

Review of the genus *Aturbina* Lugo-Ortiz & McCafferty (Ephemeroptera: Baetidae)

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Abstract – In the present work, based on material from several localities in Brazil, the genus *Aturbina* is reviewed. Two new species, *A. maculata*, sp. nov. and *A. nigra*, sp. nov. are described based on nymphs and adults; the type-species, *A. georgei*, is redescribed based on nymphs and reared adults; the nymphs and adults of *A. beatrixae* are respectively described and redescribed, as well as recorded from Brazil for the first time. Based on these findings, an updated key to nymphs and adults of the genus is provided.

Key words: New species / taxonomy / South America / macroinvertebrate

Introduction

The genus *Aturbina* Lugo-Ortiz & McCafferty was erected to include an unusual species of Baetidae (Ephemeroptera) with a remarkable and exclusive characteristic among member of the family, the absence of the turbinate portion of male compound eyes (Lugo-Ortiz and McCafferty, 1996). This species, *A. georgei* Lugo-Ortiz & McCafferty, was described based on nymphs and male and female imago collected in northern and western Brazil, French Guiana, and Paraguay.

Gillies (2001) described another species of *Aturbina*, this time from Uruguay. *Aturbina beatrixae* Gillies was described based on male and female imago, whereas one single nymph, collected from the type locality, was described and assigned tentatively to this species. Currently, records of *A. beatrixae* remain limited to its type locality.

More recently nymphs of *Aturbina* have been recorded from several localities in South America, especially in Brazil (Salles *et al.*, 2003, 2004a, 2004b, 2004c, 2010), where they proved to be an abundant, common and widespread mayfly. Based on this and additional material from several localities in Brazil, we present a review of the genus *Aturbina*. Two new species, *A. maculata*, sp. nov.

and *A. nigra*, sp. nov. are described based on nymphs and adults; the type-species, *A. georgei*, is redescribed based on nymphs and reared adults, while the nymphs and adults of *A. beatrixae* are respectively described and redescribed, as well as recorded from Brazil for the first time. Based on these findings, an updated key to nymphs and adults of the genus is provided.

Material and methods

The taxonomic descriptions presented herein were generated from a DELTA (Dallwitz, 1980; Dallwitz *et al.*, 1993) database of South American baetid genera and species under development in order to propose a standard description for members of the family.

Pictures were taken using an OPTON Q719K-AC microscope with a TA-0124S digital camera, or a Leica (M165C) stereomicroscope with a DFC420 digital camera. In the case of pictures taken at the stereomicroscope, a series of partially focused images were processed with the program Leica Application Suite V3.4.1. (Version 2009) to produce final images with enhanced quality. Line drawings were made with the aid of a camera lucida, photographs, or both. In either ways, final illustrations were prepared according to Coleman (2003, 2006).

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The identification of previously described species of *Aturbina* were made based on original descriptions, from material collected near the type-locality (*A. georgei*) and comparison with photographs of the type (*A. beatrixae*). The material examined is housed in the following institutions: Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Brazil, and Invertebrate Collection of the Centro Universitário Norte do Espírito Santo, Universidade Federal do Espírito Santo (CEUNES), São Mateus, Brazil.

Taxonomy

Aturbina Lugo-Ortiz & McCafferty, 1996

Lugo-Ortiz and McCafferty (1996): 176; Gillies (2001): 331; Domínguez *et al.* (2006): 84.

Diagnoses

Nymphs. 1) Labrum with dorsal surface flat, with submarginal row of flattened, basally broad and apically pointed setae (Figs. 10, 20, 30 and 40); 2) Prosthema of right mandible robust, with slender and frayed process at base (Figs. 12, 22, 32 and 42); 3) Maxillary palp three segmented (Figs. 14, 24, 34 and 44); 4) Labial palp with segment II without distomedial protuberance; segment III subquadrangular (Figs. 15, 25, 35 and 45); 5) Paraglossa apically with three rows of somewhat robust, pectinate setae (Figs. 15, 25, 35 and 45); 6) Hind wing pads present; 7) Tarsal claw with two rows of denticles (Fig. 16a); 8) Gills on segments I–VII.

Male adults of *Aturbina* are readily distinguished from other Baetidae by the lack of the turbinate portion of male compound eyes. Besides that, the following combination of characteristics can be used: 1) Antenna relatively long, flagellum longer than width of head capsule (Figs. 58, 60 and 62–64); 2) Forewing (Figs. 65, 67, 69 and 71) with paired marginal intercalary veins somewhat divergent; 3) Forceps three-segmented (Figs. 73–76); 4) Forceps segment I with well developed distomedial projection and longer than segments II and III combined (Figs. 73–76).

Nymph

Head. Lateral branch of epicranial suture curved (Figs. 2–5). Antenna with scape and pedicel subcylindrical. Frontal keel present (Figs. 2–5). Labrum (Figs. 10, 20, 30 and 40). Rectangular, broader than long. Dorsal surface flat, with submarginal row of flattened, basally broad, and apically pointed setae. Left mandible (Figs. 11, 21, 31 and 41). Incisors fused. Prosthema robust, apically denticulate and with comb-shape structure at apex. Right mandible. Incisors fused (Figs. 12, 22, 32 and 42). Prosthema robust, apically denticulate, with slender and frayed process at base. Denticles of mola not constricted. Basal half bare. Subtriangular process wide, above level of area between

prosthema and mola. Denticles of mola not constricted. Basal half bare. Hypopharynx (Figs. 13, 23, 33 and 43). Lingua apically broad, rounded; subequal or shorter than superlingua. Maxilla (Figs. 14, 24, 34 and 44). Crown of galea-lacinia with four denticles. Maxillary palp three segmented. Labium (Figs. 15, 25, 35 and 45). Glossa basally broad, little shorter than paraglossa; outer margin with spine-like setae. Paraglossa apically with three rows of somewhat robust, pectinate setae. Labial palp with segment II without distomedial protuberance. Segment III subquadrangular.

Thorax. Hind wing pads present (hind wing pads may be absent in a few specimens, see comments on *A. maculata*, sp. nov.). Legs (Figs. 16, 26, 36 and 46). Tarsal claw with two rows of approximately ten denticles increasing in size distally (Fig. 16a).

Abdomen. Tergal surface with scales bases (Figs. 18, 28, 38 and 48). Gills on segments I–VII (Figs. 6–9). Terminal filament as long as cerci, posterior margin of segments with short spines on each segment, and long spines on every three segments; inner margin of cercus and inner and outer margin of terminal filament with tufts of long, simple setae.

Male imago

Head. Turbinate portion of compound eyes absent (Figs. 50–59). Antenna long, flagellum longer than width of head capsule (Figs. 58, 60 and 62–64).

Thorax. Anteronotal protuberance rounded (Figs. 52–53, 55–56, 58, 60 and 63–64). Forewing (Figs. 65, 67, 69 and 71) with paired marginal intercalary veins somewhat divergent; length of each intercalary vein about 1.9× distance between adjacent longitudinal veins; length of forewing about 2.4× width; stigmatic cross veins reaching or not Sc. Hind wing (Figs. 66, 68, 70 and 72) present, with two complete longitudinal veins (hind wings may be extremely reduced in a few specimens, see comments on *A. maculata*, sp. nov.); costal projection truncate with two peaks or falcate, placed in the basal third of anterior margin, cross veins absent. Metascutellar protuberance dorsally pointed (Fig. 52) or rounded (Figs. 56, 60 and 64).

Abdomen. *Genitalia* (Figs. 73–76). Forceps three-segmented. Forceps segment I with well developed distomedial projection and longer than segments II and III combined. Forceps segment II sometimes with median constriction (appearing two segmented). Forceps segment III short. Subgenital plate produced and truncate.

Distribution. Argentina, Brazil, Colombia, French Guyana, Paraguay, and Uruguay.

Composition. *Aturbina beatrixae* Gillies, *A. georgei* Lugo-Ortiz & McCafferty (type-species), *A. maculata*, sp. nov., *A. nigra*, sp. nov.

Biology. Nymphs of *Aturbina* can be found in several types of aquatic habitats. Those of *A. georgei* seems to be ecologically less restricted, once they have been collected

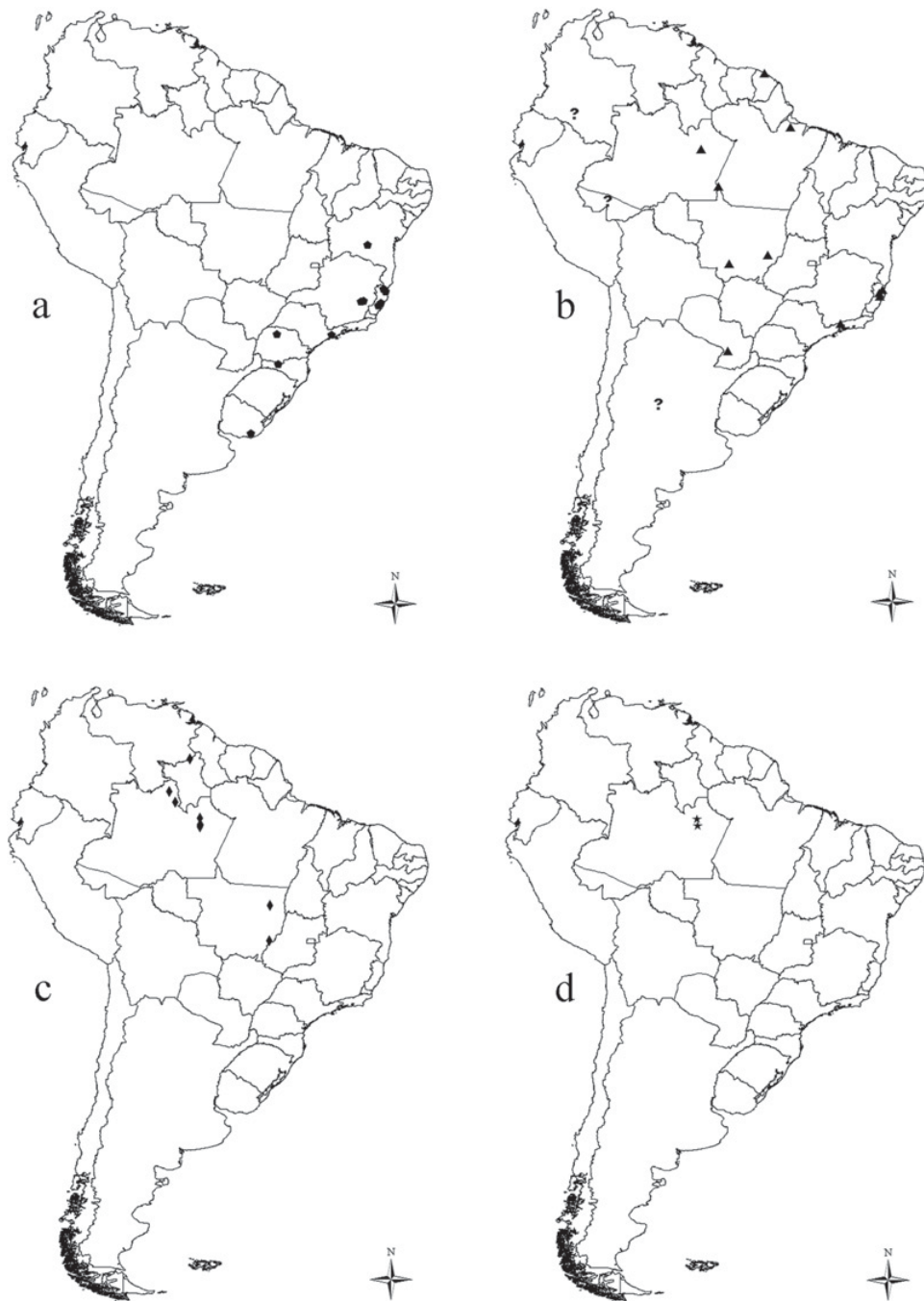


Fig. 1. Distribution of the species of *Aturbina* in South America (a, *A. beatrixae*; b, *A. georgei*; c, *A. maculata*, sp. nov.; d, *A. nigra*, sp. nov.). Question mark indicates that the species is recorded to a country, but the exact location is unknown.

from small streams to large rivers (as Rio Amazonas), or even in large lakes (as Lagoa Juparanã, one of the largest lakes in Brazil). They also can be encountered on somewhat impacted areas, like those without riparian vegetation or used for recreation. These characteristics of *A. georgei*, in turn, could explain the wide distribution of this species (Fig. 1). Nymphs of *A. maculata*, sp. nov. and *A. nigra*, sp. nov., appear to be more restricted to well preserved streams, while those of *A. beatrixae* seems to be intermediate between them (however, little ecological

data is available for nymphs of this species). In either ways, they are often found associated to organic substrates (macrophytes or vegetation from the river or stream bank that is partially submerged) in areas of slow to moderate current.

Subimagos of *Aturbina* were collected with light traps around 18:30 p.m., right after the sunset, and the imaginal emergence occurred in the morning of the next day. A small swarm of male and female imagos of *A. beatrixae* was observed by the first author around 5:30 a.m.

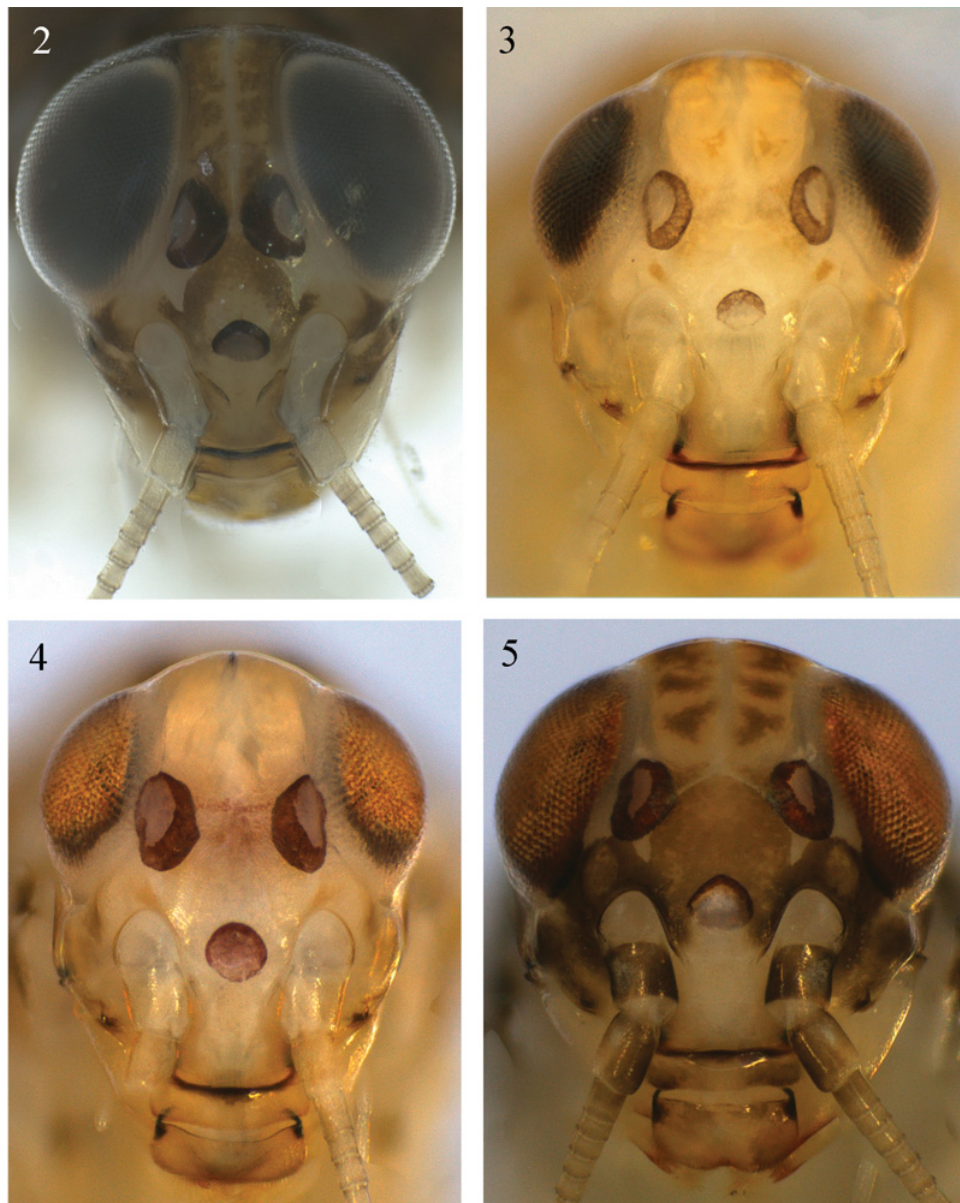


Fig. 2–5. *Aturbina* spp., nymphs, frontal view of head. 2, *A. beatrixae* (male). 3, *A. georgei* (female). 4, *A. maculata*, sp. nov. (female). 5, *A. nigra*, sp. nov. (male).

Aturbina beatrixae Gillies, 2001

(Figs. 1–2, 6, 10–19, 50–53, 65–66 and 73)
Gillies (2001): 332; Domínguez *et al.* (2006): 86.

Diagnoses

Nymphs. 1) Submarginal dorsal row of setae composed of 15 robust, spine-like setae (Fig. 10); 2) Margin between protheca and mola with crenulations (Fig. 11); 3) Segment III of labial palp with apex truncate and broader than base (Fig. 15); 4) Hind femur with one complete brown band; 5) Body color pattern as in Figure 6.

Adults. 1) Compound eye dorsally elevated (Figs. 52 and 53); 2) Mesothorax with dark brown marks on

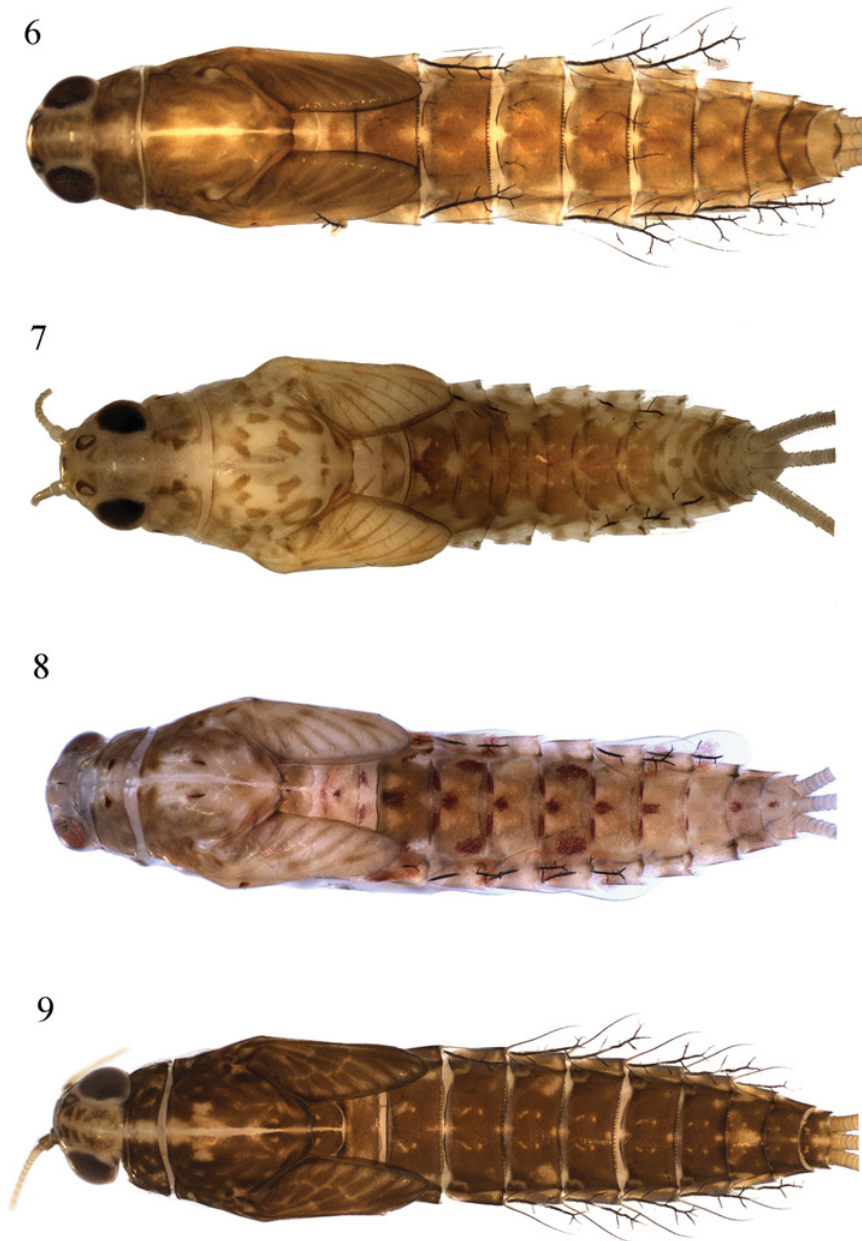
anteronotal projection and anteronotal impression, mesoscutum, submesoscutum and scutellum (Figs. 50 and 51); 3) Metascutellar protuberance pointed (Fig. 52); 4) Costal process truncate, with two peaks, located on basal third (Fig. 66); 5) Abdominal terga without reddish marks (Figs. 50 and 51); 6) Genitalia with forceps segment I wide and forceps segment II with median constriction (Fig. 73).

Nymph

Length. *Body*: 4.6–5.1 mm; *cerci*: broken; *terminal filament*: broken; *antennae*: broken.

Head (Fig. 2). Coloration: light yellowish brown.

Antenna. Flagelum with spines and fine, simple setae on apex of each segment.



Figs. 6–9. *Aturbina* spp., nymphs in dorsal view. 6, *A. beatrixae*. 7, *A. georgei*. 8, *A. maculata*, sp. nov. 9, *A. nigra*, sp. nov.

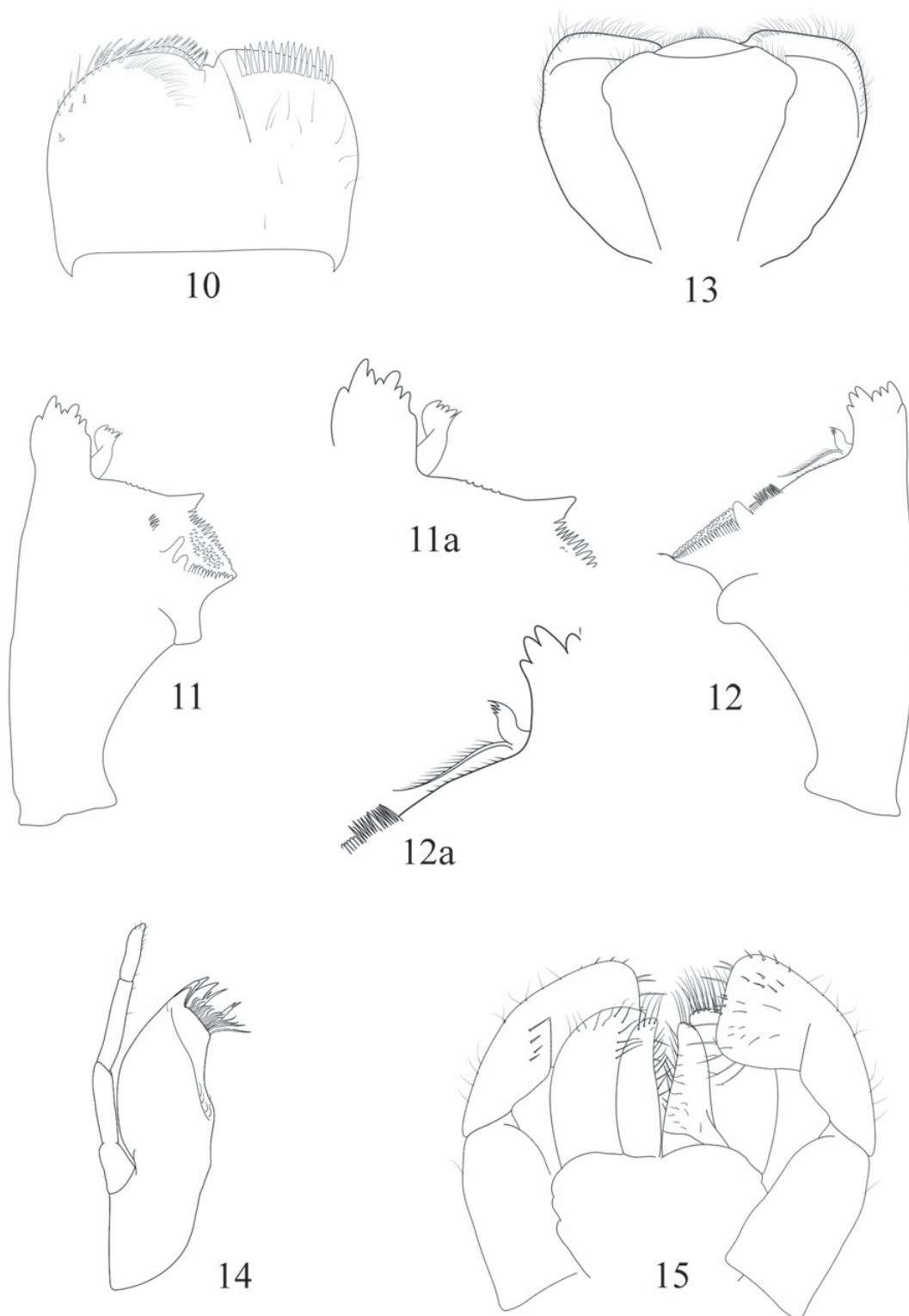
Labrum (Fig. 10). Rectangular, broad than longer; length about 0.6× maximum width; dorsal surface flat; distal margin with medial emargination and small process. Dorsally with few short, fine, simple setae scattered over surface; dorsal arc of setae restricted to a single, medial, long seta; laterodorsal arc of setae 2 + 3 + 3 long, spine-like setae; submarginal dorsal row of setae composed by 15 robust, spine-like setae; antero-lateral margin with few long, spine-like setae; ventrally with submarginal row of setae composed of bifid and frayed setae; ventral surface with short, spine-like setae near lateral and anterolateral margin.

Left mandible (Fig. 11). Inner and outer set of incisors respectively with 4 + 4 denticles. Margin between

prostheca and mola straight, with crenulations (Fig. 11a); tuft of setae absent; tuft of spine-like setae at base of mola present, but reduced to few setae; tuft of setae at apex of mola absent. Lateral margin almost straight.

Right mandible (Fig. 12). Inner and outer set of incisors respectively with 3 + 4 denticles. Margin between prostheca and mola slightly convex (Fig. 12a); tuft of setae absent; tuft of spine-like setae at base of mola present; tuft of setae at apex of mola present, reduced to a single setae. Lateral margin slightly convex.

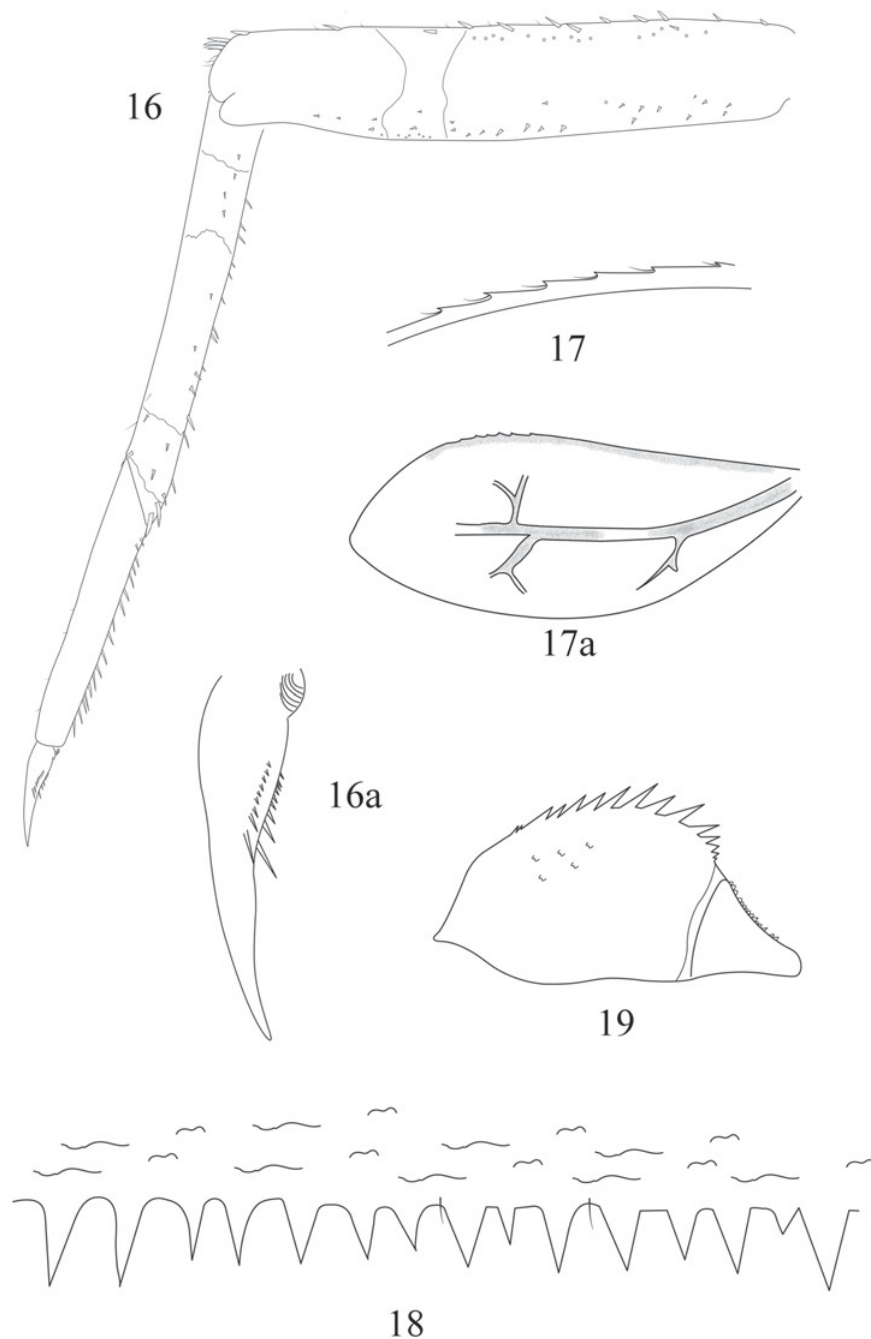
Hypopharynx (Fig. 13). Lingua subequal in length to superlingua. Apex convex; medial tuft of setae present; distal half laterally expanded. Superlingua not expanded; fine, simple setae scattered over inner and distal margin.



Figs. 10–15. *Aturbina beatrixae*, nymph. 10, Labrum (left v.v., right d.v.). 11, Left mandible (d.v.) (a, detail of incisors and prostheca). 12, Right mandible (d.v.) (a, detail of incisors and prostheca). 13, Hypopharynx (d.v.). 14, Maxilla (v.v.). 15, Labium (left d.v., right v.v.).

Maxilla (Fig. 14). Inner dorsal row of setae with two bifid denti-setae. Medial protuberance of galea with 1 + 4 spine-like setae. Maxillary palp long, 1/5 longer than length of galea-lacinia; setae on maxillary

palp long, fine and simple, scattered over surface; palp segment II 0.7× length of segment I; palp segment III 0.7× length of segment I; apex of last segment smooth.



Figs. 16–19. *Aturbina beatrixae*, nymph. 16, Foreleg (a, detail of tarsal claw). 17, Gill IV (a, detail of margin). 18, Posterior margin of terga IV. 19, Paraproct (d.v.).

Labium (Fig. 15). Glossa basally broad, narrowing apically and subequal in length to paraglossa; inner margin with 10 spine-like setae increasing in length apically; apex with four long, robust, pectinate, spine-like setae; outer margin bare; ventral surface scattered with short, fine, simple setae. Paraglossa curved inward, apically broad; apex with three rows of pectinate setae; outer margin with a row of five setae; dorsally with row of 4–5 setae increasing in length apically; ventrally with four long, fine and simple setae near inner margin. Segment I of labial palp covered with short, simple setae and

micropores; inner margin bare; outer margin with few, short, simple setae; dorsally with row of four fine and simple setae; segment III with apex truncate and broader than base; length $0.8\times$ width; covered with spine-like and fine simple setae along margins and dorsal surface.

Thorax. Yellowish-brown with yellowish-white marks as in Figure 6.

Foreleg (Fig. 16). Yellowish, femur with a subapical complete brown mark; tibia with subbasal brown mark and apical dark brown mark. Ratio of foreleg $0.7:1.0$ (0.8 mm): $0.6:0.2$.

Forefemur. Length about 5× maximum width. Dorsally with a row of *ca.* 10 spine-like setae on margin, and with few, short, spine-like setae near margin with three long, curved, stout setae; ventrally with abundant, short, spine-like setae near ventral margin.

Tibia. Dorsally with long, spine-like seta at apex; ventrally with row of *ca.* 12 short, fine, spine-like setae, apex with pectinate seta; anterior surface with row of eight short, spine-like setae, near the apex with two pectinate setae; tibio-patellar suture present.

Tarsus. Dorsally with scarce short simple setae; ventrally with one row of *ca.* 13 spine-like setae; tarsal claw (Fig. 16a) with two rows of *ca.* 10 denticles increasing in size distally.

Mid and hind legs. Similar to foreleg, except for proportion of segments. Mid and hind legs: 1.2:1.0 (0.9 mm): 0.5:0.2.

Abdomen. Yellowish-brown with yellowish-white marks as in Figure 6.

Gills (Fig. 17). Margin with broad spines intercalate short, fine, simple setae (Fig. 17a). Tracheae extending from main trunk to inner and outer margins. Gill I little longer than segment II; oblong, apically pointed. Gill IV little longer than length of segments V and VI combined; oblong, broadly pointed at apex. Gill VII longer than length of segments VIII to X; oblong.

Terga. Posterior margin with regular spines, 1.5 as long as wide (Fig. 18); spines present in posterior margin of segments: I–X.

Paraproct (Fig. 19). With 14 marginal spines; surface with scales or scale-bases; postero-lateral extension with minute marginal spines.

Male imago

Maximal length. *Body:* 4.2–4.9 mm; *forewing:* 4.4–5.1 mm; *hind wing:* 1.0–1.6 mm; *antenna:* 1.0 mm; *tibia I:* 1.6 mm; *tibia II:* 0.8 mm; *tibia III:* 0.7 mm.

Head (Figs. 50–53). Coloration yellowish. Vertex with light brown mark. Ocellus whitish with basal area black. Antenna whitish washed with light brown.

Compound eye dorsally elevated (Figs. 52 and 53).

Thorax (Figs. 50–52). Yellowish. Pronotum washed with light brown. Anteronotal transverse impression, lateroparapsidal suture and posterior scutal protuberance brown.

Scutellum at the same level of anteronotal protuberance.

Metascutellar protuberance pointed (Fig. 52).

Legs. Whitish washed with light yellow. *Leg I:* tibia 1.6× length of femur; tarsus 1.0× length of femur; and with segments I > III > IV > II. *Legs II and III:* tibia 0.9× length of femur, tarsus 0.4× length of femur.

Forewing (Fig. 65). Hyaline; base of costal and subcostal veins brown, remainder veins light brown; stigmatic area with six cross veins touching subcostal vein; marginal intercalary veins paired, absent between veins CuP and A; length of intercalary vein between IMA and

IMA2 1.6× distance between adjacent longitudinal veins; length of forewing about 2.4× width.

Hind wing (Figs. 66 and 66a). Whitish, with one complete and one incomplete vein.

Abdomen. Terga whitish washed with light brown; tracheation blackish (Figs. 50 and 51). Sterna whitish washed with light brown. Caudal filaments broken and lost.

Genitalia (Fig. 73). Forceps segment I wide. Forceps segment II with median constriction.

Female imago

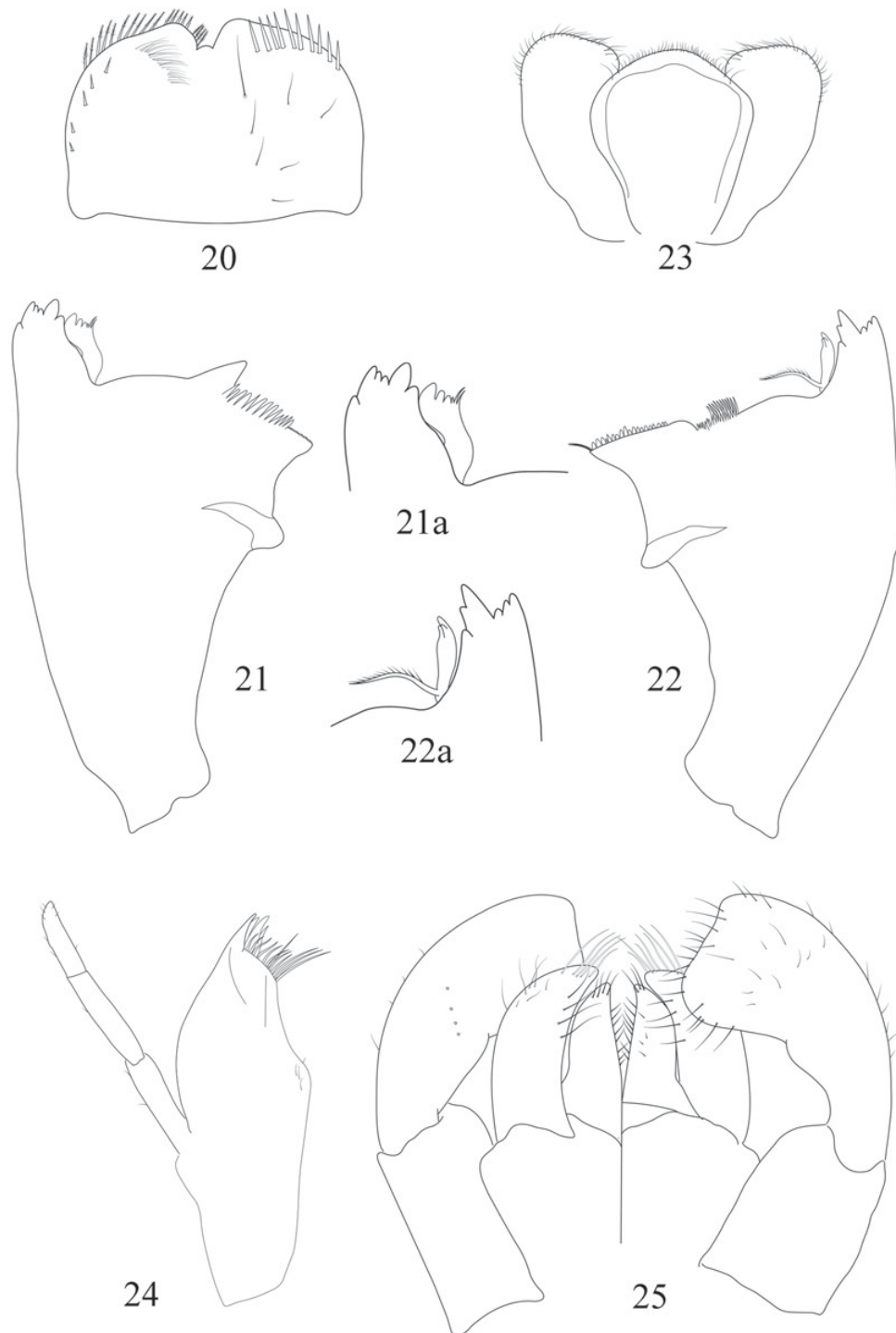
Maximal length. *Body:* 4.3–5.0 mm; *forewing:* 6.7–8.4 mm; *hind wing:* 1.1–1.5 mm; *antenna:* 1.4 mm; *tibia II:* 0.7 mm; *tibia III:* 0.8 mm.

Legs II and III: tibia 0.9× length of femur; tarsus 0.4× length of femur.

Comments. The distinct body color pattern of the imagos of this species, especially that of the thorax, vanishes shortly after some time in alcohol. When Gillies (2001) described *A. beatrixae*, it was described as a pale, colorless insect. Our hypothesis is that the lack of color in the original description was due to the fixation process.

Distribution. Argentina, Uruguay, Brazil (Santa Catarina, Paraná, São Paulo, Mato Grosso, Espírito Santo, Minas Gerais, Bahia).

Material examined. Eight male imagos, four male subimagos and five female imagos, Brazil, São Paulo, Salesópolis, Estação Biológica Boracéia, Co. Venerando, 19.iii.2001, Froehlich, C.G.; Da Silva, R.M.L. and Polegatto, C.M. col (INPA). Seven male and one female imagos, Brazil, Bahia, Rio de Contas, 04.viii.2010, 13°28'55.1"S/41°51'54.7"W, Boldrini, R.; Hamada, N. and Querino, R.B. col. Twelve nymphs, Brazil, Minas Gerais, Dionísio, Rio Mombaça, Localidade de Pingo do Ouro, próximo à ponte 19°49'658"S/42°38'509"W. 3.ix.2005, Francischetti, C.N. col. One male imago, Brazil, Espírito Santo, São Mateus, Bairro Chácara do Cricaré, 21.xii.2006, Salles, F.F. col. Three females and seven males imagos, Brazil, Espírito Santo, Reserva Biológica Córrego do Veado, 24.ii.2010, 18°22'16.8"S/40°8'30.2"W, Salles, F.F. col. One female and two male imagos, Brazil, Espírito Santo, Domingos Martins, São Miguel, 27–30.viii.2010, 20°15'02.6"S/40°43'27.4"W, Salles, F.F.; Shimano, Y., Nascimento, J.M.C. and Massariol, F.C. col. Two females imagos, Brazil, Espírito Santo, Domingos Martins, São Miguel, 28.viii.2010, 20°14'48.3"S/40°43'31.2"W, Pensilvânia, Salles, F.F.; Shimano, Y., Nascimento, J.M.C. and Massariol, F.C. col. Three nymphs and one male imago, Brazil, Paraná, Maringá, 12.viii.2010, Salles, F.F. and Higuti, J. col. Five nymphs, Brazil, Minas Gerais, Bom Jesus do Galho, 19°43'278"S/42°21'21'790"W, 30.ix.2005, Almeida, A.A. and Francischetti, C.N. col. Two nymphs, Brazil, Espírito Santo, Timbú, Hotel Fazenda Lua Nova, 23.ii.2007, 19°56'02"S/40°24'45"W, CEUNES col. One nymph, Brazil,



Figs. 20–25. *Aturbina georgei*, nymph. 20, Labrum (left v.v., right d.v.). 21, Left mandible (d.v.) (a, detail of incisors and prosthema). 22, Right mandible (d.v.) (a, detail of incisors and prosthema). 23, Hypopharynx (d.v.). 24, Maxilla (v.v.). 25, Labium (left d.v., right v.v.).

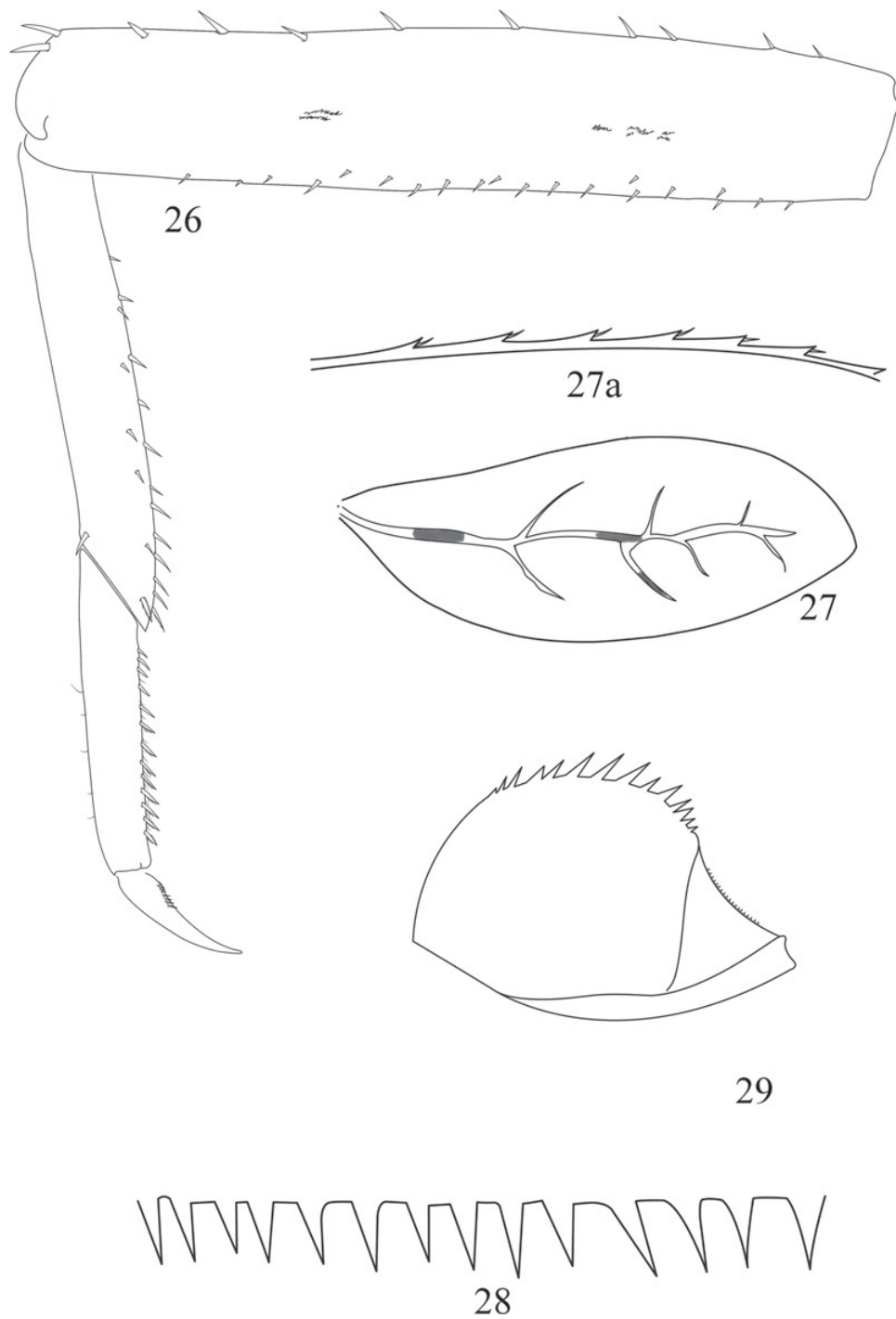
Santa Catarina, Parna Araucárias, Rio Chapecozinho, 13.iii.2009, 26°46'1.66"S/51°49'49.79"W, Raimundi, E.A. and Salles, F.F. col. (CEUNES).

Life cycle association. Nymphs and adults were collected at the same place and were the only species of *Aturbina* found in Maringá (Paraná) and Córrego do Veado (Espírito Santo).

***Aturbina georgei* Lugo-Ortiz & McCafferty, 1996**

(Figs. 1, 3, 7, 20–29, 54–56, 67–68 and 74)

Lugo-Ortiz & McCafferty (1996): 179; Domínguez *et al.* (2002): 462; Salles *et al.* (2003); Salles *et al.* (2004a): 2; Salles *et al.* (2004b): 727; Salles *et al.* (2004c): 12; Domínguez *et al.* (2006): 86.

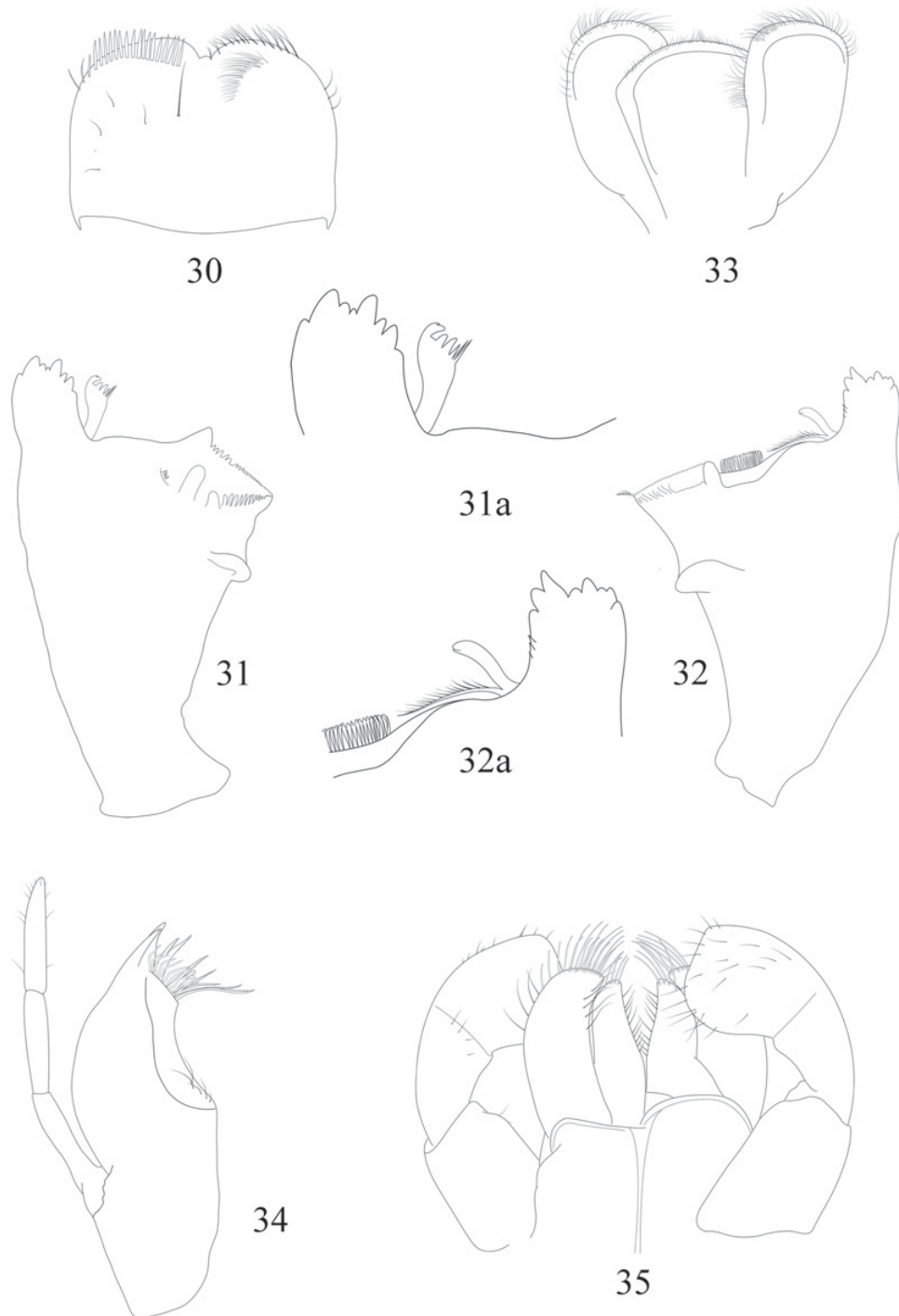


Figs. 26–29. *Aturbina georgei*, nymph. 26, Fore leg. 27, Gill IV (a, detail of margin). 28, Posterior margin of terga IV. 29, Paraproct (d.v.).

Diagnoses

Nymphs. 1) Submarginal dorsal row of setae composed of *ca.* 10 robust, spine-like setae (Fig. 20); 2) Margin between prostheca and mola without crenulations (Figs. 21); 3) Segment III of labial palp with apex truncate and broader than base (Fig. 25); 4) Hind femur with one complete brown band; 5) Body color pattern as in Figure 7.

Adults. 1) Compound eye dorsally elevated (Figs. 55 and 56); 2) Metascutellar protuberance rounded and well developed (Figs. 55 and 56); 3) Costal process truncate, with two peaks, located on basal third (Fig. 68); 4) Abdominal segments III–VI with anteromedial reddish brown mark (Figs. 54 and 55); 5) Genitalia with forceps segment I wide and forceps segment II without median constriction (Fig. 74).



Figs. 30–35. *Aturbina maculata*, sp. nov., nymph. 30, Labrum (left d.v., right v.v.). 31, Left mandible (d.v.) (a, detail of incisors and prosthema). 32, Right mandible (d.v.) (a, detail of incisors and prosthema). 33, Hypopharynx (d.v.). 34, Maxilla (v.v.). 35, Labium (left d.v., right v.v.).

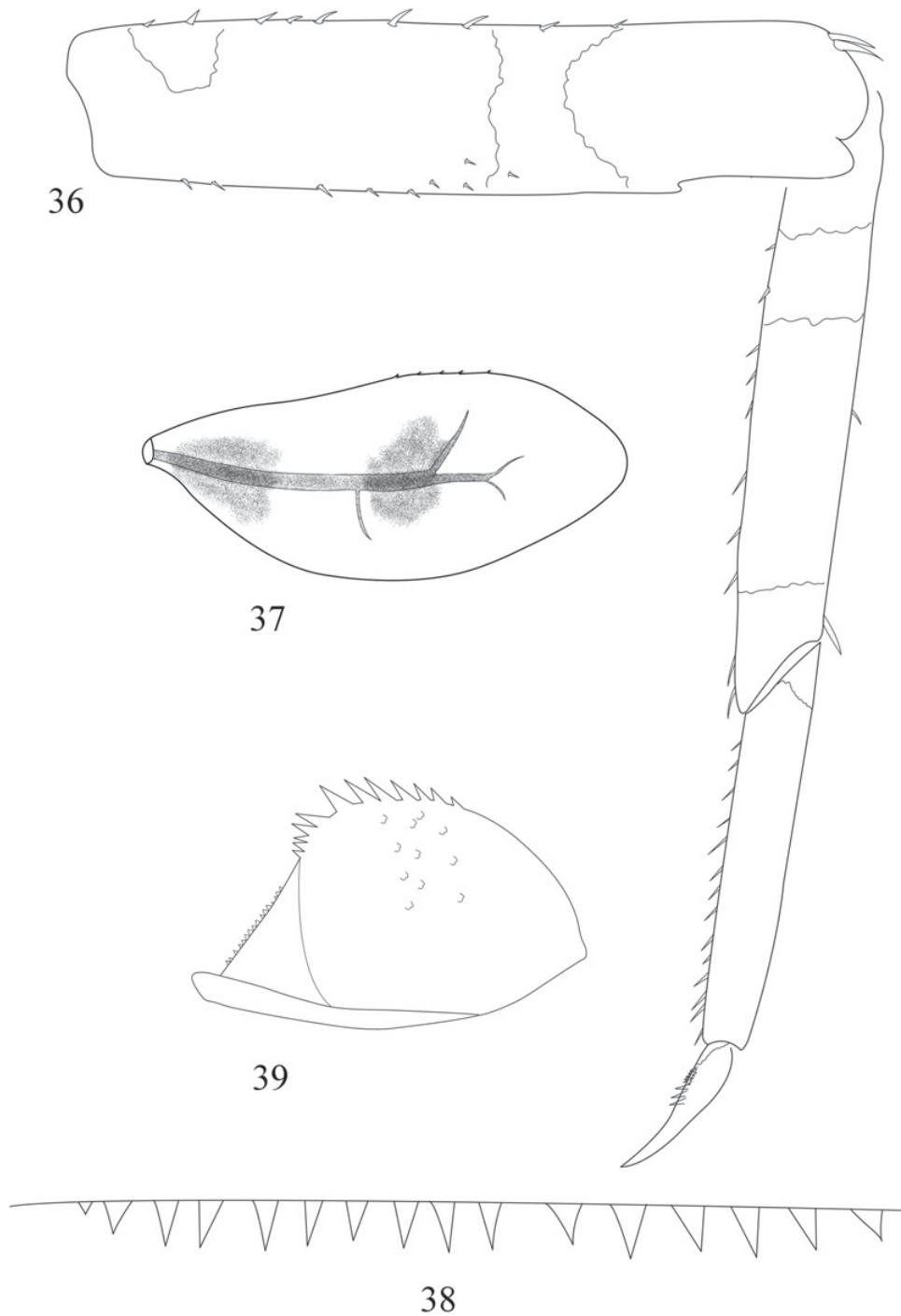
Nymph

Length. *Body:* 3.3–5.0 mm; *cerci:* 2.3 mm; *terminal filament:* 2.1 mm; *antennae:* 2.1–2.6 mm.

Head (Fig. 3). Coloration: light yellowish brown.

Antenna. Light yellowish brown, flagelum with spines and fine, simple setae on apex of each segment.

Labrum (Fig. 20). Sub-rectangular, broad than longer; length about 0.6× maximum width; dorsal surface flat; distal margin with medial emargination and small process. Dorsally with few short, fine, simple setae scattered over surface; dorsal arc of setae restricted to a single, medial, long seta; laterodorsal arc of setae composed of 1 + 1 + 1 long, spine-like setae; submarginal dorsal row of setae



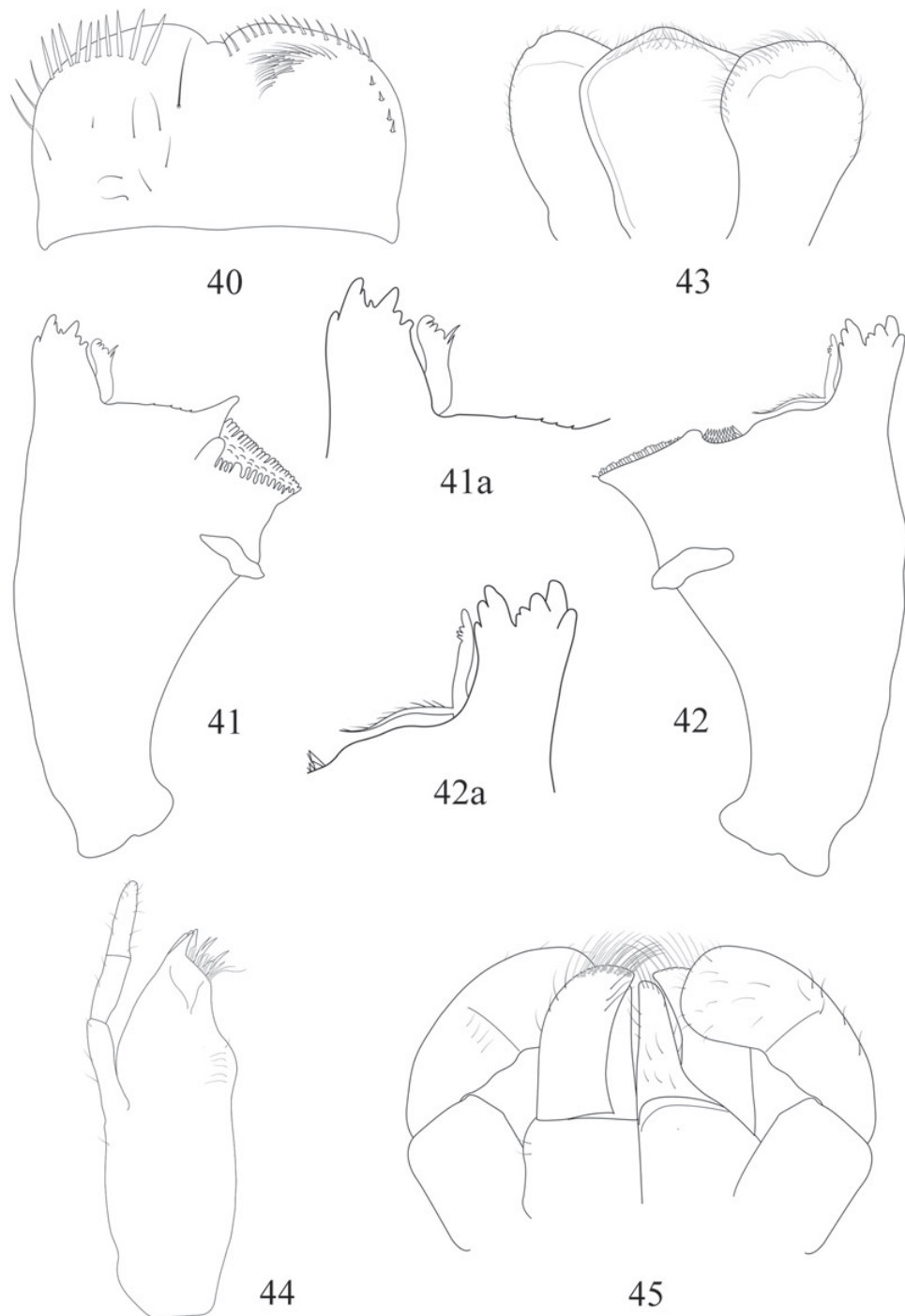
Figs. 36–39. *Aturbina maculata*, sp. nov., nymph. 36, Foreleg. 37, Gill IV. 38, Posterior margin of terga IV. 39, Paraproct (d.v.).

composed of 10–11 robust, spine-like setae; antero-lateral margin with few long, spine-like setae. Ventrally with submarginal row of setae composed of bifid and frayed setae; ventral surface with short, spine-like setae near lateral and anterolateral margin.

Left mandible (Fig. 21). Inner and outer set of incisors respectively with 4 + 4 denticles. Prosthema robust, apically denticulate and with comb-shape structure at apex. Margin between prosthema and mola slightly convex (Fig. 21a); tuft of setae absent; tuft of spine-like setae

at base of mola present, but reduced to few setae; tuft of setae at apex of mola absent. Lateral margin slightly convex.

Right mandible (Fig. 22). Inner and outer set of incisors respectively with 3 + 3 denticles. Prosthema robust, apically denticulate and with frayed and slender process at base. Margin between prosthema and mola slightly convex (Fig. 22a); tuft of setae absent; tuft of spine-like setae at base of mola present; tuft of setae at apex of mola present, reduced to a single setae. Lateral margin slightly convex.



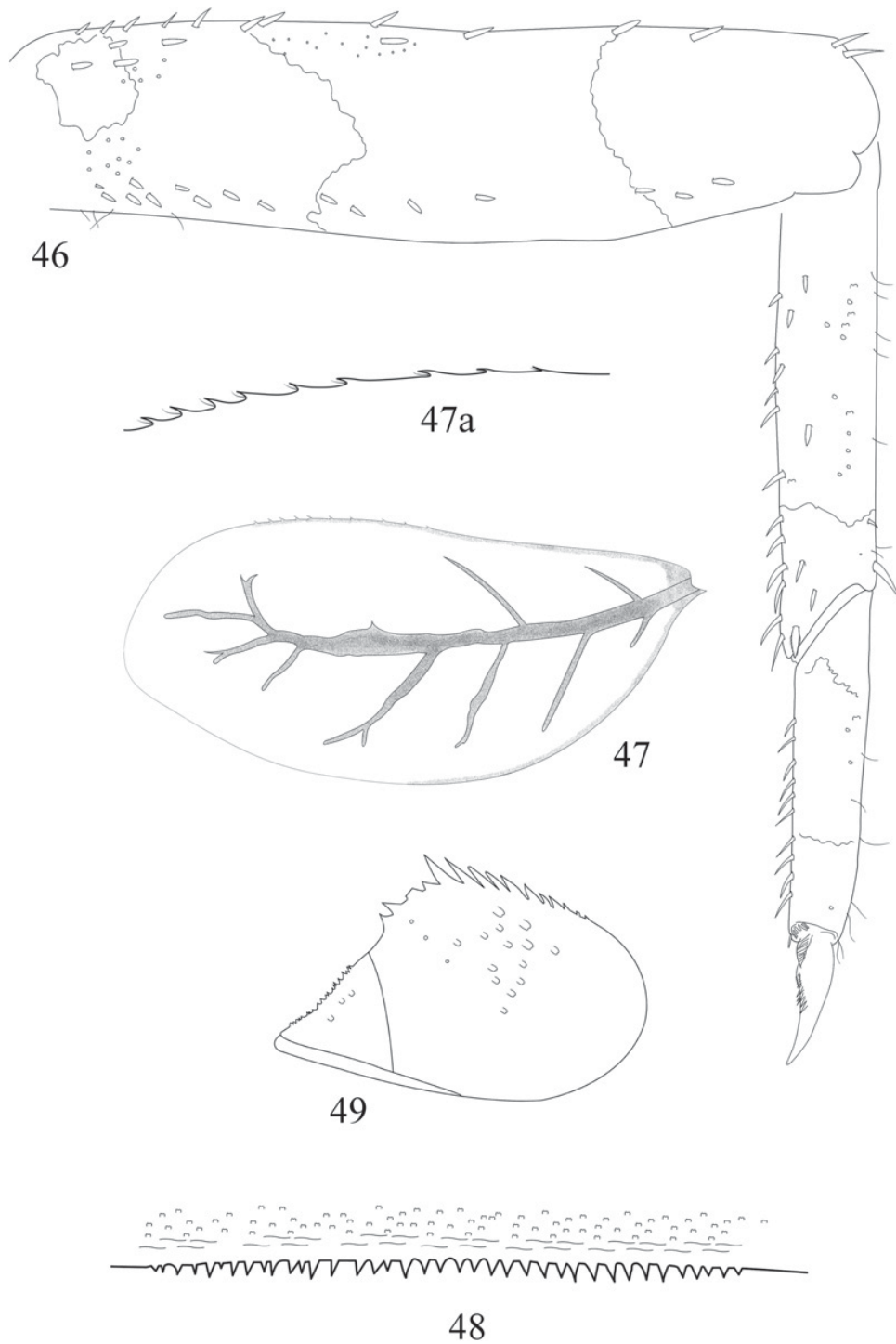
Figs. 40–45. *Aturbina nigra*, sp. nov., nymph. 40, Labrum (left d.v., right v.v.). 41, Left mandible (d.v.) (a, detail of incisors and prosthema). 42, Right mandible (d.v.) (a, detail of incisors and prosthema). 43, Hypopharynx (d.v.). 44, Maxilla (v.v.). 45, Labium (left d.v., right v.v.).

Hypopharynx (Fig. 23). Lingua subequal in length to superlingua. Apex convex; medial tuft of setae present; distal half laterally expanded. Superlingua not expanded; fine, simple setae scattered over inner and distal margin.

Maxilla (Fig. 24). Inner dorsal row of setae with two bifid denti-setae. Medial protuberance of galea with 1 spine-like seta + 3 long setae. Maxillary palp long, 1/5 longer than length of galea-lacinia; setae on maxillary

palp long, fine and simple, scattered over surface; palp segment II 1.1× length of segment I; palp segment III 0.7× length of segment II; apex of last segment smooth.

Labium (Fig. 25). Glossa basally broad, narrowing apically and subequal in length to paraglossa; inner margin with 7–8 spine-like setae increasing in length apically; apex with four long, robust, pectinate, spine-like setae; outer margin bare; ventral surface scattered with short,



Figs. 46–49. *Aturbina nigra*, sp. nov., nymph. 46, Foreleg. 47, Gill IV (a, detail of margin of gill). 48, Posterior margin of terga IV. 49, Paraproct (d.v.).

fine, simple setae. Paraglossa curved inward, apically broad; apex three rows of setae; outer margin with a row of four setae; dorsally with row of 4–5 setae increasing in length apically; ventrally with 3–4 long, spine-like setae near inner margin. Labial palp with segment I 0.6× length of segments II and III combined; segment I covered with short, simple setae and micropores; inner margin bare;

outer margin with few, short, simple setae; dorsally with row of four fine and simple setae; segment III with the apex truncate and broader than base; length 1.2× width; covered with spine-like and fine simple setae along margins and dorsal surface.

Thorax. Yellowish-brown with yellowish-white marks as in [Figure 7](#).



Figs. 50–53. *Aturbina beatrixae*, male adults 50 and 51, d.v.; 52, detail of head and thorax, l.v.; 53, detail of head, l.v.

Foreleg (Fig. 26). Yellowish, femur with a subbasal incomplete brown mark and a subapical complete brown mark; tibia with subbasal and apical brown mark. Ratio of foreleg 1.2:1.0 (0.5 mm): 0.6:0.2.

Forefemur. Length about 5.4× maximum width; dorsally with row of 6–7 spine-like setae on margin, and with few, short, spine-like setae near margin (length of setae about 0.1× maximum width of femur); apex rounded; with two long, curved, stout setae; ventrally with abundant, short, spine-like setae near ventral margin.

Tibia. Dorsally with long, spine-like seta at apex; ventrally with row of ca. 12 short, fine, spine-like setae, apex with pectinate seta; anterior surface with few short, serrate, spine-like setae; tibio-patellar suture present.

Tarsus. Dorsally with scarce short simple setae; ventrally with one row of 10 spine-like setae; tarsal claw with two rows of ca. 10 denticles increasing in size distally.

Mid and hind legs. Similar to forelegs, except for proportions of segments. Mid leg: 1.1:1.0 (0.5 mm): 0.4:0.2. Hind leg: 1.2:1.0 (0.5 mm): 0.5:0.2.

Abdomen. Yellowish-brown with yellowish-white marks as in Figure 7.

Gills (Fig. 27). Margin with broad spines intercalating short, fine, simple setae (Fig. 27a). Tracheae extending from main trunk to inner and outer margins, or with mid unpigmented area. Gill I subequal in length to segment II; oblong, apically pointed. Gill IV as long as length of segments V to VI combined; oblong, broadly pointed at apex. Gill VII subequal in length to segment VIII; oblong.

Terga. Posterior margin with regular spines, 2.5× as long as wide (Fig. 28); spines present in posterior margin of segments: II–X.

Paraproct (Fig. 29). With 14 marginal spines; surface with scales or scale-bases; postero-lateral extension with minute marginal spines.

Caudal filaments. Yellowish white, basal 3/4 light brown.

Male imago

Maximal length. Body: 4–4.3 mm; forewing: 3.4 mm; hind wing: 0.6 mm; antenna: 1.1 mm; tibia I: 1.2 mm; tibia II: 0.8 mm; tibia III: 0.8 mm.

Head (Figs. 54–56). Coloration yellowish. Antenna with scape and pedicel whitish, flagellum dark gray at base, lighter toward apex.

Compound eye. Dorsally elevated (Figs. 55 and 56).

Thorax (Figs. 54–56). Yellowish, posterior region of metanotum brown.

Scutellum above level of anteronotal protuberance.

Metascutellar process. Rounded, well developed (Figs. 55 and 56).

Legs. Whitish washed with light yellow. *Leg I:* tibia 1.5× length of femur; tarsus 0.7× length of femur; and with segments I > II > IV > III. *Legs II and III:* 1.3× length of femur, tarsus 0.4× length of femur.

Forewing (Fig. 67). Hyaline; costal vein brown, remainder veins light brown; stigmatic area with four cross veins touching and three cross veins not touching subcostal vein; marginal intercalary veins paired, absent between veins ICuA and A; length of intercalary vein between IMA and IMA2 2.2× distance between adjacent longitudinal veins; length of forewing about 2.4× width.

Hind wing (Figs. 68 and 68a). Whitish.

Abdomen. Terga segments I–VII whitish washed with light yellow. Segments VIII–X yellowish. Segments III–VI with anteromedial reddish brown mark; tracheation blackish (Figs. 54 and 55). Sterna whitish washed with light yellow.

Genitalia (Fig. 74). Forceps segment I wide. Forceps segment II without median constriction.



Figs. 54–56. *Aturbina georgei*, male adults 54, d.v.; 55, l.v.; 56, detail of head and thorax, l.v.

Female imago

Maximal length. *Body:* 3.7 mm; *tibia I:* 0.7 mm; *tibia II:* 0.8 mm; *tibia III:* 0.7 mm.

Leg I: tibia 1.1× length of femur; tarsi 0.5× length of femur; and with segments IV > I = II > III. *Legs II and III:* tibia 1.0× length of femur; tarsus 0.4× length of femur.

Distribution. Colombia, French Guyana, Paraguay, Brazil (Espírito Santo, Mato Grosso, Acre, Amazonas, Pará).

Material examined. Two nymphs, Brazil, Espírito Santo, São Mateus, Rio Preto, 10.iii.2007, 18°43.000'S/39°51.565'W, Salles, F.F. col. Five males and seven females imagos, Brazil, Espírito Santo, São Mateus, Rio Preto, 10.xi.2007, 18°43.000'S/39°51.565'W, Salles, F.F. col. Eleven nymphs, forty males and eighty-six females imagos, Brazil, Espírito Santo, Linhares, Lagoa Nova,

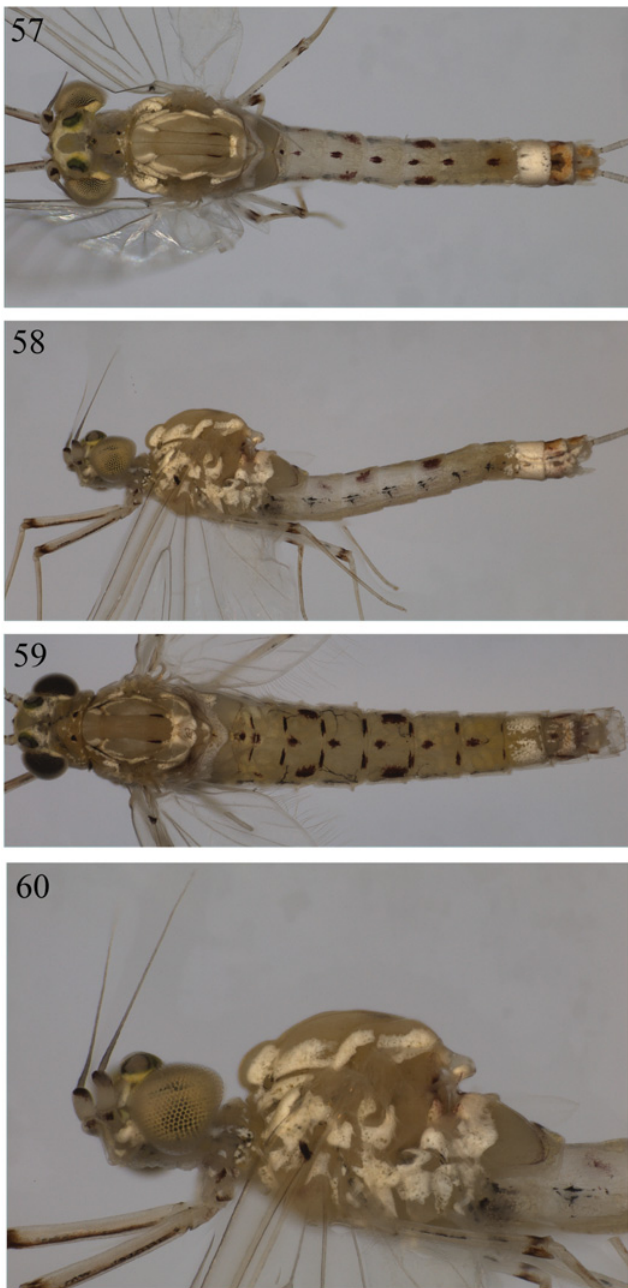
12.ix.2009, 19°25'07.2"S/40°09'26.4"W, Salles, F.F. col. Two females and two males imagos, Brazil, Espírito Santo, Reserva Biológica Sooretama, Córrego Rodrigues, 29.iv.2009, 19°01'36.6"S/40°13'39"W, Salles, F.F. col. Five nymphs, Brazil, Amazonas, Manaus, Paraná do Xiborema, 24.i.2009, Salles, F.F. and Brito, P. col. (CEUNES).

Life cycle association. Nymphs were reared to the adult stages.

***Aturbina maculata* Salles, Boldrini & Shimano, sp. nov. (Figs. 1, 4, 8, 30–39, 57–60, 69–70 and 75)**

Diagnoses

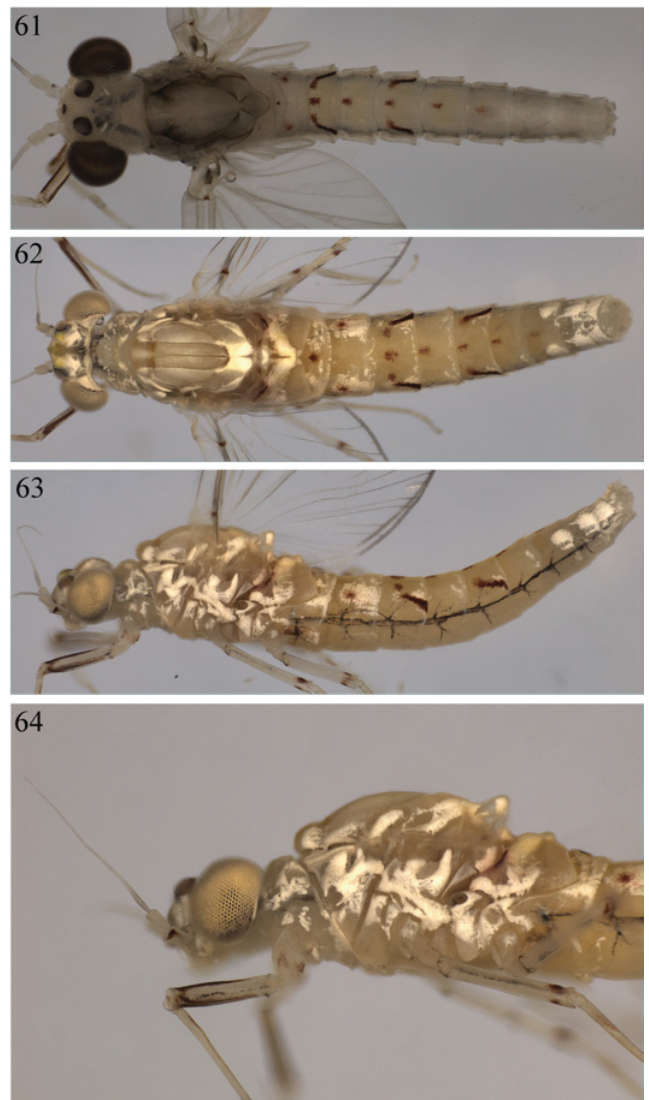
Nymphs. 1) Submarginal dorsal row of setae composed of ca. 18 robust, spine-like setae (Fig. 30); 2) Margin



Figs. 57–60. *Aturbina maculata*, sp. nov. 57, male, d.v.; 58, male, l.v.; 59, female, d.v.; 60, male, detail of head and thorax, l.v.

between prostheca and mola without crenulations (Fig. 31); 3) Segment III of labial palp with apex truncate and broader than base (Fig. 35); 4) Hind femur with one complete brown band; 5) Body color pattern as in Figure 8.

Adults. 1) Compound eye not elevated (Fig. 60); 2) Metascutellar protuberance rounded, poorly developed (Fig. 60); 3) Costal process falcate, located on basal third (Fig. 70); 4) Abdominal segments I–VII with anteromedial reddish brown mark, segments II, III and V with sublateral, circular, reddish brown mark (Figs. 57–59); 5) Genitalia with forceps segment I narrow and forceps segment II with median constriction (Fig. 75).



Figs. 61–64. *Aturbina nigra*, sp. nov. 61, male subimago d.v.; 62, female d.v.; 63, female l.v.; 64, female, detail of head and thorax, l.v.

Description

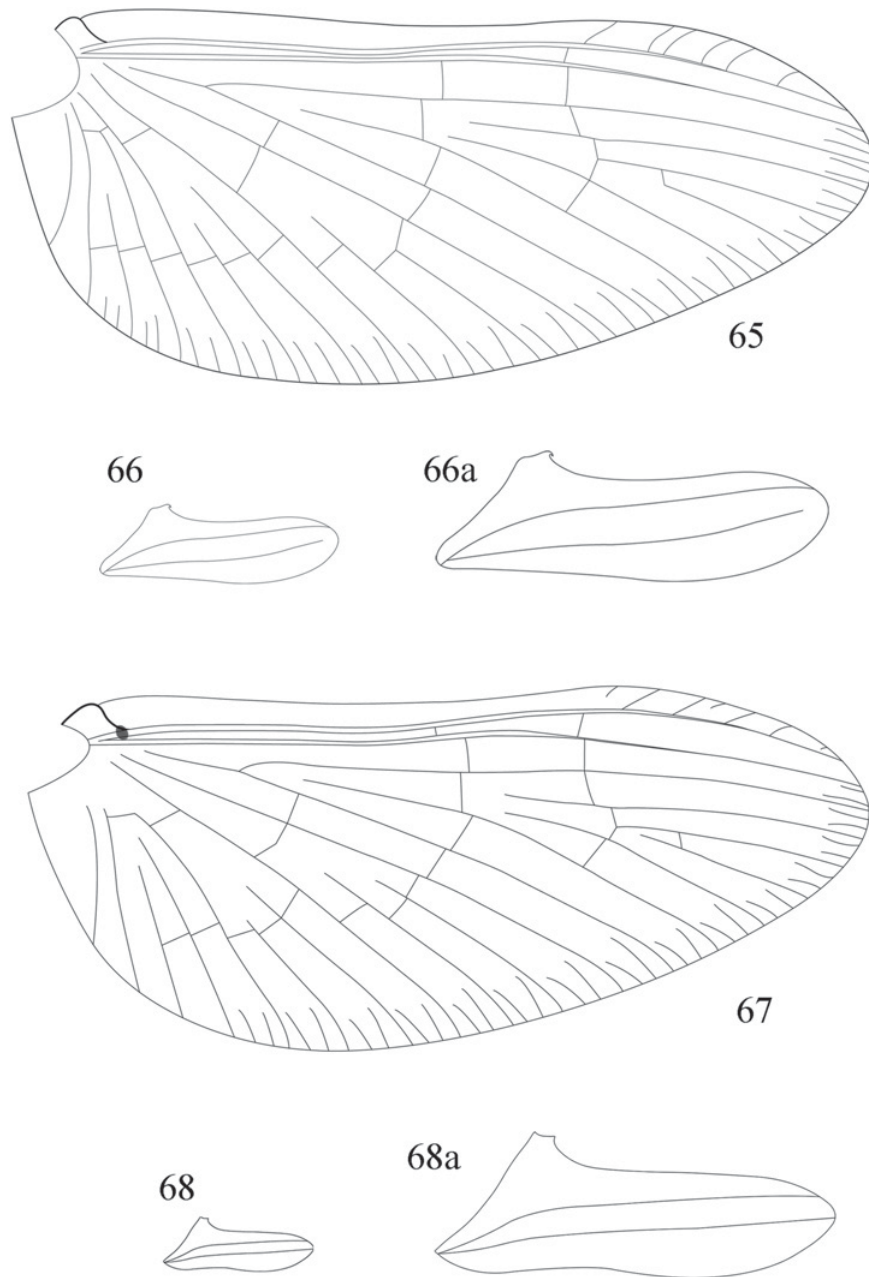
Nymph

Length. *Body:* 3.3–3.75 mm; *cerci:* broken; *terminal filament:* broken; *antennae:* broken.

Head (Fig. 4). Coloration: yellowish brown.

Antenna yellowish brown, flagelum with spines and fine, simple setae on apex of each segment.

Labrum (Fig. 30). Quadrangular; length about 0.7× maximum width; dorsal surface flat; distal margin with medial emargination and small process. Dorsally with few short, fine, simple setae scattered over surface; dorsal arc of setae restricted to a single, medial, long seta; laterodorsal arc of setae composed of 3 + 1 + 1 long, spine-like setae; submarginal dorsal row of setae composed of 17–18 robust, spine-like setae; antero-lateral margin with few long, spine-like setae. Ventrally with submarginal row



Figs. 65–68 *Aturbina* spp., wings. 65 and 66, *A. beatrixae*. 65, Forewing. 66, Hind wing (same scale as forewing) (a, enlarged). 67 and 68, *A. georgei*. 67, Forewing; 68, Hind wing (same scale as forewing) (a, enlarged).

of setae composed of bifid and frayed setae; ventral surface with short, spine-like setae near lateral and anterolateral margin.

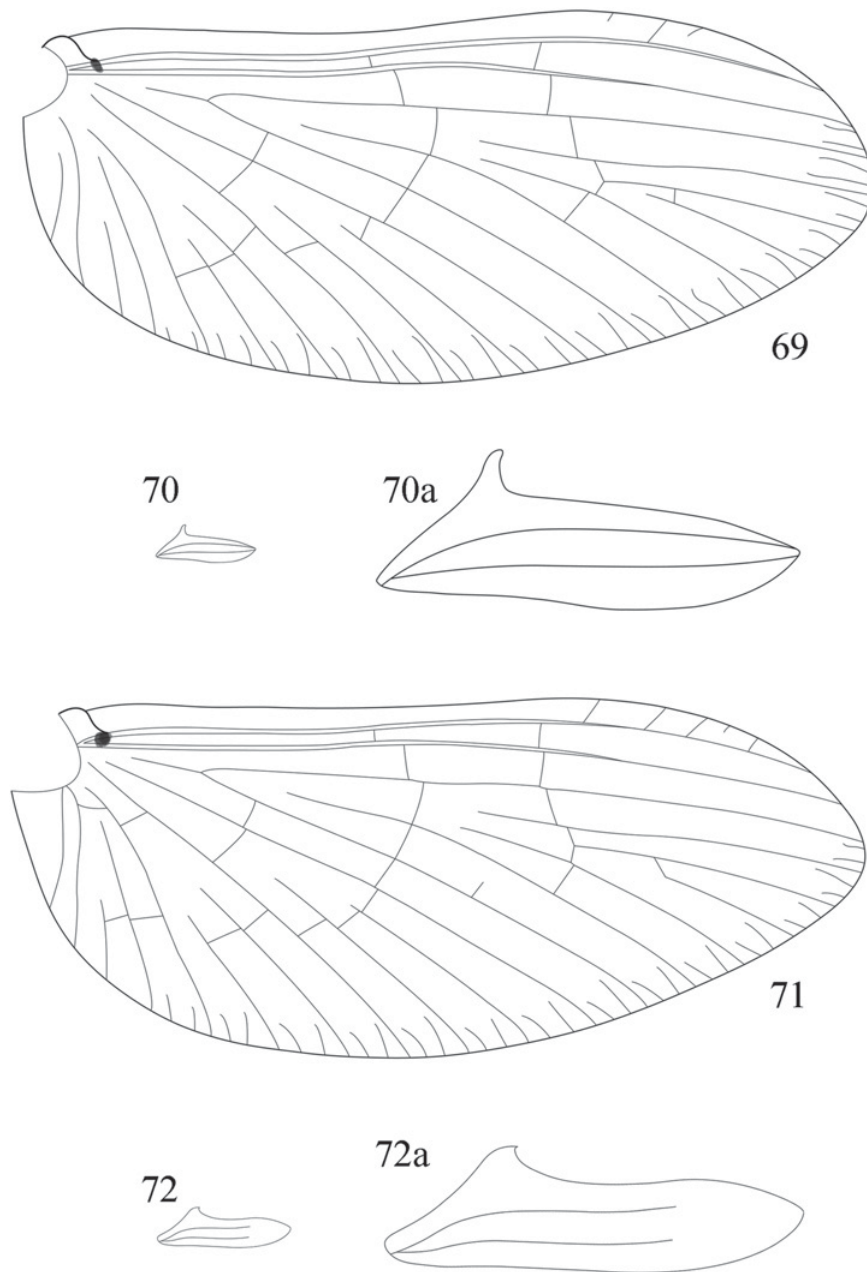
Left mandible (Fig. 31). Inner and outer set of incisors respectively with 4 + 4 denticles. Prostheca robust, apically denticulate and with comb-shape structure at apex. Margin between prostheca and mola slightly convex (Fig. 31a); tuft of setae absent; tuft of spine-like setae at base of mola present, but reduced to few setae; tuft of setae at apex of mola absent. Lateral margin slightly convex.

Right mandible (Fig. 32). Inner and outer set of incisors respectively with 3 + 4 denticles. Prostheca robust, apically denticulate and with frayed and slender process at base.

Margin between prostheca and mola slightly convex (Fig. 32a); tuft of setae absent; tuft of spine-like setae at base of mola present; tuft of setae at apex of mola present, reduced to a single frayed setae. Lateral margin slightly convex.

Hypopharynx (Fig. 33). Lingua shorter than superlingua. Apex convex; medial tuft of setae present; distal half laterally expanded. Superlingua not expanded; fine, simple setae scattered over inner and distal margin.

Maxilla (Fig. 34). Inner dorsal row of setae with two pectinate denti-setae. Medial protuberance of galea with 1 + 5 spine-like setae. Maxillary palp long, 1/5 longer than length of galea-lacinia; setae on maxillary palp long, fine



Figs. 69–72. *Aturbina* spp., wings. 69 and 70, *A. maculata*, sp. nov. 69, Forewing. 70, Hind wing (same scale as forewing) (a, enlarged). 71 and 72, *A. nigra*, sp. nov. 71, Forewing. 72, Hind wing (same scale as forewing) (a, enlarged).

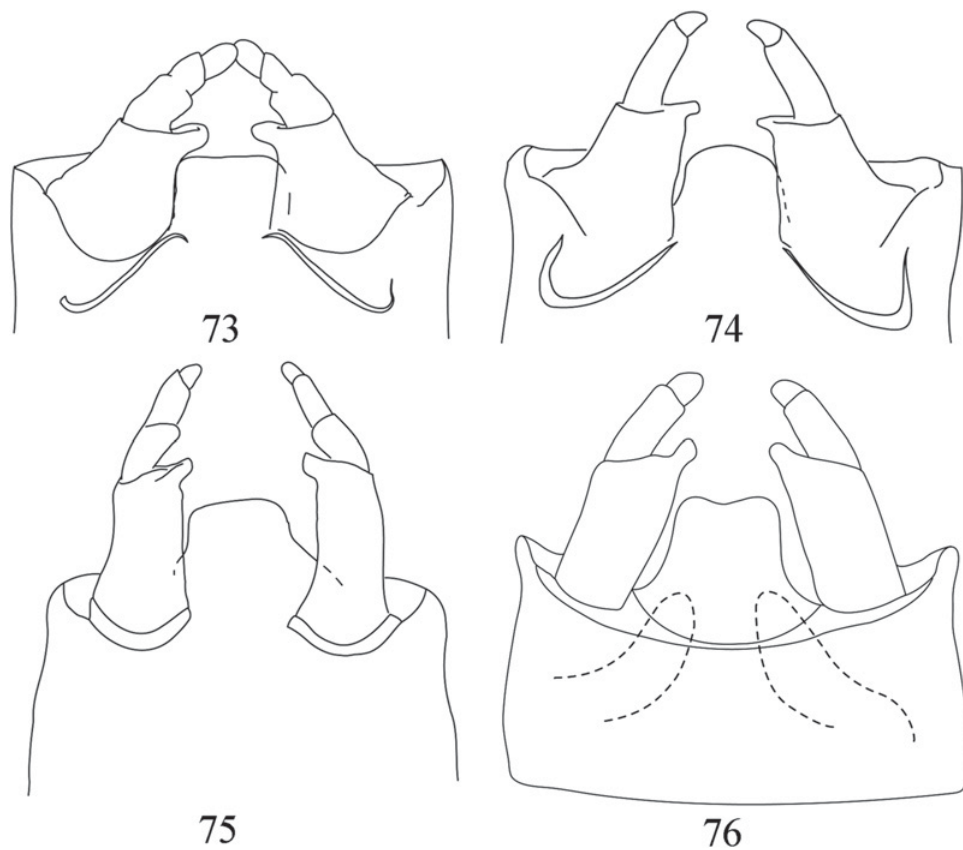
and simple, scattered over surface; palp segment II $0.8\times$ length of segment I; palp segment III $1.1\times$ length of segment II; apex of last segment smooth.

Labium (Fig. 35). Glossa basally broad, narrowing apically and subequal in length to paraglossa; inner margin with 10–14 spine-like setae increasing in length apically; apex with four long, robust, pectinate, spine-like setae; outer margin with four long, fine, simple setae; ventral surface scattered with short, fine, simple setae. Paraglossa curved inward, apically broad; apex with three rows of apically setae; outer margin with row of seven setae; dorsally with row of 4–5 setae increasing in length apically; ventrally with 3–4 long, spine-like setae near

inner margin. Labial palp with segment I $0.7\times$ length of segments II and III combined; segment I covered with short, simple setae and micropores; inner margin bare; outer margin bare; dorsally with row of four fine and simple setae; segment III with the apex truncate and broader than base; length $1.1\times$ width; covered with spine-like and fine simple setae along margins and dorsal surface.

Thorax. Yellowish-brown with yellowish-white marks as in Figure 8.

Foreleg (Fig. 36). Yellowish, femur with a subbasal incomplete brown mark and a subapical complete brown mark; tibia with subbasal brown mark and apical dark brown mark. Ratio of foreleg 1.3:1.0 (0.7 mm): 0.6:0.2.



Figs. 73–76. *Aturbina* spp., male genitalia. 73, *A. beatrixae*. 74, *A. georgei*. 75, *A. maculata*, sp. nov. 76, *A. nigra*, sp. nov.

Forefemur. Length about $4.5\times$ maximum width; dorsally with row of *ca.* 10 spine-like setae on margin, and with few, short, spine-like setae near margin; length of setae about $0.1\times$ maximum width of femur; apex rounded; with two long, curved, stout setae; ventrally with abundant, short, spine-like setae near ventral margin.

Tibia. Dorsally with long, spine-like seta at apex; ventrally with row of *ca.* 12 short, fine, spine-like setae, apex with pectinate seta; anterior surface with many short, robust, spine-like setae; tibio-patellar suture present.

Tarsus. Dorsally bare; ventrally with one row of *ca.* 13 spine-like setae; tarsal claw with two rows of denticles increasing in size distally.

Mid and hind legs. Similar to foreleg, except for proportion of segments. Mid leg: 1.3:1.0 (0.7 mm): 0.5:0.2. Hind leg: 1.4:1.0 (0.6 mm): 0.6:0.2.

Abdomen. Yellowish-brown with yellowish-white marks as in Figure 8.

Gills (Fig. 37). Margin with few broad spines intercalating short, fine, simple setae. Tracheae restricted to main trunk with two distinct marks. Gill I subequal in length to segment II; oblong, apically pointed. Gill IV as long as length of segments V to VI combined; oblong, broadly pointed at apex. Gill VII as long as length of segments VIII to IX; oblong.

Terga. Posterior margin with regular spines, $1.5\times$ as long as wide (Fig. 38); spines present in posterior margin of segments: II–X.

Paraproct (Fig. 39). With 14 marginal spines; surface with scales or scale-bases; postero-lateral extension with minute marginal spines.

Male imago

Maximal length. *Body:* 2.8–4.3 mm; *forewing:* 2.8–4.3 mm; *hind wing:* 0.4 mm; *antenna:* 1.9 mm; *tibia I:* 0.8 mm; *tibia II:* 0.6 mm; *tibia III:* 0.5 mm.

Head (Figs. 57–60). Coloration whitish. Ocellus whitish with inner margin greenish. Antenna whitish; scape washed with reddish brown, pedicel reddish brown at apex, flagellum washed with brown.

Compound eye. Not elevated (Fig. 60).

Thorax (Figs. 57–60). Whitish washed with light brown. Pronotum with submedial reddish brown mark; mesonotum with reddish brown band on posterior region of medioparapsidal suture.

Scutellum. Above level of anteronotal protuberance.

Metascutellar protuberance. Rounded, poorly developed (Fig. 60).

Legs. Whitish, tibiae and tarsi washed with light brown. Fore femora with inner margin reddish brown, apex of femora and tibiae reddish brown. *Leg I:* tibia $1.3\times$ length of femur; tarsi $0.6\times$ length of femur; and with four segments decreasing in length distally. *Legs II and III:* tibia $1.1\times$ length of femur, tarsus $0.4\times$ length of femur.

Forewing (Fig. 69). Hyaline, with a reddish brown mark at junction of costal brace, and subcostal veins light brown; stigmatic area with one cross vein touching subcostal vein and three veins not touching subcostal vein; marginal intercalary paired, absent between veins ICuA and A; length of intercalary vein between IMA and IMA2 $2.2\times$ distance between adjacent longitudinal veins; length of forewing about $2.4\times$ width.

Hind wing (Figs. 70 and 70a). Whitish, costal process falcate, located on basal third.

Abdomen (Figs. 57–59). Terga whitish washed with light brown. Segments I–VII with anteromedial reddish brown mark, segments II, III and V with sublateral, circular, reddish brown mark; tracheation blackish. Sterna whitish washed with light brown. Caudal filaments broken and lost.

Genitalia (Fig. 75). Forceps segment I narrow. Forceps segment II with median constriction.

Female imago

Maximal length. *Body*: 3.2–3.3 mm; *forewing*: 4.4–4.7 mm; *hind wing*: 0.7 mm; *antenna*: 1.8 mm; *tibia I*: 0.6 mm; *tibia II*: 0.6 mm; *tibia III*: 0.5 mm.

Leg I: tibia $1\times$ length of femur; tarsi $0.7\times$ length of femur; and with segments I > II > IV > III. *Legs II and III*: tibia $1.0\times$ length of femur; tarsi $0.4\times$ length of femur.

Etymology. From the Latin word *macula*, meaning spot, spotted. Due to the distinctive circular pigmented area on abdominal segments III and V of adults and mature nymph.

Comments. Two male imagos of *Aturbina* were collected at the Reserva Florestal Adolfo Ducke, Manaus, which presented small body size and extremely reduced hind wings with costal process located on $\frac{1}{2}$ of anterior margin (Fig. 70). At first sight these specimens were considered as belonging to a third new species. However, as they presented the same color pattern and morphology of male forceps, and were collected at the same place (just in different years), they were considered as a variation of *A. maculata*, sp. nov.

Distribution. Brazil (Amazonas).

Material examined. **Holotype:** Nymph, Brazil, Amazonas, Manaus, Reserva Florestal Adolpho Ducke, Igarapé Barro Branco, 21.i.2010, $02^{\circ}53'S/59^{\circ}58'W$, Salles, F.F.; Boldrini, R. and Cruz, P.V. col. **Paratypes:** Three nymphs, five male and four female imagos, four male and four female subimagos, same data as holotype (INPA). Two males, Brazil, Amazonas, Manaus, Reserva Adolpho Ducke, Igarapé Barro Branco, 14.i.2007, $02^{\circ}53'S/59^{\circ}58'W$, Salles, F.F. and Falcão, J.N. col. One female imago, Brazil, Amazonas, Presidente Figueiredo, AM 240, KM 20, 21.i.2009, $02^{\circ}05'57''S/60^{\circ}01'02''W$, Salles, F.F. col. (CEUNES).

Life cycle association. Nymphs and adults were collected at the same place and share the same color pattern (the distinctive circular pigmented area on abdominal segments III and V).

Aturbina nigra Salles, Boldrini & Shimano, sp. nov.

(Figs. 1, 5, 9, 40–49, 61–64, 71–72 and 76)

Diagnoses

Nymphs. 1) Submarginal dorsal row of setae composed of ca. 10 robust, spine-like setae (Fig. 40); 2) Margin between prostheca and mola with crenulations (Fig. 41); 3) Segment III of labial palp with apex as wide as base (Fig. 45); 4) Hind femur with two complete brown bands; 5) Body color pattern as in Figure 9.

Adults. 1) Compound eye not elevated (Figs. 63 and 64); 2) Metascutellar protuberance rounded, poorly developed (Figs. 63 and 64); 3) Costal protuberance truncate, located on basal third (Fig. 72); 4) Abdominal segments I and III–VII with anteromedial reddish brown mark, segment II with submedial rounded reddish brown mark, segments III and V with sublateral, oblique, reddish brown mark (Figs. 61–63); 5) Genitalia with forceps segment I wide and forceps segment II without median constriction (Fig. 76).

Description

Nymph

Length. *Body*: 3.5–4.1 mm; *cerci*: broken; *terminal filament*: broken; *antennae*: broken.

Head (Fig. 5). Coloration: dark brown, vertex with yellowish-white marks and area between base of antennae yellowish-white.

Antenna. Scape and pedicel dark brown, flagellum brown, paler toward apex, flagellum with spines and fine, simple setae on apex of each segment.

Labrum (Fig. 40). Rectangular; broader than long; length about $0.5\times$ maximum; dorsal surface medially raised; distal margin with medial emargination and small process. Dorsally with few short, fine, simple setae scattered over surface; dorsal arc of setae restricted to a single, medial, long seta; laterodorsal arc of setae composed of 3 + 0 long, spine-like setae; submarginal dorsal row of setae composed of 10–11 robust, spine-like setae; anterolateral margin with few long, spine-like setae. Ventrally with submarginal row of setae composed of bifid and frayed setae; ventral surface with short, spine-like setae near lateral and anterolateral margin.

Left mandible (Fig. 41). Inner and outer set of incisors respectively with 4 + 4 denticles. Prostheca robust, apically denticulate and with comb-shape structure at apex. Margin between prostheca and mola slightly convex (Fig. 41a); with crenulations; tuft of setae absent; tuft of spine-like setae at base of mola present, but reduced to few setae; tuft of setae at apex of mola absent. Lateral margin slightly convex.

Right mandible (Fig. 42). Inner and outer set of incisors respectively with 3 + 4 denticles. Prostheca robust, apically denticulate and with frayed and slender process at base.

Margin between prostheca and mola slightly convex (Fig. 42a); tuft of setae absent; tuft of spine-like setae at base of mola present; tuft of setae at apex of mola present, reduced to a single setae. Lateral margin slightly convex.

Hypopharynx (Fig. 43). Lingua subequal in length to superlingua. Apex with anteromedial lobe rounded; medial tuft of setae present; distal half laterally expanded. Superlingua not expanded; fine, simple setae scattered over inner and distal margin.

Maxilla (Fig. 44). Inner dorsal row of setae with two pectinate denti-setae. Medial protuberance of galea with 1 spine-like seta + 5 long setae. Maxillary palp 3/4 length of galea-lacinia; setae on maxillary palp long, fine and simple, scattered over surface; palp segment II 0.7× length of segment I; palp segment III 1.1× length of segment II, apex of last segment smooth.

Labium (Fig. 45). Glossa basally broad, narrowing apically and subequal in length to paraglossa; inner margin with five spine-like setae increasing in length apically; apex with three long, robust, pectinate, spine-like setae; outer margin with four long, fine, simple setae; ventral surface scattered with short, fine, simple setae. Paraglossa curved inward, apically broad; apex with three rows of pectinate setae; outer margin with a row of four setae; dorsally with row of 4–5 setae increasing in length apically; ventrally with four long, fine and simple setae near inner margin. Labial palp with segment I 0.6× length of segments II and III combined; segment I covered with short, simple setae and micropores; inner margin bare; outer margin bare; dorsally with row of four fine and simple setae; segment III with the apex truncate and as broad as base; length 1.1× width; covered with spine-like and fine simple setae along margins and dorsal surface.

Thorax. Dark brown with yellowish marks as in Figure 9.

Foreleg (Fig. 46). Yellowish, femur with a subbasal and subapical complete dark brown marks; tibia with subbasal and apical dark brown mark. Ratio of foreleg 1.4:1.0 (0.7 mm): 0.6:0.2.

Forefemur. Length about 4.0× maximum width; dorsally with row of *ca.* 10 spine-like setae on margin, and with few, short, spine-like setae near margin; length of setae about 0.1× maximum width of femur; apex rounded; with two long, curved, stout setae; ventrally with abundant, short, spine-like setae near ventral margin.

Tibia. Dorsally with long, spine-like seta at apex; ventrally with row of *ca.* 12 short, fine, spine-like setae, apex with pectinate seta; anterior surface with few short, serrate, spine-like setae; tibio-patellar suture present.

Tarsus. Dorsally with scarce short simple setae; ventrally with one row of 10 spine-like setae; tarsal claw with two rows of *ca.* 10 denticles increasing in size distally.

Mid and hind legs. Similar to forelegs, except for two complete bands on hind femur and proportion of segments. *Mid leg:* 1.4:1.0 (0.7 mm): 0.4:0.2. *Hind leg:* 1.4:1.0 (0.7 mm): 0.5:0.1.

Abdomen. Dark brown with yellowish marks as in Figure 9.

Gills (Fig. 47). Margin with narrow spines intercalating short, fine, simple setae (Fig. 47a). Tracheae extending from main trunk to inner and outer margins, or with mid unpigmented area. Gill I subequal in length to segment II; oblong, apically pointed. Gill IV as long as length of segments V to VI combined; oblong, apically pointed. Gill VII as long as length of segments VIII to IX; oblong, apically pointed.

Terga. Posterior margin with regular spines, 1.4× as long as wide (Fig. 48); spines present in posterior margin of segments: I–X.

Paraproct (Fig. 49). With 14 marginal spines; surface with scales or scale-bases and micropores; postero-lateral extension with minute marginal spines.

Caudal filaments. Yellowish brown, basal 3/4 dark brown, apical 3/4 yellowish.

Male imago

Maximal length. *Body:* 3.1 mm; *forewing:* 3.4–5.3 mm; *hind wing:* 0.7 mm; *antenna:* 1.6 mm; *tibia I:* 0.9 mm; *tibia II:* 0.6 mm; *tibia III:* 0.6 mm.

Head (Fig. 61). Coloration whitish. Ocellus whitish with basal area black. Antenna whitish. Scape reddish brown at apex, flagelum washed with light brown.

Compound eye not elevated (Figs. 63 and 64).

Thorax (Fig. 61). Whitish washed with light brown.

Scutellum. Above level of anteronotal protuberance.

Metascutellar protuberance rounded, poorly developed (Figs. 63 and 64).

Legs. Whitish, tibiae and tarsi washed with light brown. Fore femora with inner and outer margin reddish brown, apex of femora and tibiae reddish brown. *Leg I:* tibia 1.4× length of femur; tarsus 0.6× length of femur; and with segments I > IV > II > III. *Legs II and III:* tibia 1.1× length of femur, tarsus 0.3× length of femur.

Forewing (Fig. 71). Hyaline, with reddish brown spot at junction of costal brace and subcostal vein; veins light brown; stigmatic area with four cross veins touching subcostal vein and one not touching; marginal intercalary veins paired, absent between veins ICuA and A; length of intercalary vein between IMA and IMA2 1.6× distance between adjacent longitudinal veins; length of forewing about 2.4× width.

Hind wing (Figs. 72 and 72a). Whitish, with two incomplete longitudinal veins; costal process truncate, located on basal third.

Abdomen (Figs. 61–63). Terga whitish washed with yellowish light brown. Segments I and III–VII with anteromedial reddish brown mark, segment II with sub-medial rounded reddish brown mark, segments III and V with sublateral, oblique, reddish brown mark; tracheation blackish. Sterna whitish washed with light brown. Caudal filaments broken and lost.

Genitalia (Fig. 76). Forceps segment I wide. Forceps segment II without median constriction.

Female imago

Maximal length. *Body*: 3.2–3.9 mm; *forewing*: 5.5 mm; *antenna*: 1.2 mm; *tibia I*: 0.5 mm; *tibia II*: 0.53 mm; *tibia III*: 0.54 mm.

Leg I: tibia 1.1× length of femur; tarsi 0.4× length of femur; and with segments IV > I = II > III. *Legs II and III*: tibia 1.0× length of femur; tarsus 0.3× length of femur.

Etymology. From the Latin word *nigra*, due to the dark coloration of the nymphs.

Distribution. Brazil (Amazonas, Mato Grosso, Roraima).

Material examined. Holotype: Nymph, Brazil, Amazonas, Manaus, Reserva Florestal Adolpho Ducke, Igarapé Barro Branco, 21.i.2010, 02°53'S/59°58'W, Salles, F.F.; Boldrini, R. and Cruz, P.V. col. (INPA). **Paratypes:** One nymph, one male and one female imagos. Two nymphs, Brazil, Amazonas, Barcelos, Serra do Aracá, Igarapé Cobra, 5.viii.2009, 0°52'34.21"N/63°27'3.60"W, Salles, F.F. col. Four nymphs, Brazil, Amazonas, Barcelos, Serra do Aracá, tributary of Demeni River, 9.viii.2009, 0°21'19.91"S/62°45'56.27"W, Salles, F.F. col. One male and one female imagos, Brazil, Amazonas, Presidente Figueiredo, Igarapé Pantera, 20.i.2009, 02°00'52"S/60°01'43"W, Salles, F.F. col (INPA). One female imago (reared), Brazil, Amazonas, Manaus, Br. 174, km 18.5, 28.i.2009, 02°49'1.5"S/60°2'7.5"W, Salles, F.F. col. Four nymphs, Brazil, Roraima, 13.vi.2004, 4°26'43.26"N/61°07'27.48"W, Salles, F.F. col. One nymph, Brazil, Amazonas, Manaus, Igarapé na estrada do Turismo, mata do Aeroporto, 0825700S/9663348W. One nymph, Brazil, Mato Grosso, Barra do Garças, Córrego Taquaral, 15.i.2005, 15°41'57"S/52°19'56"W, Cabette, H.S.R. and Genevro, D. col. One nymph, Brazil, Mato Grosso, Querência, Córrego Lúcio, 27.ix.2007, 13°05'34, 5"S/52°15'16.9"W, Shimano, Y. and Cabette, H.S.R. col. Three nymphs, Brazil, Amazonas, Manaus, Br 174, km 18.5, 20.i.2009, Salles, F.F. col. One nymph, Brazil, Mato Grosso, Querência, Rio Suiá-Miçú, 18.xii.2007, 11°50'17. 8"S/52°15'07.5"W Shimano, Y. and Cabette, H.S.R. col. (CEUNES).

Life cycle association. Nymphs were reared to the adult stage.

Key to nymphs

1. Segment III of labial palp not enlarged, with apex as wide as base (Fig. 45); anterior surface of mid and hind femora with two complete brown bands; nymphs dark colored (as in Fig. 9)..... *A. nigra*, sp. nov.

1'. Segment III of labial palp enlarged, with apex wider than base (Figs. 15, 25 and 35); anterior surface of mid and hind femora with one complete brown band; nymphs light colored (as in Figs. 6–8)..... 2

2(1'). Margin between prosthema and mola of mandibles with crenulations (Fig. 11)..... *A. beatrixae*

2'. Margin between prosthema and mola of mandibles without crenulations (Figs. 21 and 31) 3

3(2'). Labrum with a submarginal dorsal row of setae composed of 10–11 robust, spine-like setae (Fig. 20); Gills elongate, more than two times length of respective segment; abdominal color pattern of mature nymphs without distinct circular reddish marks on segments III and V (Fig. 7) *A. georgei*

3'. Labrum with a submarginal dorsal row of setae composed of 17–18 robust, spine-like setae (Fig. 30); Gills not elongate, less than two times length of respective segment; abdominal color pattern of mature nymphs with distinct circular reddish marks on segments III and V (Fig. 8)..... *A. maculata*, sp. nov.

Key to adults

1. Segment II of forceps constricted, appearing two segmented (Figs. 73 and 75) 2

1'. Segment II of forceps not constricted (Figs. 74 and 76)..... 3

2(1). Thorax distinctively washed with brown (Figs. 50–52); metascutellar protuberance pointed (Fig. 52); abdominal segments lacking marks; compound eyes elevated dorsally (Figs. 52 and 53); costal process of hind wing truncate and compound (Figs. 66 and 66a)..... *A. beatrixae*

2'. Thorax coloration not as above (Figs. 57–60); metascutellar protuberance rounded (Fig. 60); abdominal segments with anteromedial reddish brown marks (Figs. 57–59); compound eyes not elevated dorsally (Fig. 60); costal process of hind wing falcate (Figs. 70 and 70a)..... *A. maculata*, sp. nov.

3(1'). Lateral reddish marks on abdominal segments III and IV oblique and elongate (Figs. 61–63); compound eyes not elevated dorsally (Figs. 63 and 64)..... *A. nigra*, sp. nov.

3'. Lateral reddish marks on abdominal segments III and IV rounded and barely discernible (Figs. 54 and 55); compound eyes elevated dorsally (Figs. 55 and 56)..... *A. georgei*.

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