

Tricorythodes faeculopsis (Ephemeroptera: Leptohiphidae), description of new stages and first record from Venezuela

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Tricorythodes faeculopsis (Ephemeroptera: Leptohiphidae), descripción de nuevos estadios y primer registro de Venezuela

RESUMEN. *Tricorythodes faeculopsis* Belmont, Salles & Hamada, es redescrito e ilustrado a partir de todos los estados. Se registra por primera vez esta especie de Venezuela. Los imagos macho y hembra y los huevos son descritos por primera vez, y se brinda nueva información para las ninfas. Esta especie se caracteriza por presentar, en los adultos: longitud del ala anterior 2.9–3.6 mm; vena CuP ausente o reducida; forceps con segmentos I y II subiguales en longitud; penes piramidales, con márgenes amarillentos; ninfas: palpo maxilar pequeño, 1-segmentado; razón longitud / ancho máximo de los fémures ca. 0.3; uñas tarsales con 4–10 denticulos marginales y 1–2 submarginales; huevos con costillas longitudinales.

PALABRAS CLAVE. Pannota. Efímera. Neotrópico. *Tricorythodes bullus*.

ABSTRACT. *Tricorythodes faeculopsis* Belmont, Salles & Hamada, is redescribed and illustrated from all the stages. The species is firstly recorded from Venezuela. The male and female imago and eggs are here firstly described and new information is provided for nymphs. The species can be recognized by, adult: forewing length 2.9–3.6 mm; vein CuP absent or reduced; forceps segments I and II subequal in length; penes pyramidal, with yellowish margins; nymphs: maxillary palp small, 1-segmented; ratio length/maximum width of femora: ca. 0.3; tarsal claws with 4–10 marginal denticles and 1–2 submarginal denticles; eggs with longitudinal ridges.

KEY WORDS. Pannota. Mayfly. Neotropics. *Tricorythodes bullus*.

INTRODUCTION

Tricorythodes Ulmer is one of the twelve most specious genera of mayflies (Barber-James *et al.*, 2008), with 51 species described from South, Central and North America. In spite of the adult stage (mainly male genitalia) being rather homogeneous throughout the genus, nymphs show a wide variety of body forms and associated heterogeneity in gills, mouthparts and legs. This differentiation in the immature stages

led different authors to recognize numerous groups of species, sometimes formalized as subgenera or genera (Allen & Murvosh, 1987; Wiersema & McCafferty, 2000; Baumgardner & Avila, 2006): *Asioplax* Wiersema & McCafferty, *Cabecar* Baumgardner, *Epiphrales* Wiersema & McCafferty, *Homoleptohiphes* Allen & Murvosh and *Tricorythyphes* Allen & Murvosh. Formal phylogenetic analyses failed to distinguish these taxa as monophyletic (Molineri, 2002; 2006) and until a comprehensive classification of the group

can be attained through the phylogenetic analysis of all the species, we follow Molineri (2002) in treating all the species in *Tricorythodes sensu lato*.

The aim of the present paper is to describe the unknown stages (male and female imago and eggs) of a recently described species, *T. faeculopsis* Belmont, Salles & Hamada (2011), from new specimens (eggs, nymphs and adults of both sexes) collected in the Guayana's Up-lands of Venezuela.

MATERIALS AND METHODS

Dissected parts of the nymphs and adults were mounted on microscope slides using Canada Balsam, except wings that were mounted dried. All the material is preserved in ethyl alcohol 96%. Photographs were taken using a NIKON SMZ-10 stereomicroscope or a microscope, with a Nikon D5000 digital camera; and line drawings were done using a camera lucida attached to a microscope.

Nymphs and adults were associated by shared color pattern of a pharate male subimago inside the nymphal cuticle; and a female mature nymph with the same coloration of adult female. Eggs used for SEM study were dehydrated in a graded ethanol series, dried by the critical point method, sputter coated with gold and observed with a JEOL 35 CF scanning electron microscope (more details of this process are given in Molineri, 2004).

Collectors are abbreviated as follows: EG (Edmundo Guerrero), Ana-María Oliveira Pes (AMO), María-Eugenia Grillet (MEG), and Carlos Augusto da Silva Azevêdo (CA). Material deposition: MLBV, the Invertebrate Collection of Laboratorio de Biología de Vectores (Instituto de Zoología y Ecología Tropical, Universidad Central de Venezuela, Caracas) and IBN (Instituto de Biodiversidad Neotropical, Tucumán, Argentina).

RESULTS

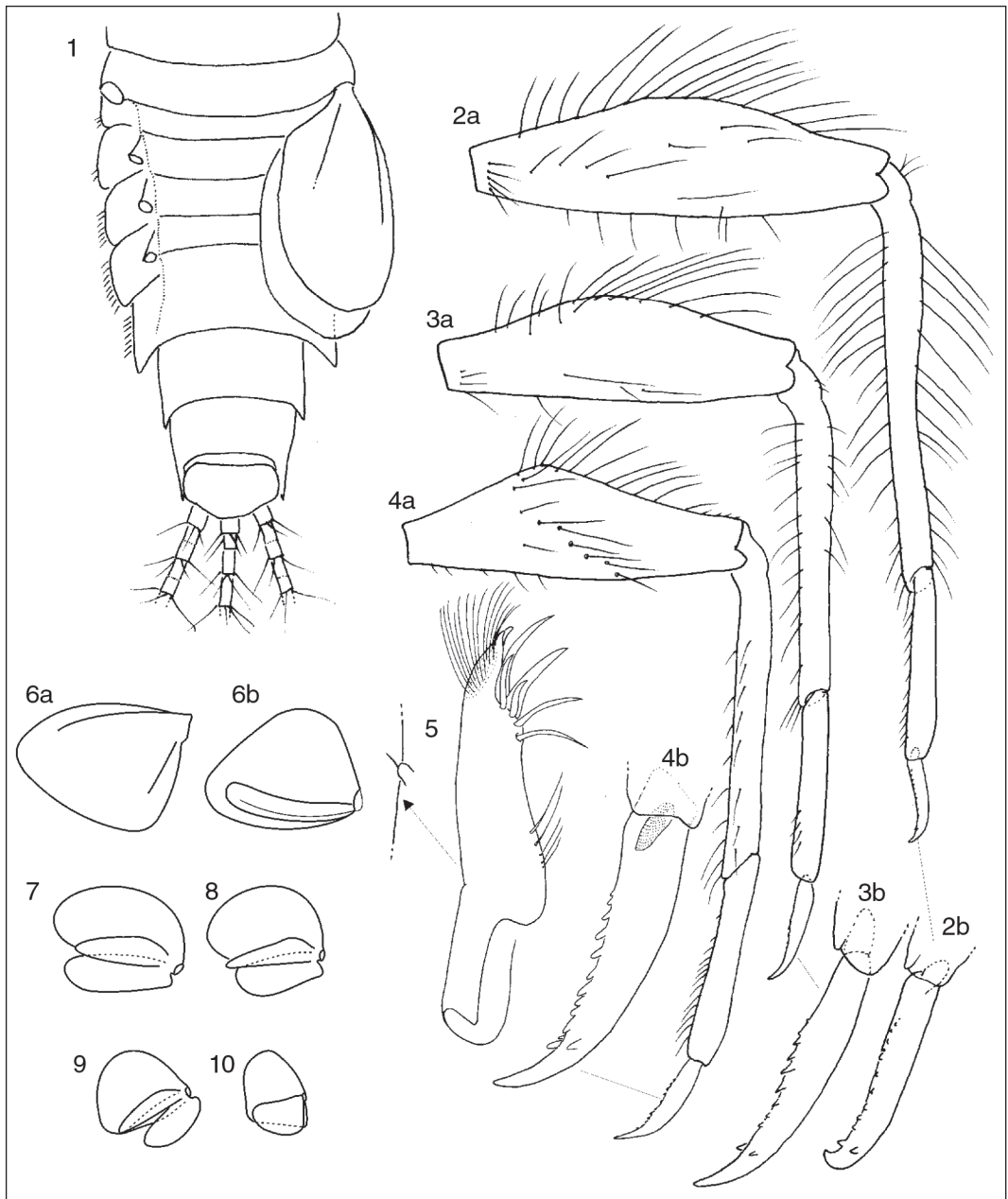
Tricorythodes faeculopsis Belmont, Salles & Hamada (2011)

Material examined. Venezuela. Two nymphs from, Bolívar State, the Kauí stream, N 05° 28' 34", W 61° 16' 20", 1196 m, 24-XI-2005, EG and MEG cols. (IBN); 1 male and 6 female imagos from the Mareman-Parú river, N 05° 44' 49", W

61° 24' 6", 1308 m, 26-VI-2007, EG, AMO, CA and MEG cols. (MLVB); 7 male imagos same data except date 28-VI-2007 (MLVB); 7 female imagos from the Kaku-Parú stream, N 4° 54' 0", W 61° 5' 25", 913 m, 29-VI-2007, EG, AMO, CA and MEG cols. (IBN); 20 male imagos same data except date 28-VI-2007 (IBN); 6 male imagos from the Tarotá stream, N 05° 49' 15", W 61° 25' 4", 1324 m, 27-VI-2007, EG, AMO, CA and MEG cols. (MLVB).

Diagnosis. Nymphs: maxillary palp small 1-segmented with apical seta, galea-lacinia twice the length of the stipes (Fig. 5); ratio length/maximum width of femora: 0.28–0.33 (Figs. 2a, 3a, 4a); transversal row of long setae on dorsum of forefemora located at 0.35 from base (Fig. 4a); tarsal claws with 4–10 marginal denticles and 1–2 submarginal denticles in a double row (Figs. 2b, 3b, 4b); operculate gills subtriangular and translucent, only with a gray minute mark on base (Figs. 6a-b); legs pale; lateral flanges on abdominal segments 3–7, and posterolateral spines on segments 7–9 (Fig. 1). **Imago:** small species (forewings 2.9–3.6 mm), with whitish males almost without gray markings, females with gray marks distally on all femora and on abdominal terga (Figs. 13, 15); compound eyes are small, holoptic and well separated in dorsum of head in both sexes (Figs. 13, 15); vein CuP absent or partially present (only basal 1/3) (Figs. 16–17); the ratio length of forceps segment I/forceps segment II is 1.0 (Figs. 11, 14); penes pyramidal, with a small apical furrow 0.1 the length of penes, and with sclerotized yellowish lateral margins (Figs. 11, 14); styliger plate projected sublaterally and with tiny spines on hind margin (Fig. 12). **Eggs:** adhesive filaments absent (Figs. 18–19); chorionic plates aligned longitudinally forming 6 ridges (Figs. 18–19); micropylar area located near the uncapped pole (Figs. 18–19).

Mature nymph (Figs. 1-10). Length of male (mm): body, 3.1; cerci, 1.75; terminal filament, 2.2. Length of female (mm): body, 3.75; hind femur, 0.85; cerci and terminal filament, 2.0. Male nymph (ready to molt to subimago) whitish, very pale, shaded very slightly with gray on abdominal sterna I–II. Female nymph (nearly mature) yellowish white with gray markings described below. Head. Occiput with a net-shaped gray pattern, darker on a transversal line between lat-



Figs. 1-10. *Tricorythodes faeculopsis* Belmont, Salles & Hamada, nymph. 1, abdomen, dorsal view (dv), without left gills; 2a-b, hind leg and detail of claw; 3a-b, middle leg and detail of claw; 4a-b, foreleg and detail of claw; 5, maxillae and detail of palpus; 6a-b, operculate gill II, dorsal and ventral view respectively; 7-10, gills III to VI, ventral view (vv).

eral ocelli, a gray medial line extending to hind margin and a blackish thin line along hind margin. Mouthparts: typical for the genus, maxillary palp small, 1-segmented with apical seta (Fig. 5), distal brush of maxilla with about 20 long and curved setae, with stipes 0.5 the length of galea-lacinia, inner proximal margin of the

galea-lacinia with 5 setae (Fig. 5); labium with paraglossae and glossae with the same length. Thorax. Mesonotum with small gray marks anterolaterally, wingbuds with developing costal veins grayish. Legs (Figs. 2-4): foreleg (Fig. 4a); proximal portion of transverse row of long setae at 0.35 of total femoral length from base;

maximum width of femur 0.33 of total length, tarsal claw with 10 marginal denticles increasing in size distally (the last one is subparallel to the margin) and with 2 submarginal denticles contiguously to this marginal row (Fig. 4b). Middle leg (Fig. 3a): femur maximum width 0.30 of total length, with long setae along entire hind margin and basal half of fore margin; tarsal claw with 9 marginal denticles increasing in size distally until the fifth denticle, then decreasing in size, subdistally with 1 submarginal denticle (Fig. 3b). Hind leg (Fig. 2a): femur maximum width 0.28 of total length, with long setae along entire hind and fore margins and along a medial scattered row dorsally; tarsal claw with 10 marginal denticles increasing in size distally and with a pair of submarginal subapical denticles (Fig. 2b). Abdomen (Fig. 1). Posterolateral spines present on segments VII–IX (smaller in male), lateral flanges present on segments III–VII. Operculate gills subtriangular (Figs. 6a-b), whitish translucent, shaded gray on a small basal mark, with a single ventral lamella. Gill formula 2/3/3/3/2 (Figs. 6–10). Caudal filaments whitish translucent (slightly shaded gray on male).

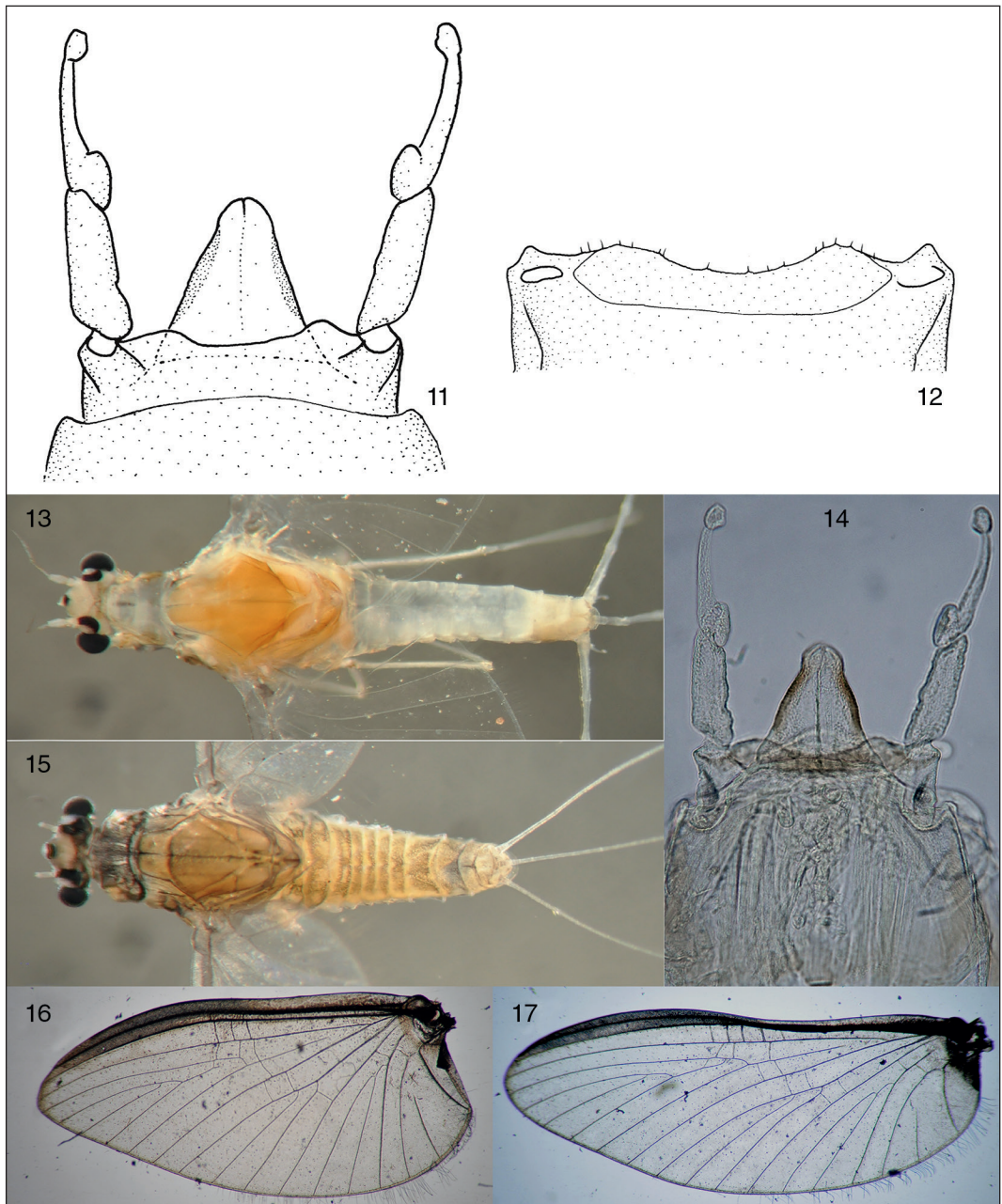
Male imago (Figs. 11-12, 13-14, 16). Length (mm): body, 2.9–3.3; forewing, 2.9–3.2; cerci, 7.0–7.5; terminal filament, 11.1–12.2. General coloration whitish translucent. Head (Fig. 13). Whitish with a thin V-shaped brownish mark between lateral ocelli, behind and superimposed to this mark a light gray shading is present, ventrally with small grayish marks on the zones previously occupied by mandibles and labium. Thorax (Fig. 13). Pronotum translucent except for yellowish marks laterally and a grayish elongated mark anteromedially. Meso- and metathorax with yellowish sclerites, membranes lighter. Legs: femora yellowish white, rest of legs whitish translucent, a subdistal gray mark is present on forefemora. Wings (Fig. 16): membrane hyaline, veins translucent except C, Sc and R_1 slightly shaded gray basally. Abdomen (Fig. 13). Hyaline translucent except segments IX–X whitish, shaded slightly with gray on sternum I. Genitalia (Figs. 11–12, 14): whitish translucent except hind margin of styliger and lateral margins of penes yellowish; the yellowish portion of the styliger is concave medially and roundly projected sublaterally and presents an irregular hind margin with

minute spines (Fig. 12); the whitish portion of the styliger forms a ventrally protruding base for each forceps; the styliger also presents small projections dorsally to forceps base (Fig. 12); forceps segment I equal in length to segment II. Penes pyramidal completely fused except for a small apical furrow 0.1 the length of penes. Caudal filaments translucent.

Female imago (Figs. 15, 17). Length (mm): body, 3.1–3.2; forewing, 3.3–3.6; cerci, 1.5; terminal filament, 2.0. General coloration yellowish (Fig. 15). Head. Similar to male but V-shaped mark wider and gray shading stronger (Fig. 15). Thorax (Fig. 15). Pronotum translucent, almost completely shaded with gray except on a pair of submedian elongated pale spots near hind margin. Mesothorax brownish yellow shaded widely with gray except, carinae and margins black; rest of thorax yellowish. Legs: all femora whitish with a gray subapical mark and a lighter grayish elongated mark near base; tibiae and tarsi translucent shaded with gray medially on hind tibiae, a small light gray spot is present basally to all tarsal claws. Wings (Fig. 17): membrane hyaline, longitudinal veins grayish, somewhat purplish at base of C, Sc and R_1 ; membranous filaments of mesoscutellum grayish. Abdomen. Yellowish white shaded with gray dorsally on extensive pattern (Fig. 15). Ninth sternum roundly projected. Caudal filaments whitish.

Eggs (Figs. 18–19). Length: 130 μ . Maximum width: 65 μ . One polar cap present. Circular micropylar area located near the uncapped pole. Chorionic plates aligned in groups (of 6–7 plates) forming 6 longitudinal ridges extending from pole to pole. The surface between the ridges is occupied by smooth chorion. Adhesive filaments absent.

Ecology. Imagos were collected along the stream margins, at night, and during the rainy season (November 2005 and June 2007), by using light traps; whereas, nymphs were collected within the rivers using a D-net. Rivers flow through an upland savanna ecosystem, and they were partially shaded (Kaku-Parú, Kauí) or unshaded (Mareman-Parú and Tarotá), small to medium size, shallow bedrock bottom (18–30 m wide; 1st–3rd order), rivers with acidic waters (pH=5).

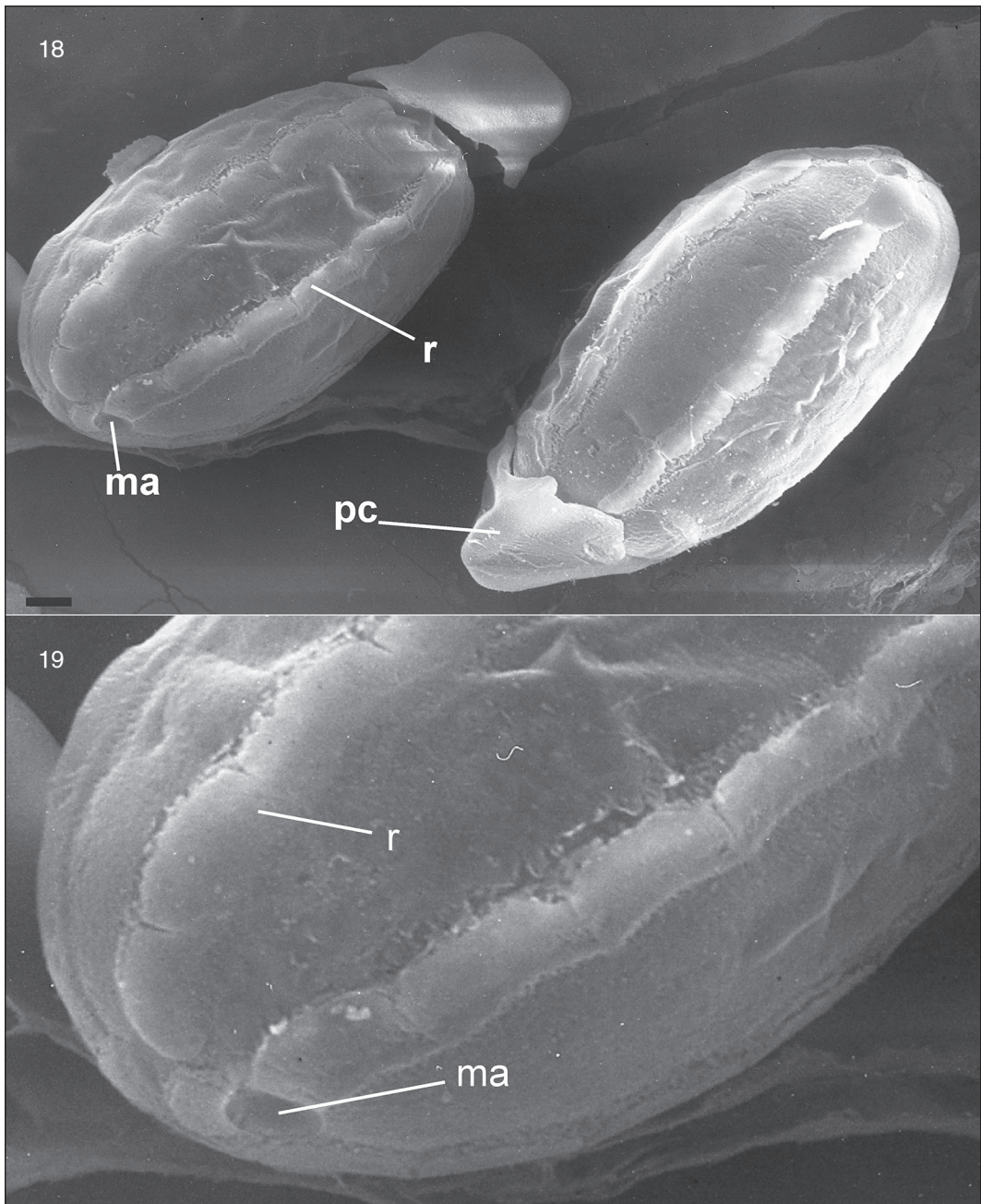


Figs. 11-17. *Tricorythodes faeculopsis* Belmont, Salles & Hamada. Imagos. Male genitalia: 11, general, vv; 12, detail of styliger, vv.; 13, male, dv; 14, male genitalia, vv; 15, female, dv; 16, male forewing; 17, female forewing.

DISCUSSION

The genus *Tricorythodes s.l.* (including *Asioplax*, *Cabecar*, *Epiphrades*, *Homoleptohyphes* and *Tricoryhyphes*) ranges from Canada to Central Argentina and is presently composed by 51 species. *Tricorythodes faeculopsis* shows

a unique combination of characters useful to distinguish the alate, nymphal and egg stages from all the species in *Tricorythodes sensu lato* (see diagnosis above). The same list of characters, together with the swelling at base of second forceps segment (a unique characteristic of *Tricorythodes s.l.*), is useful to separate this



Figs. 18-19. *Tricorythodes faeculopsis* Belmont, Salles & Hamada. Eggs. 18, general view; 19, detail of uncapped pole. Abbreviations: ma= micropylar area, pc= polar cap, r= ridge. (Scale bar= 10 μ .)

species from other taxa of the Leptohiphidae (including *Macunahyphes*).

The penes of *T. faeculopsis* are similar to *T. bullus* and *T. chalaza*, in the pyramidal form and in the almost complete fusion of the lobes. Also these three species show a reduced vein CuP in the forewings, sometimes absent or partially developed,

with different states even in the wings of the same specimen. Nevertheless, the adults of *T. faeculopsis* can be distinguished for their smaller size and much paler coloration on the body and wings.

In the nymphal stage, *T. faeculopsis* is similar to *T. cristatus* Allen (1967), *T. bullus* Allen (1967) and *T. chalaza* Gonçalves *et al.* (2010) in leg setation and

form of femora, but the new species can be differentiated by the absence of dorsal tubercles on the head and/or thorax. Belmont *et al.* (2011) reported only 4 to 6 marginal denticles on tarsal claws, so here we are extending the range to 10 denticles. These authors also mentioned that abdominal gill on segment VI is formed by a unique lamella, but our specimens show two lamellae (one of them is hard to distinguish because of its small size).

The eggs of *T. faeculopsis* are remarkable in the mode that the chorionic plates are aligned forming longitudinal ridges. The eggs of other species of *Tricorythodes* s.l. are very scarcely known (e.g., *T. hiemalis* Molineri, 2001; *T. griseus* Hofmann *et al.*, 1999) but their chorionic plates are more homogeneously distributed on the egg surface. This characteristic is common in the family Leptohiphidae (*Macunahyphes* Dias *et al.*, 2005; *Traverhyphes*, *Leptohiphys*, and *Haplohyphes*, Molineri, 2004; 2006) and the ridges shown in *T. faeculopsis* are probably the derived state that should be explored in related species. The absence of adhesive filaments is shared with *Macunahyphes australis*.

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