

***Haplohyphes* (Ephemeroptera: Leptohiphidae), new species and stage descriptions with a key to separate the species of the genus**

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Abstract

Haplohyphes yanahuicsa sp. nov. from Bolivia, is described and illustrated from adult and nymphal stages, this constitutes the first report of the genus for that country. Imagos of both sexes of *Haplohyphes aquilonius* Lugo-Ortiz & McCafferty are described for the first time, and this species together with *H. mithras* (Traver) are recorded for the first time from Colombia. *Haplohyphes furtiva* Domínguez is proposed as a junior synonym of *H. baritu* Domínguez, and is also recorded for the first time from Bolivia. SEM photographs for the egg of *H. baritu* are presented, and compared with the eggs of other genera of the family. A key and illustrations to separate the six known species of the genus are given.

Key words: taxonomy, neotropics, new species, new stages, eggs, key

Introduction

The genus *Haplohyphes* was proposed by Allen (1966) to accommodate a species previously described by Traver (1958) as *Leptohiphys mithras*, together with a new species from Peru (*Haplohyphes huallaga* Allen). Later Domínguez (1984) described two species from Argentina (*H. baritu* and *H. furtiva*), Lugo-Ortiz & McCafferty (1995) a species from Costa Rica (*H. aquilonius*), and Molineri (1999) another from Ecuador (*H. dominguezi*).

The aims of this paper are: 1) to describe and illustrate a new species of *Haplohyphes* recently collected in the mountain rain forest (Yungas) of Bolivia near Coroico; this new species is described from male imagos and nymphs; 2) to describe for the first time imagos of both sexes of *Haplohyphes aquilonius* Lugo-Ortiz & McCafferty; 3) to propose *H. furtiva* Domínguez as a junior synonym of *H. baritu* Domínguez; 4) to describe and discuss for the first time the egg stage of a species of the genus; 5) to extend the distributional

records of *Haplohyphes aquilonius* Lugo-Ortiz & McCafferty and *H. mithras* (Traver) to Colombia, and *H. baritu* Domínguez to Bolivia.

A key to separate the six known species of *Haplohyphes* is presented.

Material and methods

The material used in this study was preserved in 80% ethanol. The male genitalia and nymphal parts were dissected and placed in Canada Balsam, wings were dried mounted on microscope slides. Figures were drawn with the aid of a camera lucida mounted on a stereo-microscope. Eggs were removed from a female imago, dehydrated in a graded ethanol series, and dried by critical point-method using CO₂ in a Bomar apparatus. Eggs were then mounted with double sided tape on SEM stubs and sputter coated with gold. They were observed and photographed with a JEOL 35CF Scanning electron microscope at 25 kV.

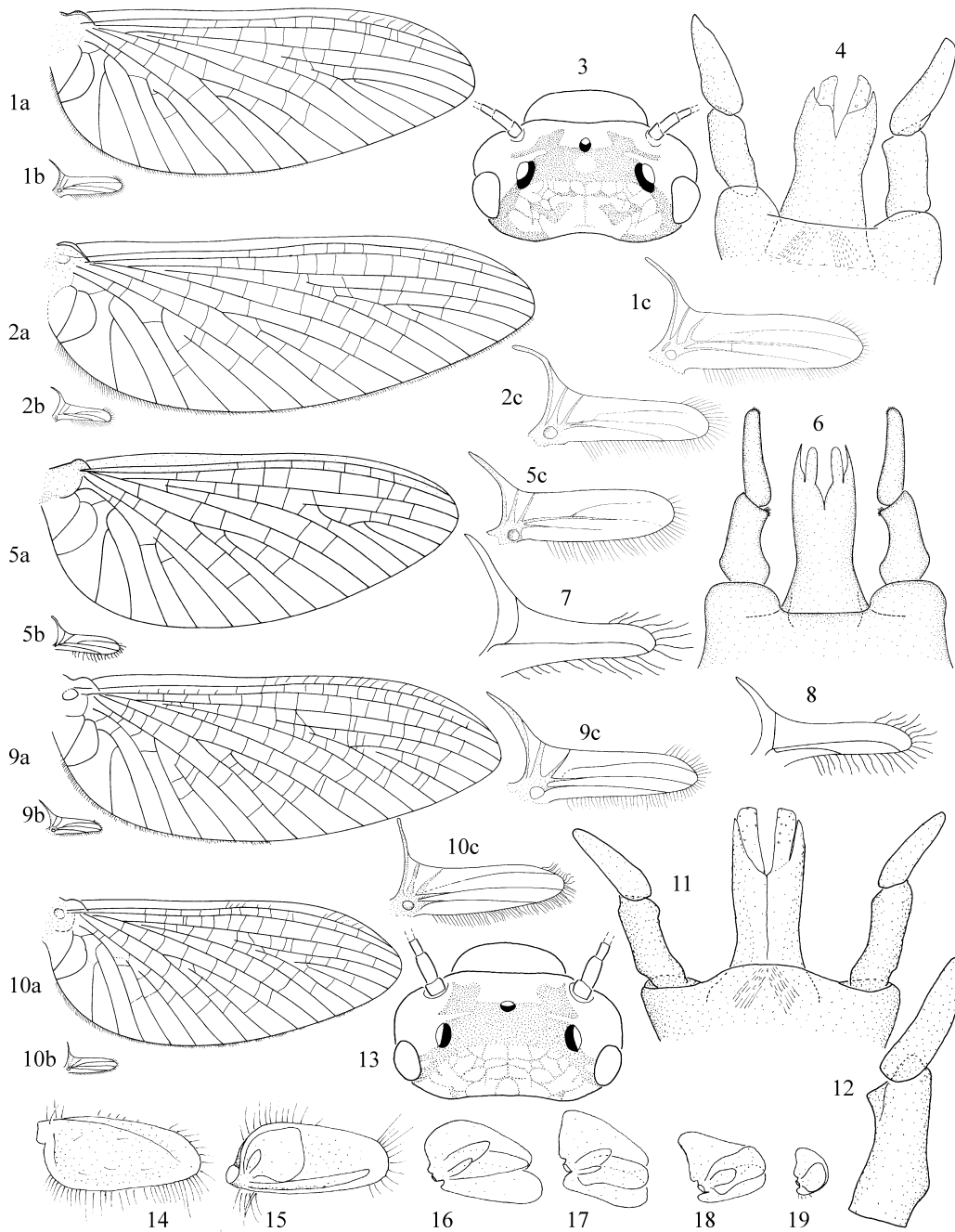
Material deposition: Instituto-Fundación Miguel Lillo, Tucumán, Argentina (IFML); Universidad Mayor de San Andrés, Instituto de Limnología, La Paz, Bolivia (UMSA); Museo de Entomología de la Universidad del Valle, Cali, Colombia (MEUV).

Haplohyphes aquilonius Lugo-Ortiz & McCafferty (Figs. 1-4)

H. aquilonius Lugo-Ortiz & McCafferty, 1995: 166; Molineri 1999: 29.

Male imago. Length: body, 4.7-5.2 mm; fore wings, 5.5-6.7 mm; hind wings, 1.0-1.1 mm. General coloration yellowish chestnut, abdomen whitish. Head shaded with grayish brown except behind median ocellus, ventrally paler. Antennae: scape and pedicel whitish shaded with gray, flagellum hyaline. Thorax. Pronotum yellowish white shaded with gray except on 5-6 oval marks at lateral zones. Mesonotum yellowish orange shaded with gray, mesoscutellum darker; membranous filaments very short, grayish. Metathorax paler. Legs: coxae, trochanters and femora yellowish, tibiae and tarsi whitish, shaded diffusely with gray. Wings (Figs. 1a-c): membrane hyaline, tinged with yellowish; longitudinal veins grayish brown, cross veins yellowish; hind wings with 3 longitudinal veins (Figs. 1b-c). Abdomen whitish translucent, except segments IX-X yellowish white; abdomen shaded completely with yellowish gray except on a mediolongitudinal paler band. Genitalia (Fig. 4): styliger plate yellowish, penes and forceps whitish. Caudal filaments whitish translucent shaded with gray.

Female imago. Length: body, 5.5 mm; fore wings, 7.8 mm; hind wings, 0.85 mm. General coloration yellowish chestnut. Head and thorax as in male except shaded with blackish. Wings (Figs. 2a-c) as in male. Abdomen as in male except shaded with gray more heavily.



FIGURES 1-19. *Haplohyphes aquilonius* Lugo-Ortiz and McCafferty: 1a, male fore wing; 1b, male hind wing; 1c, idem, detail; 2a, female fore wing; 2b, female hind wing; 2c, idem, detail; 3, nymphal head, d.v.; 4, male genitalia, v.v. *H. dominguezi* sp. nov.: 5a, male fore wing; 5b, male hind wing; 5c, idem, detail; 6, male genitalia, v.v. *H. hualлага* Allen: 7, male hind wing, detail. *H. mithras* (Traver): 8, male hind wing, detail. *H. baritu* Domínguez: 9a, female fore wing; 9b, female hind wing; 9c, idem, detail; 10a, male fore wing; 10b, male hind wing; 10c, idem, detail; 11, male genitalia, v.v.; 12, detail of forceps, l.v.; 13, nymphal head, d.v.; 14, gill II, d.v.; 15-19, gills II-VI, v.v.

Mature nymphs. Length: body, 6.5-9.0 mm; mesonotum, 2.0-2.4 mm; hind femur, 1.2-1.6 mm; caudal filaments, 5.0-6.0 mm. General coloration grayish brown, ventrally paler. Head yellowish white shaded with gray as in Fig. 3. Thorax. Fore wingpads yellowish shaded with gray along costal margin and longitudinal veins (some times shaded more extended). Abdomen yellowish gray except membranes whitish. Terga shaded with gray heavier toward rear segments, with 1-2 paler mediolongitudinal bands.

Material. COLOMBIA, P. N. Ucumari, La Cascada, 2460 m (20 nymphs); P. N. Farallones de Cali, Peñas Blancas, río Pichinde, N 03° 25' 45"-W 76° 39' 27", 17-18/III/1999, light 4-6 hs AM, M. C. Zúñiga, E. Domínguez and C. Molineri Cols. (5 male and 1 female imagos); dept. Valle, río Melendez, El Cruce, 1580 m, 17/IX/1992 (1 nymph); idem except La Candelaria, 1600 m, 22/VIII/1992 (4 male and 3 female subimagos); Valle, río Cali, Felidia, 1645 m, 18/IX/1992 (1 male and 4 female subimagos); idem except Pichinde, 1600 m, 5/XI/1992 (2 nymphs, 2 male and 2 female subimagos). All the material housed in MEUV, except 3 male imagos, 3 female subimagos and 15 nymphs in IFML. The nymphs are only tentatively associated with the adults, because they share general coloration and size, and were collected in the same localities.

Discussion. *Haplohyphes aquilonius* was described from seven Costa Rican nymphs by Lugo-Ortiz & McCafferty (1995). These authors stated that these nymphs could represent the unknown nymphal stage of *H. mithras*, described from imagos, also from Costa Rica. Newly collected adults and associated nymphs from Colombia, assignable to *H. aquilonius*, show marked differences with *H. mithras*.

H. aquilonius can be distinguished from the others species of the genus by the following combination of characters. In the imago: 1) three longitudinal veins present on hind wings (Figs. 1c, 2c); 2) segment 1 of forceps slightly shorter than segment 2 (Fig. 4); 3) penes divided on apical 0.34-0.40 (Fig. 4); 4) membranous lobes of penes obliquely truncated at apex (Fig. 4); 5) apical spines of penes shorter than membranous lobes; 6) male fore wing length 5.5-6.7 mm; 7) abdomen uniformly shaded with gray. In the nymph: 1) fore wingpads shaded with gray at least along entire costal and subcostal areas; 2) head shaded with gray as in Fig. 3.

***Haplohyphes baritu* Domínguez (Figs. 9-19, 42-45)**

H. baritu Domínguez, 1984: 106; Domínguez et al. 1994: 97; Lugo-Ortiz & McCafferty 1995: 169; Molineri 1999: 29.

Haplohyphes furtiva Domínguez, 1984: 108. SYN. NOV.

H. furtiva Domínguez et al. 1994: 98; Molineri 1999: 29.

H. furtivus Lugo-Ortiz & McCafferty 1995: 169.

Egg (Figs. 42-45). Length, 110-130 μ ; maximum width, 65-75 μ . One blunt polar cap present (Figs. 42-43). One subcircular micropylar area, surrounded by five chorionic plates (Fig. 45). Polygonal chorionic plates (Figs. 44-45) contiguous; with the margin

opposed to capped pole, elevated. Adhesive filaments (probably derived KTC) relatively long and thin (Fig. 44), sometimes widening at the apex very slightly, scattered on chorionic surface.

Material. *Haplohyphes baritu*: holotype male subimago, allotype female subimago and 28 paratype nymphs from ARGENTINA: Salta, Santa Victoria, Parque Nacional Baritu, arroyo Baritu, 1500 m, 10-17/X/1981, E. Domínguez Col. *Haplohyphes furtiva*: holotype male imago and 15 paratype male imagos from ARGENTINA, Salta, Anta, Parque Nacional El Rey, arroyo Las Salas, 25/IV/1982, E. Domínguez Col.; allotype female imago and 1 nymph, idem except date, 20/XII/1981. Other material. ARGENTINA: Salta, P. N. El Rey, arroyo Los Puestos, 24-25/III/1999, C. Molineri Col. (19 male imagos, 5 female imagos, 2 reared female subimagos, 5 nymphs); Salta, Santa Victoria, Los Toldos, río Huaico Grande, 26/X/1999, C. Molineri Col. (5 male and 4 female imagos, eggs extracted from one of these females); Jujuy, río Yala, 26/VI/1997, C. Molineri Col. (25 nymphs); Jujuy, El Carmen, arroyo Las Lanzas, S 24° 27' 17"-W 65° 17' 48", 1250 m, 3/III/2000, E. Domínguez & C. Molineri Cols. (13 male and 7 female imagos, 1 nymph). BOLIVIA: dept. La Paz, stream near Caranavi, S 15° 36' 27"-W 67° 45' 58", 27/XI/2000, E. Domínguez, C. Molineri y C. Nieto Cols. (24 nymphs); dept. La Paz, Reserva Carrasco, S 15° 43' 09"-W 67° 31' 06", 940 m, 29/XI/2000, E. Domínguez, C. Molineri y C. Nieto Cols. (6 male and 3 female imagos, 14 nymphs). All the material is housed in IFML, except 15 nymphs, 3 male and 1 female imagos in UMSA.

Discussion. Domínguez (1984) described *Haplohyphes baritu* from adults of both sexes and nymphs. Adults were described as imagos but all the type material is represented by subimagos. The characters used to distinguish this species from *Haplohyphes furtiva* are attributable to stage differences (dissimilar fore tarsal claws and division of penes). New material from all the stages collected at or near the type localities of both species show them to be synonyms. *Haplohyphes furtiva* is considered junior synonym of *H. baritu* due to page priority. *Haplohyphes baritu* is recorded from Bolivia for the first time.

The eggs of *Haplohyphes baritu* show similarities with those known for some species of *Tricorythodes* Ulmer (*T. griseus* Hofmann & Sartori, *T. hiemalis* Molineri, unpubl), showing similar chorionic sculpture and adhesive filaments. Other genera of Leptohiphidae (*Allenhyphes* Hofmann & Sartori, in Hofmann et al 1999; *Traverhyphes* Molineri 2001; *Leptohiphes* Eaton, in Molineri 2003) show adhesive filaments much shorter, widened at the apex. This suggest a closer relationship between *Haplohyphes* and *Tricorythodes* than previously accepted (Wiersema & McCafferty 2000), situation supported also by other morphological characters in gills and legs (Molineri 2002).

Haplohyphes baritu can be distinguished from the other species of the genus by the following combination of characters: 1) three longitudinal veins present on hind wings (Figs. 10b-c); 2) segment 1 of forceps as long as or longer than segment 2 (Fig. 12); 3) penes divided on apical 0.23-0.26 (Fig. 11); 4) membranous lobes of penes obliquely truncated at apex (Fig. 11); 5) apical spines of penes shorter than membranous lobes; 6) male

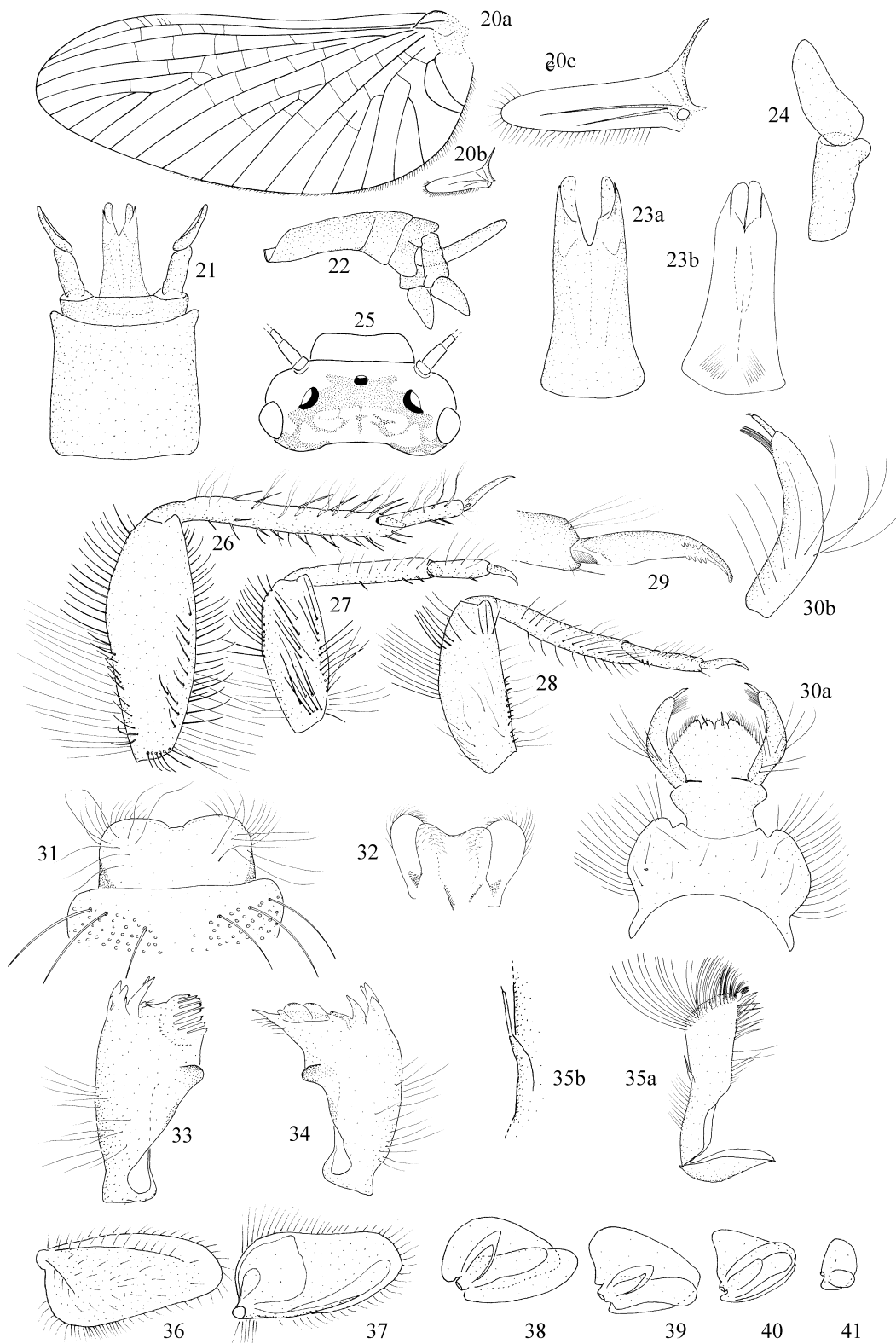
fore wing length, 5.0-7.2 mm; 7) abdomen uniformly shaded with gray. In the nymphs: 1) fore wingpads shaded with black on basal half of costal margin; 2) head shaded with gray as in Fig. 13. Abdominal gills are illustrated for comparative purposes (Figs. 14-19).

***Haplohyphes yanahuicsa* sp. nov. (Figs. 20-41, 46-47)**

Male imago. Length: 4.0-4.2 mm; fore wings, 3.7-3.9 mm. General coloration yellowish white, last segments of abdomen blackish. Head shaded with brownish gray from a transverse line at the median ocellus to posterior margin; antennae yellowish white. Thorax. Pronotum whitish translucent shaded almost completely with brownish gray, meso- and metanotum whitish yellow with few very light gray marks; pleurae and sterna whitish yellow translucent shaded with light brownish on pro- and mesopleurae and with gray in thoracic sterna. Legs: coxae I and II, fore femora and apex of fore tibiae and fore tarsi shaded with brownish gray, remaining segments of all legs whitish. Wings (Figs. 20a-c): membrane of wings hyaline, fore wings shaded with gray on C and Sc area, basally to bullae; longitudinal vein grayish, cross veins paler; hind wings only with two longitudinal veins. Abdomen (Fig. 46) whitish translucent shaded with blackish gray on terga, shaded very slightly on first segments and becoming darker and more extensive toward rear segments (segments VI-IX are much darker than the rest of body). Genitalia (Figs. 21-24): yellowish white shaded with gray on margins of styliger plate and forceps. Caudal filaments hyaline shaded with gray, except at joining.

Female imago. Unknown, but two mature female nymphs ready to moult (Fig. 47) show the same characteristic coloration of the male imago.

FIGURES 20-41. *Haplohyphes yanahuicsa* sp. nov., male imago: 20a, fore wing; 20b, hind wing; 20c, idem, detail; 21, male genitalia, v.v.; 22, idem, l.v.; 23a-b, penes, details v.v.; 24, detail of forceps, l.v.; nymph: 25, head, d.v.; 26, leg III; 27, leg II; 28, leg I; 29, fore tarsal claw; 30a, labium, v.v.; 30b, detail of labial palp; 31, labrum, d.v.; 32, hypopharynx, v.v.; 33, left mandible, d.v.; 34, right mandible, d.v.; 35a, maxillae, d.v.; 35b, detail of maxillary palp; 36, gill II, d.v.; 37-41, gills II-VI, v.v.



Nymph (Fig. 47). Length: body, 5.0-5.1 mm; mesonotum, 1.5 mm; hind femora, 1.0 mm. General coloration whitish yellow with blackish marks. Head yellowish white surrounded by thick yellowish setae; shaded with blackish gray on a transversal band between eyes; occipute shaded more slightly with a reticular pattern; antennae whitish translucent; mouth parts whitish. Mouthparts as in Figs 30-35. Thorax whitish yellow, pronotum shaded extensively with blackish gray, mesonotum shaded more slightly; wing buds shaded with black on basal half of costal margin. Thoracic sterna shaded with gray, metanotum and pleurae without shading. Legs (Figs. 26-28) whitish shaded with gray on coxae I and II; tarsal claws with double row of submarginal denticles near apex (Fig. 29). Abdomen (Fig. 47) yellowish white shaded with light gray on terga I-IV (sometimes also on V) and shaded with blackish gray on terga VI-IX (sometimes also on V); tergum X slightly shaded with gray. Abdominal sterna paler shaded very slightly with gray. Opercular gill (Figs. 36-37) whitish translucent shaded completely with light gray, remaining gills (Figs. 38-41) whitish translucent. Caudal filaments whitish yellow with whorls of setae at each joining.

Etymology. Combination of letters including the Quechua voices “yana” (=black) and “huicsa” (=abdomen).

Material. Holotype male imago from BOLIVIA: Dept. La Paz, stream between Caranavi and Guanai, S 15° 40' 18" - W 67° 42' 04" , 500 m, 27/XI/2000, E. Domínguez, C. Molineri y C. Nieto Cols. Paratypes: 3 male imagos and 2 female mature nymphs, same data as holotype. Holotype, 1 paratype male imago and 1 paratype nymph housed in UMSA; remaining material in IFML. Nymphs and adults are associated by a pharate sub-imago.

Discussion. *Haplohyphes yanahuicsa* sp. nov. can be distinguished from the other species of the genus by the following combination of characters. In the imago: 1) hind wings with two longitudinal veins (Fig. 20c); 2) segment 1 and 2 of forceps similar in length (Fig. 24); 3) penes divided on apical 0.22 (Figs. 23a-b); 4) membranous lobes of penes rounded (Fig. 23a-b); 5) distal spines of penes shorter than membranous lobes; 6) male fore wing length: 4.0 mm; 7) general coloration pale except apical segments of abdomen blackish (Fig. 46). In the nymph: 1) markings on head not reaching base of antennae (Fig. 25); 2) abdomen shaded with blackish on rear segments (Fig. 47).

Key for the identification of the species of *Haplohyphes*

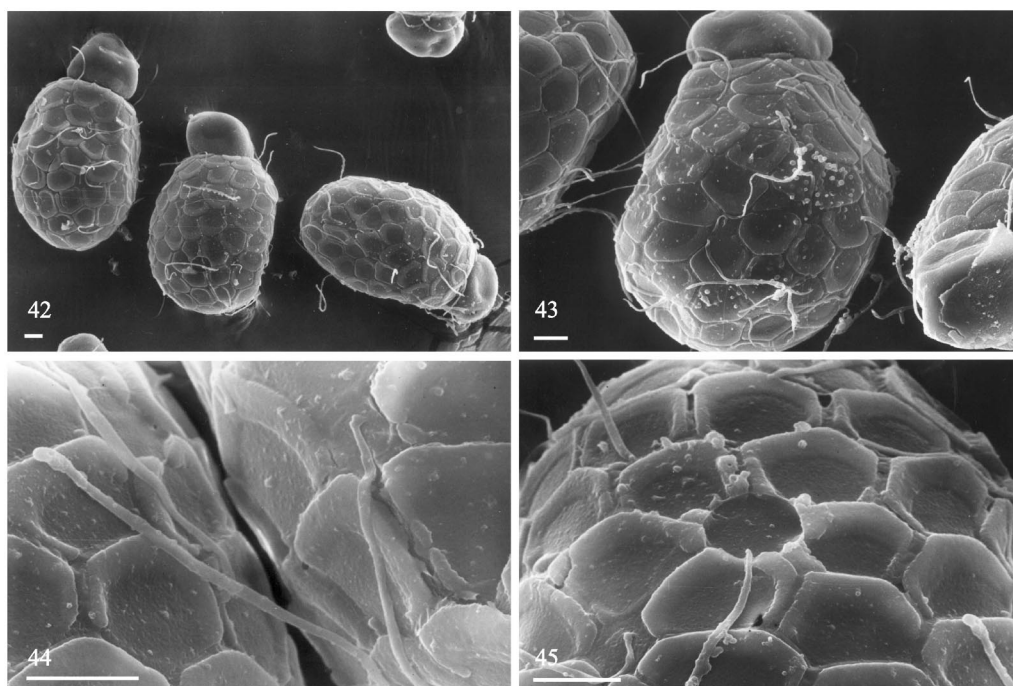
Male imagos

- 1 Rear segments of abdomen blackish, much darker than rest of body (Fig. 46); genitalia and hind wings as in Figs. 21 and 20c, respectively *H. yanahuicsa* sp. nov.
- Coloration of body, genitalia and hind wings not as above..... 2
- 2 Apical spines of penes as long as or longer than the apex of membranous lobes (Fig. 6); wings as in Figs. 5a-c..... *H. dominguezi* Molineri

- Apical spines of penes shorter than the apex of membranous lobes (Figs. 4, 11)..... 3
- 3 Hind wings with one longitudinal vein (Fig. 7) *H. huallaga* Allen
- Hind wings with two or three longitudinal veins (Figs. 1c, 8, 10c)..... 4
- 4 Membranous lobes of penes rounded (similar to Fig. 6); hind wings with two longitudinal veins (Fig. 8) *H. mithras* Traver
- Membranous lobes of penes obliquely truncated (Figs. 4, 11); hind wings with three longitudinal veins (Figs. 1c, 10c)..... 5
- 5 Segment 1 of forceps as long as or longer than segment 2 (Fig. 12); penes divided on apical 0.23-0.26 (Fig. 11)..... *H. baritu* Domínguez
- Segment 1 of forceps slightly shorter than segment 2 (Fig. 4); penes divided on apical 0.34-0.40 (Fig. 4) *H. aquilonius* Lugo-Ortiz & McCafferty

Nymphs

- 1 Apex of abdomen blackish, much darker than the rest of body (Fig. 47).....
..... *H. yanahuicsa* sp. nov.
- Coloration not as above. 2
- 2 Fore wingpad shaded with black only at basal half of costal margin.....
..... *H. baritu* Domínguez
- Fore wingpad shaded with black along the entire costal margin
..... *H. aquilonius* Lugo-Ortiz & McCafferty



FIGURES 42-43. *Haplohyphes baritu* Domínguez, SEM photographs: 42, group of eggs; 43, general view of egg; 44, a pair of eggs attached by adhesive filaments; 45, micropylar area. Scale bars= 10 μ .



FIGURES 46-47. *Haplohyphes yanahuicsa* sp. nov.: 46, general view of male imago; 47, general view of nymph.

Acknowledgements

I am greatly indebted to María del Carmen Zúñiga (MEUV) and to the "Laboratorio de Limnología de la UMSA" for organizing field trips in Colombia and Bolivia respectively, and for the loan of material. Eduardo Domínguez made useful comments on the manuscript. Also I am grateful to E. Domínguez and Carolina Nieto (IFML) for their assistance during field trips. The author belongs to the Argentine National Council of Scientific Research (CONICET), which support is greatly acknowledged.

References

- Allen, R. K. (1966) *Haplohyphes*, a new genus of Leptohiphinae (Ephemeroptera: Tricorythidae). *Journal of the Kansas Entomological Society*, 39, 565-568.
- Domínguez, E. (1984) Dos especies nuevas del género *Haplohyphes* Allen (Ephemeroptera: Tricorythidae) de la Argentina. *Revista de la Sociedad Entomológica Argentina*, 43(1-4), 103-112.
- Domínguez, E.; Hubbard M. . & Pescador, M.L. (1994) Los Ephemeroptera en Argentina. *Fauna de Agua Dulce de la Republica Argentina*, 33(1), 1-142.
- Hofmann, C.; Sartori, M. & Thomas, A. (1999) Les Ephéméroptères (Ephemeroptera) de la Guadeloupe (petites Antilles françaises). *Mémoires de la Société Vaudoise des Sciences Naturelles*, 20(1), 1-96.
- Lugo-Ortiz, C.R. & McCafferty, W.P. (1995) Contribution to the Taxonomy of the Leptohiphidae (Insecta: Ephemeroptera) of Central America. *Studies on Neotropical Fauna and Environment* 30(3), 165-176.
- Molineri, C. (1999) Descripción de una nueva especie de *Haplohyphes* Allen (Ephemeroptera: Leptohiphidae) y clave para separar los imagos machos del género. *Acta Zoologica Lilloana*, 45(1), 29-32.
- Molineri, C. (2001) *Traverhyphes*: a new genus of Leptohiphidae for *Leptohiphes* indicator and related species (Insecta: Ephemeroptera). *Spixiana*, 24(2), 129-140.
- Molineri, C. (2002) Cladistic analysis of the South American species of *Tricorythodes* (Ephemeroptera: Leptohiphidae) with the description of new species and stages. *Aquatic Insects*, 24(4), 273-308.
- Molineri, C. (2003) Revision of South American species of *Leptohiphes* (Ephemeroptera: Leptohiphidae) with a key to the nymphs. *Studies on Neotropical Fauna and Environment*, 38(1), 47-70."
- Traver, J.R. (1958) The Subfamily Leptohiphinae (Ephemeroptera: Tricorythidae). Part I. *Annals of the Entomological Society of America*, 51(5), 491-503.
- Wiersema, N.A. & McCafferty, W.P. (2000) Generic Revision of the North and Central American Leptohiphidae (Ephemeroptera: Pannota). *Transactions of the American Entomological Society*, 126 (3-4), 337-371.