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Preimaginal stages of *Acostatrichia simulans* Mosely 1939, a Neotropical microcaddisfly (Trichoptera: Hydroptilidae: Leucotrichiinae)

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Abstract

The preimaginal stages and cases of *Acostatrichia simulans* Mosely 1939, collected in Salto Encantado Provincial Park (Misiones province, Argentina) are described. This is the first description of the immature stages of this genus, and its first record from Argentina. The larvae were collected manually and transported to the laboratory, where they completed their development. Their identity was established using the metamorphotype method. They show strong resemblance to the larvae of *Abtrichia* Mosely, *Anchitrichia* Flint, *Ceratotrichia* Flint, *Leucotrichia* Mosely and *Zumatrichia* Mosely, especially to *Zumatrichia*.

Key words: larva, pupa, new records, Argentina, Neotropical

Introduction

According to Marshall (1979), the family Hydroptilidae included two subfamilies: Hydroptilinae (with 44 genera in 6 tribes) and Ptilocolepinae (with 2 genera). Recently, Malicky (2001, 2005) elevated Ptilocolepinae to family status, such that the six tribes of former Hydroptilinae became subfamilies of Hydroptilidae: Stactobiinae, Leucotrichiinae, Hydroptilinae, Ochrotrichiinae, Orthotrichiinae, and Neotrichiinae, all represented in the Neotropics.

The subfamily Leucotrichiinae is found in only North and South America. It contains 15 recognizable genera whose relationships are under discussion. Some of the morphological characteristics of the larvae have been interpreted as characteristics of Stactobiinae (Bowles et al. 1999). Knowledge of the characteristics of the preimaginal stages could help to elucidate these relationships, but for most of the genera the larvae of only 1 or a few species are known, the pupae have not been described, the descriptions are inadequate for comparisons, or the immatures are unknown, as is the situation for *Ascotrichia* Mosely, *Betrichia* Mosely, and *Costatrichia* Mosely.

The larvae of the Leucotrichiinae, as in Hydroptilidae generally, have the thoracic nota sclerotized, the anal prolegs relatively long, and the gills absent. They undergo hypermetamorphosis: the first instars are very small, free-living forms; the fifth (last larval) instar increase their body size with the abdomen becoming distended, especially in the intermediate segments, and showing deep intersegmental constrictions. Generally at the outset of the final larval instar, the larvae construct cases which they inhabit, and in which they pupate.

Fifth instar leuchotrichiine larvae are characterized by coronal and frontoclypeal sutures absent or incomplete; thoracic terga with an ecdysial line only on the pronotum; legs all similar in shape, — short and robust, without modifications; and abdominal segments with conspicuous, dorsal sclerites. Two groups can be recognized: (a) those whose larvae have their bodies and cases compressed, and (b) those with bodies and cases depressed (in some of the genera of this group the larval abdomen is fusiform, while in the others it is conspicuously widened).

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(a) The larvae and cases of *Byrsopteryx* Flint (see Holzenthal & Harris 1991, Botosaneanu 2000) and *Celaenotrichia* Mosely (see Harris & Flint 1993) are strongly compressed laterally. In the larvae of both of these genera, the coronal and frontoclypeal sutures are absent, and the abdominal terga are large. When the larva of *Byrsopteryx* pupates, its body becomes dorsoventrally depressed and changes its position inside the case such that it is now parallel to the plane of compression (i.e., the ventral and dorsal margins of the case become lateral to the body of the pupa). Based on these and other characteristics, Harris & Flint (1993) concluded that *Byrsopteryx* would more appropriately be placed in the Stactobiinae.

(b) The larvae and cases of the other genera of Leucotrichiinae are strongly depressed. The cases are oval, domed, composed of one sheet of silk attached to the substrate by the borders, leaving open the ends through which the head, thorax, and anterior abdominal segments can be projected. Some species construct the case at the beginning of the fifth instar, while others build it immediately prior to pupation.

In *Alisotrichia* Flint (see Flint 1970, Botosaneanu 1994), *Cerasmatrichia* Flint et al. (see Flint, Harris & Botosaneanu 1994), *Mejicanotrichia* Harris & Holzenthal (see Bowles et al. 1999, Wiggins 1996) and *Scelobotrichia* Harris & Bueno-Soria (see Bowles et al. 1999), the abdomen is fusiform (the segments widen gradually to the centre, becoming broader than the thorax), bearing on each segment a large tergite that covers much of its dorsum. The case is constructed before pupation (the differentiation of the larvae of these genera is beyond the aims of this work).

In the larvae of *Anchitrichia* Flint, *Abtrichia* Mosely, *Leucotrichia* Mosely, *Ceratotrichia* Flint, and *Zumatrichia* Mosely the abdomen is remarkably swollen: the 1st segment is approximately the same width as the thorax, the 2nd, 3rd, and 4th increase in size gradually, the 5th and 6th are 2 or 3 times broader and longer than the previous segments, and from the 7th to the 9th they decrease in size. They construct depressed larval and pupal cases. The larval enclosure of *Anchitrichia* Flint is also depressed, but prior to pupation it is cut, rolled up, and closed, becoming an oval, lengthened "cigar" that is attached to the substratum by a pedicel. Even though it differs from the other genera in this character (which could be interpreted as an adaptation to its lifestyle), based on its other characteristics it undoubtedly belongs to this group (Flint 1970, Guahyba 1991).

The larva of *Abtrichia antennata* has 3 rows of papillae on the frontoclypeus, 1 mesal and 2 lateral; the abdominal tergites II–VII have 2 central pores, and the tergites of segments VIII and IX bear thick, straight, and black spines (Flint 1972).

The frontoclypeus of larvae of *Anchitrichia* is depressed and has on the anterior margin a pair of submesal lobes that bear papillae; the lateral borders of the pronotum are produced; and the femora each bears a large, arborescent seta. The larva of *A. duplifurcata* Flint (Guahyba 1991) has 8 to 13 central pores on each of its abdominal sclerites II–VII, and that of *A. spangleri* Flint (Flint 1970) has 2.

The larva of *Ceratotrichia* sp. has 2 broad, transversal sclerites on abdominal segment I, and 2 small dorsal sclerites on each of segments II–VII (Oliveira-Pes & Hamada 2004, larva not associated specifically).

In the described larvae of *Leucotrichia*, the posterior part of the frontoclypeus bears rugosities, reticula, or papillae, and the anterior margin is generally not straight, although in *L. chiriquiensis* Flint the frontoclypeus lacks the posterior sculpturing and the anterior border is truncate (Flint 1970). The tentorial pits can be indistinct or well defined. The abdominal tergites are generally rectangular, without dorsal pores, and the sclerites of abdominal terga VIII and IX bear long setae (Flint 1970, Wiggins 1996). According to Wiggins (1996) the basal seta of each claw is not enlarged. In the larva of *L. fairchildi* Flint, tergite VIII is divided by a transverse suture, forming 2 plates (Botosaneanu & Alkins-Koo 1993). The larva of *L. brasiliana*, described by Sattler & Sykora (1977), differs notably in the characters mentioned above.

In *Zumatrichia* the frontoclypeus is truncate anteriorly, and the posterior part is smooth (although rough in *Z. multisetosa* Flint); the tentorial pits are well defined; abdominal sclerites II–VII are triangular and each bears 2 central pores, and tergum IX bears setae and spines (Flint 1970, Marshall 1979, Wiggins 1996). In *Z. notosa* (Wiggins 1996) the basal seta of each claw is enlarged.

The descriptions of the pupae in these genera are very scarce, more so than of the larvae, and rarely comparative. Generally, they are all very similar: mandibles without teeth, anterior dorsal plates with hooks on abdominal segments III–VII, and posterior plates on segments III–V. In *Anchitrichia duplifurcata* each plate bears 5–6 marginal teeth and numerous central, smaller ones. In *Abtrichia antennata* plates IVp and Va

are highly modified, each forming a single, wide, long plate, with 2 strong posterior spines, very conspicuous on the dorsum of the animal (Angrisano 2002).

The genus *Acostatrichia* Mosely contains 5 species (Flint et al. 1999), distributed in eastern South America (Surinam, Brazil, Argentina and Uruguay). Until now, the preimaginal stages of all species were unknown. The genus is recorded here for the first time from Argentina (Misiones Province). *Acostatrichia simulans* Mosely 1939 (p. 229), was described originally from Brazil, and subsequently recorded from Uruguay (Angrisano 1995).

Materials and methods

The specimens were collected manually from the rocky bottom of Azul Stream, Salto Encantado Provincial Park, Misiones Province, Argentina (27º 00' 46'' S, 54º 57' 06'' W, 203 m.a.s.l.) in January 2008.

As the larval cases were well attached to the rocks, making it very difficult to detach them without damaging the case (especially considering their small size), rocks of an appropriate size and bearing larvae were selected and transported to the laboratory in an aerated cooler. In the laboratory the larvae were reared to adult or pharate adult stage, following the methodology discussed in Sganga & Fontanarrosa (2006). The larvae were associated specifically using the metamorphotype method.

For viewing and drawing, the sclerites kept in the pupal cases and cleared larvae were used. The specimens were cleared in 10% NaOH heated for several minutes, then the cuticle was rinsed in distilled water, neutralized with phenol, and mounted in Fauré media or glycerine.

Voucher specimens are deposited in the Departamento de Biodiversidad y Biología Experimental, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires.

Results

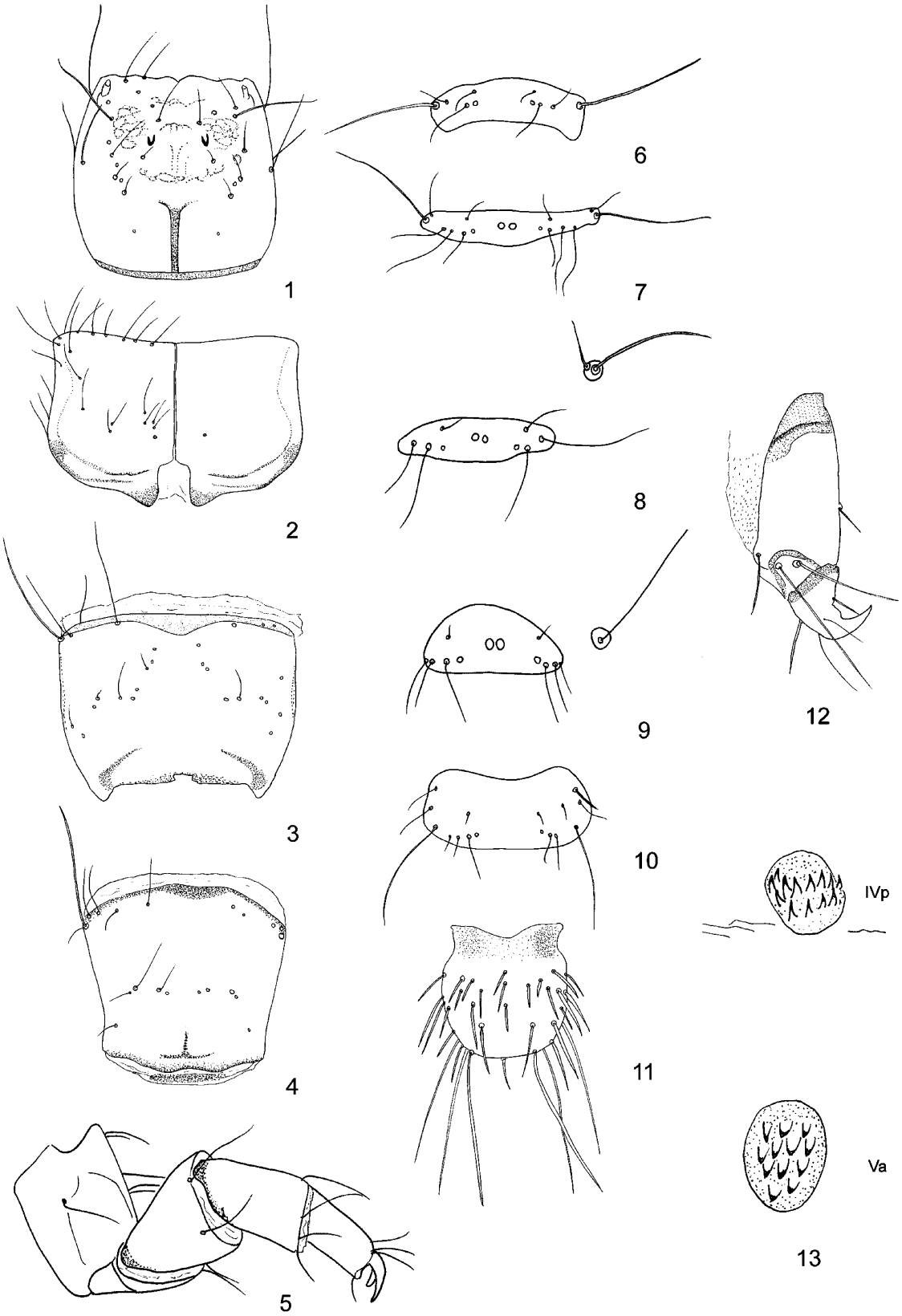
Acostatrichia simulans Mosely, 1939

Figs. 1–18

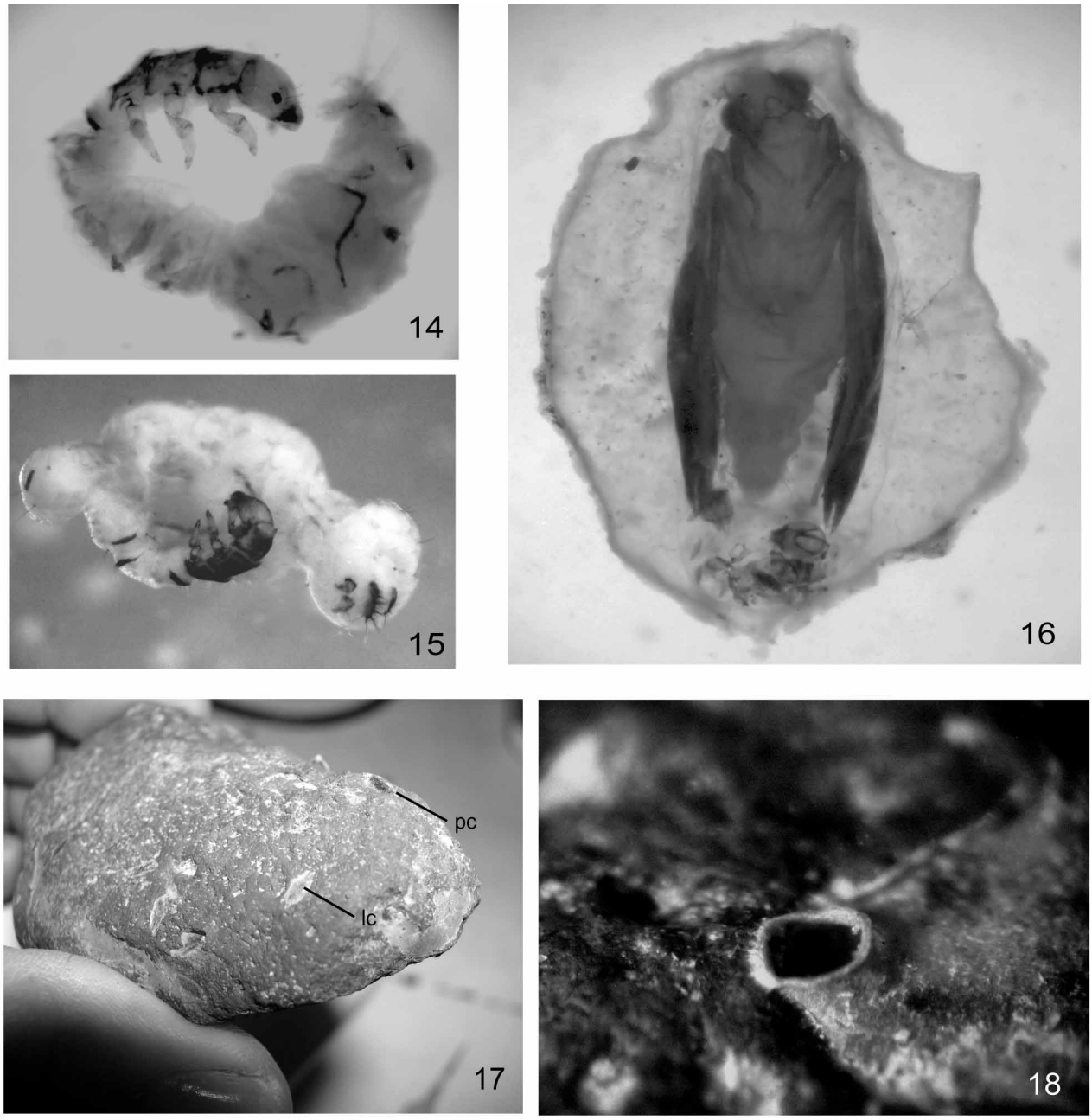
Larva. Length of body: up to 3 mm. General coloration of body white and green, with grayish brown sclerites (Figs. 14–15).

Head. Subquadrangular in dorsal view, slightly rounded laterally and posteriorly; pilosity reduced; coronal suture well defined, branches of frontoclypeal suture lightly insinuated; frontoclypeus bearing reticulate sculpturing, without papillae; tentorial pits well defined; antennae short; labrum cleft mesally, with row of 4 long, mesal setae, and shorter setae especially on inner side; mandibles subtriangular, robust, with lightly defined teeth, almost blunt (Fig. 1).

Thorax. Pronotum subquadrangular, anterior margin almost straight, posterior margin more heavily sclerotized and pigmented than rest of tergum, slightly produced mesally and with deep, U-shaped indentation, lateroposterior corners rounded; mid-dorsal ecdysial line present; with setae distributed along anterior and lateral margins, and approximately 7 to 8 setae in middle of each pronotal plate (Fig. 2). Meso- and metanota without ecdysial lines. Mesonotum quadrangular, narrower and more heavily sclerotized posteriorly, bearing 4 to 5 long setae anteriorly, and shorter setae mesally (Fig. 3). Metanotum narrower than pro- and mesonota; with short setae distributed anterior and mesally, except for a long seta on each anterolateral corner, of same length as sclerite; posterior and centre of anterior margins heavily pigmented, with strongly pigmented area, not clearly defined, between metanotum and abdominal segment I (Fig. 4). Mesothorax with small subtriangular posteroventral plate. Thoracic tergites superimposed at rest, separated by wide, membranous areas allowing extension of segments, providing great mobility to larvae. Legs short, broad, without any particular modification; chaetotaxy reduced; tarsal claws short, each with wide, curved basal seta (Fig. 5). Pro- , meso-, and metathoracic legs similar to each other except metathoracic legs with coxa longer than others.



FIGURES 1–13. *Acostatrichia simulans*. Larva. (1) Cephalic capsule, dorsal. (2) Pronotum. (3) Mesonotum. (4) Metanotum. (5) Right prothoracic leg, external. (6) Abdominal tergite I. (7) Abdominal tergite II. (8) Abdominal tergite III. (9) Abdominal tergite VII. (10) Abdominal tergite VIII. (11) Abdominal tergite IX. (12) Right anal proleg (and membranous area between the prolegs), right lateral. Pupa. (13) Dorsal abdominal plates, IVp: right posterior plate IV, Va: right anterior plate V.



FIGURES 14–18. *Acostatrichia simulans*. (14, 15) Larva, right lateral. (16) Pupa in the pupal case, ventral. (17) Cases attached to a rock, dorsal, lc: larval case, pc: pupal case. (18) Detail of the opening of the larval case, left dorsal oblique.

Abdomen. All segments with central tergite; segments I to VIII each with circular, pleural sclerite bearing 2 to 3 setae. Abdominal segment I shorter and narrower than the others; its central tergite rectangular, wide, almost entirely covering dorsum, 4 times wider than long; anterior and posterior margins slightly curved forward; bearing pair of long lateroanterior setae, 3 pairs of lateral ones, and mesolateral pair of sensory pits (Fig. 6) (there is a pair of these pits on each of segments I–VIII). Segment II with tergite wide and short, convex posteriorly and almost straight anteriorly; with pair of mesal pores (present on each of segments II–VII), and chaetotaxy similar to that of tergite I (Fig. 7). Segments III to VII with central tergite gradually narrower and longer than that of segment I, with that of segment VII almost subtriangular; each tergite with 3 to 4 pairs of lateral setae; each of these segments with additional pair of lateroanterior, circular tergites, each bearing 1-2 setae (Figs. 8–9). Tergite of segment VIII subrectangular, rounded lateroposteriorly; with pair of long, lateroposterior setae, and 6 pairs of shorter, lateral setae and rigid spines; without sensory pits (Fig. 10).

Tergite of segment IX longer than wide, quadrangular, anterior margin lightly excavated mesally and posterior end rounded; bearing approximately 32–34 stout setae, 3 pairs of long lateroposterior setae, longer than segment, and very small spines along posterior margin (Fig. 11). Anal prolegs lengthened, claws deeply arched, each without accessory claw (Fig. 12); membranous area between legs with microtrichiae.

Larval case. Length 3 mm; width 2 mm. Oval, typical of Leuchotrichiinae, irregular, open ventrally and at both ends; anterior and posterior openings with flanges (bottle neck-like) (Figs. 16-18).

Pupa. Mandibles without teeth. With dorsal anterior hook plates on segments III–VII, and posterior ones on segments III–V; plates small, circular, with 10 to 13 small hooks of same size (Fig. 13).

Pupal case. Completely closed; ventrally with a floor of thin silk, thinner than dorsal sheet (Fig. 16–17). Emergence occurring through large, anterior, subcircular opening.

Material examined. Argentina: Misiones Province: Salto Encantado Provincial Park, Arroyo Azul, 23-28.i.2008, Angrisano & Sganga leg., 6 larvae, 10 metamorphotype males, numerous larval and pupal cases.

Biology and habitat. Larvae and pupae were attached to rocky substrate in riffles and pools of the Arroyo Azul, a 1st order tributary of the Arroyo Garuhapé. They were found in a sunny section of the stream where the canopy was partially open. In this section the stream is 5–6 m wide, with clean, warm water (22 ºC, pH=7, conductivity= 210μS.cm^{-1}), ranging from 1 to 35 cm in depth. The rocks had a great number of cases that were situated separately (in *Abtrichia antennata* they are usually found in pairs); the cases were more abundant in shallow areas of the reach.

Discussion

It is difficult to provide a generic diagnosis of the larvae of *Acostatrichia* based on the characters of a single species, because it could differ notably as new descriptions of the immatures of other species in the genus are added. Nevertheless, based on larval characters of *Acostatrichia simulans*, the genus undoubtedly belongs to the generic group that includes *Abtrichia*, *Anchitrichia*, *Ceratotrichia*, *Leucotrichia*, and *Zumatrichia*.

The main characters that distinguish *Acostatrichia simulans* from the other immatures described for the group are the following: larval frontoclypeus with reticulate sculpturing laterally and posteriorly; claws each with an enlarged basal seta; abdominal tergites II–VII each with a pair of mesal pores; segment VIII with setae and spines, IX with spines or long, enlarged setae; pupae with dorsal abdominal plates bearing 10–15 small hooks; cases with irregular outline (in *Abtrichia antennata* the cases borders are curved and regular). These features are similar to those of the known larvae of *Zumatrichia*, suggesting that the two genera could be closely related.

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