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New species and records for the mayfly families Caenidae, Leptohyphidae and Coryphoridae (Ephemeroptera, Pannota) from Venezuelan Guayana's Uplands

CARLOS MOLINERI[1], MARIA-EUGENIA GRILLET[2], CAROLINA NIETO[1],
EDUARDO DOMINGUEZ[1] & EDMUNDO GUERRERO[2]

[1]*CONICET-Instituto de Biodiversidad Neotropical, Facultad de Ciencias Naturales, Universidad Nacional de Tucumán, Argentina, UNASUR (Unión de Naciones Sudamericanas)*

[2]*Laboratorio de Biología de Vectores, Instituto de Zoología y Ecología Tropical, Facultad de Ciencias, Universidad Central de Venezuela, Apartado 47058, Caracas 1041-A, Venezuela*

Abstract

We give new geographical and morphological data for the Pannota mayflies of Venezuelan Guayanan uplands. *Coryphorus aquilus* (Coryphoridae), *Amanahyphes saguassu* and *Tricorythopsis yucupe* (Leptohyphidae) are newly recorded for Venezuela, the adults of the last species are described for the first time. *Macunahyphes pemonensis* **sp. nov.** and *Macunahyphes incognitus* **sp. nov.** (Leptohyphidae) are described from adults from Venezuela and Brazil, respectively. Both new species of *Macunahyphes* are very nearly related, and are characterized among other features, by the absence of forceps, and the great development of large paired projections on the styliger plate. *Caenis teipunensis* **sp. nov.** (Caenidae) is also described from adults, its diagnostic characters include: forceps apically sharp and sclerotized, and very large apophyses of the styliger sclerite. We give new locality records for *Tricorythopsis volsellus*, previously known from other localities in Venezuela.

Key words: Ephemerelloidea, Caenoidea, *Coryphorus*, *Amanahyphes*, *Macunahyphes*, *Tricorythopsis*, *Caenis*

Resumen

En este trabajo se incluye nueva información geográfica y morfológica para las efímeras del grupo Pannota de las tierras altas del escudo Guayanés Venezolano. Se registran por primera vez para Venezuela a *Coryphorus aquilus* (Coryphoridae), *Amanahyphes saguassu* y *Tricorythopsis yucupe* (Leptohyphidae), describiéndose los adultos de esta última especie, hasta ahora desconocidos. *Macunahyphes pemonensis* **sp. nov.** y *Macunahyphes incognitus* **sp. nov.** (Leptohyphidae) se describen a partir de adultos de Venezuela y Brazil, respectivamente. Ambas especies nuevas de *Macunahyphes* están muy cercanamente relacionadas y se caracterizan, entre otras cosas, por la ausencia de fórceps, y el gran desarrollo de las proyecciones posteriores de la placa estilígera. Se describe, también de adultos, a *Caenis teipunensis* **sp. nov.** (Caenidae). Sus caracteres diagnósticos incluyen: fórceps con ápice angosto y esclerosado, y apófisis del esclerito estilígero muy grandes. Se dan nuevos registros geográficos para *Tricorythopsis volsellus*, previamente conocida de otras localidades en Venezuela.

Introduction

Taxonomic studies of Ephemeroptera fauna in Venezuela are particularly scarce and fragmentary (Segnini *et al.* 2003), with the new information given herein the mayfly fauna consists of 40 species distributed in 25 genera and 8 families (Derka 2002, Segnini *et al.* 2003, Derka *et al.* 2009, Mora-Day *et al.* 2009, Chacón *et al.* 2009, 2010). The species richness described so far represents about 9% of the mayflies in the Neotropics. Particularly, little work has been done about the Ephemeroptera fauna from Guyana Shield region (Bolívar State), in southern Venezuela, where a very high endemism is expected (Domínguez *et al.* 2006), because this area is one of the largest biodiversity and endemism reserves in the world (Huber 1995, Rull 2005). Indeed, only 8 species, 9 genera and 6 families

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(Leptophlebiidae, Oligoneuriidae, Caenidae, Euthyplociidae, Leptohyphidae and Polymitarcyidae) of mayflies have been previously reported and/or described for this region (Pescador & Peters 1990, Derka 2002, Segnini *et al.* 2003, Derka *et al.* 2009, Chacón *et al.* 2009, Mora-Day *et al.* 2009).

The Pannota is a monophyletic group of Ephemeroptera generally given the rank of a suborder (McCafferty & Wang 2000). The Pannote groups now known to occur in Venezuela are the families Leptohyphidae, Coryphoridae (newly recorded here), and Caenidae. Leptohyphidae is distributed from Argentina to Canada but with the greatest diversity found in the Neotropics (Molineri 2006). In Venezuela, *Allenhyphes*, *Leptohyphes*, *Tricorythodes* and *Tricorythopsis* have been reported (Chacón *et al.* 2009). Coryphorydae is a monotypic family previously known from Colombia, Brazil and French Guiana (Orth *et al.* 2000, Domínguez *et al.* 2006, Dias *et al.* 2007). Caenidae has been cited in Venezuela at the family or genus level (*Caenis*), but no nominal species has been recorded yet.

The main objectives of this paper are: (1) to describe some new species or stages of Caenidae and Leptohyphidae from Venezuela and Brazil, and (2) to report for the first time the following taxa from Venezuela: *Coryphorus aquilus* Peters (Coryphoridae), *Amanahyphes saguassu* Salles & Molineri, *Macunahyphes pemonensis* **sp. nov.**, and *Tricorythodes yucupe* Dias *et al.* (Leptohyphidae) and *Caenis teipunensis* **sp. nov.** (Caenidae). Additionally, we give new locality records for *Tricorythopsis volsellus* Molineri, describe for the first time the adults of *T. yucupe*, and describe a second new species of *Macunahyphes* from Brazil, *M. incognitus* **sp. nov.** Our study was intended to improve the knowledge of the mayfly fauna from this particular ecoregion known as one of the few Tropical Wilderness Area defined for America (Rull 2005).

Material and methods

Imagos were collected, by using light traps, along the margins of numerous rivers flowing through the eastern part of the Canaima National Park, Gran Sabana region (Bolívar state), southern Venezuela. Nymphs were collected from all submerged substrates or microhabitats (stones, gravels, bed-rocks, macrophytes, leafs, woody debris and trailing vegetation) in selected sections of each river by manually picking the specimens or using a D-net. The Gran Sabana is an undulating plain grass-dominated upland savanna covering close to 18 000 km^2, with altitudes ranging from about 750 to 1450 m (Huber 1995). Most of the Gran Sabana uplands have a humid submontane climate, with average annual temperatures ranging between 18 and 24ºC, average annual rainfall between 2 000 and 3 000 mm, and a short dry season occurring from December to March (Huber 1995). It is located in the area of influence of the lower Orinoco River Basin and upper Caroní River Basin (Venezuelan part of the igneous metamorphic Guyana Shield), with numerous watercourses present in the area, most of them black-water rivers (Figs. 23–26), with very acidic and low mineral waters (Huber 1995).

Dissected parts of the specimens studied were mounted on microscope slides using Canada Balsam as mounting media. All the material is preserved in ethyl alcohol 75º–96º. Line drawings were done using a camera lucida attached to a microscope. Pictures were taken using a NIKON SMZ-10 stereomicroscope or a microscope, with a Nikon D5000 digital camera. For some of the pictures a series of partially focused images were processed with the program Combine ZP to produce final images with enhanced quality.

Collectors are abbreviated as follows: EG (Edmundo Guerrero), Ana-María Oliveira Pes (AMO), María-Eugenia Grillet (MEG), Carlos Augusto da Silva Azevędo (CA). The specimens are deposited in: 1) MLBV, the Invertebrate Collection of Laboratorio de Biología de Vectores (Instituto de Zoología y Ecología Tropical, Universidad Central de Venezuela, Caracas); 2) IML (Instituto M. Lillo, UNT, Tucumán); and 3) INPA (Instituto Nacional de Pesquisas da Amazônia, Manaus).

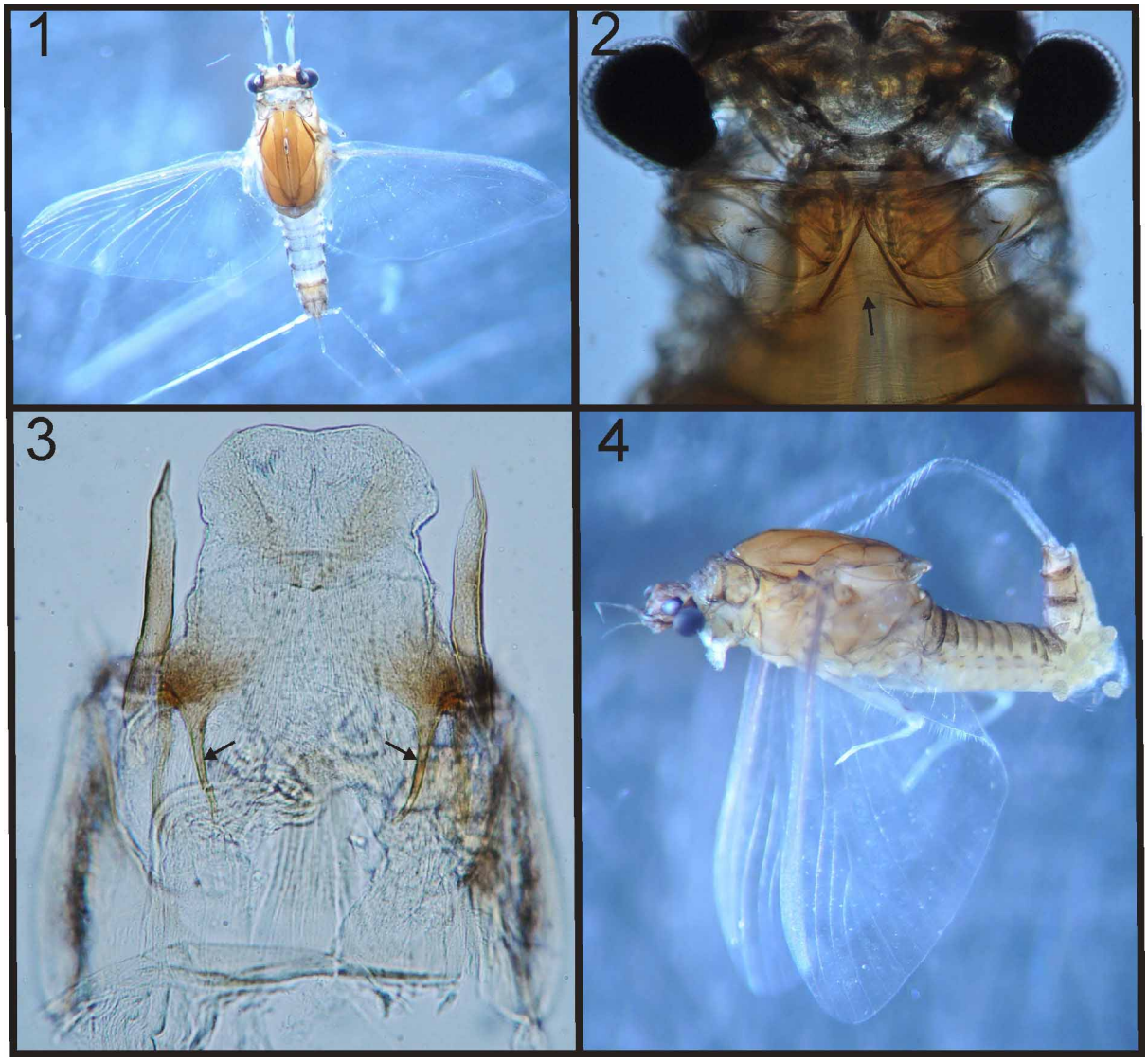
Results

Family Caenidae

***Caenis teipunensis* sp. nov.**
(Figs. 1–6)

Material. Venezuela, Estado Bolívar: 15 ♂ (slide 518) and 1 ♀ imagos from Kavanayén stream, N 5° 37' 27" - W 61° 44' 37", 1355 m, 21/XI/2005, EG, AMO, CA and MEG cols.; 23 ♂ (slides 510, 516, 517) and 3 ♀ imagos from

Kako-Parú stream, N 4° 54' 0" – W 61° 5' 25", 913 m, 28/VI/2007, EG, AMO, CA and MEG cols. Holotype ♂ imago, allotype ♀ imago and 10 paratype ♂ imagos at MLBV; 5 paratype ♂ imagos at INPA; rest in IML.

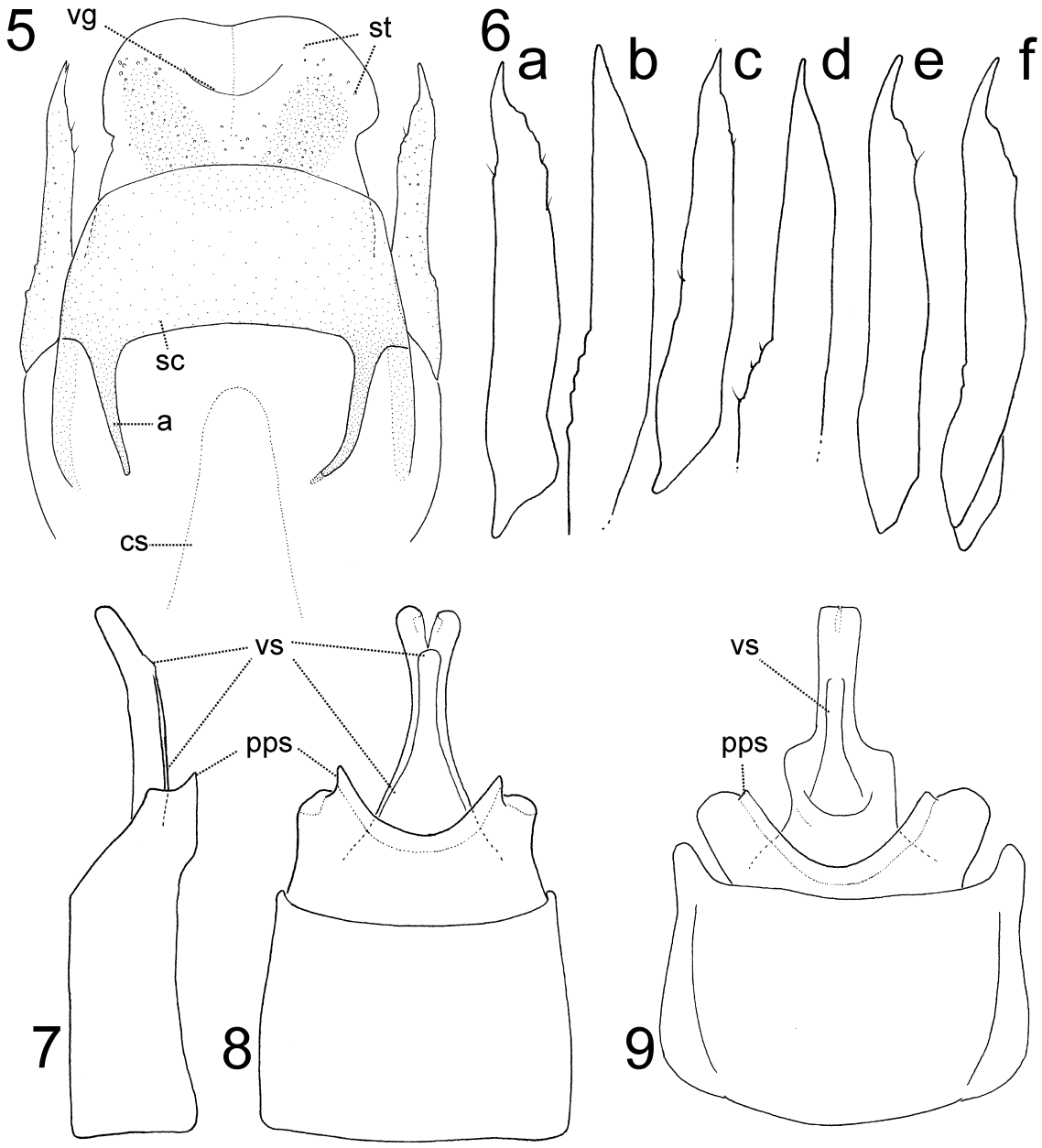


FIGURES 1–4. *Caenis teipunensis* **sp. nov.**: 1, general view of male; 2, male presternal triangle (arrow); 3, male genitalia, v.v. (arrows indicate apophyses of styliger sclerite); 4, general view of female.

Male imago. Length (mm): body, 3.0–3.6; forewings, 2.5–2.9; foreleg (from base of trochanter to apex of claw), 1.8–2.3; caudal filaments, 6.5–9.0. General coloration yellowish light brown (Fig. 1). Head yellowish white shaded with gray widely except on a transversal pale band between anterior part of lateral ocelli; venter of head pale. Antennae: scape yellowish gray, pedicel yellowish translucent, flagellum hyaline. Thorax. Prothorax yellowish translucent shaded with gray dorsally, darker on a pair of submedian spots; presternal triangle anteriorly pointed (Fig. 2). Mesonotum and metanotum yellowish orange shaded with gray on carinae, pleurae and sterna paler. Wings hyaline, veins translucent except C, Sc and Rs grayish. Legs. All coxae, fore femora and base of fore tibiae yellowish; rest of foreleg and middle and hind legs whitish; median and subapical gray marks present on all femora, submedian gray mark also on middle and hind tibiae. Abdomen. Segments 1–8 whitish-translucent, 9–10 yellowish, without lateral or dorsal filaments; all terga shaded widely with gray, darker on terga 1–2 and lateral spots of terga 1–9; sterna translucent white with light gray marks on lateral margins of sterna 8–9. Genitalia (Figs. 3, 5–6) with whitish membranes and yellowish sclerites; forceps orangeish, long and slender, apically pointed and sclerotized, generally sharpening abruptly at the apex, few setae and small tubercles present but variable (Figs. 6a–f); penes (Figs. 3, 5) whitish with a yellowish V-shaped mark, ventral surface with small tubercles and shallow groove, lobes of the penes rounded laterally; styliger plate with elongated and oval central sclerite, apophyses strongly developed, wide and long (Figs. 3, 5). Caudal filaments whitish translucent.

Female imago (Fig. 4). Length (mm): body, 3.0–3.5; forewings, 2.8–3.2; fore leg (from base of trochanter to apex of claw), 1.5; caudal filaments, 2.1–2.5. Color pattern as in male. Abdominal sternum 9 rounded, not projected. Eggs light yellow.

Nymph. Unknown.



FIGURES 5–9. *Caenis teipunensis* **sp. nov.**: 5, male genitalia, v.v. (a=apophysis, cs=central sclerite, sc=styliger sclerite, st=small tubercles, vg=ventral groove); 6a-f, variations in forceps. *Macunahyphes pemonensis* **sp. nov.**; 7, male genitalia, l.v.; 8, same, v.v. *Macunahyphes incognitus*: 9, male genitalia, v.v. (pps= posterior projection of styliger, vs=ventral structure of penes).

Etymology. The specific epithet *teipunensis* is a combination of "tei-pun" (meaning “sabana”, according to the Pemon indigenous group from "La Gran Sabana", our study area) and the Latin suffix "-ensis" (denoting place or locality).

Diagnosis. Male imagos of *Caenis teipunensis* **sp. nov.** can be distinguished from all other species in the genus by the following combination of characters: 1) length of body, 3.0–3.6 mm, and of forewings, 2.5–2.9 mm; 2) presternal triangle anteriorly pointed (Fig. 2); 3) fore legs 0.6–0.7 times the length of body; 4) finger-like process on abdominal tergum 2 and lateral processes on other abdominal segments absent; 5) cerci 2.1–2.5 times the length of

body; 6) styliger plate with elongated and oval central sclerite, apophyses strongly developed, wide and long (Figs. 3, 5); 7) penes (Figs. 3, 5) completely fused, laterally constricted, lateral lobes rounded, small tubercles and shallow grooves present on ventral surface; 8) forceps sclerotized, sharp, generally with small tubercles and setae on outer basal margin (Figs. 6a–f), forceps 7.3–9.5 times longer than width at the middle.

Discussion. Except for the extremely long apophyses of the styliger sclerite and shape of the forceps, *Caenis teipunensis* **sp. nov.** is similar to *C. fittkaui* Malzacher, and belongs to the same group of species defined by the apically pointed forceps (Malzacher 2001).

Ecology. Imagos were collected along the stream margins, at night, and during the rainy season (November 2005 and June 2007), by using light traps. Streams flow through an upland undulating savanna ecosystem (913–1355 m) and they were partially shaded (Kaku-Parú, Fig. 23) or not shaded at all (Kavanayén, Fig. 24). They were small to medium size streams (18–20 m wide), of low order (1st–2nd), with shallow (8–32 cm) and acidic (pH = 5) waters, and with bottoms mainly composed of bed-rock (Kavanayén) and gravels (Kaku-Parú).

Family Coryphoridae

Coryphorus aquilus Peters
(Figs. 10–13)

Coryphorus aquilus Peters 1981: 211; Molineri *et al.* 2002: 120.

Material. Venezuela, Estado Bolívar: 2 ♂ imagos (slide 511) from Tarotá, N 5° 49' 15" – W 61° 25' 4", 1324 m, 27/VI/2007, EG, AMO, CA and MEG cols.; and 1 ♀ imago (slide 512) from Mareman-Parú, N 5° 44' 49" - W 61° 24' 6", 1308 m, 28/VI/2007, EG, AMO, CA and MEG cols. One ♂ and 1 ♀ deposited in MLBV; 1 ♂ in IML.

Discussion. In spite of some differences in size and coloration between the Venezuelan material and that previously known from Colombia and Brazil (Peters 1981, Molineri *et al.* 2002), we consider all specimens as the same species, *Coryphorus aquilus* Peters. The specimens from these different populations are not morphologically distant, and we cannot find distinct features defining them. A short comparison of the new material with the previously known specimens is provided below.

Male imago (Fig. 10, at right). Length (mm): body, 7.0; forewings, 7.5–7.7; cerci, 11.0; terminal filament, 8.0. Much larger than previous known material (with a wing length of 5.1–5.3 mm, Fig. 10 at left). Color pattern (Fig. 13) more extended and marked than in males from other populations (Leticia, Colombia and Presidente Figueiredo, Brazil). Fore wings (Fig. 12) with more numerous cross veins (110–123 versus 75–100).

Female subimago (Fig. 11). Length (mm): body, 6.0; forewings, 8.1–8.2; cerci, 4.0; terminal filament, broken off and lost. As discussed in male, this female from Venezuela show a general coloration strongly marked, and a large size if compared with the previously known female from Colombia. Also, the wings present 93–99 cross veins (versus 75 in the Colombian material), and are much less pigmented with black (only in the basal third of C and Sc cells, versus the entire wing base in Colombian female). Abdominal sternum 9 (arrow in Fig. 11) projected and medially cleft (originally described as not projected and broad, but the previously known female is somewhat dry and shrunken, so this structure was not well seen by Molineri *et al.* (2002).

Ecology. Imagos were collected along the stream margins at night, during the rainy season (June 2007). Streams flow through the savanna area (1308–1325 m) and they were bed-rock, uncovered small to medium size streams (12–30 m wide; 2nd–3rd order), with very shallow (~30 cm) and acidic (pH = 5) waters (Fig. 25).

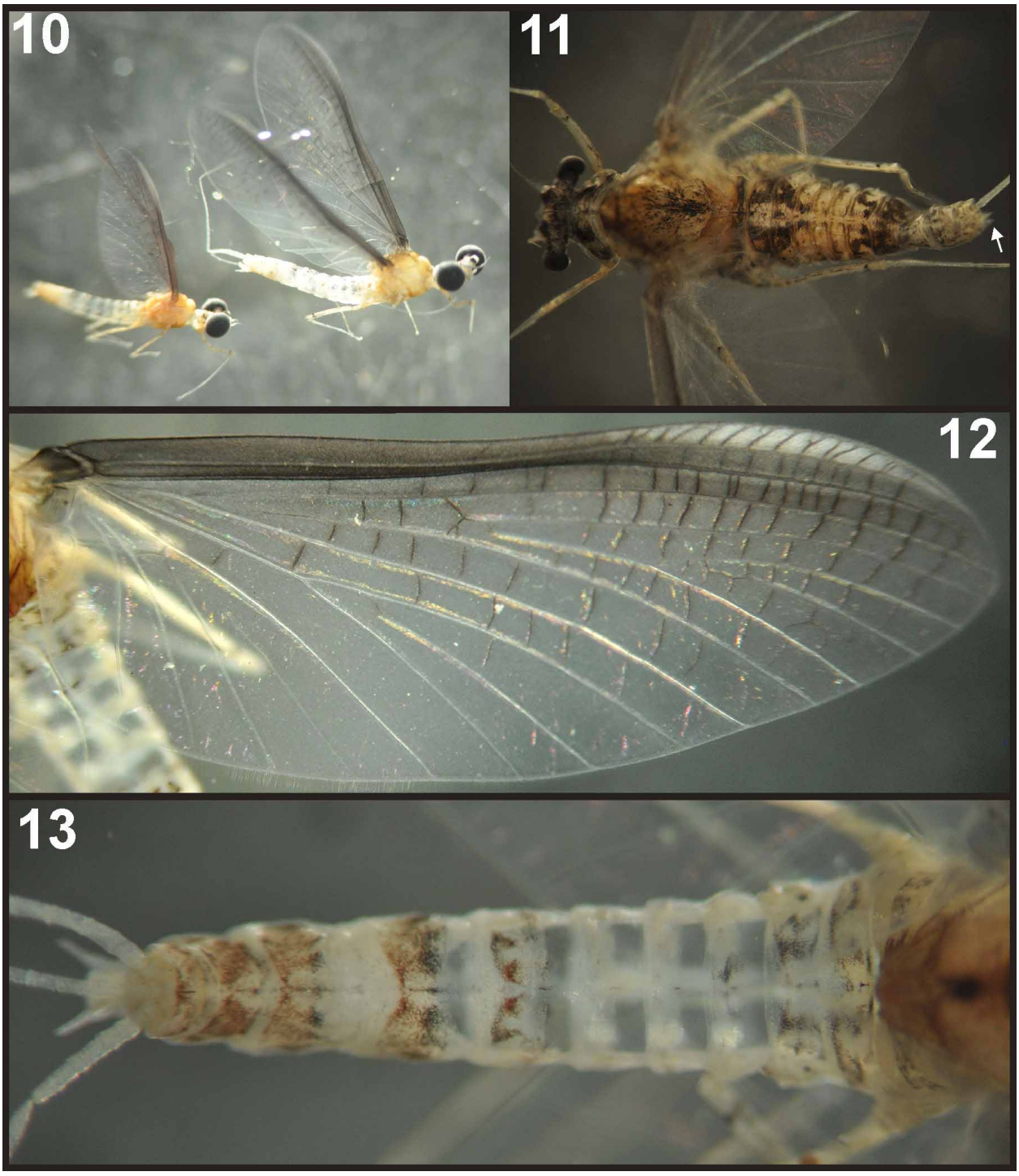
Family Leptohyphidae

Amanahyphes saguassu Salles & Molineri

Amanahyphes saguassu Salles & Molineri, 2006: 9.
Material. One ♂ subimago from Venezuela, Estado Bolívar, Tarota, N 5° 49' 15" –W 61° 25' 4", 1324 m, 27/VI/2007, EG, AMO, CA and MEG cols. Deposited in MLBV.

Discussion. Salles & Molineri (2006) described the genus and species from adults and nymphs from Northern Brazil. The only specimen reported here does not show differences in morphology or pigmentation with the type material.

Ecology. As described in the previous species.



FIGURES 10–13. *Coryphorus aquilus*: 10, male imago from Leticia (Colombia) at left and from Venezuela at right; 11, female subimago; 12, male fore wing; 13, male abdomen, d.v.

***Macunahyphes pemonensis* sp. nov.**
(Figs. 7–8, 14–16)

Material. Venezuela, Estado Bolívar: 2 ♂ imagos (slide 364) from Aponwao, N 5° 51' 2" – W 61° 27' 52", 1340 m, 20/XI/2005, EG, AMO, CA and MEG cols.; 1 ♂ (slide 515) and 1 ♀ imagos from Mareman-Paru, N 5° 44' 49" – W 61° 24' 6", 1308 m, 28/VI/2007, EG, AMO, CA and MEG cols. Holotype ♂ imago and allotype ♀ in MLBV, 2 paratype ♂ imagos in IML.

Male imago (Fig. 14). Length (mm): body, 2.9–3.0 mm; fore wings, 3.1; fore leg, 1.6; cerci, 6.8; terminal filament, 9.0. General coloration whitish yellow. Head yellowish shaded heavily with gray except on two pale transversal strikes and a median blotch between lateral ocelli; antennae whitish, not shaded; venter of head pale, shaded gray on vestiges of submentum. Thorax. Prothorax yellowish translucent completely shaded with black. Meso- and metathorax yellowish orange shaded widely with gray, darker on carinae, anterolateral corners of mesonotum, and pleural membranes; sterna paler. Legs yellowish white shaded with gray on coxa, tibia and tarsus of forelegs. Wings, only fore wings present (Fig. 16), hyaline, membrane tinged with gray on basal half of C and Sc regions and basally to vein A; longitudinal veins blackish, cross veins grayish; vein CuP absent. Abdomen whitish translucent shaded heavily with black on terga 3–7, and with gray on 8–10 (Fig. 14); intersegmental membranes and median line not shaded, translucent; pleural folds 3–7 with black dashes; sterna not shaded. Genitalia (Figs. 7–8) with yellowish white styliger and orangeish penes, forceps absent; styliger plate very slightly projected posteriorly as a columnar base for each forceps with a pair of sublateral acute projections on hind margin (pps in Figs. 7–8); penes long and slender with apical furrow and a somewhat protruded ventral structure (vs in Figs. 7–8). Caudal filaments translucent very slightly shaded with gray.

Female imago (Fig. 15). Length (mm): body, 3.0 mm; fore wings, 3.1; cerci, 1.0; terminal filament, 1.7. Similar to male except more widely shaded with gray, including thoracic and abdominal sterna, and apex of hind femur. Sternum 9 projected slightly, apically blunt. Caudal filaments whitish.

Etymology. The name of the species, *pemonensis*, include the voice "Pemon" (meaning "people", according to the Pemon indigenous group from La Gran Sabana) and the Latin suffix "-ensis" (denoting place).

Discussion. This and the following described species are extremely rare, only few specimens are known from different collections. All male adults lack forceps, that may have been present and lost, or more likely their absence is a natural characteristic defining both species in a separate clade. We include the species in *Macunahyphes* Dias *et al.* because they show a ventral structure on the penes, a diagnostic character of that genus (Dias *et al.* 2005). Other important character defining *Macunahyphes* is in the shape of forceps, feature obviously impossible to check in the new species described here. All the other characters including wing venation and even color pattern are similar to *Macunahyphes australis*, the only previously known species. The main difference between the two new species here described and *M. australis* are: 1) the stronger development of the sublateral processes on the hind margin of the styliger, 2) the slender penes and 3) the absence of spines and the general smaller size of the ventral structure of the penes.

Diagnosis. *Macunahyphes pemonensis* **sp. nov.** can be distinguished from all other species in the family by the following combination of characters: 1) eyes similar in both sexes, undivided (Figs. 14–15); 2) fore wings with well developed CU-A lobe, especially in males; longitudinal vein CuP absent in both sexes (Fig. 16); 3) hind wings absent in both sexes; 4) membranous filaments of mesoscutellum absent; and 5) styliger plate very slightly projected posteriorly as a columnar base, forceps absent (Figs. 7–8); 6) penes heavily sclerotized, wide basally and narrowing distally, with a smooth (without spines) ventral projection along their entire length (Figs. 7–8).

Ecology. Imagos were collected along the river margins, at night, and during the rainy season (June 2007 and November 2005). Rivers flow through the upland savanna ecosystem (~ 1308–1340 m) and were non shaded, bedrock bottom rivers with acidic waters (pH=5). Mareman-Parú is a medium river (30 m wide, Fig. 25), whereas Aponwao is a large (100 m wide, > 4th order) river (Fig. 26).

***Macunahyphes incognitus* sp. nov.**
(Figs. 9, 17)

Material. Holotype ♂ imago (slide 43) from Brazil: Para, río Xingú, Campament S 3° 39' – W 52° 22', ca. 60 km S Altamira, 1 to 21/X/1986, P. Spangler & O. Flint cols. Deposited at INPA.

Male imago. Length (mm): body, 2.1; fore wing, 2.2; hind femur, 0.4. General coloration whitish yellow. Head yellowish white, ventrally with a pair of small submedian gray marks on submentum. Thorax. Prothorax whitish shaded dorsally with black; meso- and metathorax yellowish, shaded dorsally with gray. Hind legs whitish. Fore wings (Fig. 17) with hyaline membrane except around basal half of vein Sc, shaded with gray; veins C, Sc and R_1 blackish, R_2 grayish, remaining veins whitish translucent, grayish cross veins on Sc and R sectors. Abdomen whitish. Genitalia: forceps absent, styliger with a pair of sublateral acute projections on hind margin; penes completely fused apically, with subquadrate base, narrowing abruptly on median zone, and with a ventral structure (Fig. 9). Caudal filaments (only basal segments present) whitish translucent.

Etymology. From Latin *incognitus* (meaning unknown, strange) because of the scarcity of the material and the unusual genitalia.

Discussion and diagnosis. Characters that distinguish *Macunahyphes incognitus* from all other Leptohyphidae, including *M. australis*, are listed in the diagnosis of the previous species. *M. incognitus* can be distinguished from *M. pemonensis* by: 1) smaller size, with a relatively shorter and broader wing (Fig. 17); 2) penes (Fig. 9) with a subquadrate base, and almost completely fused apically; and 3) posterolateral projections of styliger less developed (pps in Fig. 9).

Tricorythopsis yucupe Dias, Salles & Ferreira
(Figs. 18–22)

Tricorythopsis yucupe Dias, Salles & Ferreira, 2008: 238.

Material. Venezuela, Estado Bolivar: 2 nymphs from Soroape, N 5° 6' 29" – W 61° 34' 40", 935 m, 21/III/2006, EG, AMO and MEG cols.; 3 nymphs from Aponwao, N 5° 51' 2" – W 61° 27' 52", 1340 m, 27/IV/2007, EG, AMO, CA and MEG cols.; 1 nymph idem except date: 18/III/2006; 2 ♀ imagos and 2 nymphs from Mareman-Parú, N 5° 44' 49" – W 61° 24' 6", 1308 m, 27/VI/2007, EG, AMO, CA and MEG cols.; 1 pharate ♂ subimago (slide 513) from Kamá, N 5° 25' 11" – W 61° 13' 5", 1035 m, 24/XI/2005, EG, AMO, CA and MEG cols. Four nymphs and 1 ♀ imago in MLBV, rest in IML.

Female imago (Fig. 18). Length (mm): body, 2.7–2.8; forewing, 3.1–3.2; caudal filaments, 0.6. General coloration yellowish brown shaded gray. Head yellowish except occiput and ecdysial suture whitish, shaded gray on hind margin behind eyes. Antennae yellowish translucent. Thorax. Pronotum hyaline except lateral regions yellowish, shaded gray almost completely. Mesonotum yellowish brown shaded widely with gray; membranous filaments short and wide, medially curved. Thoracic sterna paler. Legs. Forelegs absent as usual in the genus, middle and hind legs yellowish with gray shading on femora (except small pale marks) and subapical band on tibiae. Wings. Membrane hyaline, longitudinal veins blackish. Abdomen (Fig. 18). Segments yellowish white shaded widely with gray dorsally, except on anterior and posterior margins of all terga, on lateral zones of terga 1–6, and pale anterolateral marks on tergum 7. Caudal filaments yellowish translucent.

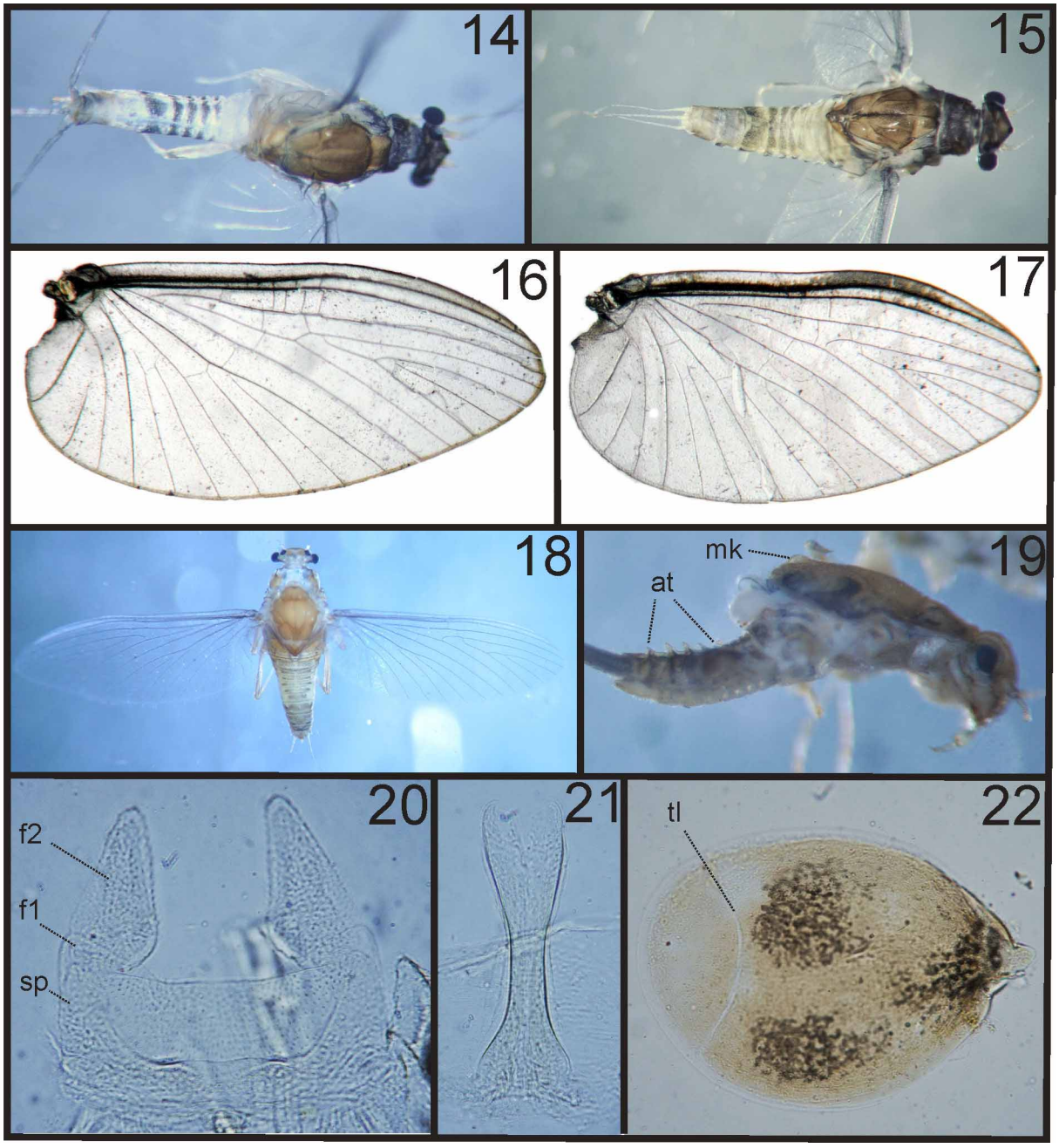
Male subimago, pharate. Body length, 2.7 mm. General coloration as female, except head paler, and abdominal terga 1–7 not shaded gray on lateral zones. Genitalia (Figs. 20–21): styliger plate with long projections forming a columnar base for each forceps (sp in Fig. 20); penes slender, medially narrow with a moderately expanded apical part (Fig. 21).

Nymphs (Fig. 19). Length (mm): body, 2.2 (male)–2.7 (female); terminal filaments, 1.8 (male)–2.3 (female); cerci, 1.9 (male)–2.5 (female). As in the original description except that abdominal dorsal tubercles (Fig. 19) are present on segments 6 to 9, much larger on 7–8 (original description reported them in terga 7–9).

Discussion. The nymphs are easily distinguished from other species of the genus by their large size and other characters listed in Dias *et al.* (2008), mainly the mesonotal paired keels on hind margin (mk in Fig. 19), the abdominal dorsal tubercles (at in Fig. 19), the operculate gills with 3 dark marks (Fig. 22), the pale head without gray shading, contrary to the rest of body widely shaded with gray and black. The adults can be distinguished from the other species by the following combination of characters: 1) large size (body length >2.7 mm); 2) abdomen shaded with gray almost completely except at lateral margins of terga 1–6 and pale anterior marks at each side of tergum 7 (Fig. 18); 3) middle and hind femora shaded widely with gray or black; 4) penes slender, medially narrow but widening in distal portion (Fig. 21). The combination of mesonotal keel, abdominal dorsal tubercles and projec-

tions on middle and hind coxae is also present in *T. gibbus* (Allen) and *T. pseudogibbus* Dias & Salles. The adults also share some features with *T. gibbus* (those of *T. pseudogibbus* are unknown): the widely pigmented femora, and the relatively great expansion of the distal lobes of the penes (Fig. 21). Nevertheless, the strong narrowing of the penes on the medial portion, somewhat resembling those of *T. artigas* Traver, distinguishes *T. yucupe* from *T. gibbus*.

Ecology. Imagos were collected along the river margins, at night, during the rainy season (November 2005 and June 2007) and dry season (March 2006), using light traps, whereas, nymphs were collected within the rivers using a D-net. All the sampled rivers (Figs. 25–26), flowing through the upland savanna ecosystem (935–1340 m), were large (30–100 m wide; > 4th order), non shaded, and bed-rock bottom rivers, with very acidic waters (pH=5).



FIGURES 14–22. *Macunahyphes pemonensis* **sp. nov.**; 14, male imago; 15, female imago; 16, male fore wing. *Macunahyphes incognitus*: 17, male fore wing. *Tricorythopsis yucupe*: 18, female imago; 19, nymph, l.v. (at=abdominal tubercle, mk=mesonotal keel); 20, styliger and forceps of pharate male adult (sp=styliger projections, f1=forceps segment 1, f2= forceps segment 2); 21, penes of pharate male; 22, operculate gill, d.v. (tl=transverse line).

FIGURES 23–26. Study sites: 23, Kaku Parú; 24, Kavanayén; 25, Mareman Parú; 26, Aponwao.

Tricorythopsis volsellus Molineri

Tricorythopsis volsellus Molineri 1999: 294.

Material. One ♂ imago (slide 514) from Venezuela, Estado Bolívar, Tarota, N 5° 49' 15" – W 61° 25' 4", 1324 m, 27/VI/2007, EG, AMO, CA and MEG cols. Deposited in MLBV.

Discussion. *T. volsellus* was described from imagos of both sexes from Rio Negro (TFA, Venezuela), Molineri (1999) discussed and illustrated the characters defining this species.

Ecology. The specimen was collected along the river margins, at night, and during the rainy season (June 2007). The river was a non shaded, medium size (12 m wide; 3rd order) and bed-rock bottom river with acidic waters (pH=5).

Tricorythodes sp.

Material. Venezuela, Estado Bolívar: 1 ♂ and 6 ♀ imagos from Mareman-Parú, N 5° 44' 49" – W 61° 24' 6", 1308 m, 26/VI/2007, EG, AMO, CA and MEG cols. (MLBV); 7 ♂ imagos same data except date 28/VI/2007 (MLBV); 7 ♀ imagos from Kaku-Parú, N 4° 54' 0" – W 61° 5' 25", 913 m, 29/VI/2007, EG, AMO, CA and MEG cols. (IML); 20 ♂ imagos same data except date 28/VI/2007 (IML); 6 ♂ imagos from Tarotá, N 5° 49' 15" – W 61° 25' 4", 1324 m, 27/VI/2007, EG, AMO, CA and MEG cols. (MLBV).

Discussion. As the nymphal characters are necessary to correctly diagnose and describe species in this genus, we prefer not to erect a new species for this material until the immature stages could be known.

Ecology. Imagos were collected along the river margins (Fig. 25), at night, and during the rainy season (June 2007). Rivers were uncovered or partially shaded (Kaku-Parú), with acidic waters (pH=5). They were small to medium size streams (17–30 m wide; 2nd–3rd order), with bottoms mainly composed of bed-rock and gravels (Kaku-Parú).

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