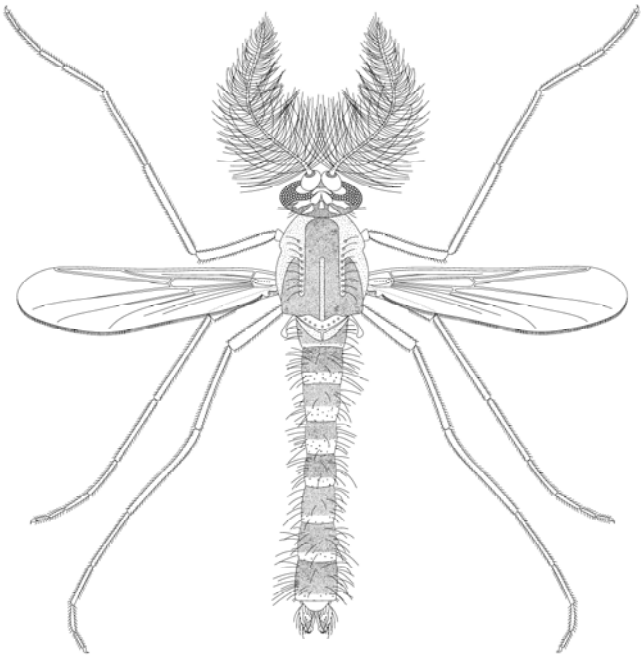
Universidade Federal de São Carlos

Centro de Ciências Biológicas e da Saúde

Programa de Pós-Graduação em Ecologia e Recursos Naturais

Labrundinia Fittkau, 1962 (Diptera: Chironomidae: Tanypodinae: Pentaneurini): taxonomia e história natural de espécies do Estado de São Paulo.



Fabio Laurindo da Silva

Dissertação apresentada ao Programa de Pós-Graduação em Ecologia e Recursos Naturais da Universidade Federal de São Carlos, como parte dos requisitos para obtenção do Título de Mestre em Ecologia e Recursos Naturais.

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Dissertação apresentada à Universidade Federal de São Carlos, como parte dos requisitos para obtenção do título de Mestre em Ecologia e Recursos Naturais.

Aprovada em 05 de março de 2009

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Ilustração capa: *Labrundinia* sp. n.

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Profa. Dra. Alaide Aparecida Fonseca Gessner

"As coisas são semelhantes: isto faz a Ciência possível;

as coisas são diferentes: isto faz a Ciência necessária"

Levins e Lewontin

Aos meus pais

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Resumo

O objetivo deste trabalho foi estudar espécies de *Labrundinia* Fittkau, 1962 (Diptera: Chironomidae: Tanypodinae: Pentaneurini) no Estado de São Paulo. Esse táxon é comumente citado em muitos trabalhos de cunho ecológico, sempre em nível genérico. Na região Neotropical são conhecidas 10 espécies, porém nenhuma especificamente mencionada para o Brasil. As coletas em campo seguiram a metodologia convencional para estudos bentônicos. Em laboratório as larvas foram mantidas vivas para a obtenção das três fases de desenvolvimento: larva, pupa e adulto. Os resultados permitiram a identificação de cinco espécies*, das quais quatro são espécies novas para a ciência e o primeiro registro de *Labrundinia tenata* Roback (1987) para o Brasil. As espécies são descritas com as respectivas diagnoses. Informações sobre a história natural das espécies do gênero são apresentadas e propostas de chaves de identificação, para os diferentes estágios de vida, são dadas.

Palavras-Chave: insetos aquáticos, larva, pupa, adulto, ecologia.

Abstract

The aim this work was study species *Labrundinia* Fittkau, 1962 (Diptera: Chironomidae: Tanypodinae: Pentaneurini) at São Paulo State. This taxon is commonly cited in ecological studies, always in generic level. In the Neotropical region are known 10 species, however none specifically mentioned for Brazil. The sampling followed the conventional methods of benthonic studies. In laboratory the larvae were kept alive to obtain the three development phases: larva, pupa and adult. The results allowed the identification of five species*, four of which are new species and the first record of *Labrundinia tenata* Roback (1987) for Brazil. The species are described with their respective diagnoses. Information about species natural history of genus is presented and propels for the identification keys, for the different stages of life, are given.

Key-words: aquatic insects, larva, pupa, adult, ecology.

Résumé

L'objectif de ce travail a été d'etudier espèces *Labrundinia* Fittkau, 1962 (Diptera: Chironomidae: Tanypodinae: Pentaneurini) dans l'État de São Paulo. Ce taxon est communément cité dans les études écologiques, toujours dans le niveau générique. Dans la région néotropicale 10 espèces sont connues, mais aucune spécifiquement mentionné pour le Brésil. L'échantillonnage a suivi les méthodes conventionnelles de benthoniques études. En laboratoire, les larves ont été maintenues en vie pour obtenir les trois phases de développement: larve, nymphe et adulte. Les résultats a permis l'identification de cinq espèces*, dont quatre sont des nouvelles espèces pour la science et le premier enregistrement de *Labrundinia tenata* Roback (1987) pour le Brésil. Les espèces sont décrites avec leur diagnostic. Informations sur l'histoire naturelle des espèces du genre sont présentées et des propositions pour les clés d'identification pour les différentes étapes de la vie sont donnés.

Mots-clés: insectes aquatiques, larves, nymphes, adultes, écologie.

Sumário

1. Introdução

A família Chironomidae

A família Chironomidae compreende um grupo de Diptera pertencente à subordem Nematocera. Junto com as famílias Ceratopogonidae, Simuliidae e Thaumaleidae, constituem a superfamília Chironomoidea. O registro geológico mais antigo desses insetos data do Jurássico Inferior, sendo que a família provavelmente evoluiu no Triássico (Ansorge, 1999).

Os insetos pertencentes à esta família são insetos holometábolos, possuindo quatro estágios distintos em seu ciclo de vida: ovo, larva (com quatro estádios), pupa e adulto (imago). A fase larval corresponde à etapa mais longa do ciclo de vida desses insetos e pode variar de dias a alguns anos, de acordo com a espécie e/ou condições ambientais (Coffman & Ferrington, 1996).

As larvas, em sua maioria, são apnêusticas, possuem cabeça bem desenvolvida, completa, não retrátil e mandíbulas com movimentos de oblíquo a horizontal; corpo segmentado, alongado, estreito, com dois pares de pseudópodos (localizados ventralmente nos segmentos protorácico e anal), um par de procercos (localizados dorsalmente no segmento anal, cada um com um tufo de cerdas em seu ápice) e túbulos anais (Cranston, 1995a). No estágio larval, a diferenciação das subfamílias e gêneros de Chironomidae faz-se com base, principalmente, nas estruturas da cápsula cefálica.

As pupas possuem cefalotórax mais robusto que o abdome, sendo este último achatado dorsoventralmente (Cranston, 1995a). Nos estágio de pupa, os Chironomidae são identificados com base, principalmente, na morfologia dos órgãos respiratórios, presença ou ausência de espinhos ou cerdas nos lóbulos anais.

Os adultos de Chironomidae possuem asas estreitas, com nervuras Costal e Radial, em geral, mais esclerosadas que as outras. Várias características morfológicas das asas constituem informações importantes para a taxonomia, como: pilosidade, padrões de pigmentação das membranas, distribuição de setas nas nervuras e proporções relativas entre as nervuras. Observa-se também, dimorfismo sexual nas asas, sendo as das fêmeas mais largas que as dos machos (Cranston, 1995a).

Segundo Ferrington (2008), a família Chironomidae compreende um total de 339 gêneros válidos até 2006 distribuídos em 11 subfamílias (Sæther, 2000): Aphroteniinae, Buchonomyiinae, Chilenomyiinae, Chironominae, Diamesinae, Orthocladiinae, Podonominae, Prodiamesinae, Tanypodinae, Telmatogetoninae e Usambaromyiinae, com exceção apenas de Usambaromyiinae, todas as demais subfamílias são registradas para Região Neotropical (Spies & Reiss, 1996).

A família Chironomidae possui distribuição cosmopolita e seus representantes freqüentemente dominam as comunidades de insetos aquáticos, tanto em abundância quanto em riqueza de espécies. As espécies ocorrem em todos os continentes, incluindo a Antártica e Ilhas Oceânicas. Apesar de algumas espécies terem hábitos terrestres, semi-terrestres ou semi-aquáticos e marinhos, a grande maioria é dulcícola (Ferrington, 2008). Algumas espécies toleram condições extremas de temperatura, pH, salinidade, profundidade, velocidade de correnteza e altitude, pois são favorecidas por adaptações morfológicas, fisiológicas e comportamentais (Cranston, 1995b).

A importância ecológica dos Chironomidae ganhou destaque com os trabalhos de tipologia dos lagos da região paleártica (Lampert & Sommer, 1997; Thienemann, 1922) com as classificações de oligotrófico, mesotrófico, eutrófico e distrófico, respectivamente relacionados à presença dominante de espécies pertencentes aos gêneros *Tanytarsus* van der Wulp, *Sergentia* Kieffer, *Chironomus* Meigen e *Zalutschia* Lipina no bentos dos lagos. Tal

classificação foi confirmada por Brundin (1949; 1956) e um paralelo com a fauna neártica foi estabelecido por Sæther (1975). Atualmente os Chironomidae têm um papel importante no biomonitoramento dos corpos d'água da região Holártica e Neotropical (Brönmark & Hansson, 1998), sendo objeto de estudo de diversos trabalhos de cunho ecológico e taxonômico, dos quais cito: Fonseca-Gessner & Guereschi (2000), Correia *et al*. (2006), Stur *et al*. (2006), Aburaya & Callil (2007), Roque & Trivinho-Strixino (2007), Silva *et al*. (2007; 2008).

Apesar desses estudos, o número de gêneros e espécies neotropicais descritas ainda é incipiente em relação a outras regiões zoogeográficas (Sanseverino, 2006). Na região Neotropical são registradas apenas 618 espécies para 154 gêneros (Ferrington, 2008), o que representa menos da metade dos gêneros descritos mundialmente.

No Brasil, embora nas últimas décadas haja um número crescente de trabalhos, de cunho ecológico e taxonômico com a família Chironomidae, a maior dificuldade refere-se à identificação das espécies deste grupo. Em geral, estes estudos ficam restritos a listas dos gêneros encontrados, uma vez que as descrições específicas estão fundamentadas em adultos machos; portanto, o reconhecimento das espécies, na fase larval, é dificultado pela ausência de trabalhos que relacionem todas as fases do ciclo de vida do inseto.

A subfamília Tanypodinae

A subfamília Tanypodinae foi estabelecida por Thienemann & Zavrel em 1916, principalmente com base nos estágios imaturos (Roback, 1971). As larvas deste grupo possuem: cabeça alongada; antenas retráteis constituídas por 4 segmentos; manchas ocelares reniformes; mento transformado em um apêndice M; mandíbulas em forma de gancho; complexo hipofaríngeo formado por uma lígula esclerotizada, um par de paralígulas, um pente hipofaríngeo e um par palpos maxilares; tórax com pilosidade esparsa, ao contrário do

abdome, em alguns grupos pode conter uma franja de pelos longos laterais; procercos longos com cerdas apicais; pseudópodos anteriores e posteriores com vários tipos de garra. Possuem, ainda, quatro túbulos anais (raramente seis), alongados.

O cefalotórax das pupas é mais robusto que o abdome, este achatado dorsoventralmente e constituído por nove segmentos. O tergito I caracteriza-se pela presença de uma sutura denominada *scar*; os tergitos portam setas (laterais e dorsais) que variam em posição, número e comprimento; ainda nos tergitos e esternitos, podem ocorrer grupos de espinhos minúsculos denominados *shagreen*, que variam em forma, posição e número.

Os adultos pertencentes à esta subfamília diferenciam-se das demais por possuírem: cabeça arredondada, olhos grandes, peças bucais reduzidas; antenas com acentuado dimorfismo sexual e com o último flagelômero menor do que o penúltimo; nas asas com nervura, a M-CU, localizada entre R-M e F-CU; a forma dos esporões das tíbias e a posição dos gonóstilos são características diagnósticas da subfamília (Fittkau & Roback, 1989).

As larvas de Tanypodinae são consideradas predadoras (Coffman & Ferrington, 1996), devido à grande maioria de suas espécies ingerir alimento de origem animal (inclusive outras larvas da mesma família), algumas ainda sugam o fluído corpóreo da presa. No entanto, há registros na literatura de larvas deste grupo que se alimentam de algas e detritos (Pinder, 1986; Roback, 1969).

Conforme o catálogo de Spies & Reiss (1996) são registrados 26 gêneros desta subfamília para o Neotrópico, sendo apenas 10 para o Brasil. Desde essa data, vários gêneros têm sido registrados pela primeira vez para o país ou descritos como novos, como é o caso de *Guassutanypus* Roque e Trivinho-Strixino (Roque & Trivinho-Strixino, 2003) e *Parapentaneura* Stur *et. al.* (Stur *et. al.*, 2006). Tais dados sustentam a premissa de que a fauna brasileira de Chironomidae, em especial a da subfamília Tanypodinae, é pouco conhecida.

O gênero *Labrundinia* Fittkau 1962

O gênero *Labrundinia* foi proposto por Fittkau (1962) com base em *Tanypus longipalpis* (Goetghebuer, 1921). Nos trabalhos anteriores a esta data, o grupo era considerado como um subgênero de *Pentaneura*, sendo que Edwards, 1929, o designava como grupo F, enquanto Johannsen, 1946, o chamava de grupo E (Roback, 1971).

Os adultos pertencentes ao gênero distinguem-se dos demais gêneros pelas asas com a nervura Costal terminando próximo ou exatamente sobre o ápice de $R_{4+5;}$ a R_{2+3} ausente ou pouco desenvolvida e M-Cu e R-M distintamente separadas ao longo de M. O gênero é, também, reconhecido pela extremidade da antena pouco diferenciada e pelo abdome e tórax marcados por padrões variados de manchas acastanhadas e tíbias com esporões pouco desenvolvidos (Roback, 1971; Beck & Beck, 1966).

As pupas são acastanhadas, muito semelhantes entre si, e diferem das demais pelo tamanho e coloração do corno respiratório, possuem espinhos (*shagreen*) e lobo anal de formato e tamanhos variados, podendo conter um longo espinho lateral (Beck & Beck, 1966).

As larvas possuem variabilidade morfológica: cápsula cefálica lisa ou granulada, com ou sem manchas, com ou sem espinhos laterais, e diferem dos demais gêneros, principalmente pela lígula com cinco dentes, sendo o mediano maior que o primeiro lateral e paralígulas desigualmente bífidas. Pseudópodos posteriores com garras bífidas (com dente externo menor que o interno), e abdome com pilosidade esparsa (Fittkau & Roback, 1983).

Atualmente são registradas 15 espécies de *Labrundinia*, sendo que a maioria concentra-se nas regiões Neártica e Neotropical, havendo apenas 1 espécie reconhecida para a região Paleártica. Na região Neotropical, são reconhecidas dez espécies de *Labrundinia*, conforme o catálogo de Spies & Reiss (1996) e as quais estão assim distribuídas: *L. fera* Roback, *L. fosteri* Roback, *L. hirsuta* Roback, *L. meta* Roback, *L. opela* Roback, *L. parabecki* Roback, *L. tenata* Roback da Colômbia (Roback, 1987a), *L. maculata* Roback para o México

e Trinidad (Roback, 1971), *L. pilosella* Loew para o México e Porto Rico (Roback, 1971) e *L. separata* Edwards descrita para a Argentina (Spies & Reiss, 1996). Das espécies citadas, *Labrundinia maculata* e *Labrundinia pilosella* ocorrem também na região Neártica (Roback, 1971; Spies & Reiss 1996).

O gênero *Labrundinia* é considerado característico de áreas tropicais e subtropicais (Fittkau, 1962). As larvas deste táxon são comuns nos diferentes sistemas aquáticos continentais, preferencialmente em águas limpas associadas à vegetação aquática, sendo que há citações na literatura de espécies do gênero em águas eutrofizadas (Simpson & Bode, 1980).

Apesar do registro de dez espécies para região Neotropical, nenhuma é registrada para o Brasil. Os trabalhos nacionais, de cunho ecológico, citam a ocorrência do gênero (Trivinho-Strixino & Strixino, 1993; Dornfeld & Fonseca-Gessner, 2005) alguns distinguem morfoespécies (Roque *et al*., 2004), porém não se identificam as espécies. Dessa forma, uma revisão do gênero torna-se necessária e de suma importância. Este trabalho contribui com a descrição de quatro espécies novas e o primeiro registro de *Labrundinia tenata* para o Brasil.

2. Objetivos

1. Estudar as espécies de *Labrundinia* Fittkau, 1962 (Diptera: Chironomidae: Tanypodinae: Pentaneurini), com ênfase no Estado de São Paulo.

2. Elaborar chaves de identificação para os diferentes estágios de desenvolvimento das espécies estudadas.

3. Aumentar o conhecimento das espécies do gênero, através da descrição de espécies novas e/ou de estágios imaturos.

4. Descrever aspectos da história natural de espécies do gênero.

3. Material e Métodos

Material examinado

O material das espécies *Labrundinia* sp. 1 spec. nov., *Labrundinia* sp. 2 spec. nov. e *Labrundinia* sp. 3 spec. nov. foi doado pelo Dr. Humberto Fonseca Mendes (The Natural History Collections, University of Bergen, Bergen, Norway), sendo proveniente de coletas realizadas no Lago Monte Alegre, Ribeirão Preto, SP. Enquanto que o material correspondente às espécies *Labrundinia tenata* e *Labrundinia* sp. 4 spec. nov. provém de coletas realizadas no município de São Carlos (SP) durante este estudo.

O material tipo será depositado parte no Museu de Zoologia da Universidade de São Paulo (MZUSP) e parte na Coleção de Referência do Laboratório de Entomologia Aquática (LEA), do Departamento de Hidrobiologia da Universidade Federal de São Carlos.

Caracterização ambiental e métodos de coleta e criação

A fim de caracterizar os ambientes onde as larvas vivem e foram coletadas, as variáveis físicas e químicas da água foram aferidas *in situ*: teor de oxigênio dissolvido, potencial hidrogeniônico (pH), condutividade elétrica e temperatura, utilizando-se um multisensor da marca YSI, modelo 556 MPS. Além disso, foi medida a profundidade da coluna d'água com auxílio de uma régua graduada.

As larvas foram coletadas com o auxílio de diferentes amostradores dependendo do tipo de ambiente (lótico ou lêntico) e rede manual em D (malha de 250μm de abertura), e um sistema de criação foi estabelecido para a obtenção de associações seguras entre larvas, pupas

e adultos. Nesses ambientes foram coletadas também macrófitas aquáticas, onde as larvas do gênero têm sido relatadas como abundantes (Dornfeld & Fonseca-Gessner, 2005).

As amostras foram levadas para o laboratório, onde após triagem as larvas foram mantidas em pequenos frascos plásticos, contendo água do local de origem e com a boca protegida por tecido de voile branco, para a retenção do adulto e assim a obtenção das exúvias da larva e da pupa.

Montagem de lâminas, identificação e ilustração

Seguindo métodos descritos por Pinder (1983, 1986, 1989), foram preparadas lâminas permanentes, em Euparal, dos exemplares adultos, exúvias pupais e larvais de cada morfótipo coletado. O tórax e abdome dos adultos foram diafanizados em solução de KOH 10%.

A identificação do material foi realizada com o auxílio de equipamentos ópticos, seguindo as descrições originais de espécies (Beck & Beck, 1966; Roback, 1971, 1987a, 1987b). As medições foram realizadas de acordo com o sistema de medidas sugerido por Epler (1988). As medidas mínimas e máximas são citadas seguidas pela média entre parênteses, quando examinados três ou mais espécimes.

As ilustrações finais foram feitas em nanquim e/ou através dos programas *Corel Draw* e *Adobe Photoshop* e *Adobe Illustrator* a partir de esquemas a traço de lápis feitos pelo autor com auxílio de câmara clara acoplada ao microscópio óptico.

Terminologia e abreviaturas

A terminologia morfológica e abreviaturas seguiram basicamente aquela proposta por Sæther (1980), complementadas por Kowalyk (1985) para setação cefálica, e Roback (1987a,b) para terminologia específica para *Labrundinia*.

As seguintes abreviaturas adicionais foram usadas no texto: ALR, razão do lobo anal; AMD, segmento antenal I da larva/comprimento da mandíbula; APR, segmento antenal I da larva/comprimento segmento basal do palpo; GcR, razão do gonocoxito; IO, comprimento do dente interno da ligula/comprimento do dente externo; MO, comprimento do dente mediano da lígula/comprimento do dente externo; PR, razão do segmento basal do palpo; PTH, comprimento da papila preapical/comprimento do corno torácico; THR, razão do corno torácico. Razão equivale ao comprimento dividido pela largura da estrutura em questão. Papila preapical (apical nipple) corresponde à projeção membranosa apical do corno torácico da pupa.

4. Taxonomia

Labrundinia Fittkau 1962

Ablabesmyia: Johannsen 1905 (Part): 152; *Tanypus*: Malloch 1915a (Part): 372; *Tanypus* Walley 1928 (Part): 583; *Pentaneura*: Edwards 1929 (Group F, Part): 294; *Pentaneura*: Johannsen, 1946 (Group E, Part): 283; *Labrundinia* Fittkau 1962; *Labrundinia*: Beck & Beck 1966: 337; *Labrundinia*: Roback 1971: 275.

Type genus: *Tanypus longipalpis*

Other species of genus: *Labrundinia becki* Roback 1971; *L. fera* Roback 1987; *L. fosteri* Roback 1987; *L. johannseni* Beck & Beck 1966; *L. hirsuta* Roback 1987; *L. maculata* Roback 1971; *L. longipalpis* Fittkau 1962; *L. meta* Roback 1987; *L. neopilosella* Beck & Beck 1966; *L. opela* Roback 1987; *L. parabecki* Roback 1987; *L. pilosella* Loew 1866; *L. separata* Edwards 1931; *L. virescens* Beck & Beck 1966.

Diagnostic characters

Males can be distinguished by absence of tibial spurs on the hind leg and by apical flagellomere to be almost fused to preapical flagellomere. Pupae showing thoracic horn with plastron plate reduced and typical shape. Larvae present posterior parapod with a bifid claw with outer tooth shorter than inner tooth.

Generic diagnostic

Male: characterized by terminal flagellomere not offset; eyes bare. C short, not produced beyond R4+5, ending level with or very slightly beyond tip M_{3+4}; R_{2+3} much reduced or absent. Adults brownish to brown, with coloration patterns on thorax. Hind leg without spur. Tergite IX large, arched with an apical row of setae. Inferior volsella of hypopygium absent.

Pupa: distinguished by cephalothorax with thoracic horn broad; external membrane with pale spines; horn sac occupies most of lumen; plastron plate reduced. Abdominal tergite I with scar; shagreen sparse. Anal lobe with inner border membranous, slightly concave. Male genital sac longer than the anal lobe.

Larva: characterized by mandible strongly curved. Surface of cephalic capsule may be smooth or crenulated with/without lateroventral spine group indistinct, posteroventral spine group present. Middle tooth of ligula very large, extending far beyond the other teeth. Paraligula bifid. Body without fringe setae. Posterior parapod with numerous simple claws and a bifid claw with outer tooth shorter than inner tooth.

***Labrundinia tenata* Roback 1987**

(Figs. 1-28)

Material examined. BRAZIL, São Paulo State, São Carlos, Fazzari reservoir, 21°58'S e 47°53'W, 1 male with associated pupal and larval exuviae, F. L. Silva leg.; as previous except for 14.v.2008; as previous except for 22.v.2008; as previous except for Espraiado reservoir, 21°59'S e 47°52', vi.1998, 2 larvae, S. Trivinho-Strixino leg.; as previous except for Itirapina, Itaqueri stream, 22°13'S e 47°52'W, 07.iii.2008, 1 larva, C. C. Andrade leg.

Diagnostic characters. *Labrundinia tenata* can be separated from others species by the following combination of characters: male with abdominal segments I brownish, II-VI with brown transverse band near proximal margin, VII, VIII almost wholly brown; hypopygium brown; anterior margin of sternapodeme rounded, no distinct spur. Pupa with thoracic horn S-shaped and with a shallow preapical groove with cleft in upper margin; abdominal segment VII with 2 lateral setae. Larva with lateroventral spine group indistinct, posteroventral spine group present; posterior parapod with single elongate claw serrated on inner margin and numerous simple claws.

Male (n = 3 unless otherwise stated)

Dimensions. Total length 1.85-1.99, 1.94 mm. Wing length 1.14-1.15, 1.14 mm. Total length/wing length 1.63-1.75, 1.70. Wing length/length of profemur 2.4-3.2, 2.9.

Coloration. Head brownish with dark brown occipital margin. Antenna brown. Thorax brownish with brown longitudinal strips. Wing clear with veins brownish, without spots. Legs pale. Fore, mid and hind femur pale yellow. Fore tibia brownish, mid and hind tibiae pale yellow. All fore tarsomeres brownish and mid and hind tarsomeres pale yellow. Abdomen

brownish with maculation as in figure 10; tergite IX with brown distal margin. Hypopygium brown.

Head (Figs. 1-2). AR 1.03-1.22, 1.12; flagellum 600-657, 632 μm long. Temporal setae 10-12. Eyes ratio 1.4-1.9, 1.7. Clypeus with 12-13 setae. Tentorium 128-137, 131 μm long. Palpomere lengths 1-5 (in μm): 31 (1); 54 (1); 88 (1), 131 (1); 209 (1), respectively.

Thorax. Antepronotum with 2-3 (2) setae. Acrostichals 24-27, biserial, all starting close to the anterior end; dorsocentrals 16-18, biserial anteriorly; prealars 5. Scutellum with 6-7 setae across disc and numerous fine anterior setae.

Wing (Fig. 3) 0.33-0.34, 0.33 mm wide. Costa not produced beyond R_{4+5}, ending very slightly beyond tip of M_{3+4}. Base of radial sector 0.08-0.10, 0.09 mm. VR 0.75-0.79, 0.76.

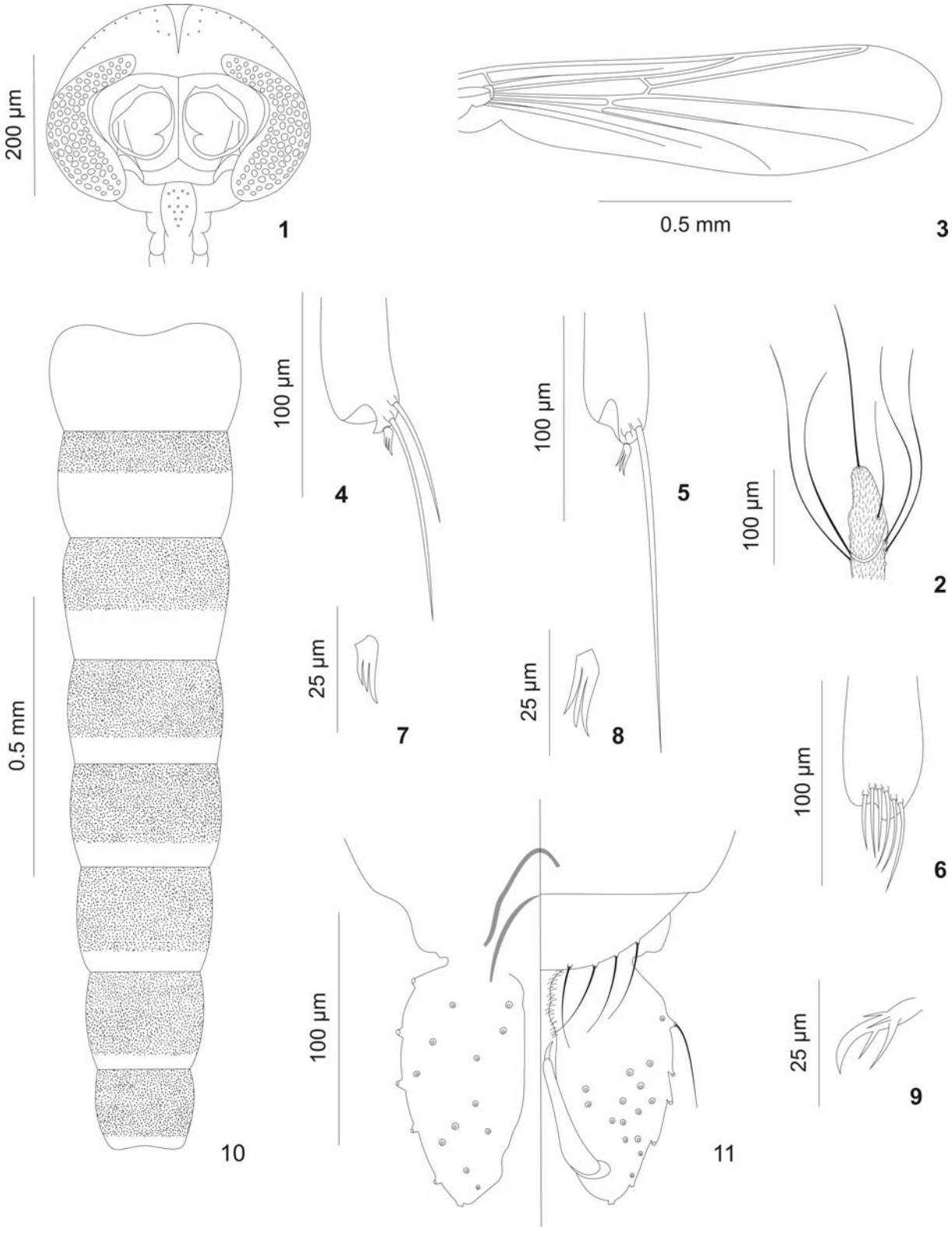
Legs (Figs. 5-9). Fore tibia with single pectinate spur, 13-15, 14 μm long with 3 teeth; mid tibia with single pectinate spur, 12-14, 13 μm long with 3 teeth. Width at apex of fore tibia 34-35, 34, mid tibia 29-32, 31, hind tibia 32-35, 33 μm wide. Hind tibial comb with 6-7 setae. Mid leg with two pseudospurs on Ta_{1-4}. Claws slender as in figure 9. Length and proportion of legs as in Table I.

Table I. Lengths (in μm) and proportions of legs of *Labrundinia tenata* Roback, 1987, male.

	fe	**ti**	**ta_1**	**ta_2**	**ta_3**
p_1	356-469, 417	381-406, 392	319 (2)	143 (2)	131 (2)
p_2	431-450, 444	406-413, 408	475-531, 498	225-231, 227	119-125, 121
p_3	450-494, 473	419-581, 515	513-563, 538	206-225 (2)	131-150 (2)

continued.

	ta_4	**ta_5**	**LR**	**BV**	**SV**
p_1	94-100 (2)	56-69 (2)	0.78-0.82 (2)	2.62-2.72 (2)	2.55-2.74 (2)
p_2	81-88, 83	63-81, 77	1.15-1.30, 1.22	2.62-2.68, 2.66	1.61-172, 1.72
p_3	100-119 (2)	63-69 (2)	0.94-0.96 (2)	2.84-3.06 (2)	1.84-1.99 (2)



Figures 1-11. *Labrundinia tenata* Roback 1987, male. **1.** Head, dorsal view. **2.** Apex of Antenna. **3.** Wing. **4.** Apex of fore tibia. **5.** Apex of mid tibia. **6.** Apex of hind tibia with comb. **7.** Fore spur. **8.** Mid spur. **9.** Hind tarsal claw. **10.** Abdomen coloration, dorsal aspect. **11.** Hypopygium, left: ventral aspect, right: dorsal aspect.

Hypopygium (Fig. 11). Tergite IX arched with 7-8 dorsal setae. Anterior margin of sternapodeme slightly rounded, no distinct spur. Phallapodeme 45-51, 49 μm long. Gonocoxite 98-109, 103 μm long. GcR 2.03-2.30, 2.16. Gonostylus 62-65, 63 μm long; megaseta 11-12, 11 μm long. HR 1.50-1.74, 1.63. HV 2.90-3.19, 3.09. Apical hairs of gonocoxite not numerous.

Pupa (n = 3 unless otherwise stated)

Coloration. Brownish. Thoracic horn brown.

Cephalothorax (Figs. 13-14). Frontal apotome as in figure 12. Wing sheath 0.73-0.76, 0.75 mm long. Thoracic horn S-shaped, 203-228, 214 μm long, 65 μm wide, THR 3.14-3.52, 3.31, reticulation of respiratory atrium indistinct, external membrane with pale spinules basally concentrated, membranous preapical papilla 38-40, 39 μm, PTH 0.17-0.20, 0.18, aeropyle tube simple 13-18, 15 μm long, plastron plate much reduced. Thoracic comb with 10-12 conical teeth.

Abdomen. (Figs. 15-18) 1.67-1.68, 1.68 mm long. Tergite I with elongate scar, without shagreen, sternites II-VII with shagreen apparently concentrated on basal and lateral margins. Chaetotaxy of abdomen as in figures 15-17. Segment VII with 2 lateral setae, segment VIII with 5 lateral setae. Anal lobe 250 μm long, with 2 lateral setae, outer margins with 7-10 spines, longest spine 9-11, 10 μm long, membranous inner margins. ALR 1.34-1.38, 1.36. Genital sac elongate, longer than anal lobe.

4th instar larva (n = 3 unless otherwise stated)

Coloration. Body pale yellow. Head pale yellow with postoccipital margin brown; antennal segment II brownish; mandibular distal tooth and apex of ligula brown. Procercus and anal setae brownish. Posterior parapod claws all pale yellow.

Head (Fig. 19) 456-494, 473 µm long, 331-388 (2) µm wide; lateroventral spine group indistinct, posteroventral spine group present; cephalic index 0.73-0.78 (2). Chaetotaxy as in figure 19.

Antenna (Fig. 20-21) 295-317, 304 µm long, basal antennal segment 192-208, 199 µm long, with ring organ 169-188, 176 µm from base, antennal segment II 95-100, 97 µm long. AR 1.78-2.05, 1.91. Blade longer than antennal segment II.

Maxilla. Basal palp segment 26-31, 29 µm long, 6-8, 7 µm wide, with ring organ 17-23, 20 µm from base. PR 3.9-4.3, 4.1. APR 6.3-7.6, 7.0.

Mandible (Fig. 22) 69-76, 72 µm long, with 3 lateral setae. Campaniform sensilium 51-55, 52 µm from apex. Basal tooth bifid, with seta subdentalis projecting from sloping end towards apical tooth. AMD 2.7-2.9, 2.8.

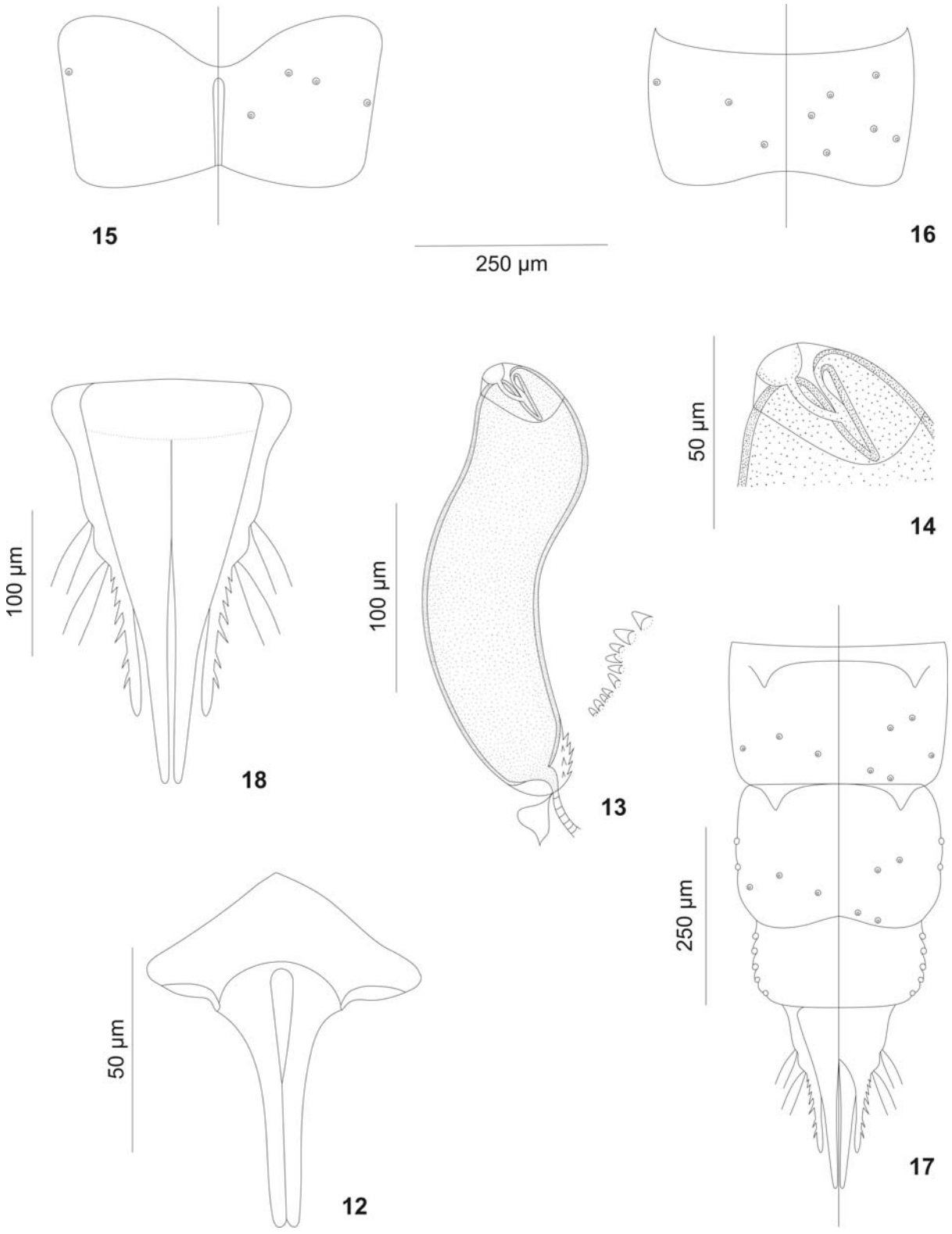
Mentum (Fig. 23). Dorsomental teeth reduced and pseudoradula uniformly granulate.

Hypopharyngeal complex (Figs. 24-25). Ligula 46-60, 53 µm long, 28-30, 29 µm wide, with row of 5 teeth. IO 0.65-0.78, 0.70, MO 1.00-1.04, 1.01. Paraligula bifid, 21-23, 22 µm long, inner tooth 16-18, 17 µm long, shorter than outer tooth. Pectin hypopharyngis with 6 teeth almost equal sized.

Abdomen (Figs. 26-28). Without lateral fringe. Procercus 4.4-6.7, 5.5 times as long as wide, with seven anal setae 254-398, 342 µm long. Anal tubules 145-158, 150 µm long. Posterior parapod 192-211 (2) µm long, with single elongate claw serrated on inner margin and numerous simple claws; bifid claw with U-shaped lower groove, subbasal seta simple with 2 teeth near base.

Remarks on taxonomy

The measures recorded in this study for adult males are near of measures obtained by Roback (1987a), with exception to leg lengths that presented wide variation. The coloration



Figures 12-18. *Labrundinia tenata* Roback 1987, pupa. **12.** Frontal apotome. **13.** Thoracic horn with basal lobe and medial row of teeth. **14.** Apex of thoracic horn showing preapical papilla. **15-17.** Abdominal segments I, IV and VI-VIII respectively, left: ventral aspect, right: dorsal aspect. **18.** Anal lobe and genital sac.

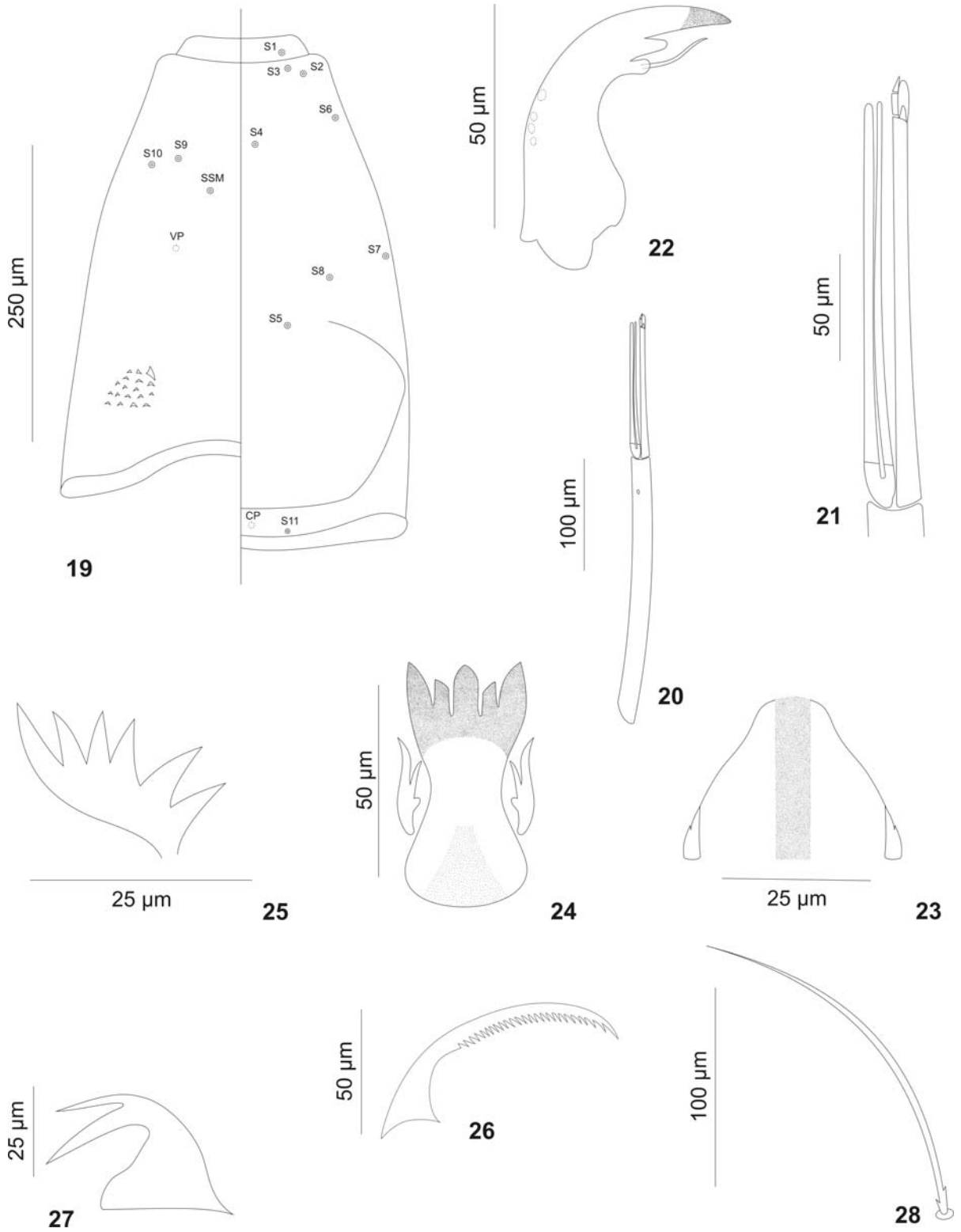
pattern of the abdominal segments II-VI allows separate the males of *L. tenata* of *L. becki* and *L. parabecki* that also have brown hypopygium, however the abdomen of these species is wholly darkened. Some specimens of *L. pilosella* also have brown hypopygium, but they differ of *L. tenata* by abdominal coloration pattern exhibited by segments III and V that are totally darkened. The coloration of abdominal segments I and II separate *L. tenata* of *L.* sp. 1 spec. nov. and *L.* sp. 2 spec. nov. that have these segments pale. The segments VII and VIII almost wholly brown allow also distinguish *L. tenata* of *L.* sp. 3 spec. nov. and *L.* sp. 4 spec. nov. that have evident brown transverse band near proximal margin these segments.

The shallow preapical groove with cleft in upper margin distinguish the pupa of *L. tenata* from other species of *Labrundinia*. As well as the combination of the characters cephalic capsule with posteroventral spine group and absence of lateroventral spine group also allow separate the larva of *L. tenata* from other species of *Labrundinia.*

The female remains unknown.

Remarks on ecology

The larvae of *Labrundinia tenata* were collected associated with aquatic macrophytes of the genus *Salvinia* in the Fazzari reservoir, which is located in a preserved area from São Carlos city, in *campus* of Universidade Federal de São Carlos, surrounded by cerrado fragment with low level of anthropic impact. This system is shallow (0.60 m depth), with acid water (pH 6.8), high level of dissolved oxygen (9.4 $mg.L^{-1}$), low electrical conductivity (8 $\mu S.cm^{-1}$) and temperature ranging from 19-23ºC. Previously, *Labrundinia tenata* had only been collected in Colombia, by Selwyn S. Roback (Roback, 1987a).



Figures 19-28. *Labrundinia tenata* Roback 1987, larva. **19.** Head, left: ventral aspect, right: dorsal aspect, showing distribution of cephalic setae and pores. **20.** Antenna. **21.** Apex of antenna. **22.** Mandible. **23.** Mentum. **24.** Ligula and paraligula. **25.** Pectin hypopharyngis. **26.** Serrated claw. **27.** Bifid claw. **28.** Subbasal seta.

***Labrundinia* sp. 1 spec. nov.**

(Figs. 29-54)

Type material. Holotype: BRAZIL, São Paulo State, Ribeirão Preto, Monte Alegre lake, 21°11'S e 47°43'W, 3.viii.1997, 1 male with associated pupal and larval exuviae, H. F. Mendes *leg*. Paratype: as holotype except for 2 male with associated pupal exuvia; as holotype except for 26.ii.1997, male with associated pupal exuvia.

Diagnostic characters. *Labrundinia* sp. 1 spec. nov. can be separated from others species by the following combination of characters: male with R_{2+3} present at wing. Fore tibial comb with 6 setae. Abdominal segments I and II pale, III-VIII with brown transverse band near proximal margin, segment VI almost wholly brown; hypopygium pale; anterior margin of sternapodeme with distinct spur. Pupa with thoracic horn very globose and no preapical groove evident. Larva with head crenulated, with a large single lateroventral spine, posteroventral spine group present; maculation present.

Male (n = 4 unless otherwise stated)

Dimensions. Total length 1.89-2.23, 2.07 mm. Wing length 1.13-1.38, 1.25 (3) mm. Total length/wing length 1.56-1.78, 1.71 (3). Wing length/length of profemur 2.4-3.3, 3.0 (3).

Coloration. Head pale slightly brown. Antenna brown. Thorax brownish with brown longitudinal strips. Wing clear with veins brownish, without spots. Legs pale. Fore, mid and hind femur pale yellow. Fore, mid and hind tibiae pale yellow with extremity brownish. Fore, mid and hind tarsomeres I and II pale yellow with extremity brownish. Fore, mid and hind tarsomeres III-V brownish. Abdomen brownish with maculation as in figure 38; tergite IX with brown distal margin. Hypopygium pale.

Head (Figs. 29-30). AR 1.07-1.24, 1.13 (3); flagellum 681-788, 545 (3) μm long. Temporal setae 9-11. Eyes ratio 0.73-1.51, 1.18. Clypeus with 15-20 setae. Tentorium 54-85, 66 (3) μm long. Palpomere lengths 1-5 (in μm): 18-32, 26; 38-51, 45; 103-115, 111, 115-128, 120; 195-208, 202, respectively.

Thorax. Antepronotum with 2 (2) setae. Acrostichals 32 (3), biserial, all starting close to the anterior end; dorsocentrals 14-18, biserial anteriorly; prealars 6-7. Scutellum with 6-8 (3) setae across disc and numerous fine anterior setae.

Wing (Fig. 31) 0.35-0.38, 0.36 mm wide. Costa not produced beyond R_{4+5}, ending very slightly beyond tip of M_{3+4}. R_{2+3} present. Base of radial sector 0.05-0.08, 0.06 mm. VR 0.76-0.84.

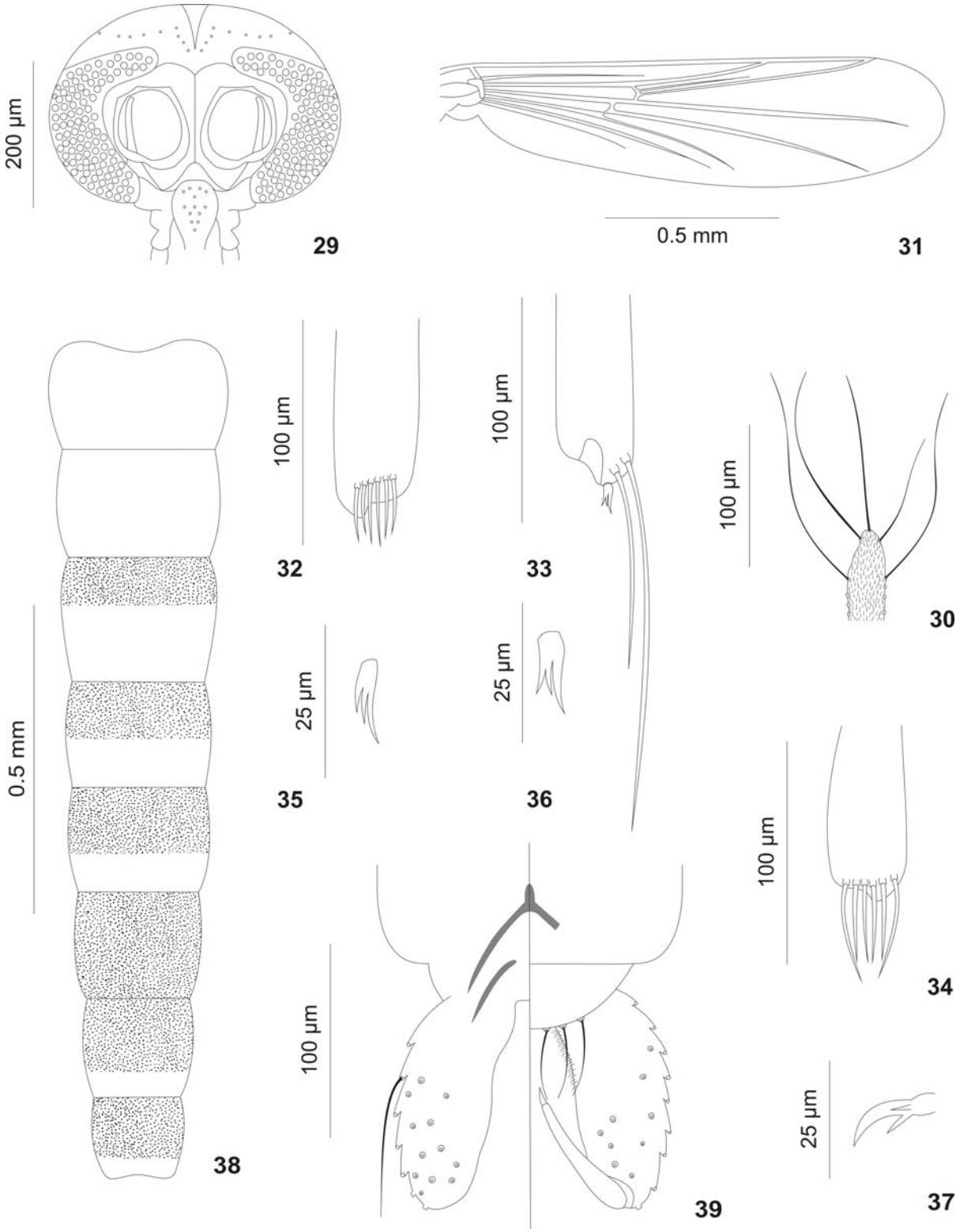
Legs (Figs. 32-37). Fore tibia with single pectinate spur, 14-19, 17 μm long with 3 teeth; mid tibia with single pectinate spur, 19 (3) μm long with 3 teeth. Width at apex of fore tibia 32-35, 34, mid tibia 31-37, 34, hind tibia 32-37, 34 μm wide. Fore and hind tibial combs with 6 setae. Mid leg with two pseudospurs on Ta_{1-4}. Claws slender as in figure 37. Length and proportion of legs as in Table II.

Table II. Lengths (in μm) and proportions of legs of *Labrundinia* sp. 1 spec. nov., male.

	fe	**ti**	**ta_1**	**ta_2**	**ta_3**
p_1	375-475, 419	394-575, 452	250-306, 283	194-200, 197	119-138, 128
p_2	538-600, 528	350-450, 400	463-575, 534	238-263, 247	144-163, 153
p_3	456-469, 466	500-581, 528	487-575, 531 (3)	238-250, 244 (3)	157-181, 171 (3)

continued.

	ta_4	**ta_5**	**LR**	**BV**	**SV**
p_1	94-106, 102	56-75, 70	0.50-0.72, 0.64	2.16-2.54, 2.32	2.61-3.48, 3.10
p_2	100-138, 114	69-119, 90	1.22-1.57, 1.34	2.32-2.52, 2.42	1.38-1.74, 1.75
p_3	94-119, 104 (3)	69-81, 77 (3)	0.98-1.12, 1,04 (3)	2.47-2.57, 2.53 (3)	1.71-1.86, 1.84 (3)



Figures 29-39. *Labrundinia* sp. 1 spec. nov., male. **29.** Head, dorsal view. **30.** Apex of antenna. **31.** Wing. **32.** Apex of fore tibia. **33.** Apex of mid tibia. **34.** Apex of hind tibia with comb. **35.** Fore spur. **36.** Mid spur. **37.** Hind tarsal claw. **38.** Abdomen coloration, dorsal aspect. **39.** Hypopygium, left: ventral aspect, right: dorsal aspect.

Hypopygium (Fig. 39). Tergite IX arched with 9-10 dorsal setae. Anterior margin of sternapodeme with a distinct spur. Phallapodeme 52-62, 56 µm long. Gonocoxite 107-115, 113 µm long. GcR 2.12-2.50, 2.33. Gonostylus 58-82, 72 µm long; megaseta 11-15, 14 µm long. HR 1.38-2.68, 1.77. HV 2.74-3.13, 2.88. Apical hairs of gonocoxite not numerous.

Pupa (n = 4 unless otherwise stated)

Coloration. Pale. Thoracic horn pale.

Cephalothorax (Figs. 40-42)**.** Frontal apotome as in figure 40. Wing sheath 0.74-0.83, 0.80 mm long. Thoracic horn very globose, 266-285, 275 µm long, 162-203, 180 µm wide, THR 1.40-1.66, 1.53, reticulation of respiratory atrium indistinct, external membrane with pale spinules basally concentrated, membranous preapical papilla 42-80, 55 µm, PTH 0.23-0.46, 0.31 aeropyle tube simple 22-38, 31 (3) µm long, plastron plate much reduced. Thoracic comb with 8-9 conical teeth.

Abdomen. (Figs. 43-46) 2.03-2.09, 2.05 mm long. Tergite I with elongate scar, without shagreen, sternites IV-VIII with shagreen apparently concentrated on basal and lateral margins. Chaetotaxy of abdomen as in figures 43-45. Segment VII with 4 lateral setae, segment VIII with 5 lateral setae. Anal lobe 294-331, 233 µm long, with 2 lateral setae, outer margins with 10-11 spines, longest spine 11-14, 12 µm long, membranous inner margins. ALR 1.81-2.31, 2.03. Genital sac elongate, longer than anal lobe.

4th instar larva (n = 1)

Coloration. Body pale yellow. Head pale yellow with postoccipital margin brown; antennal segment II brownish; mandibular distal tooth and apex of ligula brown. Procercus and anal setae brownish. Posterior parapod claws all pale yellow.

Head (Fig. 47) 494 µm long, 369 µm wide. Head crenulated, with a large single lateroventral spine, posteroventral spine group present. Maculation as in figure 47. Cephalic index 0.74. Chaetotaxy as in figure 47.

Antenna (Fig. 48-49) 277 µm long, basal antennal segment 200 µm long, with ring organ 135 µm from base, antennal segment II 69 µm long. AR 2.6. Blade longer than antennal segment II.

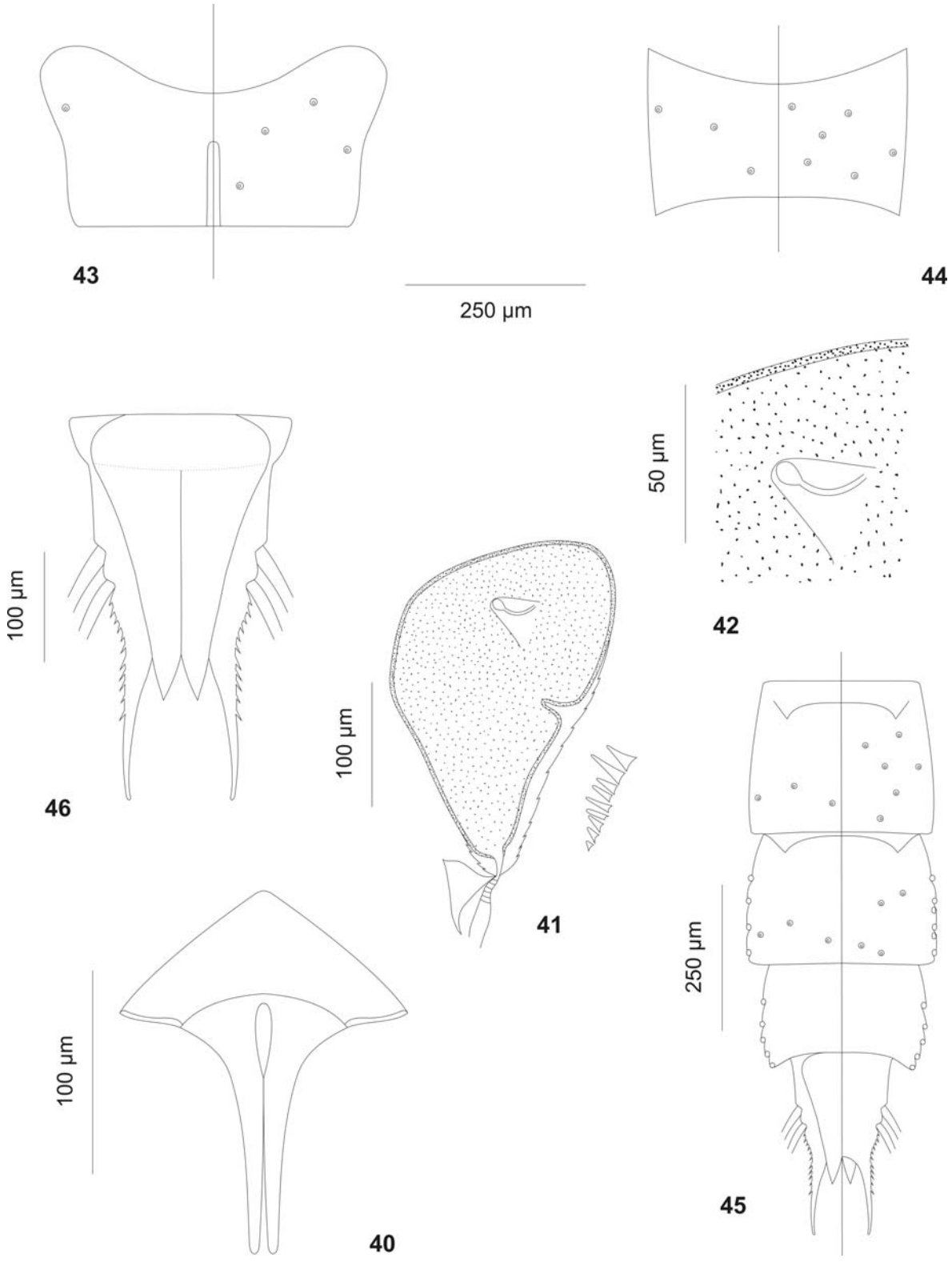
Maxilla. Basal palp segment 25 µm long, 12 µm wide, ring organ not observed. PR 2.0. APR 8.1.

Mandible (Fig. 50) 83 µm long, with 3 lateral setae. Campaniform sensilium 63 µm from apex. Basal tooth bifid, with seta subdentalis projecting from sloping end towards apical tooth. AMD 2.4.

Mentum. Dorsomental teeth not observed and pseudoradula uniformly granulate.

Hypopharyngeal complex (Figs. 51-52). Ligula 56 µm long, 24 µm wide, with row of 5 teeth. IO 0.58, MO 0.89. Paraligula bifid, 25 µm long, inner tooth 18 µm long, shorter than outer tooth. Pectin hypopharyngis with 6 teeth almost equal sized.

Abdomen (Figs. 53-54). Without lateral fringe. Procercus 4.8 times as long as wide, with six anal setae 462 µm long. Anal tubules 211 µm long. Posterior parapod 406 µm long, with numerous simple claws; bifid claw with U-shaped lower groove, subbasal seta simple.



Figures 40-46. *Labrundinia* sp. 1 spec. nov., pupa. **40.** Frontal apotome. **41.** Thoracic horn with basal lobe and medial row of teeth. **42.** Apex of thoracic horn showing preapical papilla. **43-45.** Abdominal segments I, IV and VI-VIII respectively, left: ventral aspect, right: dorsal aspect. **46.** Anal lobe and genital sac.

Remarks on taxonomy

The presence of the fore tibial comb allows separate *L.* sp. 1 spec. nov. from the other species of *Labrundinia*. The coloration pattern of the abdominal segment VI, almost wholly brown, distinguish *L.* sp. 1 spec. nov. of *L.* sp. 2 spec. nov that has the abdominal segment VI with a distinct brown transverse band near proximal margin.

The absent of a preapical groove and the thoracic horn very globose distinguish the pupa of *L.* sp. 1 spec. nov. from the other species. The combination of the characters cephalic capsule with lateroventral spine, posteroventral spine group and maculation allow separate the larva of *L.* sp. 1 spec. nov. from the other species of *Labrundinia.*

The female remains unknown.

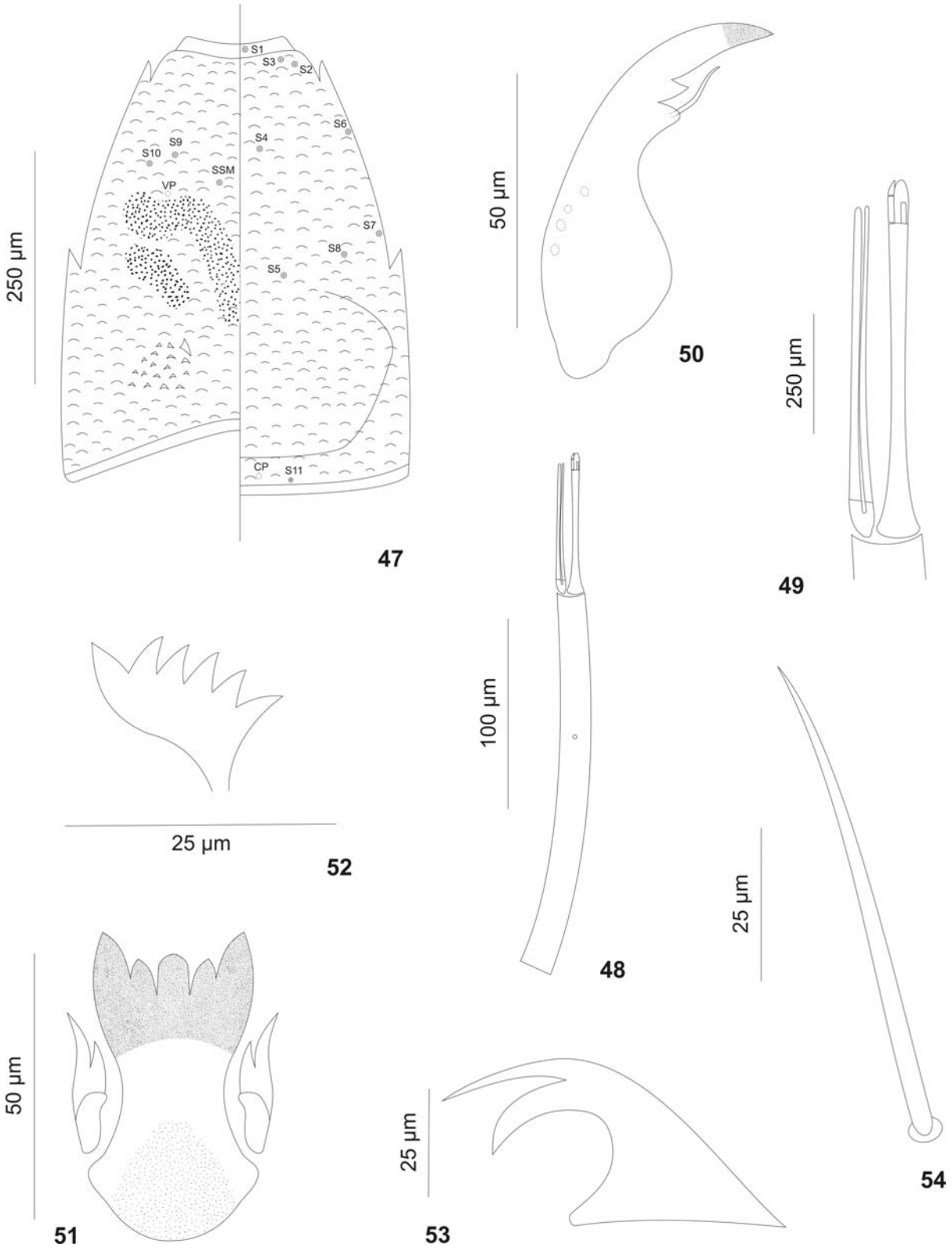
Remarks on ecology

The larva of *L.* sp. 1 spec. nov. was collected in the Monte Alegre lake, which is located in Ribeirão Preto city, in *campus* of Universidade de São Paulo. This system is shallow (2.90 m depth), with acid water (pH 6.8), medium level of dissolved oxygen (6.5 $mg.L^{-1}$), low electrical conductivity (64 $\mu S.cm^{-1}$) and temperature ranging from 22-28ºC.

***Labrundinia* sp. 2 spec. nov.**

(Figs. 55-81)

Type material. Holotype: BRAZIL, São Paulo State, Ribeirão Preto, Monte Alegre lake, 21°11'S e 47°43'W, 30.v.1997, 1 male with associated pupal and larval exuviae, H. F. Mendes *leg*. Paratype: as holotype except for São Carlos, Rubi lake, 22°06'S e 47°49'W, 05.vi.2008, F. L. Silva *leg*.



Figures 47-54. *Labrundinia* sp. 1 spec. nov., larva. **47.** Head, left: ventral aspect, right: dorsal aspect, showing distribution of cephalic setae and pores. **48.** Antenna. **49.** Apex of antenna. **50.** Mandible. **51.** Ligula and paraligula. **52.** Pectin hypopharyngis. **53.** Bifid claw. **54.** Subbasal seta.

Diagnostic characters. *Labrundinia* sp. 2 spec. nov. can be separated from others species by the following combination of characters: male with abdominal segments I and II pale, III-VIII with brown transverse band near proximal margin, VII and VIII almost wholly brown; hypopygium pale; anterior margin of sternapodeme with only a suggestion of a spur. Pupa with thoracic horn S-shaped and a deep preapical groove. Larva with a large single lateroventral spine, posteroventral spine group absent.

Male (n = 2 unless otherwise stated)

Dimensions. Total length 2.51-2.75 mm. Wing length 1.51-1.69 mm. Total length/wing length 1.49-1.80. Wing length/length of profemur 3.0-3.6.

Coloration. Head brownish. Antenna brown. Thorax brownish with brown longitudinal strips. Wing clear with veins brownish, without spots. Legs pale. Fore, mid and hind femur pale yellow. Fore, mid and hind tibiae brownish. Fore, mid and hind tarsomeres I-V brownish. Abdomen brownish with maculation as in figure 64; tergite IX brownish distal. Hypopygium pale.

Head (Figs. 55-56). AR 1.35-1.42; flagellum 881-938 μm long. Temporal setae 10-11. Eyes ratio 1.0-1.1. Clypeus with 12-15 setae. Tentorium 82-132 μm long. Palpomere lengths 1-5 (in μm): 26-37; 48-65; 132-134; 142-149; 234-246, respectively.

Thorax. Antepronotum with 2 setae. Acrostichals 40, biserial, all starting close to the anterior end; dorsocentrals 16-22, biserial anteriorly; prealars 6. Scutellum with 7-9 setae across disc and numerous fine anterior setae.

Wing (Fig. 57) 0.40-0.41 mm wide. Costa not produced beyond R_{4+5}, ending very slightly beyond tip of M_{3+4}. Base of radial sector 0.03-0.05 mm. VR 0.80-0.84.

Legs (Figs. 58-63). Fore tibia with single pectinate spur, 14-16 μm long with 4 teeth; mid tibia with single pectinate spur, 16-23 μm long with 4 teeth. Width at apex of fore tibia 35-38, mid tibia 35-37, hind tibia 38 μm wide. Hind tibial comb with 7 setae. Mid leg with two pseudospurs on Ta_{1-4}. Claws slender as in figure 63. Length and proportion of legs as in Table III.

Table III. Lengths (in μm) and proportions of legs of *Labrundinia* sp. 2 spec. nov., male.

	fe	**ti**	**ta_1**	**ta_2**	**ta_3**
p_1	469-500	519-569	319-362	219-250	150-194
p_2	475-700	531-706	656-713	219-306	156-188
p_3	613-669	431-750	713-750	325-319	163-200

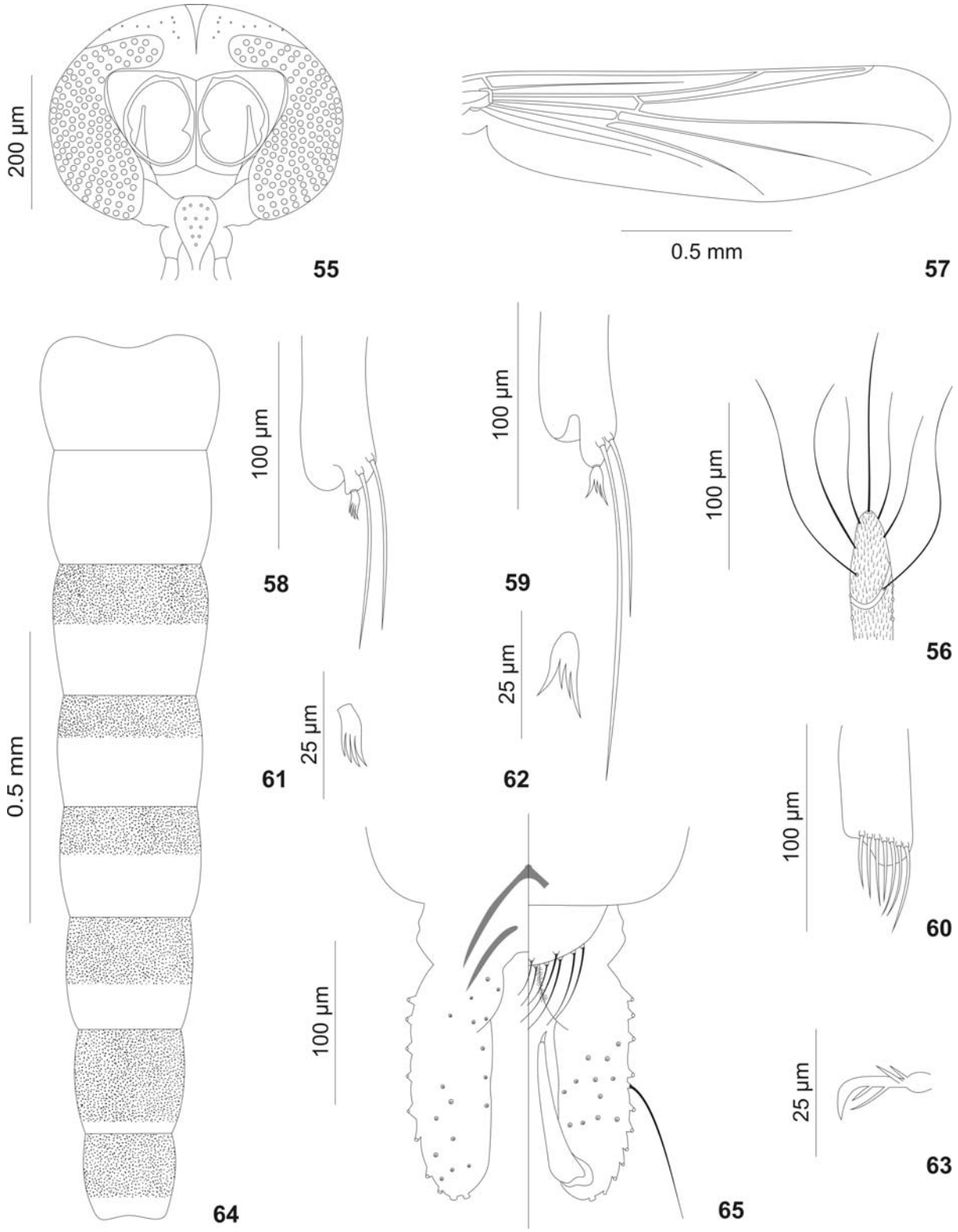
continued.

	ta_4	**ta_5**	**LR**	**BV**	**SV**
p_1	125-138	69-81	0.61-0.63	2.16-2.32	2.94-3.09
p_2	125 (1)	94 (1)	0.93-1.34	3.30 (1)	1.72-180
p_3	106-138	81-113	0.95-1.41	2.69-2.88	1.60-1.91

Hypopygium (Fig. 65). Tergite IX arched with 9-16 dorsal setae. Anterior margin of sternapodeme with only a suggestion of a spur. Phallapodeme 54-62 μm long. Gonocoxite 142-151 μm long. GcR 2.71-3.2. Gonostylus 80-94 μm long; megaseta 11-12 μm long. HR 1.51-1.88. HV 2.91-3.10. Apical hairs of gonocoxite not numerous.

Pupa (n = 2 unless otherwise stated)

Coloration. Brownish. Thoracic horn brownish.



Figures 55-65. *Labrundinia* sp. 2 spec. nov., male. **55.** Head, dorsal view. **56.** Apex of antenna. **57.** Wing. **58.** Apex of fore tibia. **59.** Apex of mid tibia. **60.** Apex of hind tibia with comb. **61.** Fore spur. **62.** Mid spur. **63.** Hind tarsal claw. **64.** Abdomen coloration, dorsal aspect. **65.** Hypopygium, left: ventral aspect, right: dorsal aspect.

Cephalothorax (Figs. 66-68)**.** Frontal apotome as in figure 66. Wing sheath 0.92-1.00 mm long. Thoracic horn S-shaped, 281-304 µm long, 102-123 µm wide, THR 2.29-2.98, reticulation of respiratory atrium indistinct, external membrane with pale spinules basally concentrated, membranous preapical papilla 45-46 µm, PTH 0.11-0.15, aeropyle tube simple 35 µm long, plastron plate much reduced. Thoracic comb with 9-10 conical teeth.

*Abdomen***.** (Figs. 69-72) 2.20-2.24 mm long. Tergite I with elongate scar, without shagreen, sternites IV-VIII with shagreen apparently concentrated on basal and lateral margins. Chaetotaxy of abdomen as in figures 69-71. Segment VII with 4 lateral setae, segment VIII with 5 lateral setae. Anal lobe 300-363 µm long, with 2 lateral setae, outer margins with 9-11 spines, longest spine 17-18 µm long, membranous inner margins. ALR 1.54-1.71. Genital sac elongate, longer than anal lobe.

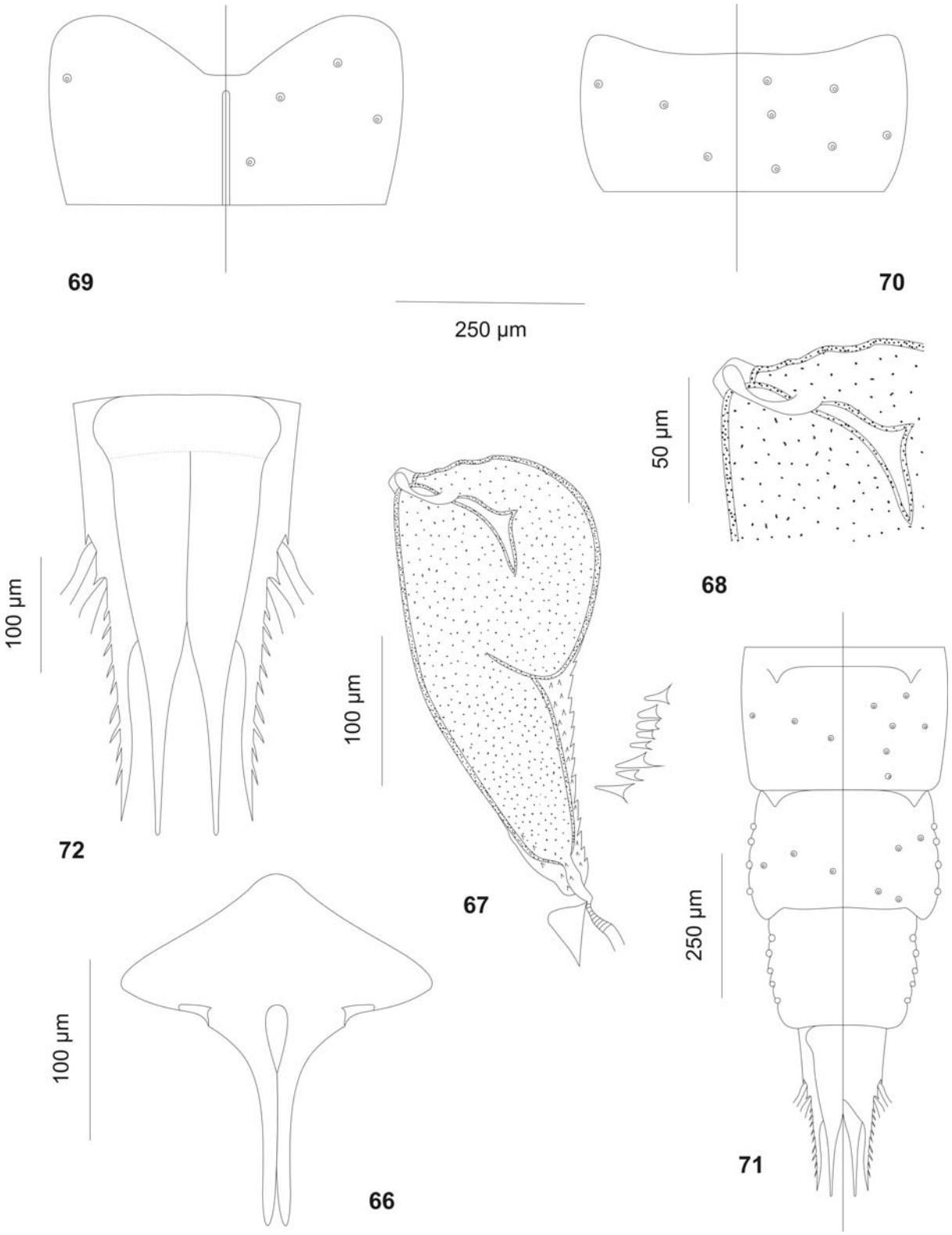
4th instar larva (n = 2 unless otherwise stated)

Coloration. Body pale yellow. Head pale yellow with postoccipital margin brown; antennal segment II brownish; mandibular distal tooth and apex of ligula brown. Procercus and anal setae brownish. Posterior parapod claws all pale yellow.

Head (Fig. 73) 581-594 µm long, 400-444 µm wide, with a large single lateroventral spine, posteroventral spine group absent; cephalic index 0.67-0.76. Chaetotaxy as in figure 73.

Antenna (Fig. 74-75) 329-338 µm long, basal antennal segment 238-246 µm long, with ring organ 215 (1) µm from base, antennal segment II 83-85 µm long. AR 2.6-2.7. Blade longer than antennal segment II.

Maxilla. Basal palp segment 22-25 µm long, 8-10 µm wide, with ring organ 9-14 µm from base. PR 2.0-3.2. APR 10.0-11.1.



Figures 66-72. *Labrundinia* sp. 2 spec. nov., pupa. **66.** Frontal apotome. **67.** Thoracic horn with basal lobe and medial row of teeth. **68.** Apex of thoracic horn showing preapical papilla. **69-71.** Abdominal segments I, IV and VI-VIII respectively, left: ventral aspect, right: dorsal aspect. **72.** Anal lobe and genital sac.

Mandible (Fig. 76) 95-108 μm long, with 3 lateral setae. Campaniform sensilium 69-71 μm from apex. Basal tooth bifid, with seta subdentalis projecting from sloping end towards apical tooth. AMD 2.2-2.5.

Mentum (Fig. 77). Dorsomental teeth reduced and pseudoradula uniformly granulate.

Hypopharyngeal complex (Figs. 78-79). Ligula 61-62 μm long, 26 μm wide, with row of 5 teeth. IO 0.37-0.71, MO 0.53-0.89. Paraligula bifid, 24-29 μm long, inner tooth 16-23 μm long, shorter than outer tooth. Pectin hypopharyngis with 8 teeth almost equal sized.

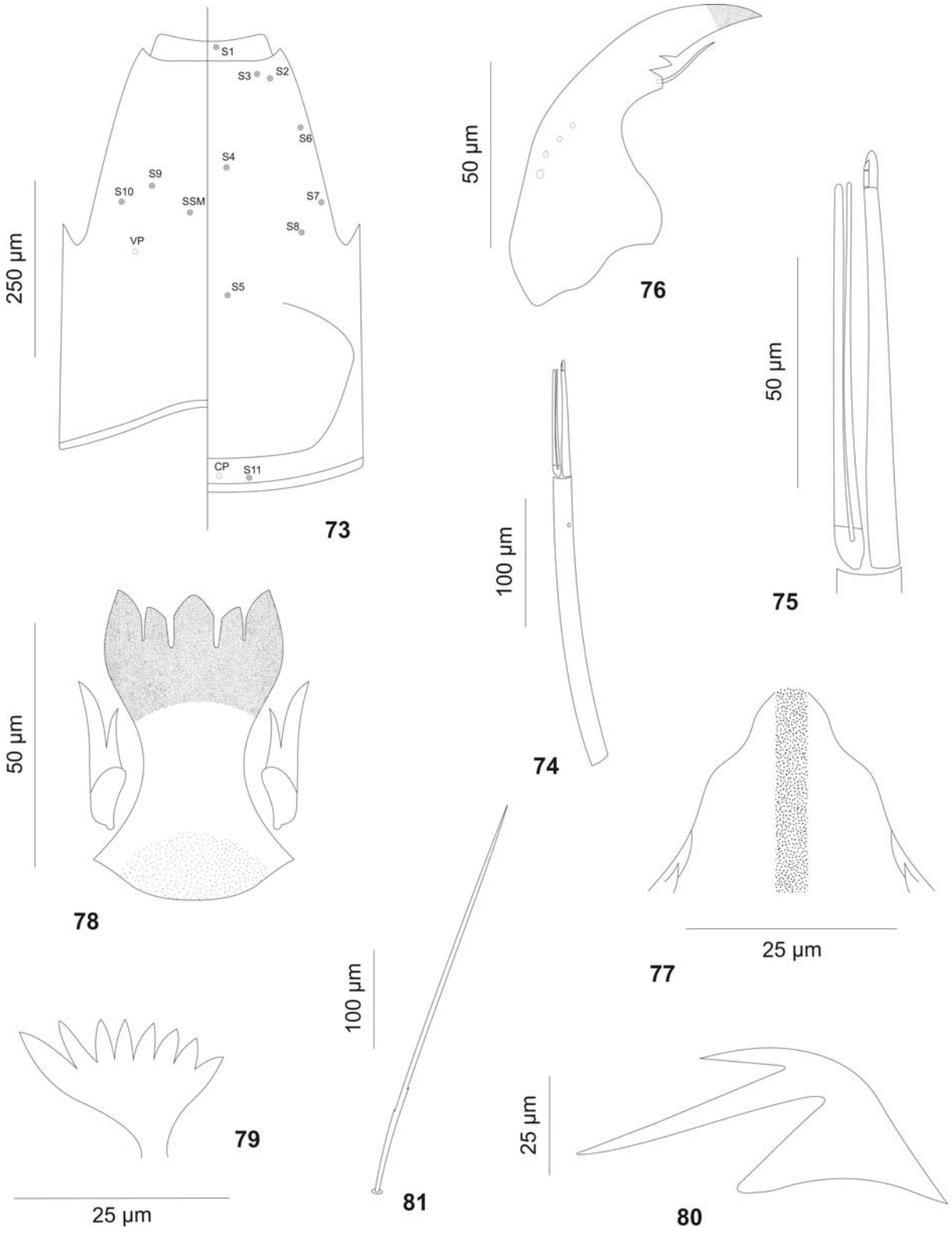
Abdomen (Figs. 80-81). Without lateral fringe. Procercus 4.6-5.6 times as long as wide, with seven anal setae 409-423 μm long. Anal tubules 169 (1) μm long. Posterior parapod 308-344 μm long, with numerous simple claws; bifid claw with U-shaped lower groove, subbasal seta simple with 2 teeth near base.

Remarks on taxonomy

The anterior margin of sternapodeme with only a suggestion of a spur, allows separate the males of *L.* sp. 2 spec. nov. of *L.* sp. 1 spec. nov. and *L.* sp. 3 spec. nov that have the anterior margin of sternapodeme with distinct spur and with moderate spur, respectively.

The typical shape of thoracic horn and his deep preapical groove distinguish the pupa of *L.* sp. 2 spec. nov. from the other species of *Labrundinia*. The combination of the characters: cephalic capsule with a large single lateroventral spine and posteroventral spine group absent allow separate the larva of *L.* sp. 2. spec. nov. of *L. tenata* that has cephalic capsule with posteroventral spine group and lateroventral spine group absent and of *L. neopilosella* that has lateroventral spine group with more than one spine.

The female remains unknown.



Figures 73-81. *Labrundinia* sp. 2 spec. nov., larva. **73.** Head, left: ventral aspect, right: dorsal aspect, showing distribution of cephalic setae and pores. **74.** Antenna. **75.** Apex of antenna. **76.** Mandible. **77.** Mentum. **78.** Ligula and paraligula. **79.** Pectin hypopharyngis. **80.** Bifid claw. **81.** Subbasal seta.

Remarks on ecology

The larva of *L.* sp. 2 spec. nov. was collected in the Monte Alegre lake, which is located in Ribeirão Preto city, in *campus* of Universidade de São Paulo (USP). This system is shallow (2.90 m depth), with acid water (pH 6.8), medium level of dissolved oxygen (6.5 $mg.L^{-1}$), low electrical conductivity (64 $\mu S.cm^{-1}$) and temperature ranging from 22-28ºC.

Labrundinia sp. 3 spec. nov.

(Figs. 82-107)

Type material. Holotype: BRAZIL, São Paulo State, Ribeirão Preto, Monte Alegre lake, 21°11'S e 47°43'W, 15.vii.1997, 1 male with associated pupal and larval exuviae, H. F. Mendes *leg*.

Diagnostic characters. *Labrundinia* sp. 3 spec. nov. can be separated from others species by the following combination of characters: male with abdominal segments I-VIII with brown transverse band near proximal margin; hypopygium brown; anterior margin of sternapodeme with a moderate spur. Pupa with thoracic horn club-shaped and a shallow preapical groove. Larva with head, slender almost rectangular, lateroventral spine group and posteroventral spine group absents.

Male (n = 1)

Dimensions. Total length 1.72 mm. Wing length 1.20 mm. Total length/wing length 1.43. Wing length/length of profemur 2.56.

Coloration. Head pale slightly brown. Antenna brown. Thorax brownish with brown longitudinal strips. Wing clear with veins brownish, without spots. Legs pale. Fore, mid and hind femur pale yellow. Fore tibia brownish, mid and hind tibiae pale yellow. Fore tarsomeres not observed, mid and hind tarsomeres I-V pale yellow. Abdomen brownish with maculation as in figure 91; tergite IX brownish. Hypopygium brown.

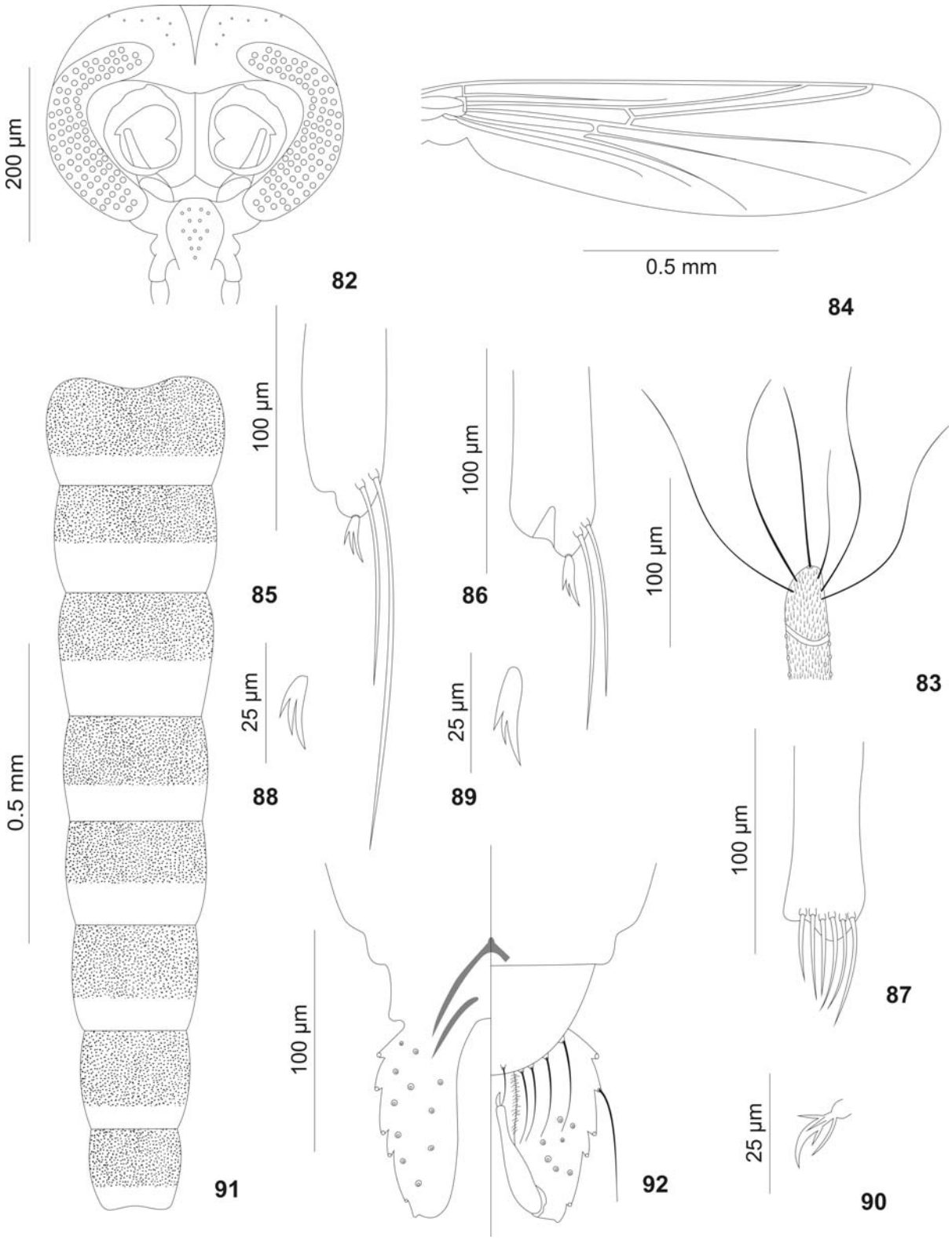
Head (Figs. 82-83). AR 1.26; flagellum 706 µm long. Temporal setae 12. Eyes ratio 0.93. Clypeus with 14 setae. Tentorium 103 µm long. Palpomere lengths 1-5 (in µm): 31; 40; 92; 118; 215, respectively.

Thorax. Antepronotum with 2 setae. Acrostichals 26, biserial, all starting close to the anterior end; dorsocentrals 16, biserial anteriorly; prealars 6. Scutellum with 5 setae across disc and numerous fine anterior setae.

Wing (Fig. 84) 0.33 mm wide. Costa not produced beyond R_{4+5}, ending very slightly beyond tip of M_{3+4}. Base of radial sector 0.07 mm. VR 0.90.

Legs (Figs. 85-90). Fore tibia with single pectinate spur, 12 µm long with 3 teeth; mid tibia with single pectinate spur, 14 µm long with 3 teeth. Width at apex of fore tibia 31, mid tibia 32, hind tibia 32 µm wide. Hind tibial comb with 6 setae. Mid leg with two pseudospurs on Ta_{1-4}. Claws slender as in figure 90. Length and proportion of legs as in Table IV.

Hypopygium (Fig. 92). Tergite IX arched with 10 dorsal setae. Anterior margin of sternapodeme with a moderate spur. Phallapodeme 46 µm long. Gonocoxite 86 µm long. GcR 2.43. Gonostylus 60 µm long; megaseta 60 µm long. HR 1.44. HV 2.50. Apical hairs of gonocoxite not numerous.



Figures 82-92. *Labrundinia* sp. 3 spec. nov., male. **82.** Head, dorsal view. **83.** Apex of antenna. **84.** Wing. **85.** Apex of fore tibia. **86.** Apex of mid tibia. **87.** Apex of hind tibia with comb. **88.** Fore spur. **89.** Mid spur. **90.** Hind tarsal claw. **91.** Abdomen coloration, dorsal aspect. **92.** Hypopygium, left: ventral aspect, right: dorsal aspect.

Table IV. Lengths (in μm) and proportions of legs of *Labrundinia* sp. 3 spec. nov., male.

	fe	**ti**	**ta$_1$**	**ta$_2$**	**ta$_3$**
p$_1$	469	513			
p$_2$	519	456	594	244	138
p$_3$	513	613	575	238	163

continued.

	ta$_4$	**ta$_5$**	**LR**	**BV**	**SV**
p$_1$					
p$_2$	88	75	1.30	2.89	1.64
p$_3$	113	75	0.94	2.89	1.96

Pupa (n = 1)

Coloration. Pale. Thoracic horn pale.

Cephalothorax (Figs. 93-95)**.** Frontal apotome similar to figure 93. Wing sheath 0.81 mm long. Thoracic horn club-shaped, 200 μm long, 43.07 μm wide, THR 4.64, reticulation of respiratory atrium indistinct, external membrane with pale spinules basally concentrated, membranous preapical papilla 40 μm, PTH 0.2, aeropyle tube simple 14 μm long, plastron plate much reduced. Thoracic comb with 13 conical teeth.

Abdomen. (Figs. 96-99) 1.67 mm long. Tergite I with elongate scar, without shagreen, sternites IV-VIII with shagreen apparently concentrated on basal and lateral margins. Chaetotaxy of abdomen as in figures 96-98. Segment VII with 4 lateral setae, segment VIII with 5 lateral setae. Anal lobe 256 μm long, with 2 lateral setae, outer margins with 9 spines,

longest spine 9 μm long, membranous inner margins. ALR 1.86. Genital sac elongate, longer than anal lobe.

4th instar larva (n = 1)

Coloration. Body pale yellow. Head pale yellow with postoccipital margin brown; antennal segment II brownish; mandibular distal tooth and apex of ligula brown. Procercus and anal setae brownish. Posterior parapod claws all pale yellow.

Head (Fig. 100) 469 μm long, 250 μm wide, slender almost rectangular, lateroventral spine group and posteroventral spine group absents; cephalic index 0.54. Chaetotaxy as in figure 100.

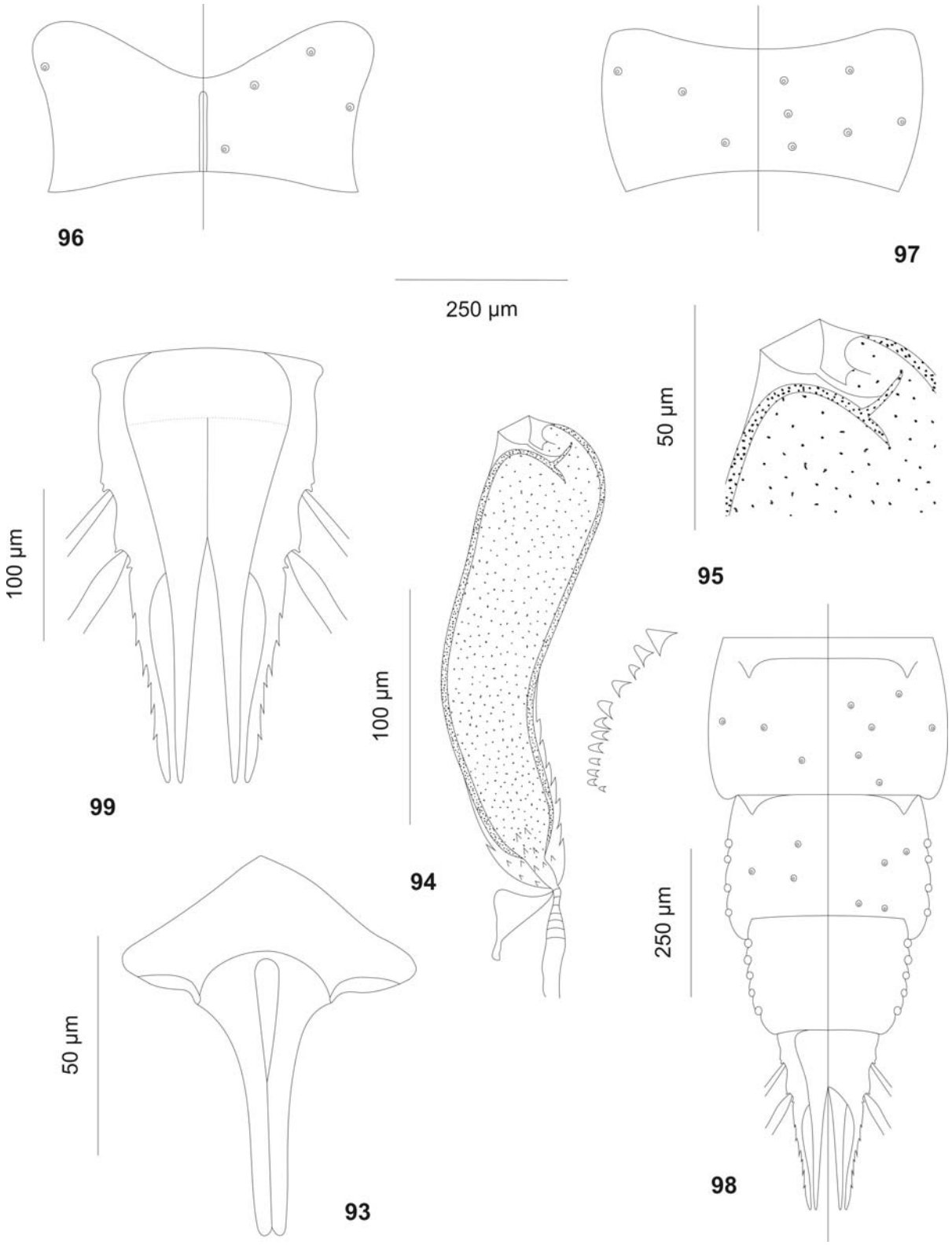
Antenna (Fig. 101-102) 262 μm long, basal antennal segment 178 μm long, with ring organ 134 μm from base, antennal segment II 75 μm long. AR 2.1. Blade longer than antennal segment II.

Maxilla. Basal palp segment 20 μm long, 8 μm wide, with ring organ 9 μm from base. PR 2.6. APR 8.9.

Mandible (Fig. 103) 63 μm long, with 3 lateral setae. Campaniform sensilium 45 μm from apex. Basal tooth bifid, with seta subdentalis projecting from sloping end towards apical tooth. AMD 2.8.

Mentum. Dorsomental teeth and pseudoradula not observed.

Hypopharyngeal complex (Figs. 104-105). Ligula 46 μm long, 21 μm wide, with row of 5 teeth. IO 0.65, MO 1.00. Paraligula bifid, 23 μm long, inner tooth 18 μm long, shorter than outer tooth. Pectin hypopharyngis with 8 teeth almost equal sized.



Figures 93-99. *Labrundinia* sp. 3 spec. nov., pupa. **93.** Frontal apotome. **94.** Thoracic horn with basal lobe and medial row of teeth. **95.** Apex of thoracic horn showing preapical papilla. **96-98.** Abdominal segments I, IV and VI-VIII respectively, left: ventral aspect, right: dorsal aspect. **99.** Anal lobe and genital sac.

Abdomen (Figs. 106-107). Without lateral fringe. Procercus 5.3 times as long as wide, with nine anal setae 300 μm long. Anal tubules 146 μm long. Posterior parapod 331 μm long, with numerous simple claws; bifid claw with U-shaped lower groove, subbasal seta simple with 2 teeth near base.

Remarks on taxonomy

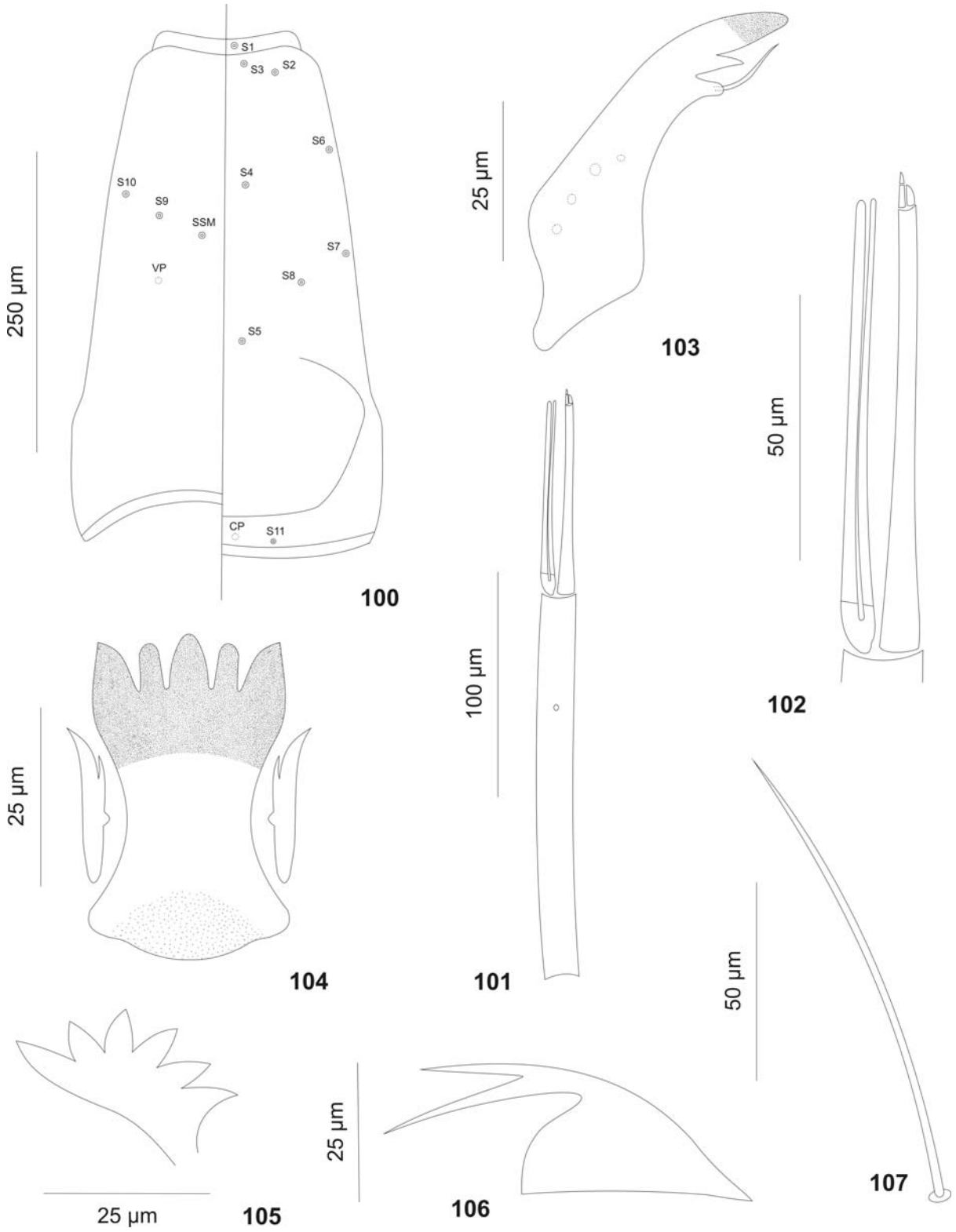
The coloration pattern of the abdominal segment I-VIII, with a distinct brown transverse band near proximal margin, allows separate the males of *L.* sp. 3 spec. nov. of *L.* sp. 4 spec. nov. that have of the segment I almost wholly brown and of *L. tenata* that has the segments VII and VIII almost wholly brown, beyond the abdominal segment I.

The shallow preapical groove and the club-shaped of thoracic horn distinguish the pupa of *L.* sp. 3 spec. nov. of *L. neopilosella* and *L.* sp. 4 spec. nov that practically not present an preapical groove and has an thoracic horn S-shaped, respectively. The cephalic capsule slender almost rectangular without lateroventral spine group and posteroventral spine group allow separate the larva of *L.* sp. 3 spec. nov. from the other species of *Labrundinia.*

The female remains unknown.

Remarks on ecology

The larva of *L.* sp. 3 spec. nov. was collected in the Monte Alegre lake, which is located in Ribeirão Preto city, in *campus* of Universidade de São Paulo (USP). This system is shallow (2.90 m depth), with acid water (pH 6.8), medium level of dissolved oxygen (6.5 $mg.L^{-1}$), low electrical conductivity (64 $\mu S.cm^{-1}$) and temperature ranging from 22-28ºC.



Figures 100-107. *Labrundinia* sp. 3 spec. nov., larva. **100.** Head, left: ventral aspect, right: dorsal aspect, showing distribution of cephalic setae and pores. **101.** Antenna. **102.** Apex of antenna. **103.** Mandible. **104.** Ligula and paraligula. **105.** Pectin hypopharyngis. **106.** Bifid claw. **107.** Subbasal seta.

***Labrundinia* sp. 4 spec. nov.**

(Figs. 108-133)

Type material. Holotype: BRAZIL, São Paulo State, São Carlos, Fazzari stream, 21°59'S e 47°54'W, 25.viii.2008, 1 male with associated pupal and larval exuviae, F. L. Silva *leg*. Paratype: as holotype except for Canchim farm reservoir, 21°58'S e 47°50'W, 05.vi.2007.

Diagnostic characters. *Labrundinia* sp. 4 spec. nov. can be separated from others species by the following combination of characters: male with abdominal segments I-VIII with brown transverse band near proximal margin, segment I almost wholly brown; hypopygium brown; anterior margin of sternapodeme without distinct spur. Pupa with thoracic horn S-shaped and a shallow preapical groove. Larva with lateroventral and posteroventral spine group absents.

Male (n = 2 unless otherwise stated)

Dimensions. Total length 2.12-2.15 mm. Wing length 1.31-1.47 mm. Total length/wing length 1.44-1.64. Wing length/length of profemur 2.7-3.0.

Coloration. Head brownish. Antenna brown. Thorax brownish with brown longitudinal strips. Wing clear with veins brownish, without spots. Legs pale. Fore, mid and hind femur pale yellow. Fore, mid and hind tibiae brownish. Fore, mid and hind tarsomeres I-V brownish. Abdomen brownish with maculation as in figure 117; tergite IX brownish. Hypopygium brown.

Head (Figs. 108-109). AR 0.76-1.02; flagellum 569-794 μm long. Temporal setae 9-10. Eyes ratio 0.82-1.07. Clypeus with 10 setae. Tentorium 88-89 μm long. Palpomere lengths 1-5 (in μm): 28-31; 43-46; 83-115; 109 (1); 192 (1), respectively.

Thorax. Antepronotum with 2 setae. Acrostichals 32-40, biserial, all starting close to the anterior end; dorsocentrals 18-21, biserial anteriorly; prealars 6-7. Scutellum with 7-9 setae across disc and numerous fine anterior setae.

Wing (Fig. 110) 0.31-0.36 mm wide. Costa not produced beyond R_{4+5}, ending very slightly beyond tip of M_{3+4}. Base of radial sector 0.08 mm. VR 0.82-0.84.

Legs (Figs. 111-116). Fore tibia with single pectinate spur, 9-14 μm long with 3 teeth; mid tibia with single pectinate spur, 8-15 μm long with 3 teeth. Width at apex of fore tibia 38-35, mid tibia 32-34, hind tibia 34-40 μm wide. Fore and hind tibial combs with 6 setae. Mid leg with two pseudospurs on Ta_{1-4}. Claws slender as in figure 116. Length and proportion of legs as in Table V.

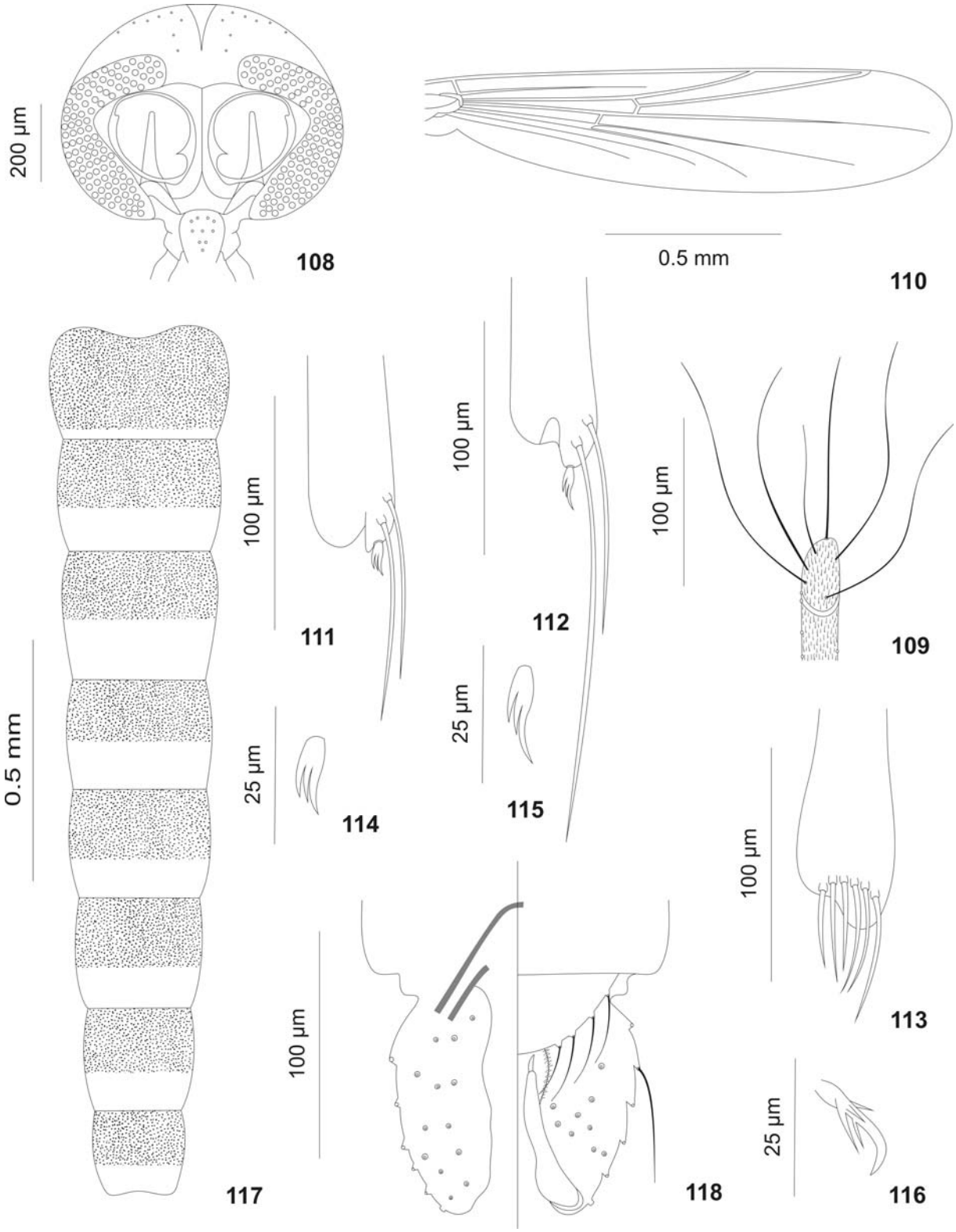
Table V. Lengths (in μm) and proportions of legs of *Labrundinia* sp. 4 spec. nov., male.

	fe	**ti**	**ta_1**	**ta_2**	**ta_3**
p_1	481-488	469-499	300-350	200-269	144-156
p_2	544-625	494-569	575-681	236-281	131-156
p_3	494-575	606-763	575-688	238-288	150-169

continued.

	ta_4	**ta_5**	**LR**	**BV**	**SV**
p_1	113-144	69-81	0.64-0.71	2.04-2.38	2.80-3.17
p_2	106-113	94	1.16-1.20	2.80-2.94	1.75-1.80
p_3	113-125	75-94	0.90-0.94	2.91-3.00	1.91-1.94

Hypopygium (Fig. 118). Tergite IX arched with 9 dorsal setae. Anterior margin of sternapodeme without a distinct spur. Phallapodeme 49-51 μm long. Gonocoxite 92-95 μm long. GcR 2.70-2.72. Gonostylus 48-65 μm long; megaseta 8 μm long. HR 1.42-2.00. HV 3.39-3.82. Apical hairs of gonocoxite not numerous.



Figures 108-118. *Labrundinia* sp. 4 spec. nov., male. **108.** Head, dorsal view. **109.** Apex of antenna. **110.** Wing. **111.** Apex of fore tibia. **112.** Apex of mid tibia. **113.** Apex of hind tibia with comb. **114.** Fore spur. **115.** Mid spur. **116.** Hind tarsal claw. **117.** Abdomen coloration, dorsal aspect. **118.** Hypopygium, left: ventral aspect, right: dorsal aspect.

Pupa (n = 2 unless otherwise stated)

Coloration. Pale. Thoracic horn pale.

Cephalothorax (Figs. 119-121). Frontal apotome similar to figure 121. Wing sheath 0.83-0.93 mm long. Thoracic horn S-shaped, 192-223 μm long, 42-48 μm wide, THR 4.63-4.67, reticulation of respiratory atrium indistinct, external membrane with pale spinules basally concentrated, membranous preapical papilla 35-49 μm, PTH 0.16-0.26, aeropyle tube simple 11 μm long, plastron plate much reduced. Thoracic comb with 9-11 conical teeth.

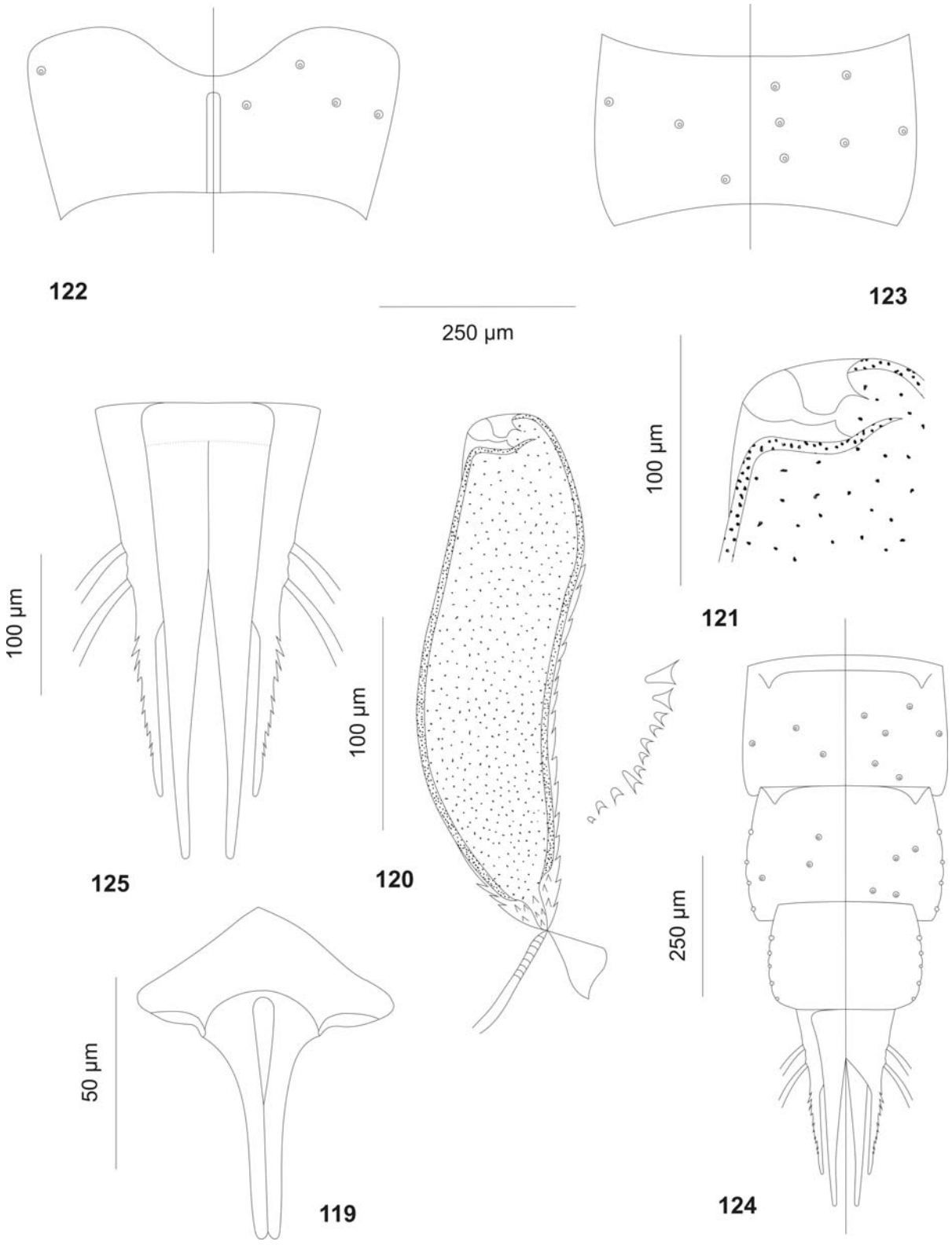
Abdomen. (Figs. 122-125) 1.71-2.00 mm long. Tergite I with elongate scar, without shagreen, sternites III-VIII with shagreen apparently concentrated on basal and lateral margins. Chaetotaxy of abdomen as in figures 122-124. Segment VII with 4 lateral setae, Segment VIII with 5 lateral setae. Anal lobe 252-263 μm long, with 2 lateral setae, outer margins with 9-10 spines, longest spine 9-14 μm long, membranous inner margins. ALR 1.68-1.78. Genital sac elongate, longer than anal lobe.

4th instar larva (n = 2)

Coloration. Body pale yellow. Head pale yellow with postoccipital margin brown; antennal segment II brownish; mandibular distal tooth and apex of ligula brown. Procercus and anal setae brownish. Posterior parapod claws all pale yellow.

Head (Fig. 126) 450-469 μm long, 237-269 μm wide, lateroventral spine group and posteroventral spine group absents. Cephalic index 0.50-0.60. Chaetotaxy as in figure 126.

Antenna (Fig. 127-128) 269-275 μm long, basal antennal segment 180-185 μm long, with ring organ 126-132 μm from base, antennal segment II 65-77 μm long. AR 2.0. Blade longer than antennal segment II.



Figures 119-125. *Labrundinia* sp. 4 spec. nov., pupa. **119.** Frontal apotome. **120.** Thoracic horn with basal lobe and medial row of teeth. **121.** Apex of thoracic horn showing preapical papilla. **122-124.** Abdominal segments I, IV and VI-VIII respectively, left: ventral aspect, right: dorsal aspect. **125.** Anal lobe and genital sac.

Maxilla. Basal palp segment 22-23 μm long, 8 μm wide, ring organ not observed. PR 2.7-2.8. APR 8.0-8.3.

Mandible (Fig. 129) 63-71 μm long, with 3 lateral setae. Campaniform sensilium 46-49 μm from apex. Basal tooth bifid, with seta subdentalis projecting from sloping end towards apical tooth. AMD 2.6-2.9.

Mentum. Dorsomental teeth not observed and pseudoradula uniformly granulate.

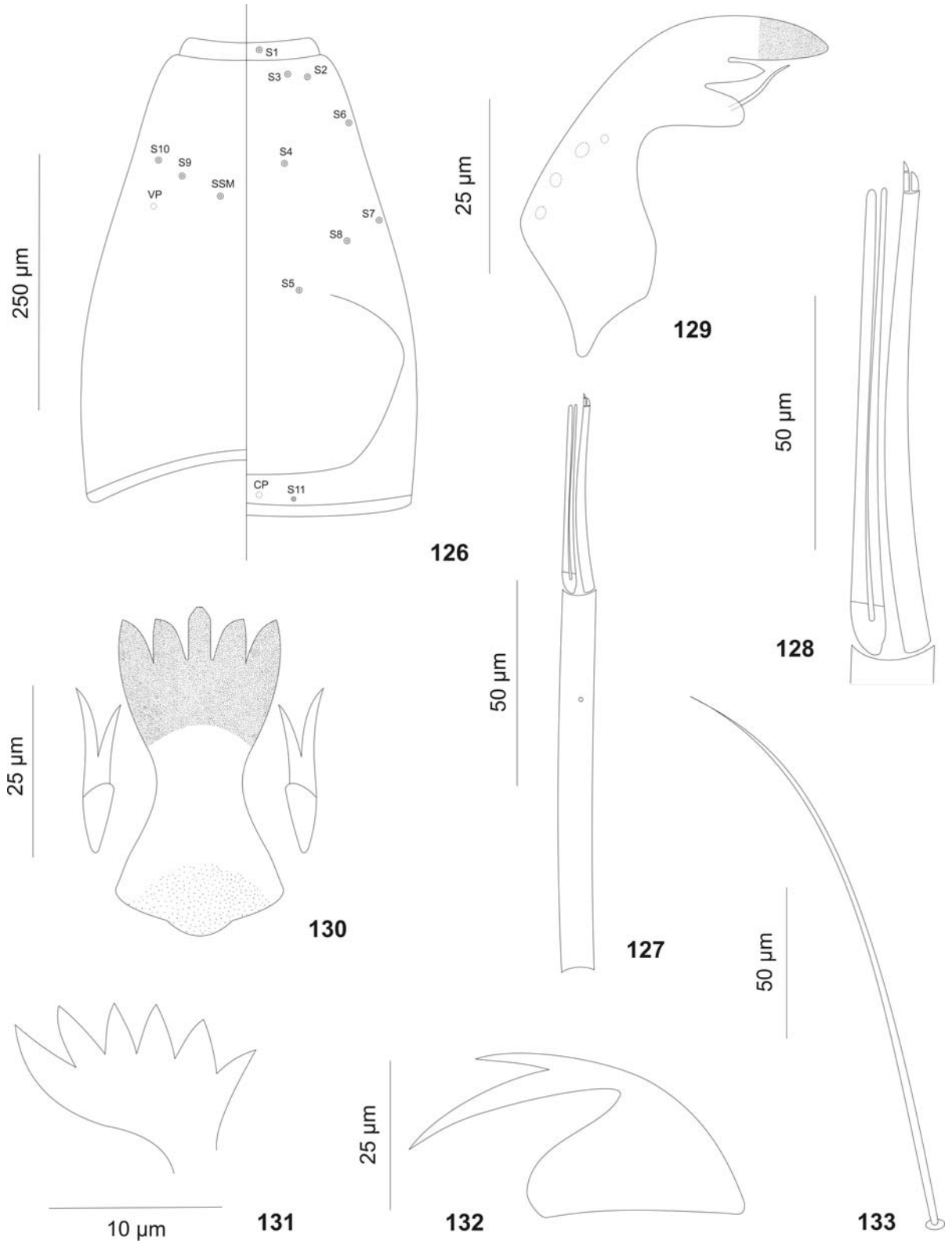
Hypopharyngeal complex (Figs. 130-131). Ligula 48-50 μm long, 24 μm wide, with row of 5 teeth. IO 1.00, MO 1.38-1.44. Paraligula bifid, 19 μm long, inner tooth 17-18 μm long, shorter than outer tooth. Pectin hypopharyngis with 6 teeth almost equal sized.

Abdomen (Figs. 132-133). Without lateral fringe. Procercus 4.8-4.9 times as long as wide, with seven anal setae 317-318 μm long. Anal tubules and posterior parapod not measurable. Posterior parapod with numerous simple claws; bifid claw with U-shaped lower groove, subbasal seta simple.

Remarks on taxonomy

The coloration pattern of the abdominal segment I, almost wholly brown, allows separate the males of *L.* sp. 4 spec. nov. of *L.* sp. 3 spec. nov. that has a distinct brown transverse band near proximal margin of the segment I and of *L. tenata* that have the abdominal segment VII and VIII almost wholly brown in addition to abdominal segment I.

The shallow preapical groove and the S-shaped of thoracic horn distinguish the pupa of *L.* sp. 4 spec. nov. of *L. neopilosella* and *L.* sp. 3 spec. nov that practically not present an preapical groove and has an thoracic horn club-shaped, respectively. The cephalic capsule without lateroventral spine group and posteroventral spine group allow separate the larva of *L.* sp. 4 spec. nov. of *L.* sp. 1 spec. nov. and *L.* sp. 2 spec. nov. that have evident lateroventral



Figures 126-133. *Labrundinia* sp. 4 spec. nov., larva. **126.** Head, left: ventral aspect, right: dorsal aspect, showing distribution of cephalic setae and pores. **127.** Antenna. **128.** Apex of antenna. **129.** Mandible. **130.** Ligula and paraligula. **131.** Pectin hypopharyngis. **132.** Bifid claw. **133.** Subbasal seta.

spine group. *L. tenata* and *L.* sp. 3 spec. nov. distinguish of *L.* sp. 4 spec. nov. by presence posteroventral spine group and by head slender almost rectangular, respectively.

The female remains unknown.

Remarks on ecology

The larva of *L.* sp. 4 spec. nov was in the Fazzari stream, a stream first order forested located in a protected area from São Carlos city, in *campus* of Universidade Federal de São Carlos. This system is shallow (< 0.50 m depth), with acid water (pH 4.8), medium level of dissolved oxygen (7.0 $mg.L^{-1}$), low electrical conductivity (0.003 $\mu S.cm^{-1}$) and temperature ranging from 19-23ºC.

Key to the adult males of the species of *Labrundinia* studied

1. Abdominal segment I wholly brownish or with brown transverse band near proximal margin. Abdominal segment II with brown transverse band near proximal margin 2

- Abdominal segment I and II wholly pale..... 3

2. Abdominal segment VII and VIII almost wholly brown ..... *Labrundinia tenata*

- Abdominal segment VII and VIII with brown transverse band near proximal margin 4

3. Anterior margin of sternapodeme with distinct spur ..... *Labrundinia* sp. 1 spec. nov.

- Anterior margin of sternapodeme with only a suggestion of a spur .. *Labrundinia* sp. 2 spec. nov.

4. Anterior margin of sternapodeme with moderate spur ..... *Labrundinia* sp. 3 spec. nov.

- Anterior margin of sternapoderme without spur..... *Labrundinia* sp. 4 spec. nov.

Key to the pupae of the species of *Labrundinia* studied

1. Thoracic horn globose ..... *Labrundinia* sp. 1 spec. nov

- Thoracic horn not above 2

2. Thoracic horn club-shaped..... *Labrundinia* sp. 3 spec. nov

- Thoracic horn S-shaped 3

3. Thoracic horn with deep preapical groove ..... *Labrundinia* sp. 2 spec. nov.

- Thoracic horn with shallow preapical groove..... 4

4. Abdominal segment VII with 2 lateral setae ..... *Labrundinia tenata*

- Abdominal segment VII with 4 lateral setae ..... *Labrundinia* sp. 4 spec. nov.

Key to the larvae of the species of *Labrundinia* studied

1. Cephalic capsule completely crenulated..... *Labrundinia* sp. 1 spec. nov.

- Cephalic capsule non-crenulated 2

2. Cephalic capsule with lateroventral spine group or posteroventral spine group 3

- Cephalic capsule not as above 4

3. Cephalic capsule with lateroventral spine group ..... *Labrundinia* sp. 2 spec. nov.

- Cephalic capsule with posteroventral spine group ..... *Labrundinia tenata*

4. Cephalic capsule slender almost rectangular ..... *Labrundinia* sp. 3 spec. nov.

- Cephalic capsule not above, more rounded ..... *Labrundinia* sp. 4 spec. nov.

5. História Natural

Em estudos ecológicos com a comunidade de macroinvertebrados bentônicos, as larvas de *Labrundinia*, embora sejam registradas com freqüência, não ocorrem em abundância, quando comparado com outros gêneros de Chironomidae. Os estágios imaturos deste gênero são encontrados tanto em ambientes lóticos, quanto em lênticos, sendo que neste último em geral em maior abundância e freqüência. Neste estudo, as maiores abundâncias de *Labrundinia* foram registradas na estação de seca, entre os meses de Maio e Agosto.

As espécies *Labrundinia tenata* e *Labrundinia* sp. 4 spec. nov. foram coletadas associadas com macrófitas aquáticas do gênero *Salvinia*. A predominância de Chironomidae vivendo associados à macrófitas aquáticas tem sido salientada em diversos trabalhos realizados em ambiente lênticos (Pinder, 1986; Trivinho-Strixino *et al*., 1997). Dornfeld & Fonseca-Gessner (2005) registram *Labrundinia* como um dos gêneros mais abundantes associados com *Salvinia*, em seu estudo na represa do córrego do Espraiado, no município de São Carlos (SP). Os autores também observaram larvas do gênero associadas, em menor quantidade, com macrófitas aquáticas do gênero *Myriophyllum*.

A predominância de larvas de *Labrundinia* associadas à *Salvinia* sugere a utilização deste vegetal como um refúgio (Karassoska, 1960 *apud* Mc Lachlan, 1969), onde os animais podem exercer melhor suas estratégias de caça. A dificuldade de penetração de luz, proporcionada pela densidade comum aos bancos de *Salvinia*, pode resultar na ausência de microalgas e conseqüentemente, o único recurso alimentar para os organismos, seria os detritos retidos nas "raízes" de *Salvinia.* Porém, devido a sua rizosfera reduzida o acúmulo de detrito é dificultado impedindo, assim, a presença de outros grupos, além dos predadores (Trivinho-Strixino *et al*., 1997).

As larvas são registradas na literatura como predadoras (Simpson & Bode, 1980), e Coffman & Ferrington (1996) citaram Cladocera, Oligochaeta e Ostracoda como elementos importantes na dieta de larvas de espécies de *Labrundinia.* Em estudos sobre os hábitos alimentares de larvas de Chironomidae Henriques-Oliveira *et al.* (2003) observaram alterações nos hábitos alimentares de *Labrundinia*: em um período os detritos representaram 90% do alimento ingerido; em outro, grãos de pólen foram os itens mais importantes representando 10,6% da dieta alimentar; ainda em um terceiro período, algas representaram 7% do alimento ingerido, o que demonstra uma diversidade de hábitos para o gênero.

Neste estudo, as larvas de *Labrundinia tenata* e *Labrundinia* sp. 4 spec. nov. continham detritos no seu trato digestivo, indicando uma diversidade de hábitos alimentares. Isto sugere que *Labrundinia* é um gênero oportunista alimentando-se dos itens disponíveis no ambiente, podendo ocupar diferentes guildas tróficas.

6. Considerações Finais

Atualmente, maioria das descrições de *Labrundinia* está fundamentada em adultos machos, o que não contempla o reconhecimento das larvas em nível específico. Esta restrição impede o refinamento da resolução taxonômica em trabalhos de cunho ecológico e a sua compreensão em estudos de avaliações ambientais. O gênero *Labrundinia* ocupa diferentes ambientes aquáticos com características distintas e a identificação das larvas em nível genérico é insuficiente para maioria das propostas de biomonitoramento. Tornar-se importante ressaltar que embora neste estudo sejam apresentadas ilustrações, descrições e chaves de identificação para todos os estágios de vida de *Labrundinia*, somente a criação e a associação entre larvas, pupas e adultos pode assegurar identificações em nível específico com confiabilidade.

Neste estudo apesar da reduzida abrangência dos locais de amostragem, quatro novas espécies são descritas e uma quinta é registrada pela primeira vez para o Brasil, o que comprova grande diversidade do gênero *Labrundinia* e indica a falta de estudos taxonômicos para o país. O catálogo de Spies & Reiss (1996) evidencia tal fato, dado que não apresenta o registro de nenhuma espécie de *Labrundinia* para o Brasil. Desta forma, estudos filogenéticos, sistemáticos e moleculares que permitam a associação entre os diferentes estágios de vida de *Labrundinia* devem ser conduzidos para uma melhor compreensão entre as espécies do gênero.

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8. Anexo

Artigo submetido à Revista Brasileira de Zoologia

The immature stages of *Labrundinia tenata* Roback, 1987 (Diptera: Chironomidae: Tanypodinae) and redescription of the male.

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ABSTRACT. The immature stages of *Labrundinia tenata* Roback, 1987 are described and illustrated and the male is redescribed. Larvae were collected in ponds in southeastern Brazil, where they are associated with aquatic macrophytes. Information on the species life history is given.

KEY-WORDS. Pentaneurini; *Labrundinia*; Neotropical; Brazil; taxonomy.

RESUMO. Os estágios imaturos de *Labrundinia tenata* Roback, 1987 (Diptera: Chironomidae: Tanypodinae) e redescrição do macho. Os estágios imaturos de *Labrundinia tenata* Roback, 1987 são descritos e ilustrados e o macho é redescrito. As larvas foram coletadas em diferentes sistemas aquáticos no sudeste do Brasil, associadas à macrófitas aquáticas. Informações sobre a história de vida dessa espécie são dadas.

PALAVRAS-CHAVE. Pentaneurini; *Labrundinia*; Neotropical; Brasil; taxonomia.

INTRODUCTION

The genus *Labrundinia* was erected by Fittkau in 1962, based on *Tanypus longipalpis* Goetghebuer, 1921. Currently it gathers 15 species, of which eight are Neotropical (ROBACK 1987, EDWARDS 1931), four Nearctic (BECK & BECK 1966, ROBACK 1971) and one Palaearctic (FITTKAU 1962). The species *Labrundinia pilosella* Beck & Beck, 1966 and *Labrundinia maculata* Roback, 1971 originally described from Nearctic region also occur in Neotropical region (SPIES & REISS 1996).

In Brazil, although *Labrundinia* have been recorded from many ecological studies (TRIVINHO-STRIXINO & STRIXINO 1993, HENRIQUES-OLIVEIRA *et al.* 2003, SIQUEIRA & TRIVINHO-STRIXINO 2005, ABURAYA & CALLIL 2007), their species is poorly known taxonomically. *Labrundinia tenata* was described by Roback (1987a) from Colombia, based only on characters of the males and their immatures have thus so far been unknown. In the present paper, the immatures stages of *L. tenata* are described and the male is redescribed in full detail. Information on the midge life history is given.

MATERIAL AND METHODS

Larvae were collected associated with aquatic macrophytes in small ponds from São Paulo State, Brazil and they were reared in the laboratory to obtain pupae and adults as suggested by MENDES (2002). Specimens examined were slide-mounted in Euparal, following the procedures outlined by PINDER (1983, 1986, 1989).

Morphological terminology and abbreviations follow SÆTHER (1980), supplemented by KOWALYK (1985) for larval cephalic setation, and Roback (1987a,b) for terminology relating to *Labrundinia*. The following additional abbreviations are used in text: ALR, anal lobe ratio; AMD, larval antennal segment I/mandible length ratio; APR, larval antennal segment I/basal palp segment length ratio; GcR, gonocoxite ratio; IO, inner teeth of

ligula/outer teeth length ratio; MO, median teeth of ligula/outer teeth length ratio; PR, larval basal palp segment ratio; PTH, preapical papilla/thoracic horn length ratio; THR, thoracic horn ratio. Ratio equals to length divided by width of structure in question. Preapical papilla corresponds to membranous projection present apically on thoracic horn of pupa.

Measurements are given as ranges, followed by the mean with the number of observed specimens in parenthesis if it differs from the number (n) stated at the beginning of the description. Seta counts are given only as the range. Humerals were incorporated into the dorsocentrals.

The material examined is housed in the Reference Collection of Laboratório de Entomologia Aquática (LEA), Universidade Federal de São Carlos (UFSCar). One male with associated pupal and larval exuviae will be deposited in the Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (MZUSP).

***Labrundinia tenata* Roback, 1987** (Figs. 1-27)

Material examined. BRAZIL, São Paulo State, São Carlos, Fazzari reservoir, 04.v.2007, 1 male with associated pupal and larval exuviae, F. L. Silva leg.; as previous except for 14.v.2008; as previous except for 22.v.2008; as previous except for Espraiado reservoir, vi.1998, 2 larvae, S. Trivinho-Strixino leg.; as previous except for Itaqueri stream, 07.iii.2008, 1 larva, C. C. Andrade leg.

Diagnostic characters. *Labrundinia tenata* can be separated from others species by the following combination of characters: male with abdominal segments I brownish, II-VI with brown transverse band near proximal margin, VII, VIII almost wholly brown; hypopygium brown; anterior margin of sternapodeme rounded, no distinct spur. Pupa with thoracic horn S-shaped exhibiting a shallow preapical groove with cleft in upper margin; abdominal segment

VII with 2 lateral setae. Larva with caudoventral spine group, lateroventral spine group indistinct; posterior parapod with single elongate claw serrated on inner margin and numerous simple claws.

Male (n = 3 unless otherwise stated)

Dimensions. Total length 1.85-1.99, 1.94 mm. Wing length 1.14-1.15, 1.14 mm. Total length/wing length 1.63-1.75, 1.70. Wing length/length of profemur 2.4-3.2, 2.9.

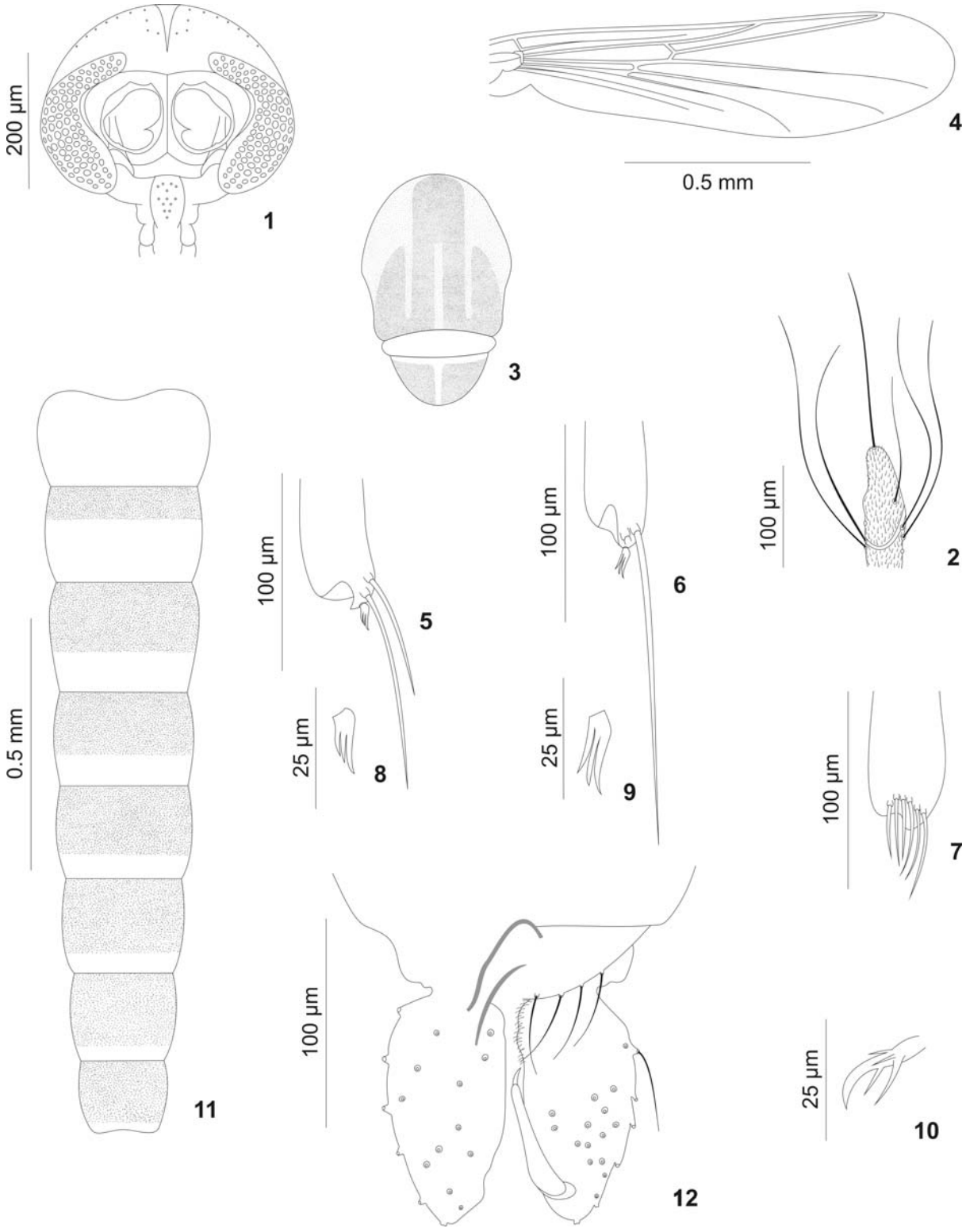
Coloration. Head brownish with dark brown occipital margin. Antenna brown. Thorax brownish with brown strips as in figure 3. Wing clear with veins brownish, without spots. Legs pale. Fore, mid and hind femur pale yellow. Fore tibia brownish, mid and hind tibiae pale yellow. All fore tarsomeres brownish and mid and hind tarsomeres pale yellow. Abdomen brownish with maculation as in figure 11; tergite IX with brown distal margin. Hypopygium brown.

Head (Figs. 1-2). AR 1.03-1.22, 1.12; flagellum 600-657, 632 μm long. Temporal setae 10-12. Eyes ratio 1.4-1.9, 1.7. Clypeus with 12-13 setae. Tentorium 128-137, 131 μm long. Palpomere lengths 1-5 (in μm): 31 (1); 54 (1); 88 (1), 131 (1); 209 (1).

Thorax. Antepronotum with 2-3 (2) setae. Acrostichals 24-27, biserial, all starting close to the anterior end; dorsocentrals 16-18, biserial anteriorly; prealars 5. Scutellum with 6-7 setae across disc and numerous fine anterior setae.

Wing (Fig. 4) 0.33-0.34, 0.33 mm wide. Costa not produced beyond R_{4+5}, ending very slightly beyond tip of M_{3+4}. Base of radial sector 0.08-0.10, 0.09 mm. VR 0.75-0.79, 0.76.

Legs (Figs. 5-10). Fore tibia with single pectinate spur, 13-15, 14 μm long with 3 teeth; mid tibia with single pectinate spur, 12-14, 13 μm long with 3 teeth. Width at apex of fore tibia 34-35, 34, mid tibia 29-32, 31, hind tibia 32-35, 33. Hind tibial comb with 6-7 setae. Mid leg with two pseudospurs on Ta_{1-4}. Claws slender as in figure 10. Length and proportion of legs as in Table 1.



Figures 1-12. *Labrundinia tenata* Roback, 1987, male. **1.** Head, dorsal view. **2.** Apex of Antenna. **3.** Thorax. **4.** Wing. **5.** Apex of fore tibia. **6.** Apex of mid tibia. **7.** Apex of hind tibia with comb. **8.** Fore spur. **9.** Mid spur. **10.** Hind tarsal claw. **11.** Abdomen coloration, dorsal aspect. **12.** Hypopygium, left: ventral aspect, right: dorsal aspect.

Table I. Lengths (in μm) and proportions of legs of *Labrundinia tenata* Roback, 1987, male.

	fe	**ti**	**ta_1**	**ta_2**	**ta_3**
p_1	356-469, 417	381-406, 392	319 (2)	143 (2)	131 (2)
p_2	431-450, 444	406-413, 408	475-531, 498	225-231, 227	119-125, 121
p_3	450-494, 473	419-581, 515	513-563, 538	206-225 (2)	131-150 (2)

continued.

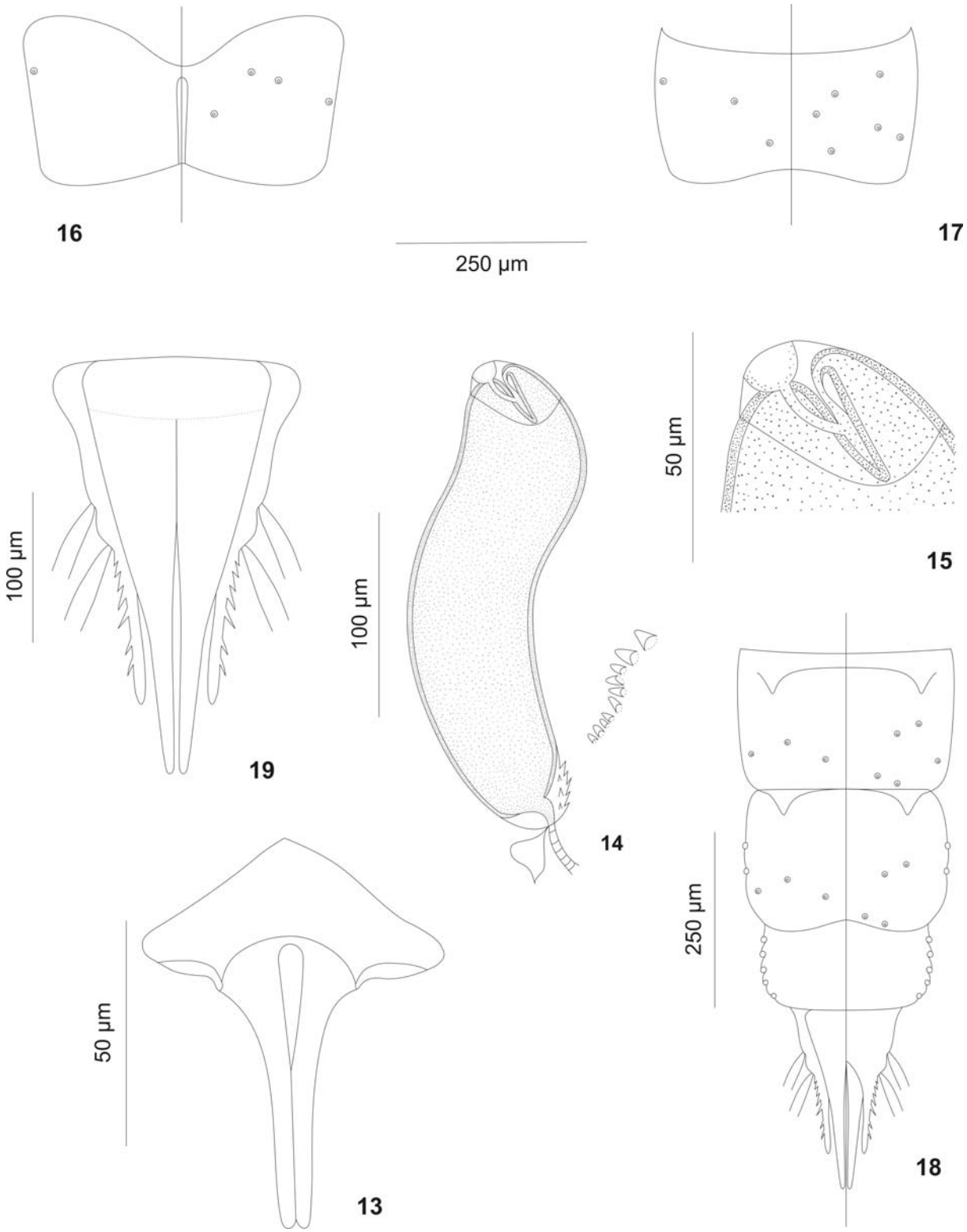
	ta_4	**ta_5**	**LR**	**BV**	**SV**
p_1	94-100 (2)	56-69 (2)	0.78-0.82 (2)	2.62-2.72 (2)	2.55-2.74 (2)
p_2	81-88, 83	63-81, 77	1.15-1.30, 1.22	2.62-2.68, 2.66	1.61-172, 1.72
p_3	100-119 (2)	63-69 (2)	0.94-0.96 (2)	2.84-3.06 (2)	1.84-1.99 (2)

Hypopygium (Fig. 12). Tergite IX arched with 7-8 dorsal setae. Anterior margin of sternapodeme slightly rounded, no distinct spur. Phallapodeme 45-51, 49 μm long. Gonocoxite 98-109, 103 μm long. GcR 2.03-2.30, 2.16. Gonostylus 62-65, 63 μm long; megaseta 11-12, 11 μm long. HR 1.50-1.74, 1.63. HV 2.90-3.19, 3.09. Apical hairs of gonocoxite not numerous.

Pupa (n = 3 unless otherwise stated)

Coloration. Brownish. Thoracic horn brown.

Cephalothorax (Figs. 13-15)**.** Frontal apotome as in figure 13. Wing sheath 0.73-0.76, 0.75 mm long. Thoracic horn S-shaped, 203-228, 214 μm long, 65 μm wide, THR 3.14-3.52, 3.31, reticulation of respiratory atrium indistinct, external membrane with pale spinules basally concentrated, membranous preapical papilla 38-40, 39 μm, PTH 0.17-0.20, 0.18, aeropyle tube simple 13-18, 15 μm long, plastron plate much reduced. Thoracic comb with 10-12 conical teeth.



Figures 13-19. *Labrundinia tenata* Roback, 1987, pupa. **13.** Frontal apotome. **14.** Thoracic horn with basal lobe and medial row of teeth. **15.** Apex of thoracic horn showing preapical papilla. **16-18.** Abdominal segments I, IV and VI-VIII respectively, left: ventral aspect, right: dorsal aspect. **19.** Anal lobe and genital sac.

Abdomen. (Figs. 16-19) 1.67-1.68, 1.68 mm long. Tergite I with elongate scar, without shagreen, sternites II-VII with shagreen apparently concentrated on basal and lateral margins. Chaetotaxy of abdomen as in figures 16-18. Segment VII with 2 lateral setae, Segment VIII with 5 lateral setae. Anal lobe 250 μm long, with 2 lateral setae, outer margins with 7-10 spines, longest spine 9-11, 10 μm long, membranous inner margins. ALR 1.34-1.38, 1.36. Genital sac elongate, longer than anal lobe.

4th instar larva (n = 3 unless otherwise stated)

Coloration. Body pale yellow. Head pale yellow with postoccipital margin brown; antennal segment II brownish; mandibular distal tooth and apex of ligula brown. Procercus and anal setae brownish. Posterior parapod claws all pale yellow.

Head (Fig. 20) 456-494, 473 μm long, 331-388 (2) μm wide, slender almost rectangular; lateroventral spine group indistinct, caudoventral spine group present, with about 20 teeth; cephalic index 0.73-0.78 (2). Chaetotaxy as in figure 20.

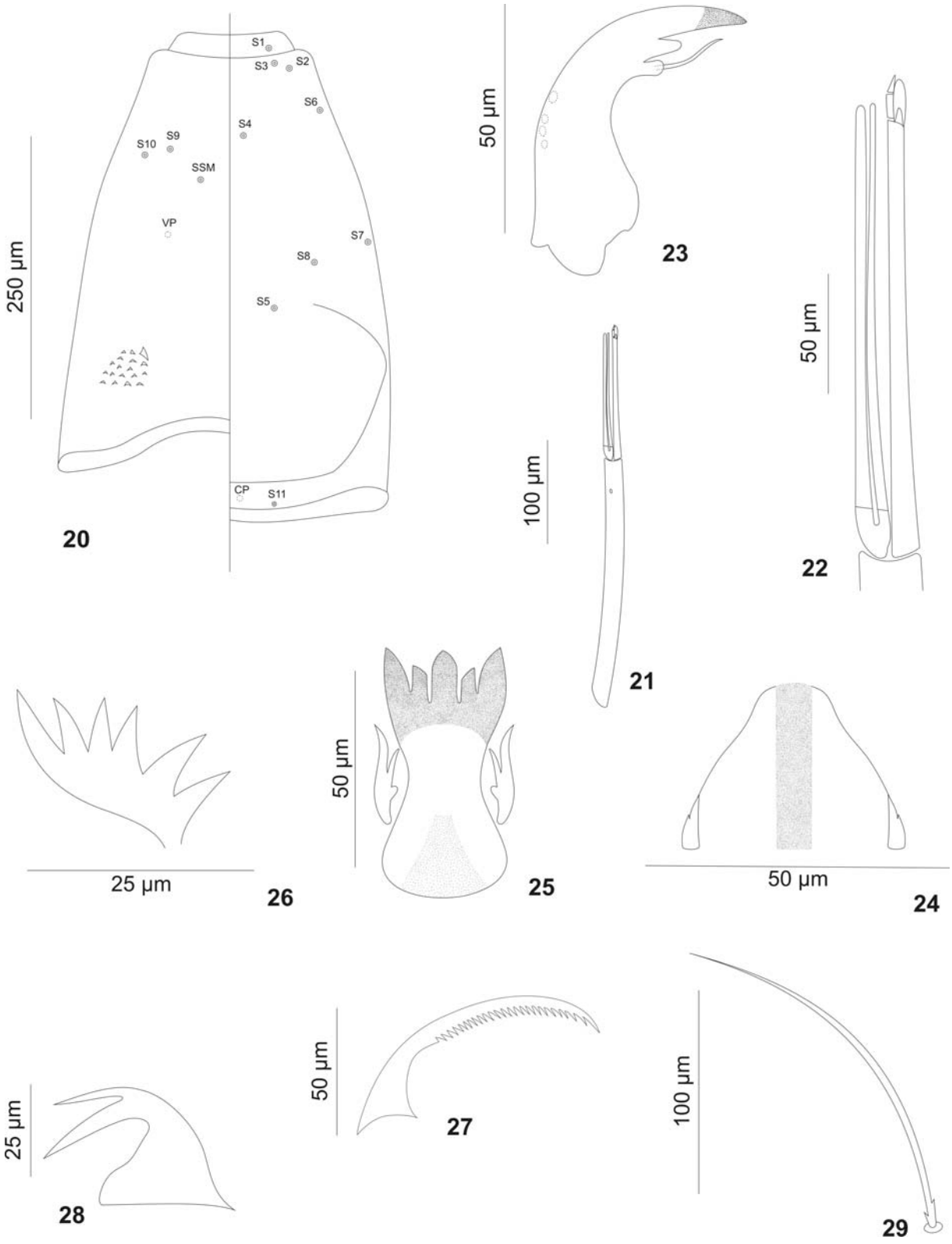
Antenna (Fig. 21-22) 295-317, 304 μm long, basal antennal segment 192-208, 199 μm long, with ring organ 169-188, 176 μm from base, antennal segment II 95-100, 97 μm long. AR 1.78-2.05, 1.91. Blade longer than antennal segment II.

Maxilla. Basal palp segment 26-31, 29 μm long, 6-8, 7 μm wide, with ring organ 17-23, 20 μm from base. PR 3.9-4.3, 4.1. APR 6.3-7.6, 7.0.

Mandible (Fig. 23) 69-76, 72 μm long, with 3 lateral setae. Campaniform sensilium 51-55, 52 μm from apex. Basal tooth bifid, with seta subdentalis projecting from sloping end towards apical tooth. AMD 2.7-2.9, 2.8.

Mentum (Fig. 24). Dorsomental teeth reduced and pseudoradula uniformly granulate.

Hypopharyngeal complex (Figs. 25-26). Ligula 46-60, 53 μm long, 28-30, 29 μm wide, with row of 5 teeth. IO 0.65-0.78, 0.70, MO 1.00-1.04, 1.01.



Figures 18-27. *Labrundinia tenata* Roback, 1987, larva. **20.** Head, left: ventral aspect, right: dorsal aspect, showing distribution of cephalic setae and pores. **21.** Antenna. **22.** Apex of antenna. **23.** Mandible. **24.** Mentum. **25.** Ligula and paraligula. **26.** Pectin hypopharyngis. **27.** Serrated claw. **28.** Bifid claw. **29.** Subbasal seta.

Paraligula bifid, 21-23, 22 μm long, inner tooth 16-18, 17 μm long, shorter than outer tooth. Pectin hypopharyngis with 6 teeth almost equal sized.

Abdomen (Figs. 27-29). Without lateral fringe. Procercus 4.4-6.7, 5.5 times as long as wide, with seven anal setae 254-398, 342 μm long. Anal tubules 145-158, 150 μm long. Posterior parapod 192-211 (2) μm long, with single elongate claw serrated on inner margin and numerous simple claws; bifid claw with U-shaped lower groove, subbasal seta simple with 2 teeth near base.

REMARKS ON TAXONOMY

The measures in this work for adult males are near of measures obtained by Roback (1987a), with exception to leg lengths that presented wide variation. The coloration pattern of the abdominal segments II-VI allows separate the males of *L. tenata* of *L. becki* and *L. parabecki* that also have brown hypopygium, however abdomen this species is wholly darkened. Some specimens of *L. pilosella* also have brown hypopygium, but they differ of *L. tenata* by abdominal coloration pattern exhibited by segments III and V, that are totally darkened.

The deep of apical groove and the short aeropyle tube distinguish the pupa of *L. tenata* of *L. neopilosella* that practically not present an apical groove and has an elongated aeropyle tube. The combination of the characters cephalic capsule with caudoventral spines group and absence of lateroventral spines group allow separate *L. tenata* of *L. neopilosella* that has evident lateroventral spur group.

REMARKS ON ECOLOGY

The larvae of *Labrundinia tenata* were collected associated with aquatic macrophytes of the genus *Salvinia* in the Fazzari reservoir, which is located in a protected area from São

Carlos city, in *campus* of Universidade Federal de São Carlos, surrounded by cerrado fragment with low level of anthropic impact. This system is shallow (0.60 m depth), with acid water (pH 6.8), high level of dissolved oxygen (9.4 $mg.L^{-1}$), low conductivity (8 $\mu S.cm^{-1}$) and temperature ranging from 19-23º C.

The larvae of genus *Labrundinia* are considered predators (COFFMAN & FERRINGTON 1996), feeding on small invertebrates, including other Chironomidae larvae. In this work, the larvae of *L. tenata* analyzed exhibited basically detritus in their digestive tracts, which shows a diversity of habits for the genus as indicated by HENRIQUES-OLIVEIRA *et al.* (2003).

The female remains unknown.

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