

9º ARTIGO

Amanahyphes saguassu: a new genus and species of Leptohyphidae (Ephemeroptera: Ephemerelloidea) from Northern Brazil

F. F. SALLES¹ & C. MOLINERI²

¹Museu de Entomologia, Departamento de Biologia Animal, Universidade Federal de Viçosa, MG, Brazil, and ²INSUE-CONICET-Facultad de Ciencias Naturales, Universidad Nacional de Tucumán, Argentina.

Abstract

Amanahyphes saguassu gen. et sp. nov. is described and illustrated from all life stages from the Amazon basin. This is the second known genus in Leptohyphidae to show divided eyes in the male, a rather infrequent characteristic in the family. Some defining characters of this new taxon include: adults dipterous, forewings with Cu-A lobe not enlarged, forceps bisegmented, and nymphs slender with very long legs, abdominal gills on segments II-V, and subquadrate operculate gills on abdominal segment II.

Keywords: *Amanahyphes saguassu*, new genus, taxonomy, Amazonia, Neotropics.

Correspondence: Frederico Falcão Salles, Universidade Federal de Viçosa, Museu de Entomologia, Departamento de Biologia Animal, CEP 36570-000, Viçosa, Minas Gerais, Brasil. Fax: +55 31 3899 2537. Email: ffsalles@gmail.com

Introduction

The family Leptohyphidae (Ephemeroptera) is endemic to the Western Hemisphere and one of the most representative groups of mayflies in South America. All the leptohyphid genera (Molineri & Zúñiga, 2004, Emmerich, 2004) are represented in South America, whereas *Leptohyphes*, *Leptohyphodes*, *Traverhyphes*, *Tricorythodes*, and *Tricorythopsis* are recorded from Brazil (Molineri, 2004, Salles et al., 2004).

Recently, during field trips in the city of Manaus and in bordering areas of Brazil's Amazon Basin, an unusual nymph of Leptohyphidae with enlarged eyes was found. After associating these nymphs with adults presenting that same characteristic, we concluded that they represent a new genus and species.

In the present paper *Amanahyphes saguassu* gen. et sp. nov., is described based on eggs, nymphs and adults to include these specimens.

Material and methods

Material was preserved in 75% ethanol. Body parts of nymphs and adults were mounted on microscope slides in Canada balsam and drawn with a camera lucida attached to a stereo microscope. Eggs were extracted from a mature nymph, dehydrated in a graded ethanol series, dried by critical point-method, and mounted on SEM stubs and sputter coated with gold; then observed and photographed with Leo VP 1430 scanning electron microscope. Terms used in descriptions of thorax are from Kluge (1992, 2004). Material deposition is abbreviated as follows: Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil (INPA), Instituto-Fundación Miguel Lillo, Tucúman, Argentina (IFML).

Amanahyphes Salles & Molineri, gen. nov.

Type species: *Amanahyphes saguassu* Salles & Molineri, sp. nov.

Included species: *Amanahyphes saguassu* Salles & Molineri, sp. nov.

Distribution: Northern Brazil (Amazon basin)

Imago. All appendages broken-off and lost; wings and body damaged. Male genitalia: forceps two-segmented, segments subequal in length, distal segment distally pointed (fig. 9); styliger plate posteriorly projected, forming a columnar base for each forceps (this may be confused with an additional forceps segment); penes dorsoventrally

flattened, distal portion somewhat rounded laterally, with a median incision; lateral margins with many tiny spines on ventral side (fig. 9). Female imago unknown.

Subimago. Length of male: body, 2.8-3.5 mm; forewings, 3.5-3.9 mm. Length of female: body, 3.0-3.6 mm; forewings, 3.5-4.2. Head. Eyes of male enlarged, divided in large upper and small lower portions (figs. 1-3); eyes of female undivided (fig. 4). Antennae: scape short, pedicel 2.6 times length of scape; flagellum 6.7 times length of pedicel. Thorax (fig. 5). Mesonotum with anterior and posterior parapsidal sutures running independently until transversal interscutal suture; sulcus absent; membranous filaments of mesoscutellum present, long. Wings. Hind wings absent in both sexes. Forewings (figs. 6-7) without enlarged cubito-anal lobe, similar in both sexes; longitudinal veins IMP and MP₂ subequal in length, MP fork absent (MP₂ ending free in membrane); vein ICu₁ long and almost fused with CuP basally (almost forming a triad); vein CuP recurved and basally joined to vein A. Legs. Ratios of male and female fore, middle and hind femora, 1 (0.55–0.6mm): 1.3 : 1.2. Ratios of tibiae and tarsi (combined) of male, 1 (0.75-0.8mm): 1.3 : 1.3–1.6, and of female 1 (0.9mm): 1.3 : broken-off and lost. First tarsal segment partially fused with tibiae; tibiae not projected distally; tarsal claws of a pair dissimilar, one blunt and one apically hooked. Abdomen. Genitalia: forceps two-segmented, short, penes with small apical furrow. Caudal filaments [broken-off and lost in female] shorter than body, cerci shorter than terminal filament, covered with small setae.

Eggs (figs. 41-43). Length: 168 µm. Maximum width: 78 µm. Ovoid, one polar cap present, polar cap (fig. 43) apically blunt or pointed. Egg surface completely covered by scale-like imbricated plates, these plates subrectangular to subtriangular with margins slightly elevated. On the uncapped pole a cap-like structure present, formed by 6 large triangular plates tightly joined (fig. 42). Relatively long adhesive filaments present, scattered on egg surface, attached between the chorionic plates (more numerous on uncapped pole) (fig. 42).

Mature nymph (fig. 10). Length of male: body, 3.4 mm; mesonotum, 0.7 mm; caudal filaments, 1.9 mm. Length of female: body, 3.4 mm; mesonotum, 0.6 mm; caudal filaments, 1.7 mm. Body relatively long and slender without tubercles. Head hypognathous. Antennae: scape and pedicel thin, slightly wider than flagellum; scape

1/3 length of pedicel, flagellum slightly longer than head. Mouthparts (figs. 11-20). Clypeus and labrum of subequal width, anteromedian emargination of labrum shallow (fig. 11). Hypopharynx (fig. 12): lingua subrectangular with slightly concave anterior margin. Mandibles (figs. 13, 15, 29-32) with weakly curved outer margin and with a large ventral concavity near the apex; outer canines 4-pointed, inner canines 2-pointed (both with ventral brushes of small setae, fig. 30); left prosthema figs. 14, 32) with stout base and 7 plumose setae apically, right prosthema slender with 3-4 plumose setae. Maxillae (fig. 16, 33) long and slender, outer margin with thin setae on basal half; inner margin with a row of 5 marginal and 1 ventral long setae; galea and lacinia separated by a thin line; apex of galea (fig. 19) with 2 canines and with a brush of less than 20 curved setae; apex of lacinia with 1 canine, and with 7 sharp setae (2 larger than the rest, dentisetae) on the distomedial margin; maxillary palpi setiform located on a tiny palpifer (figs. 17-18). Labium (figs. 20-21): submentum laterally rounded with anterolateral corners projected and margins fringed with setae; prementum small, wider at base, glossae and paraglossae slightly differentiated (fig. 21); palpi 3-segmented, apical segment constricted at middle. Thorax. Pronotum sub-cylindrical, small, without anterolateral projections (fig. 10). Mesonotum wider than the rest of body (fig. 10), metanotum small without hind wing pads. Legs (figs. 10, 22-23, 34-35) very long and slender; dorsum of all femora with subdistal transversal band of long spatulate and apically fringed spines (fig. 36); mediolongitudinal rows of spines also present on dorsum of mid and hind femora; tibiae with 3 longitudinal rows of spines (fig. 37); tarsi with longitudinal row of spines on inner margin; entire legs with scattered long and very thin twin-setae; tarsal claws (fig. 38) elongated, with a marginal row of 4-6 denticles near the base, and with a double row of 1-3 subapical submarginal denticles. Abdomen (figs. 10, 39) almost cylindrical, slightly wider at base, without lateral flanges or posterolateral spines; hind margins of terga II-V smooth (fig. 40), but with small spicules on terga VI-IX; bases of gills on segment II projected posteriorly (fig. 40). Gills present on abdominal segments II-V, the first pair operculate covering completely the remaining gills (figs. 10, 39-40); operculate gills subquadrate and broadly rounded apically, overlapping, with a transverse weaker line near apex (figs. 24, 39-40), ventrally with two pair of smaller lobes (fig. 25); gills on abdominal segments III, IV and V progressively smaller with 4, 3, and 2 lobes respectively (figs. 26-28). Caudal filaments with whorls of long spines at each articulation; terminal filament as long as cerci.

Etymology

Arbitrary combination of the words "Amanã", water of rain in the Tupi-guarani language, and the Greek suffix "hyphes" (reticulate or webbed), commonly used in leptohyphid generic names.

Diagnosis

Unique characters defining this genus in the imago are the male genitalia: penes with tiny ventral spines on subapical lateral margins (fig. 9); and, in the nymphs: gills present on abdominal segments II-V, gill formulae 5/4/3/2 (figs. 25-28).

This genus can be distinguished from the other genera of the family by the following combination of characters. In the adults: (1) Eyes of male enlarged, divided into upper and lower portions, both portions similar in color, blackish (figs. 1-3); (2) forewings widest medially, without marked sexual dimorphism (figs. 6-7); (3) hind wings absent in both sexes; (4) membranous filaments of mesoscutellum present, long (fig. 5); (5) styliger posteriorly projected as a columnar base for each forceps (fig. 9); (6) forceps two-segmented (fig. 9); (7) penes fused except apical furrow (fig. 9), and with tiny spines on lateral ventral margin. In the nymphs: (1) maxillary palpi reduced, with two small segments, without apical seta (figs. 16-18, 33); (2) legs very long and slender (fig. 10); (3) gills present on abdominal segments II-V (figs. 25-28), lamellae of gills with entire margin (without a series of imbricated lobes as in *Leptohyphodes*); (4) operculate gills subquadrate and broadly rounded apically, touching on median line, with a weaker transverse line (figs. 24, 40); (5) gill basket absent; (6) dorsum of femora of all legs with 5-7 spatulate spines, forming a subdistal transverse row (figs. 22-23, 34-35); (7) tarsal claws long and slender, with 4-6 marginal denticles and a double row of 1-3 submarginal denticles (fig. 38).

Discussion

Amanahyphes shows a striking assemblage of characters distinguishing it from other genera of Leptohyphidae. However, the forewing form and venation are similar to *Leptohyphodes* (an endemic Brazilian taxon); both genera also share similarities in male genitalia (styliger plate posteriorly projected, forceps form) and, most notably, large divided eyes in the male. As male imagines of *Amanahyphes* are badly damaged we could not confirm the shape of the foretarsal claws, the synapomorphic character of

Leptohyphidae (Molineri et al. 2002), but we expect *Amanahyphes* to have this character state.

The nymphal mouthparts are similar to those of *Tricorythopsis*, as are the abdominal gills (operculate gills with transverse weak band and with four ventral lamellae, gills on III-V with similar gill formula). The absence of gills on abdominal segment VI is a feature shared with *Leptohyphodes* and *Coryphorus*. The legs are very long and the posterior margins of the gill-bearing segments are smooth, as in the group formed by *Leptohyphodes*, *Haplohyphes* and *Tricorythodes*.

The eggs are surprisingly similar to those of the African genus *Ephemerythus* (Ephemerythidae) (Sartori, pers. comm.), mainly by the presence of a conical cap-like structure on the uncapped pole, formed by elongated chorionic plates.

This set of shared characteristics suggests that *Amanahyphes* occupies a rather basal position in Leptohyphidae. Preliminary cladistic analyses (Molineri, data unpub.) suggest that *Amanahyphes* constitutes the sister taxon of all other Leptohyphidae except *Tricorythopsis*.

Amanahyphes saguassu Salles & Molineri, sp. nov.

Male subimago (in alcohol). General coloration yellowish shaded with gray. Head whitish yellow shaded with black as in figs. 1-2, ocelli surrounded with black. Antennae whitish translucent. Thorax. Pronotum and propleurae yellowish translucent slightly shaded with gray; prosternum yellowish shaded with gray. Mesonotum with mesoscutum yellow, anteronotal protuberance whitish yellow; submesoscutum and sublateroscutum yellowish entirely shaded with gray; posterior scutal protuberances yellow shaded with gray at posterior margin; mesoscutellum yellowish translucent; anterolateral corners of mesonotum, submesoscutum and sublateroscutum strongly shaded with gray. Metanotum yellow. Pleural sclerites of pterothorax yellow, with several areas strongly shaded with gray, membranes whitish translucent. Mesosternum with basisternum brown, furcasternum yellowish light brown; median membranous zones of mesosternum whitish translucent. Metasternum whitish translucent. Legs. Coxae of all legs yellow shaded with gray. Femora of all legs whitish slightly shaded with gray and with grayish subapical mark; forefemora darker than mid and hind femora. Tibiae and tarsi of all legs whitish; tibiae with grayish basal mark. Wings (fig. 6). Membrane and veins whitish; veins C and Sc of some individuals tinged with light

brown. Abdomen (fig. 8) translucent whitish yellow, except segments IX-X whitish yellow. Terga III-V with posterolateral blackish marks; tergum VI with posterolateral margins blackish, subtriangular blackish mark medially; posterior margins of terga VIII-IX blackish; tergum X shaded with black along midline. Abdominal sterna VI-IX shaded with gray, except midline of sterna VI-VII; other sterna translucent whitish. Penes and caudal filaments translucent whitish.

Female subimago (in alcohol). General coloration yellowish brown shaded with gray. Head (fig. 4) completely shaded with gray. Antennae whitish translucent. Thorax. Pronotum completely shaded with gray, with unpigmented and blackish marks as in fig. 4. Prosternum whitish slightly shaded with gray. Mesonotum brown shaded with gray, except anteronotal projection yellowish brown; sutures strongly shaded with gray. Metanotum brown shaded with gray (fig. 4). Mesosternum brown, membraneous zone translucent. Metasternum translucent. Legs as male subimago, except gray shading more distinct. Wings (fig. 7). Membrane and veins whitish. Abdomen translucent whitish yellow, almost completely shaded with gray, mid region of tergum VI with subtriangular blackish mark. Abdominal sterna translucent whitish yellow, shaded with gray mainly on segments VI-IX. Caudal filaments whitish translucent shaded with gray.

Mature nymph (fig. 10). General coloration whitish yellow with gray to black markings. Head whitish yellow with irregular grayish marks between ocelli and blackish oblique band posterior to compound eyes. Antennae whitish translucent. Mouthparts yellowish. Thorax whitish yellow shaded with gray, especially on anterior half of pro and mesonotum; metanotum whitish yellow strongly shaded with gray. Thoracic pleurae and sterna whitish yellow, shaded with gray on pleurae. Legs whitish yellow with gray subapical mark on femora and gray basal mark on tibiae. Abdomen whitish yellow shaded with gray on posterolateral regions of terga VI-IX; tergum I almost completely shaded with gray; median zone of tergum VI, and posterolateral corners of terga V-VI shaded with black; tergum X whitish yellow. Abdominal sterna with transverse grayish band. Gills. Operculate lamellae whitish yellow shaded with gray as in fig. 24; remaining gills translucent whitish yellow. Caudal filaments whitish yellow with whorls of spines at articulations becoming longer toward apex.

Etymology

From *saguaçu*, eyes enlarged in the Tupi-guarani language. An allusion to the male's compound eyes.

Diagnosis and discussion

As this genus remains monospecific, those characters used in the generic section should be used also for specific diagnosis.

Material examined

Holotype male subimago: Brazil, Amazonas state, Manaus, Reserva Florestal Adolpho Ducke, Igarapé do Tinga, light trap, 10-13/vi/2002, A.M.O. Pes leg (INPA).

Paratypes: Brazil, Amazonas state: five females and 13 males subimagines, same data as holotype (INPA); two male imagines, same data as holotype, except Igarapé do Barro Branco, 16-20/ix/2002, M.J. Ferreira leg (INPA); six nymphs, Presidente Figueiredo, Igarapé do Sr. José, km 24, road AM 240, 09/x/2003, F.F. Salles leg (INPA); one nymph, Presidente Figueiredo, Igarapé Santa Cruz, 08/x/2003, F.F. Salles leg (IFML); one nymph, Presidente Figueiredo, Iracema Falls, 08/x/2003, F.F. Salles leg (IFML); two males subimagines, one female subimago, Presidente Figueiredo, 31/v-01/vi/2000, light trap, N. Hamada, J.L. Nessimian legs (IFML); two nymphs, Presidente Figueiredo, Igarapé da Onça, Balneário Sossego da Pantera, 07/x/2003, F.F. Salles leg (INPA).

Biology

The material of *Amanahyphes saguassu* is represented by ten nymphs, and most of them were found inhabiting areas of the streams with slow current. In Igarapé do Sr. José, nymphs were found among small roots and sand, together with several other nymphs of mayflies, as: *Coryphorus aquilus* Peters (Coryphoridae), *Tricorythodes* sp. (Leptohyphidae), *Apobaetis* sp., *Cloeodes auwe* Salles & Batista (Baetidae), *Farrodes* sp. (Leptophlebiidae). In Igarapé da Onça, Igarapé Santa Cruz and Iracema Falls, nymphs were found among aquatic vegetation. An attempt to collect more nymphs was made in November 2004, but only three very immature nymphs were found.

Subimagines were all caught in light traps, most in the Reserva Florestal Adolpho Ducke (INPA), an area of undisturbed *terra firme* forest, with little light penetration and streams from 1st to 3rd order (Holzenthal & Pes, 2004). Igarapé do Tinga is a 3rd order stream where the subimagines were collected. In the same

collection, undetermined adults of Baetidae and several imagines and subimagines of *Farrodes ochraceous* Domínguez, Molineri & Peters were caught.

Acknowledgments

We are grateful to Núcleo de Microscopia e Microanálise da Universidade Federal de Viçosa, and Dr. José E. Serrão, for making available the scanning electron microscope, and to Dr. Maria José N. Ferreira and Dr. Neusa Hamada (Instituto Nacional de Pesquisas da Amazônia) for supplying some of the Brazilian specimens. The first author is also grateful to Neusa Hamada and Ana M. O. Pes for their assistance in collecting trips in Manaus and Presidente Figueiredo. We also thank the CNPq for providing funds to FFS to conduct doctoral studies at the Universidade Federal de Viçosa; and the CONICET for financial support to CM.

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Captions

Figs. 1-9. *Amanahyphes saguassu*, adult (all figures from subimagos, except when indicated). 1, male head, frontal view; 2, same, d.v. (dorsal view); 3, same, l.v. (lateral view); 4, female head and pronotum, d.v.; 5, male mesonotum, d.v.; 6, male forewing; 7, female forewing; 8, male abdomen, d.v.; 9, male genitalia, d.v. (imago).

Fig. 10. *Amanahyphes saguassu*, habitus of nymph.

Figs. 11-28. *Amanahyphes saguassu*, nymph. 11, labrum, d.v.; 12, hypopharynx, v.v.; 13, left mandible, d.v.; 14, same, detail of prosthema; 15, right mandible, d.v.; 16, right maxillae, d.v.; 17-18, details of maxillary palp; 19, detail of apex of maxillae, d.v.; 20, labium, v.v.; 21, detail of glossae and paraglossae, v.v.; 22, foreleg; 23, hind leg; 24, gill 2, d.v.; 25, gill 2, v.v.; 26-28, gills 2-5, v.v.

Figs. 29-33. *Amanahyphes saguassu*, SEM photographs. Nymphal mouthparts: 29, right mandible, v.v.; 30, same, detail of canines; 31, left mandible, v.v.; 32, same, detail of mola; 33, right maxillae, v.v. Scale bars = 30 μm (figs. 29, 33), 10 μm (figs. 30, 32), 20 μm (fig. 31).

Figs. 34-40. *Amanahyphes saguassu*, SEM photographs. Nymphal legs and abdomen: 34, foreleg; 35, hind leg; 36, detail of forefemoral spines; 37, detail of foretibial spines; 38, detail of foretarsal claw; 39, abdomen, d.v. (left gills removed); 40, same, detail of operculate gill. Scale bars = 100 μm (figs. 34-35, 40), 200 μm (fig. 39), 20 μm (figs. 36-38).

Figs. 41-43. *Amanahyphes saguassu*, SEM photographs. Eggs: 41, general aspect; 42, detail of uncapped pole; 43, detail of polar cap. Scale bars = 20 μm (figs. 41-42), 10 μm (fig. 43).









