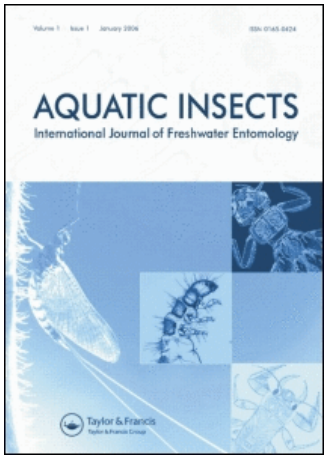


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Carlos Molineri [a]
[a] INSUE-CONICET, National University of Tucumán, Argentina

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# The larvae of the burrowing mayfly genus *Tortopus* (Ephemeroptera: Polymitarcyidae)

Carlos Molineri*

*INSUE-CONICET, National University of Tucumán, Argentina*

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The larval stage of *Tortopus* is redescribed based on three species: *T. puella* from North America, the only species of the genus previously known from larva, and the larvae of *T. obscuripennis* and *T. sarae* from South America described here. Generic characters of the larva include: relatively large finger-like gill near base of maxilla, inner margin of mandibular tusks with a subdistal tubercle, straight or weakly convex frontal ridge present between antennae, reduced unilamellated gill on abdominal segment I. Additionally the male imagines of both Neotropical species are described for the first time, and *T. obscuripennis* is recorded from Bolivia. Diagnoses, SEM photographs, and illustrations are given for the new stages described and for the identification of the three *Tortopus* species known as larvae.

**Keywords:** taxonomy; Campsurinae; ultrastructure; filtering mouthparts; *Tortopus*

## Introduction

The family Polymitarcyidae is mainly known from adults and larvae have seldom been described. The genus *Tortopus* is presently composed of 12 species, three from North America: *T. circumfluus* Ulmer (1942), *T. primus* (McDunnough 1924, as *Campsurus*) and *T. puella* (Pictet 1843, as *Palingenia*), and nine from Central and South America: *T. bellus* Lugo-Ortiz and McCafferty (1996), *T. bruchianus* (Navás 1926, as *Campsurus*), *T. harrisi* Traver (1950), *T. igaranus* Needham and Murphy (1924), *T. obscuripennis* Domínguez (1985), *T. parishi* (Banks 1918, as *Campsurus*), *T. sarae* Domínguez (1985), *T. unguiculatus* (Ulmer 1920, as *Campsurus*), and *T. zottai* (Navás 1920, as *Campsurus*). The larval stage of *Tortopus* is known only from one North American species (*T. puella*). This species inhabits U-shaped tunnels burrowed into clay banks of large rivers; larvae were thoroughly described by Scott, Berner and Hirsch (1959). Here I describe the larvae and male imagines of two species from Argentina previously known only from female imagines (*T. obscuripennis* and *T. sarae*). A generic redescription of the larva is included.

## Material and methods

Larvae were obtained by removing part of the clay substrate of river margins. Adults were caught with light traps around sunset. Additional adults were obtained from

*Email: cmolineri@csnat.unt.edu.ar

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laboratory reared larvae. Larvae and adults were reared in aquaria provided with clay substrate obtained from the natural habitat. Larvae were fed with fine particulate fish food. Adults were maintained alive for at least 15 minutes in the same aquaria, with a large mesh preventing their escape. Observations on burrowing larvae were conducted in the same aquaria. Morphological terms are from Kluge (2004).

For SEM study a JEOL 35CF scanning electron microscope at 25 kV was used. Male genitalia and larval parts were dehydrated in a graded ethanol series, and dried by critical point-method using CO2 in a Bomar apparatus. Then they were mounted with double-sided tape on SEM stubs and sputter coated with gold.

### *Depositories*

IFML (Entomological collections of Instituto-Fundacion Miguel Lillo, Tucuman, Argentina), UMSA (Universidad Mayor de San Andres, La Paz, Bolivia), UMSS (Universidad Mayor de San Simon, Cochabamba, Bolivia).

## Taxonomy

### *Tortopus* Needham & Murphy (Figures 1–41)

*Tortopus* Needham and Murphy 1924, p. 23; Ulmer 1933, p. 197; Traver 1950, p. 596; Scott et al. 1959, p. 205; McCafferty 1975, p. 489; Domínguez, Molineri, Pescador, Hubbard and Nieto 2006, p. 581 (type-species: *Tortopus igaranus* Needham and Murphy, original designation).

#### *Mature larva*

Length of body (from apex of tusks to apex of abdominal tergum X): female, 17–23 mm; male, 13–17 mm. Head (Figures 12–14, 29) with dense tufts of plumose setae dorsally between base of antennae and compound eyes (preocular tuft, pt in Figure 29) and on frontal ridge (fr in Figure 29); an expanded, concave clypeal region present between the prominent frontal ridge and the labrum (fc in Figure 29). Antennae relatively short, less than 1½ times length of tusks, dorsally with dense tuft of setae on pedicel (antennal tufts, as in Figure 29), scape only with few setae, flagellum bare except for few and very small sensillae (Figures 35–37). Mouthparts: labrum small covered dorsally with long plumose setae (Figure 34), maxillae with large bi-segmented palpi, covered with numerous long plumose setae, stipes with a membranous finger-like gill at base (Figures 28, 32). Mandibles (Figures 20–23, 29, 33) with molar region protruded medially, incisors present but very reduced; large mandibular tusk present, basal region between tusk and protruding molar region covered by a dense tuft of setae dorsally (dt in Figures 22, 33); inner margin of tusk with few to many robust spines, the subapical spine largest (=subdistal tubercle); outer margin of tusk with none or few long setae, except basally with a double sinuous line of long plumose setae (fs in Figure 33). Hypopharynx with bare lingua, superlinguae heavily covered with plumose setae (Figure 31). Labium heavily covered with long plumose setae, bi-segmented palpi very well developed (Figures 17–19, 30). Thorax. Fossorial legs (Figures 38–40) robust; forefemora with a tuft of very long plumose setae at base, similar setae present on inner margin of foretibia (fs in Figure 38) forming a filtering structure in natural position (fs in Figure 26); middle and hind femora with heavier setation (Figures 39–40) but without long plumose setae, some grouped setae forming a subdistal band on

hind femora (Figure 40); tibiae and tarsi of all legs heavily covered with setae, foretarsi reduced and fused with tibiae; tarsal claws large, pointed and smooth, without denticles, with small sensillae (Figure 41). Abdomen. First pair of abdominal gills reduced in size, single (not lobed); remaining gills very large, formed by two lamellae, dorsally directed and curving rearward in the middle. Genital rudiments of males visible in last instars (Figures 4–9). Female terminal filament slightly longer or subequal in length to cerci, about 0.5 length of abdomen. Male terminal filament short ca. 0.5 length of cerci; terminal filament 0.6–0.8 times length of abdomen, cerci 1.3–1.5 times length of abdomen.

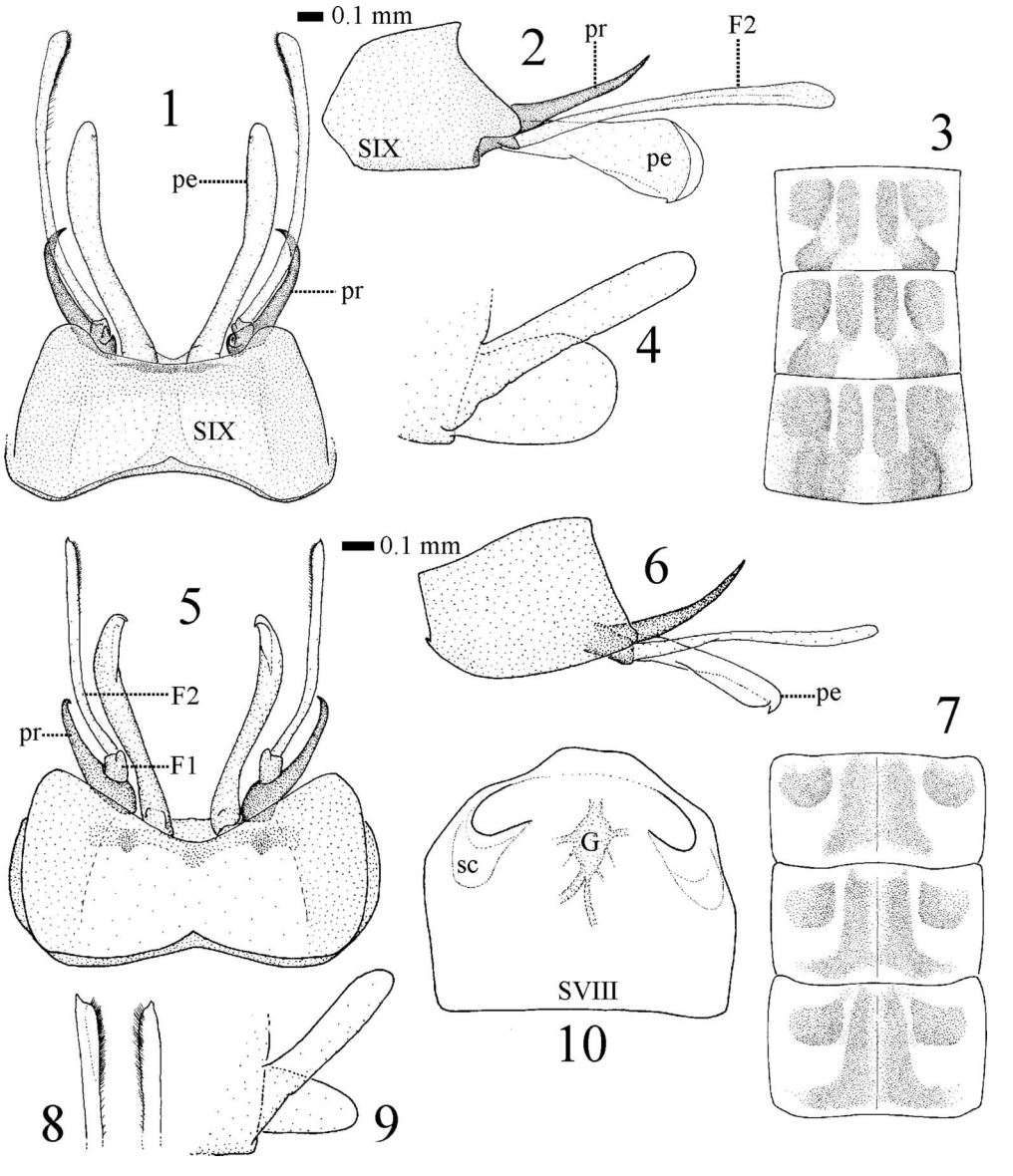
*Diagnosis*. The adult stage of the genus can be recognised by (after Domínguez et al. 2006): (1) the presence of reticulated veins in anal margin of hind wings; (2) middle and hind legs with all segments present, although atrophied and non-functional; (3) small basal segment (not totally divided) present between forceps and parastyli (Figures 1–2, 24); (4) penes relatively simple, U or V-shaped (Figures 1–2, 25); and (5) females with complementary structure to male parastyli (Figure 10), consisting of a pair of sockets in female sternum VIII (McCafferty and Bloodgood 1989). In the larva: (1) mandibular tusks with single prominent subdistal tubercle on median margin (arrow in Figures 20–23, 29); (2) few long setae on outer lateral margin of mandibles; (3) maxillae with a well-developed ventral finger-like gill near base (Figures 28, 32); (4) frontal ridge between antennae straight to very slightly concave, forming the posterior limit of a well-developed clypeal region (Figure 29); (5) abdominal gill I not lobed (single).

*Discussion*. The basal finger-like gill on maxillae is first reported here, as it was not previously described for *T. puella*. This structure is not unique to *Tortopus*, since larvae of some species of *Campsurus* also present a membranous outgrowth at base of maxillae, but much smaller. The presence of this gill could probably be a synapomorphy of Campsurinae since *Asthenopus* sp. larvae present a very small projection at base of the maxillae but in a different (dorsal) position.

The frontal ridge between antennae is strongly convex in *Campsurus* larvae and projects anteriorly beyond the anterolateral spine above each antennal socket, resulting in a much less developed clypeal area. In *Tortopus* the frontal ridge may not appear straight depending on the angle, but never projects beyond the apex of spines.

Scott et al. (1959) suggested that the relative length of the terminal filament and cerci of larvae could be used to separate larvae of *Tortopus* and *Campsurus*, but this character is variable in *Campsurus*.

*Distribution and biology*. From central Argentina to Canada. Larvae of this genus burrow U-shaped tunnels in clay banks of rivers and streams, where they filter organic particulate matter for food (Scott, Berner and Hirsch 1959; Tsui and Peters 1974). The larva is positioned facing one of the U-tube entrances, with forelegs positioned as in Figure 26. The long plumose setae present on the forelegs (Figures 26–27, 38), base of mandibles (Figure 33), and apex of maxillae (Figures 28, 32) are used for filtering food. The very mobile maxillary and labial palpi constantly clean these setae and conduct the food to the mouth. Mandibular tusks are used to burrow by means of small movements that remove substrate, pushing it away using the dorsal surface of the tusks and the concave clypeal area (Figure 29).




Figures 1–10. Figures 1–4, *T. obscuripennis*: (1) male genitalia, ventral view; (2) same, lateral view (F1, F2 = forceps segments, pe = penes, pr = parastyli, SIX = sternum IX); (3) male abdominal terga V–VII; (4) male genital rudiments of mature larva, lateral view. Figures 5–10, *T. sarae*: (5) male genitalia, ventral view; (6) same, lateral view; (7) male abdominal terga V–VII; (8) apex of forceps, detail; (9) male genital rudiments of mature larva, lateral view; (10) abdominal sternum VIII of female imago (G = ganglion, sc = socket for male parastylus).

### ***Tortopus obscuripennis*** **Domínguez** (Figures 1–4, 11, 14, 17–21, 26–29, 37)

*Tortopus obscuripennis* Domínguez 1985, p. 71 (female imago); Domínguez et al. 2006, p. 585.

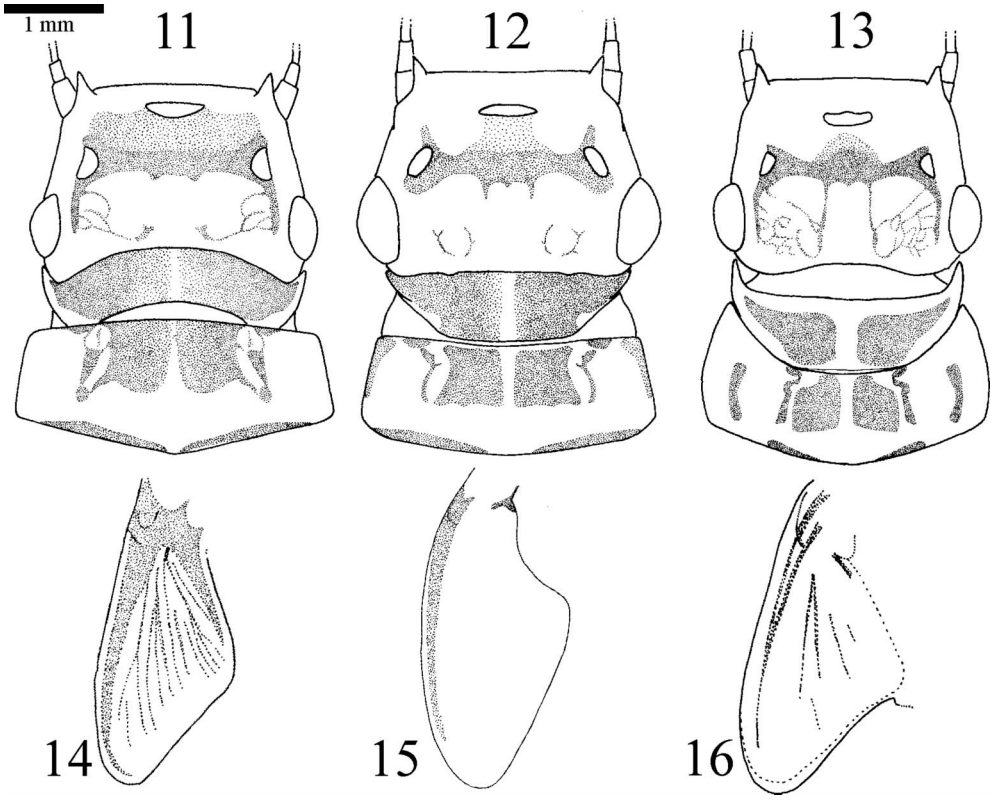
*Studied material* (IFML). Holotype ♀ imago and 18 paratype ♀ imagines from ARGENTINA, Salta, Aguas Blancas, Estancia El Arrayazal, 9-XII-1981, E. Domínguez col. Additional material: 2 ♂ and 2 ♀ imagines from BOLIVIA, Tarija, río Conchas, S 22° 17′ 44.5″–W 64° 23′ 18.7″, 828 m,

2-III-2006, C. Nieto & P. Rueda cols.; 2 ♂ and 2 ♀ imagines from Tarija, quebrada El Molino, río El Molino, S 21° 35′ 35.7″–W 64° 46′ 4.7″, 1907 m, 26-II-2006, C. Nieto & P. Rueda cols.; 2 ♀ imagines from Tarija, río Salinas, S 21° 47′ 12.9″–W 64° 14′ 29.8″, 1069 m, 6-III-2006, E. Domínguez & C. Nieto cols.; 50 larvae from Tarija, río Salinas, S 21° 38′ 42.5″–W 64° 9′ 8.2″, 1160 m, 6-X-2004, C. Molineri & V. Manzo cols.; 50 larvae from Tarija, río Saicán, S 21° 46′ 28.5″–W 64° 5′ 24.2″, 1000 m, 7-X-2004, C. Molineri & V. Manzo cols.; 1 reared ♂ subimago (larval cuticle partially shed) and 30 larvae from ARGENTINA, Jujuy, Bananal, río Piedras, S 23° 30′ 47″–W 64° 33′ 09″, 580 m, 2-VI-2000, C. Molineri & C. Nieto cols.; 14 larvae from Salta, P. N. El Rey, A° Los Noques, S 24° 44′ 44″–W 64° 38′ 11″, 905 m, 11-XI-2005, C. Molineri col.

*Male imago*. Length: body, 14.5–15.5 mm; forewings, 14.5–15.0 mm; hind wings, 6.0–6.5 mm; forelegs, 6.0 mm; cerci, 36.0–41.0 mm. General colouration cream with grey shading dorsally. Head whitish shaded black between lateral ocelli, extending forward to median ocellus and posteriorly toward posterior margin of head along medial margin of compound eyes. Antennae: scape and pedicel heavily shaded grey, flagellum hyaline. Thorax: pronotum medially translucent, laterally whitish, with grey shading. Meso- and metanotum yellowish white with grey shading; shading on mesonotum forming a pair of submedian longitudinal bands and a smaller anteromedian mark; shading on metanotum forming a pair of transversely elongated sublateral marks. Thoracic pleura and sterna paler, without shading, prealar bridge orangish yellow. Legs whitish, forelegs shaded grey on subapex of femora, on median and apical part of tibiae, and (darker) on tarsi, claws whitish. Wings. Membrane of wings hyaline very slightly shaded with purplish grey, much heavier between veins C and $R_1$, longitudinal and cross-veins completely shaded with purplish grey. Abdomen whitish shaded with grey dorsally; terga I–II with a pair of sublateral trapezoid marks (much darker on I), sometimes tergum II almost without shading; terga III–VII with a pair of submedian subrectangular grey marks and two pairs of sublateral subcircular grey marks (Figure 3); terga VIII–X shaded black more extensively except on small pale marks; terga III–VIII with a thin blackish medial line. Genitalia (Figures 1–2) whitish, except parastyli yellowish; penes long and robust, extremely widened apically in lateral view (Figure 2), with small subapical ventral hook; forceps apically rounded; parastyli relatively long (slightly shorter than penes, nearly ½ length of forceps) and dorso-medially curved. Terminal filament rudimentary, whitish; cerci whitish completely shaded with gray except at annulations.

*Female imago*. Length: body, 13.0–14.5 mm; forewings, 18.0–19.0 mm; hind wings, 7.7–8.0 mm; cerci, 2.5–5.0 mm. These female imagines are slightly smaller than the type material, as Domínguez (1985) reported a forewing length of 19.5–20.5 mm.

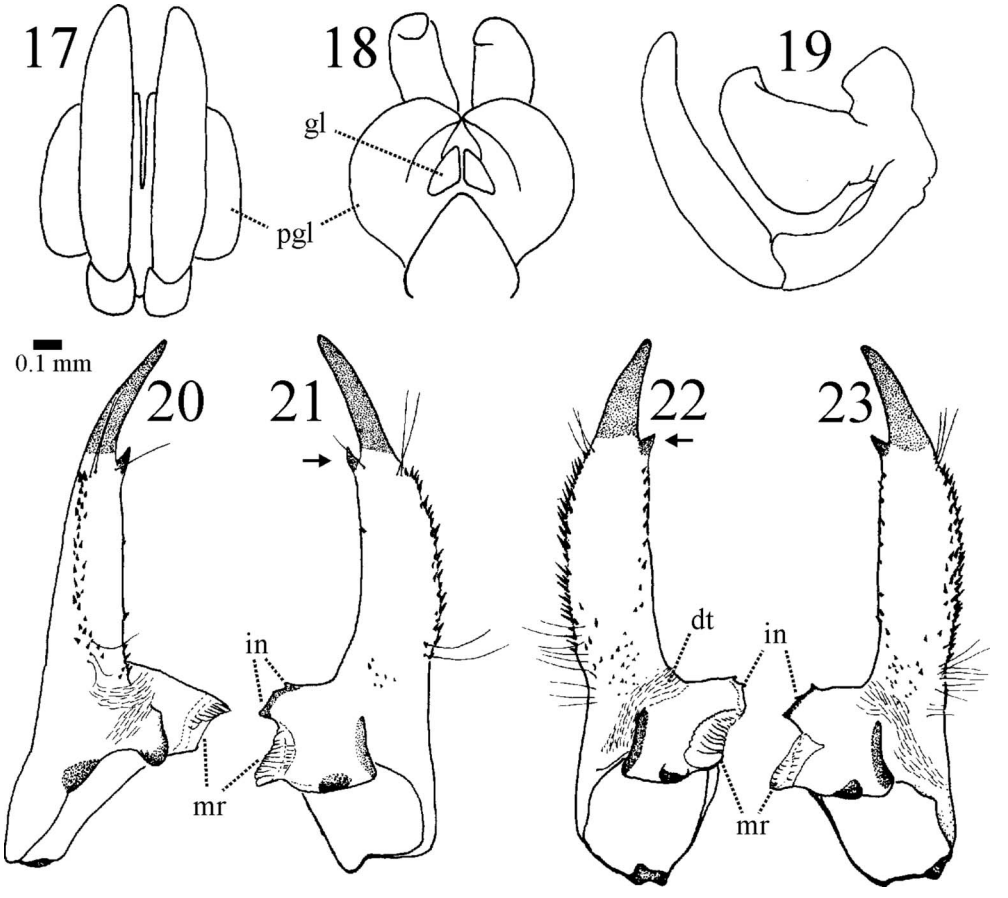
*Larvae* (nearly mature). Length of body (from apex of tusks to apex of abdominal tergum X): female, 19.5–22.8 mm; male, 15.5–16.5 mm. General colouration yellowish white with grey markings. Head (Figure 11) cream shaded black on a narrow band between lateral ocelli, extending anteriorly toward median ocellus, and posteriorly as lateral narrow bands (similar to male adult); occiput without marks or very slightly patterned with thin interconnected lines. Antennae and mouthparts paler except spines and spurs dark brown, setae yellowish. Finger-like gill present near base of maxillae (Figure 28). Mandibles with 1–2 spines on inner margin, basal to subdistal tubercle; outer margin of mandibles with ca. 30 spines (Figures 20–21). Thorax. Pronotum, anterior ring shaded black almost completely except on anterolateral spines, posterior ring patterned as in Figure 11, without blackish marks on lateral margins. Meso- and metanotum with grey and black marks, lighter on median band; wingbuds whitish, shaded extensively with grey on costal margin, and




Figures 11–16. Figures 11–13. Colour pattern of head and pronotum of larvae with setae and mandibular tusks omitted: (11) *T. obscuripennis*; (12) *T. sarae*; (13) *T. puella*. Figures 14–16, wing buds: (14) *T. obscuripennis*; (15) *T. sarae*; (16) *T. puella*.

longitudinal veins (Figure 14). Thoracic pleura and sterna whitish. Legs whitish except setae and apex of tarsal claws yellowish. Abdomen. Abdominal colour pattern sexually dimorphic, mature females with terga more broadly and heavily pigmented than males. Female terga I–VI widely shaded black except on a pair of consecutive pale dots at each side of median line, anterior and posterior pale dots of each segment joined by a thin pale line. Male larvae with grey marks as in male adult. Both sexes present a pale narrow band along abdominal terga, sometimes also a thin mediolongitudinal black line along terga III–VIII. Tergum X is often much darker than the rest. Gills: vestigial gills I translucent; gills II–VII well developed, formed by a pair of large whitish lamellae, the outer (dorsal) lamellae of each pair is shaded with black on a mediolongitudinal band (except on gill II), the inner (ventral) lamellae of each pair do not show black pigments. Genital rudiments of males as in Figure 4. Caudal filaments yellowish white.

*Diagnosis*. *Tortopus obscuripennis* can be distinguished from all other species of the genus by the following combination of characters. In the adult: (1) black band between lateral ocelli extending posteriorly along lateral margins of head (similar to Figure 11); (2) female wings with grey-shaded veins; (3) male abdominal colour pattern as in Figure 3; (4) apically rounded forceps (Figure 1); (5) penes broad apically and rounded in lateral view (Figure 2); (6) long parastyli. In the larva: (1) finger-like gill at base of maxillae relatively



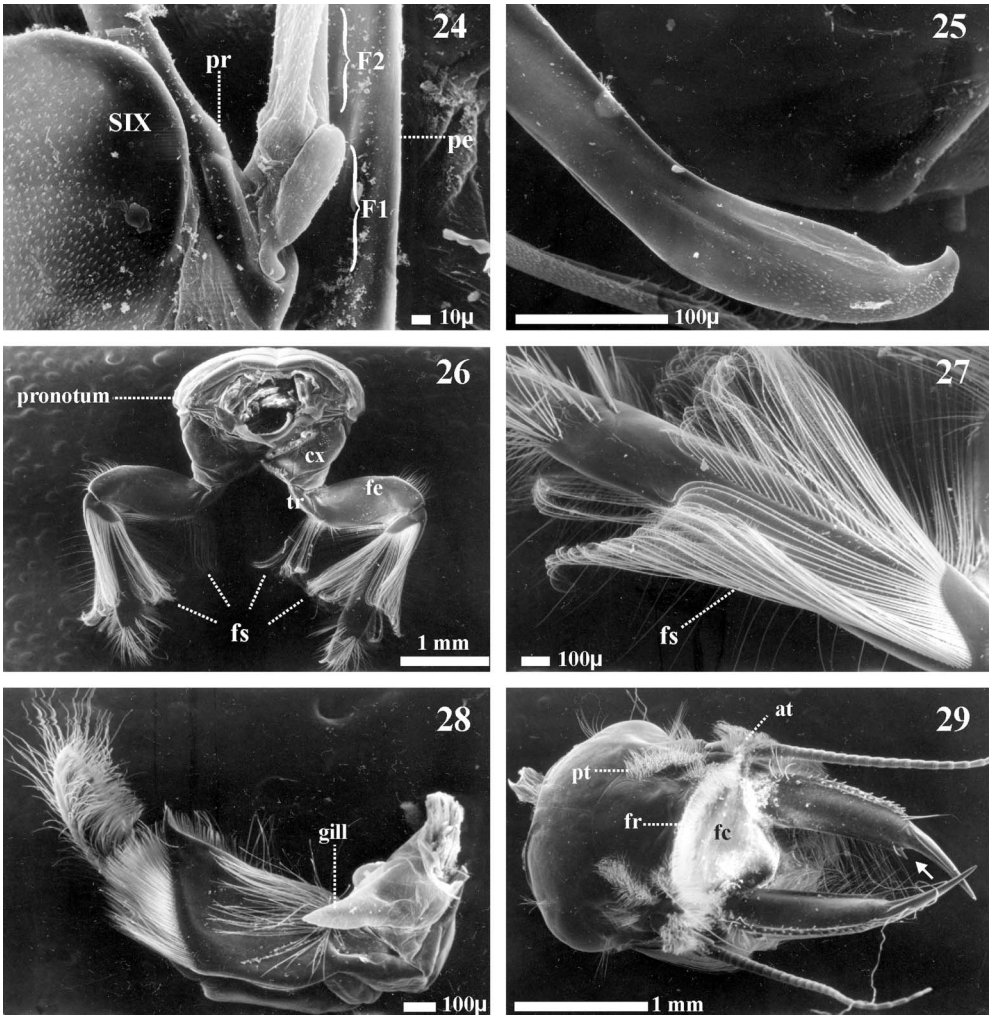

Figures 17–23. Larvae. Figures 17–21, *T. obscuripennis*: (17) labium, ventral view; (18) same, dorsal view (gl = glossae, pgl = paraglossae); (19) same, lateral view; (20) left mandible, inner-dorsal view; (21) right mandible, inner-dorsal view. Figures 22–23, *T. sarae*: (22) left mandible, dorsal view; (23) right mandible, inner-dorsal view (dt = dorsal tuft, in = incisors, mr = molars).

long (Figure 28); (2) inner margin of mandibular tusks with 1–2 spines basal to subdistal tubercle (Figures 20–21); (3) colour pattern of head (Figure 11) as in adults; (4) pronotum not shaded black on anterolateral projections and lateral margins of posterior ring (Figure 11); (5) wingbuds shaded grey on costal margin and longitudinal veins (Figure 14); (6) abdominal gills II without black pigment.

*Distribution and biology*. Argentina (Salta Province). New records: Jujuy Province (Argentina) and Bolivia (Tarija). The larvae were collected from compacted clay substrates in fast flowing (ca. 1 m/sec) streams and rivers.

***Tortopus sarae* Domínguez** (Figures 5–10, 12, 15, 22–25, 30–36, 38–41)

*Tortopus sarae* Domínguez 1985, p. 71 (female imago); Domínguez et al. 2006, p. 586.



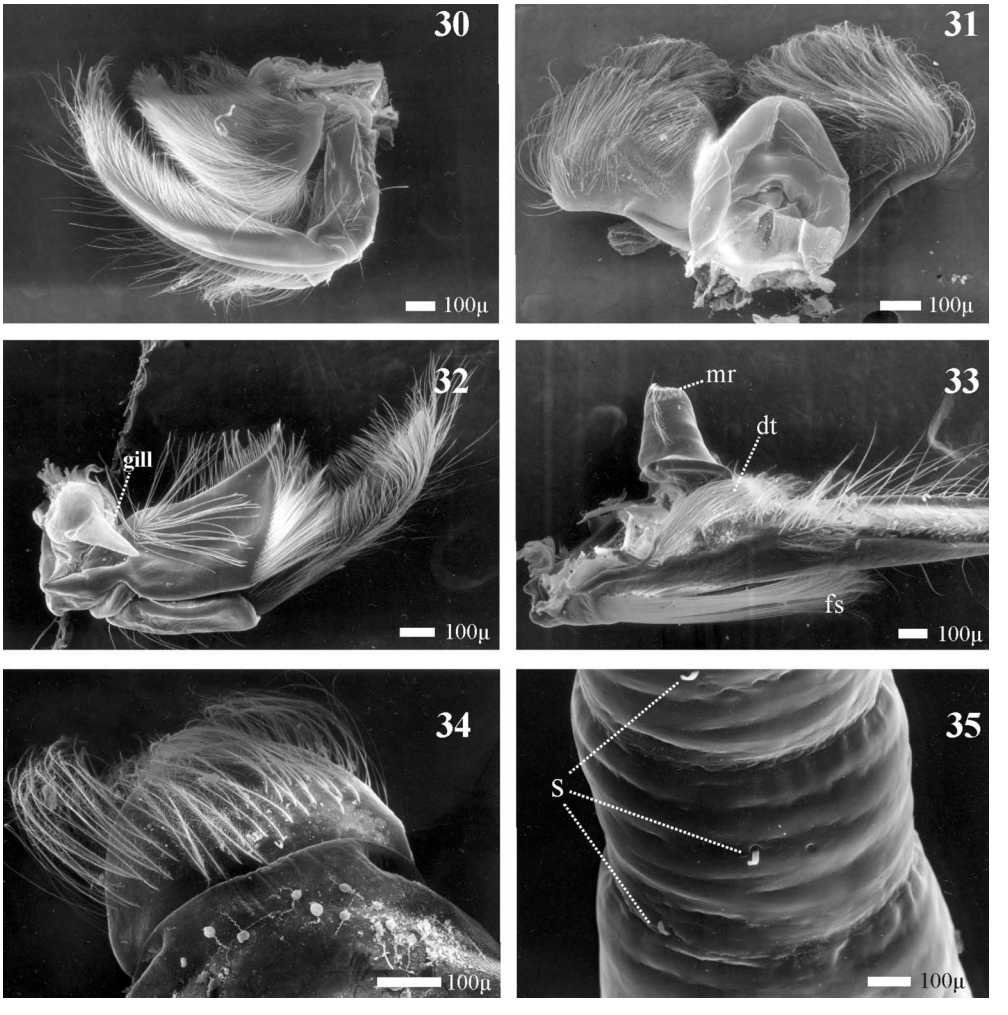

Figures 24–29. Figures 24–25, *T. sarae* male imago: (24) forceps base (F1 and F2 = forceps segment 1 and 2, pe = penes, pr = parastylus, SIX = sternum IX); (25) detail of penes, l.v. Figures 26–29, *T. obscuripennis* larva: (26) prothorax, frontal view (cx = coxa, tr = trochanter, fe = femur, fs = filtering plumose setae); (27) foretibia, detail (fs = filtering plumose setae); (28) maxilla, ventral view; (29) head, dorsal view (mouthparts dissected except mandibles, at = antennal tuft, fc = frontoclypeus, fr = frontal ridge, pt = preocular tuft).

*Studied material* (IFML). Holotype ♀ imago and 16 paratype ♀ imagines from ARGENTINA, Jujuy, 10 km al N de Ledesma, río Zora, 14-XII-1983, E. Domínguez col. Additional material: ARGENTINA, Tucumán, Aguilares, A° Barrientos, S 27° 26′ 52.6″–W 65° 37′ 33.1″, 380 m, C. Molineri col.: 8 larvae, 1 reared ♂ and 1 reared ♀ imagines (13-II-1998), 3 larvae (17-IX-1998), 8 larvae (16-XII-1998), 20 larvae (5-IV-2005), 13 ♂ and 25 ♀ adults (reared from larvae collected on 5-IV-2005); 6 larvae from Tucumán, Trancas, río Salí, El Boyero, S 26° 14′–W 65° 17′, 12-IV-2007, C. Molineri col.; and 24 larvae (many pharated subimagines) from ARGENTINA, Tucumán, Acheral, río Aranillas, 362 m, S 22° 6′ 58.3″–W 65° 27′ 42.1″, 20-V-2007, C. Molineri, D. dos Santos & J. Giordano cols.

*Male imago* (subimaginal cuticle partially shed). Length: body, 11.5–13.0 mm; forewings, 11.0–13.0 mm; hind wings, 5.0–5.9 mm; cerci (not extended), 24.0 mm. General colouration yellowish white with grey shading dorsally. Head creamy, shaded black between lateral ocelli and forwardly to median ocellus; occiput with a pair of submedian grey dashes; ventrally whitish. Antennae: scape and pedicel whitish tinged with light purplish grey, flagellum hyaline. Thorax. Prothorax whitish with extensive black shading dorsally. Mesonotum cream shaded with greyish and black except on anteronotal protuberance and medial band, pleura and sternum cream, without grey shading. Metanotum cream shaded black except medially. Legs. Forelegs whitish shaded with purplish grey on margins and subapical band of femora; tibiae, tarsi and tarsal claws shaded more extensively; middle and hind legs whitish. Wings. Membrane hyaline, all veins whitish translucent, except veins C, Sc and $R_1$ purplish grey, and cross-veins of sectors C, Sc and R slightly shaded grey. Hind wings similar to forewings but only veins C and Sc shaded grey. Abdomen. Sterna whitish, shaded with grey on submedian marks of segments VIII–IX. Terga whitish shaded gray, shading darker and more extensive toward posterior segments. All terga with a narrow medial line surrounded by a paler zone within a wider grey mediolongitudinal band; terga I–VII with darker grey marks anterolaterally (Figure 7); terga VIII–X almost completely shaded except small submedian pale dashes. Genitalia (Figures 5–6) whitish except parastyli yellowish. Penes long and slender, with ventrally directed hooked apex (Figure 6). Forceps apically pointed (Figure 8). Parastyli relatively long (nearly ½ length of forceps) and dorsally curved (Figure 6). Terminal filament shaded with purplish grey at apex of each annulation. Cerci whitish shaded with grey basally.

*Female imago*. Length: body, 11.0–14.0 mm; forewings, 14.0–16.0 mm; hind wings, 6.0–6.5 mm; cerci, 4.5–5.6 mm. Domínguez (1985) reported slightly larger forewings (17.5–18.0 mm). Figure 10 shows gonostyle receptors (sc) of the abdominal sternum VIII almost identical to those of *T. obscuripennis*.

*Mature larva*. Length of body (from apex of tusks to apex of abdominal tergum X): female, 17.0–20.6 mm; male, 13.5–15.0 mm. General colouration yellowish white with grey markings. Head (Figure 12) cream, shaded black on a narrow band between lateral ocelli, extending anteriorly toward median ocellus; occiput without marks or with small and slightly marked sublateral patterning. Antennae and mouthparts paler except spines and spurs dark brown, setae yellowish. Finger-like gill near base of maxillae triangular and relatively short (Figure 32). Mandibles with a row of 9–10 spines on inner margin, basal to subdistal tubercle (Figures 22–23); outer margin of mandibles strongly covered with ca. 40 spines (Figures 22–23). Thorax. Anterior ring of pronotum shaded with black almost completely, posterior ring shaded on large median area and on lateral and posterior margins (Figure 12). Mesonotum cream, widely shaded grey and black, lighter on median band; wingbuds whitish, shaded grey only on costal margin (Figure 15). Metanotum shaded with black. Thoracic pleura and sterna whitish, with a light grey line anterior to mesocoxal cavity. Legs whitish except setae and apex of tarsal claws yellowish. Abdomen. Sterna whitish without marks. Terga whitish with grey to blackish markings progressively heavier on posterior segments. Abdominal colour pattern sexually dimorphic, females with terga more widely and heavily pigmented than males. Female terga I–VI widely shaded black except for a pair of consecutive pale dots at each side of median line, anterior and posterior pale dots of each segment joined by a thin pale line. In male, pale areas much larger, especially posterior pale dots. Both sexes with a thin mediolongitudinal black line along



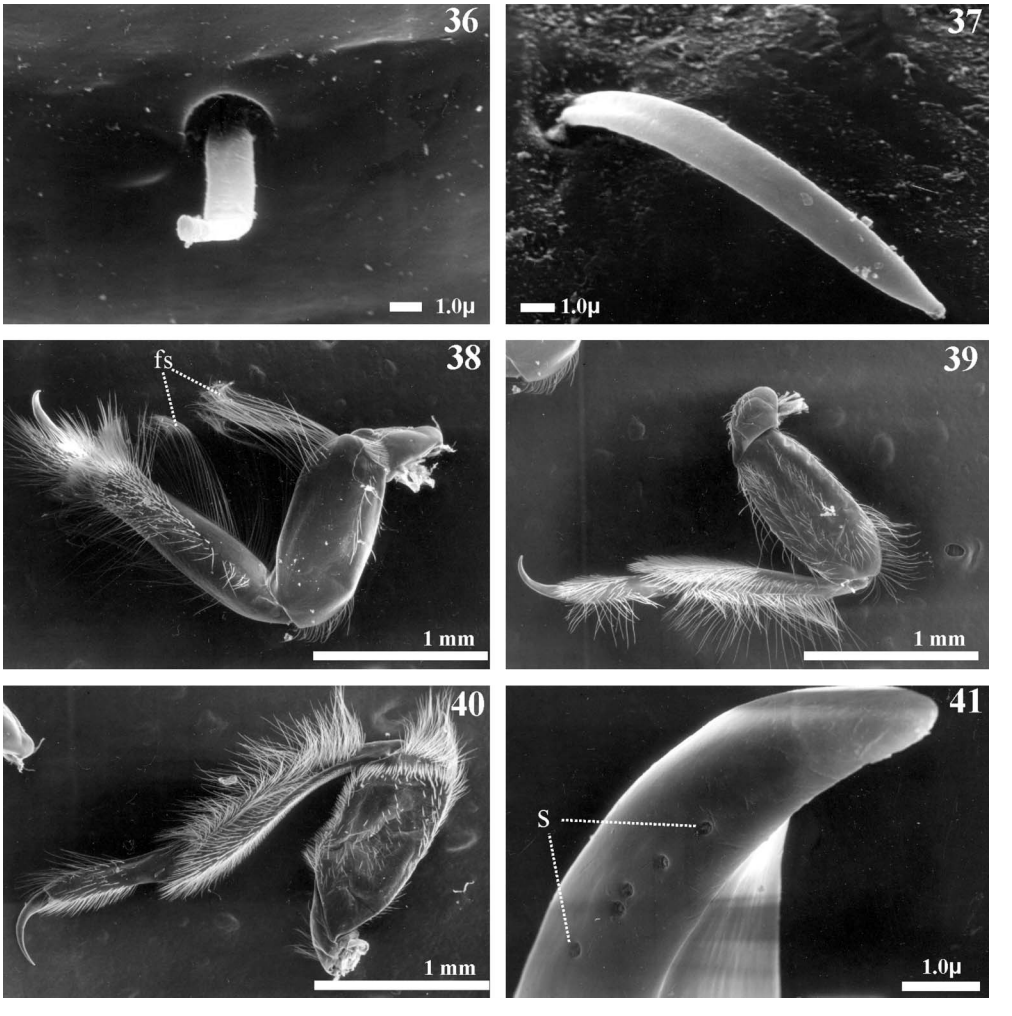

Figures 30–35. *T. sarae* larva: (30) labium, lateral view; (31) hypopharynx, ventral view; (32) maxilla, ventral view; (33) detail of mandible, dorsal view (fs = filtering plumose setae, mr = molar, dt = dorsal tuft); (34) labrum, dorsal view; (35) detail of antenna, dorsal view (s = sensillae).

abdominal terga (similar to adults). Tergum X often much darker than preceding terga. Gills: vestigial gills I translucent, remaining gills whitish shaded with black on a mediolongitudinal band of outer lamellae (the inner, smaller lamellae are not pigmented). Genital rudiments of males as in Figure 9. Caudal filaments yellowish white.

*Diagnosis*. *Tortopus sarae* can be distinguished from all other species of the genus by the following combination of characters. In the adult: (1) black band between lateral ocelli not extending posteriorly (similar to Figure 12); (2) female wings with whitish veins; (3) male abdominal colour pattern as in Figure 7; (4) apically pointed forceps (Figure 8); (5) penes slender, not broader apically (Figures 5–6); (6) long parastyli. In the larva: (1) gill near

base of maxillae relatively short (Figure 32); (2) inner margin of mandibular tusks with 9–11 spines basad to subdistal tubercle (Figures 22–23); (3) colour pattern of head as in Figure 12; (4) pronotum shaded black on anterolateral spines and lateral margins of posterior ring (Figure 12); (5) wingbuds of nearly mature larvae shaded grey only on costal margin (Figure 15); (6) abdominal gills II with a mediolongitudinal blackish band on anterior lamella.

*Distribution and biology*. Argentina (Jujuy Province). New record: Tucumán Province (Argentina). Larvae were collected from the same kind of substrate (hardened clay banks) as the other species of the genus. But in Aranillas river (Tucumán) they were found digging in much softer river banks, made up mainly of organic-clayed sediments.




Figures 36–41. Figures 36–37, detail of antennal sensillae: (36) *T. sarae*; (37) *T. obscuripennis*. Figures 38–41, *T. sarae* legs of larva: (38) foreleg, dorsal view (fs = filtering plumose setae); (39) middle leg; (40) hind leg; (41) detail of foreclaw (s = sensillae).

***Tortopus puella* (Pictet)** (Figures 13, 16)

*Palingenia puella* Pictet 1843, p. 145 (orig.); Edmunds and Allen 1957, p. 317 (nomen dubium).
*Tortopus puella* (Pictet), McCafferty 1996, p. 3.
*Campsurus incertus* Traver, in Needham, Traver and Hsu 1935, p. 286.
*Tortopus incertus* (Traver), Ulmer 1942, 108; Scott et al. 1959, p. 210 (larva); Tsui and Peters 1974, p. 350; McCafferty 1975, p. 491.

*Studied material* (IFML). USA: Florida, Liberty Co., Apalachicola river at Hwy. 20, 10-V-1967, P. H. Carlson col., 10 larvae.

*Diagnosis*. *Tortopus puella* is a relatively well known Nearctic species, described from adults and larvae of both sexes. The following characters can be used to distinguish *T. puella*, previously the only described larva in the genus, from the larvae of *T. obscuripennis* and *T. sarae*: (1) gill at base of maxillae relatively large; (2) inner margin of mandibular tusks with 10–20 spines basal to subdistal tubercle; (3) head colour pattern as in Figure 13; (4) pronotum shaded black medially and sublaterally Figure 13; (5) wingbuds shaded grey on costal margin and some veins (Figure 16); (6) abdominal gills II with a mediolongitudinal blackish band on outer lamella.

*Distribution*. USA: South East.

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