation. Integral protection of the STF still depends on Brazilian and regional laws.

***Baetodes liviae* Polegatto & Salles, n. sp.**

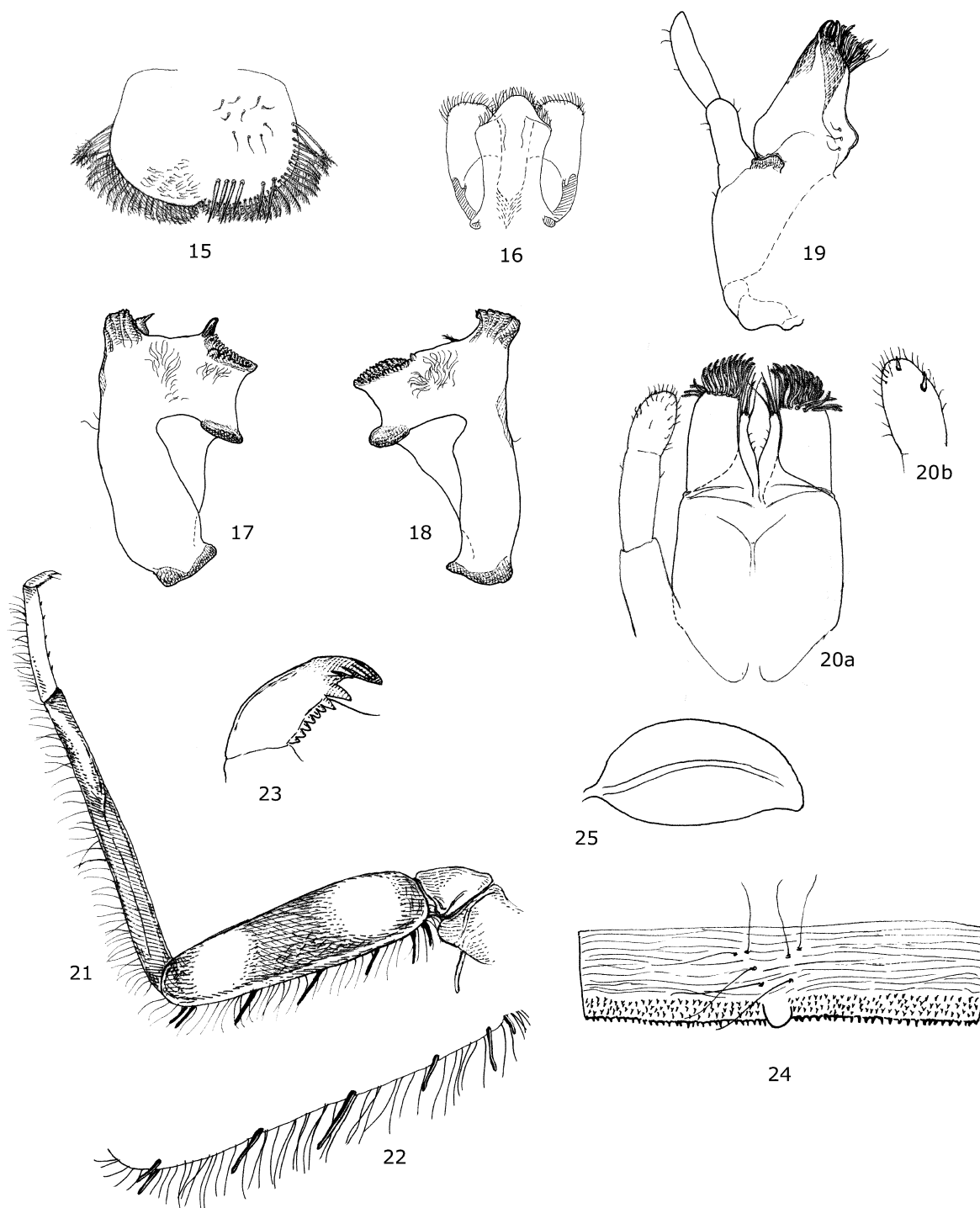
(Figs. 14 – 25)

*Nymph.* Body length: 4.2mm; cerci: 5.0mm; terminal filament: 0.5mm. General coloration brownish.



**FIGURE 14.** *Baetodes liviae*, n. sp., General habitus of nymph.

*Head.* Coloration brownish, with anterior gray areas and dark brown spots on midline and posterior area of head capsule. Compound eyes black; turbinate portion dark brown. Antennae whitish. Labrum (Fig. 15) not expanded laterally, dorsal surface of each side of midline with a row of six setae; four setae near midline, alternating one long, one short, and two long setae near lateral margin, and also a group of ca. nine short, fine, setae posteriorly. Hypopharynx as in Figure 16, apex of lingua broadly pointed. Mandibles as in Figs. 17 – 18, with a ventral group of fine, long, simple setae near anterior margin; right prostheca covered with minute setae. Maxillae (Fig. 19) with three setae medially. Labium (Fig. 20). Glossa little shorter than paraglossa, apex with one pectinate blade-like seta and four fine, stout, simple setae; paraglossa without nonpectinate blade-like, but with one robust, pectinate seta.



**FIGURES 15–25.** *Baetodes liviae*, n. sp., nymph; 15, labrum. 16, hypopharynx. 17, left mandible. 18, right mandible. 19, maxilla. 20, labium (a, left, dorsal view, right, ventral view; b, detail of segment 3 of palp). 21, foreleg. 22, detail of dorsal edge of femora. 23, tarsal claw. 24, tergum 4. 25, gill.

*Thorax.* Coloration brownish, with dark brown marks as in Fig. 14; pleura whitish with hard parts gray, sterna white. Pronotum with posterior margin slightly elevated (similar to Fig. 13). Metanotum with tubercle. Legs (Fig. 14, 21) coloration dark brown with light brown areas on femur and tarsus, dorsal edge of femora with 6 to 8 clavate setae, eventually 13, nearly the length of long fine setae (Figs. 21 – 22). Tarsal claws (Fig. 23), with one large subapical denticle, and about 7 basal small denticles. One gill on each coxae (Fig. 21).

**Abdomen.** Coloration light brown; anterior and posterior margin of terga with brownish to dark brownish marks as in Fig. 14; sterna whitish-brown. Segments 1 – 9 with median blunt, small, dorsal tubercle, and fine long setae; posterior ¼ of terga covered with minute spines (Fig. 24). Gills oblong, whitish translucent, main trachea weakly pigmented (Fig. 25). Caudal filaments light brown.

**Adults:** unknown

**Etymology:** the name of this new species is in honor of Livia Pinheiro, who collected the specimens and for her friendship and help.

**Material examined:** Holotype. Mature nymph. Brazil, Paraná State, Morretes, Nhundiaquara Stream, near Porto de Cima, 8km from city, 10.II.2005, Livia Pinheiro. Paratypes. 12 nymphs, same data as holotype, but collected in VIII.2005.

**Diagnosis:** *Baetodes liviae*, **n. sp.**, can be distinguished from the other known species of the genus by the following combination of characters: 1) large body size; 2) glossae with one pectinate bladelike setae, paraglossa without nonpectinate blade-like (Fig. 20); 3) third segment of labial palp nearly half the length of the second segment (Fig. 20a); 4) dorsal edge of femora often with 6 to 8 clavate setae, nearly the length of long fine setae (Figs. 21 – 22); 5) one gill on each coxa (Fig. 21); 6) metanotum and abdominal segments 1 – 9 with dorsal small tubercles; and 7) body color pattern (Fig. 14).

**Biology:** The stream where this species was collected has a width near 10m, shallow water, with large and medium stones. There is a large area with well preserved forest, but some parts are disturbed by human activity, mainly because of tourism points and farms.

## Discussion

Two other species of *Baetodes* also possess one gill on each coxa and tubercles on metanotum and abdominal segments 1 – 9: *B. uruguayi* Nieto, recently described based on nymphs and adults from Uruguay (Nieto 2004); and *B. peniculus* Mayo, known only from Venezuelan nymphs (Mayo 1973). Whereas the new species herein described can be differentiated from *B. peniculus* simply by the shape of the abdominal tubercles (they are prominent and pointed in *B. peniculus* – see Fig. 13, Mayo 1973), the distinction between *B. liviae*, **n. sp.**, *B. santatereza*, **n. sp.**, and *B. uruguayi*, is more based on details of setae on glossae and legs, body size, and relative length of segments in labial palpi. The clavate setae on the dorsal edge of the femora of *B. santatereza*, **n. sp.**, are nearly one half the length of the fine setae, and the glossae, as in *B. liviae*, **n. sp.**, has one pectinate bladelike seta. Besides that, the body length of *B. santatereza* **n. sp.** (2.75 mm) is one of the smallest among the species of the genus, which often range in size, at least in South America, between four and five millimeters (see Mayo 1968, 1972, 1973, Nieto 2004). *Baetodes liviae*, **n. sp.**, and *B. uruguayi* have the clavate setae of the femora as long as the fine setae and are larger than *B. santatereza* **n. sp.**, but can be distinguished from each other based on the number of pectinate bladelike setae on the glossae (two in *B. uruguayi* and one in *B. liviae* **n. sp.**), the body color pattern, the slightly larger body size of *B. liviae*, **n. sp.**, and by the third segment of the labial palp being nearly half the length of the second segment in *B. liviae*, **n. sp.**, contrasting with segments subequal in *B. uruguayi*.

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