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Article

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A description of the nymph of *Anacroneuria ofaye* Froehlich (Plecoptera: Perlidae) and a apparatus for rearing Neotropical stonefly species

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Abstract

The Neotropical genus *Anacroneuria* (Perlidae) is represented by more than 300 species. Among the Brazilian *Anacroneuria*, only the nymphs of two species have been described. In this paper, we described the nymph of *A. ofaye* Froehlich and an apparatus for rearing this genus. This is the first record of *A. ofaye* from Paraná State, Brazil.

Keywords: Plecoptera, *Anacroneuria*, nymph, rearing apparatus, Brazil

Resumo

O gênero neotropical *Anacroneuria* (Perlidae) é representado por mais de 300 espécies. Entre os *Anacroneuria* brasileiros, apenas as ninfas de duas espécies foram descritas. Neste trabalho, descrevemos a ninfa de *A. ofaye* Froehlich e um aparato para criação deste gênero. Este é o primeiro registro de *A. ofaye* no Estado do Paraná, Brasil.

Palavras chave: Plecoptera, *Anacroneuria*, ninfa, aparato de criação, Brasil

Introduction

Anacroneuria Klapálek 1909 (Plecoptera: Perlidae) is represented by more than 300 recognized species (Stark et al. 2009; DeWalt et al. 2010; Froehlich 2010; Righi-Cavallaro & Lecci 2010; Stark et al. 2012) distributed throughout the Neotropics into the southwestern United States (Stark & Kondratieff 2004; Stark et al. 2009). Considerable progress in the taxonomic knowledge of the genus has been achieved in recent decades (Stark 1995, 1998, 1999, 2001a, 2001b; Stark et al. 1999, 2001; Stark & Sivec 1998; Zúñiga & Stark 2002; Ribeiro-Ferreira & Froehlich 2001; Froehlich 2002, 2007), both in descriptions of new species and in redescriptions of older species (Bispo & Froehlich 2004). About seventy species of *Anacroneuria* are known from Brazil (Froehlich 2010); the nymphs of only two have been described (Righi-Cavallaro & Lecci 2010; Avelino-Capistrano et al. 2011a).

Recently, material from southern Brazil was examined by Froehlich (2002) and Ribeiro & Froehlich (2007), which resulted in reports of new records and descriptions of new species of *Anacroneuria*. *Anacroneuria debilis* (Pictet 1841), *A. fuscicosta* (Enderlein 1909a), *A. novateutonia* Jewett 1959, *A. petersi* Froehlich 2002, *A. polita* (Burmeister 1839), *A. tinctilamella* Jewett 1959 and *A. uyara* Froehlich 2002 have been reported in Paraná State (Froehlich 2002), one of the three states of southern Brazil. In this paper, we describe the nymph of *A. ofaye* Froehlich 2007 and a rearing apparatus. We also present comments on the species which is recorded for the first time from Paraná State, Brazil.

Material and Methods

The material was collected in 2007 and 2008 from streams in Maringá, north of Paraná State. The nymphs were collected with the aid of sieves (mesh size 0.5 mm) by the third author (JH) and kept in jars with water and leaf litter. In the laboratory, the material was placed individually in compartments of a rearing apparatus. Stones collected from the streams were added into the apparatus as natural substrate. Nymph and emerged adults with their associated exuviae were preserved in 70% ethanol.

Description of the rearing apparatus

In tropical regions, Plecoptera nymphs are often difficult to rear in the laboratory. A rearing apparatus that allows nymphs of *Anacroneuria* to be reared is described. The rearing apparatus was built using acrylic sheets and has a total length of 1 m and a total width of 30 cm. The apparatus is divided into 30 compartments, each 10 cm wide, 10 cm long and 20 cm deep, and covered with 0.5 mm mesh. The compartments are arranged in three rows of 10 compartments each (Fig. 1), and are interconnected by an opening in the upper half, each of which is also covered with a 0.5 mm mesh. The water flows to the tank by gravity (Fig. 1), from where it is pumped back to the top creating a circulating current for oxygenation.

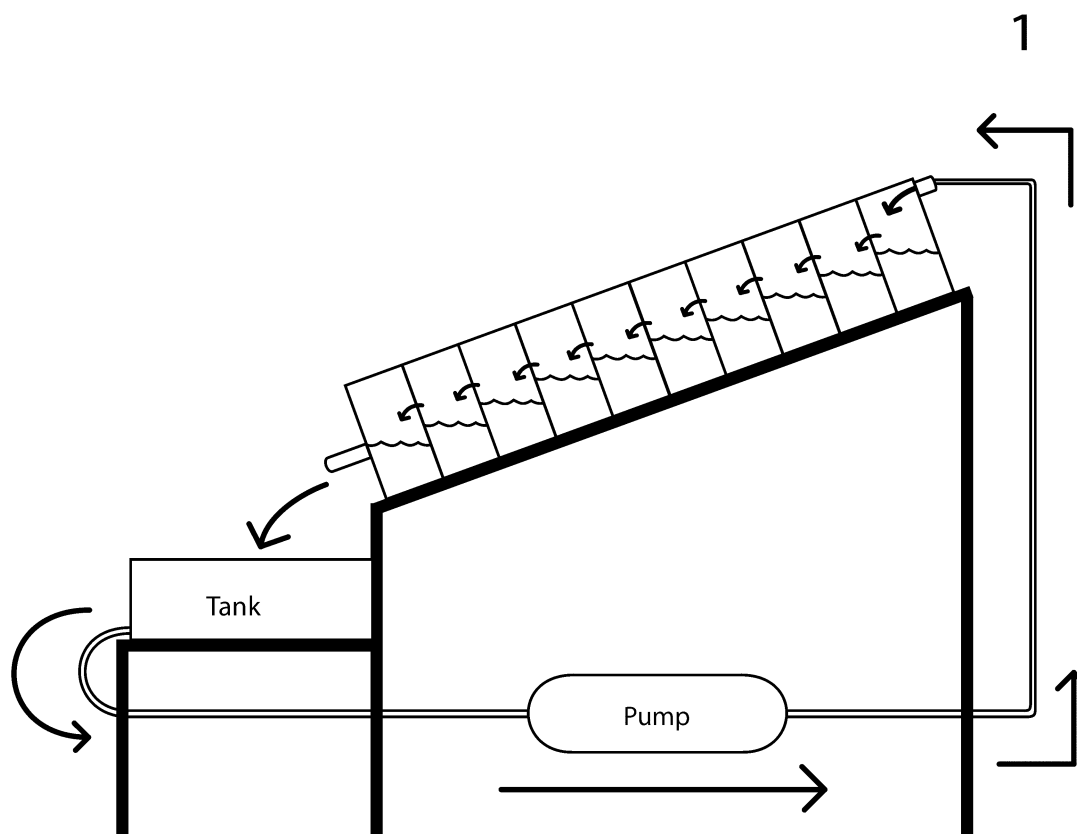


FIGURE 1. Rearing apparatus of the nymphs of *A. ofaye*.

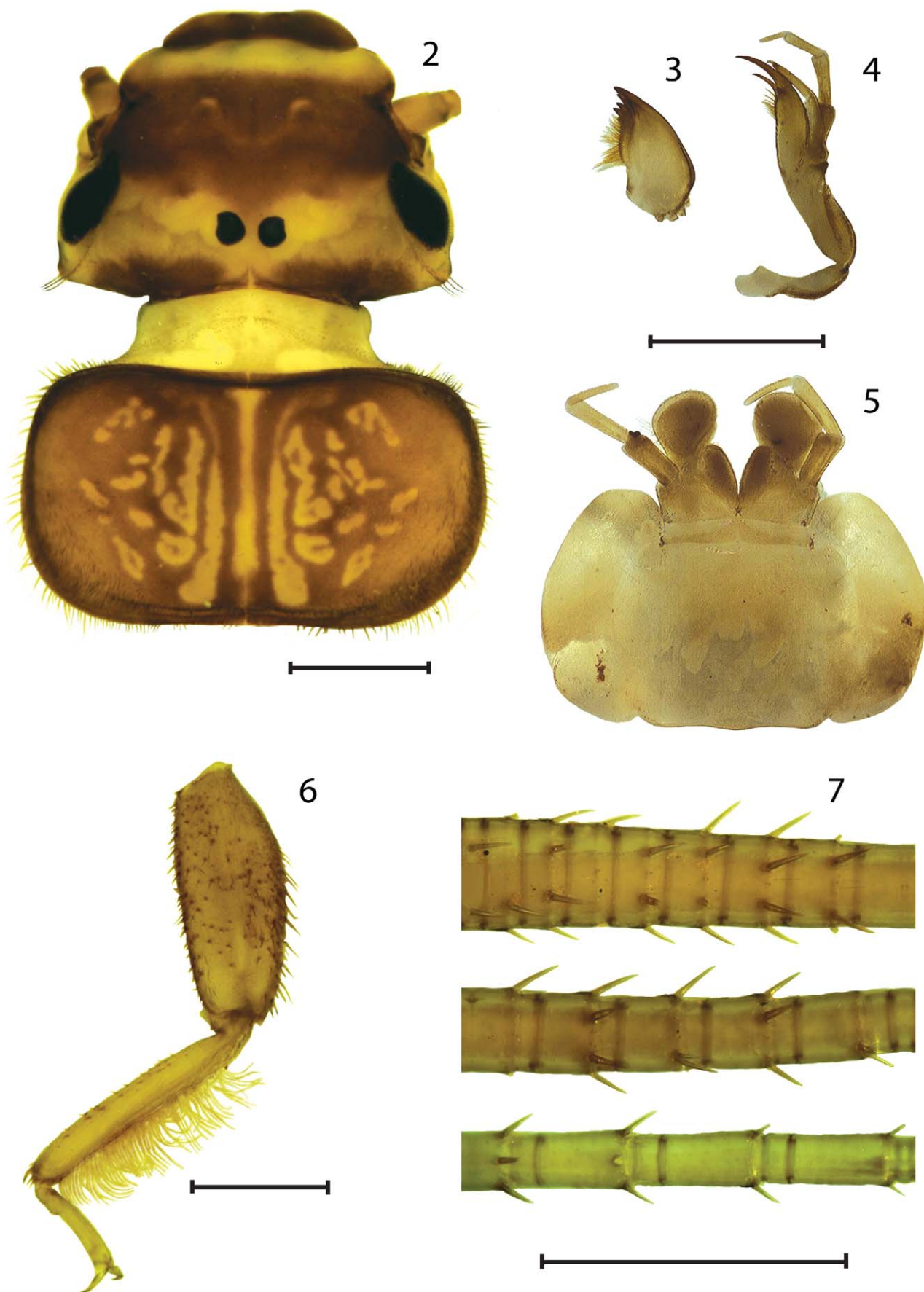
Results and Discussion

Material examined: Adults: BRAZIL, PR, Maringá, Córrego Água Queçaba, 1 male collected in 11.ii.2008 (emerged in 22.ii.2008); Córrego Romeira, 1 male collected in 01.ix.2007; Córrego Remo, 1 male and 2 females collected in 24.ix.2007; Córrego Remo, 3 males and 4 females collected in 10.x.2007 (1 male emerged in 11.x.2007, 1 male emerged in 12.x.2007, 1 male emerged in 13.x.2007, 2 females emerged in 14.x.2007, 1 female emerged in 18.x.2007, 1 female emerged in 19.x.2007); Córrego Água da Roseira, 3 females collected in 07.xii.2007 (1 female emerged in 08.xii.2007, 1 female emerged in 09.xii.2007, 1 female emerged in 10.xii.2007); Córrego Zauna, 1 female collected in 15.ii.2008 (emerged in 08.iii.2008); Córrego Remo, 2 males collected in 04.iii.2008 (emerged in 10.iii.2008); Córrego Romeira, 1 female collected in 03.iv.2008 (emerged in 11.iv.2008); Córrego Remo, 1 female collected in 10.iv.2008 (emerged in 24.iv.2008); Córrego Zauna, 3 males and 1 female collected in 11.iv.2008 (2 males emerged in 14.iv.2008, 1 male emerged in 19.iv.2008, 1 female emerged in 20.iv.2008); Córrego Água Queçaba, 1 male collected in 30.v.2008 (emerged in 01.vi.2008); Córrego Romeira, 2 males collected in 03.vi.2008 (1 male emerged in 04.vi.2008, 1 male emerged in 14.vii.2008); Córrego Zauna, 2 males collected in 05.vi.2008 (1 male emerged in 08.vi.2008, 1 male emerged in 09.vi.2008). Nymph: BR, PR, Maringá, Córrego Zauna, 2 specimens collected in 04.x.2007.

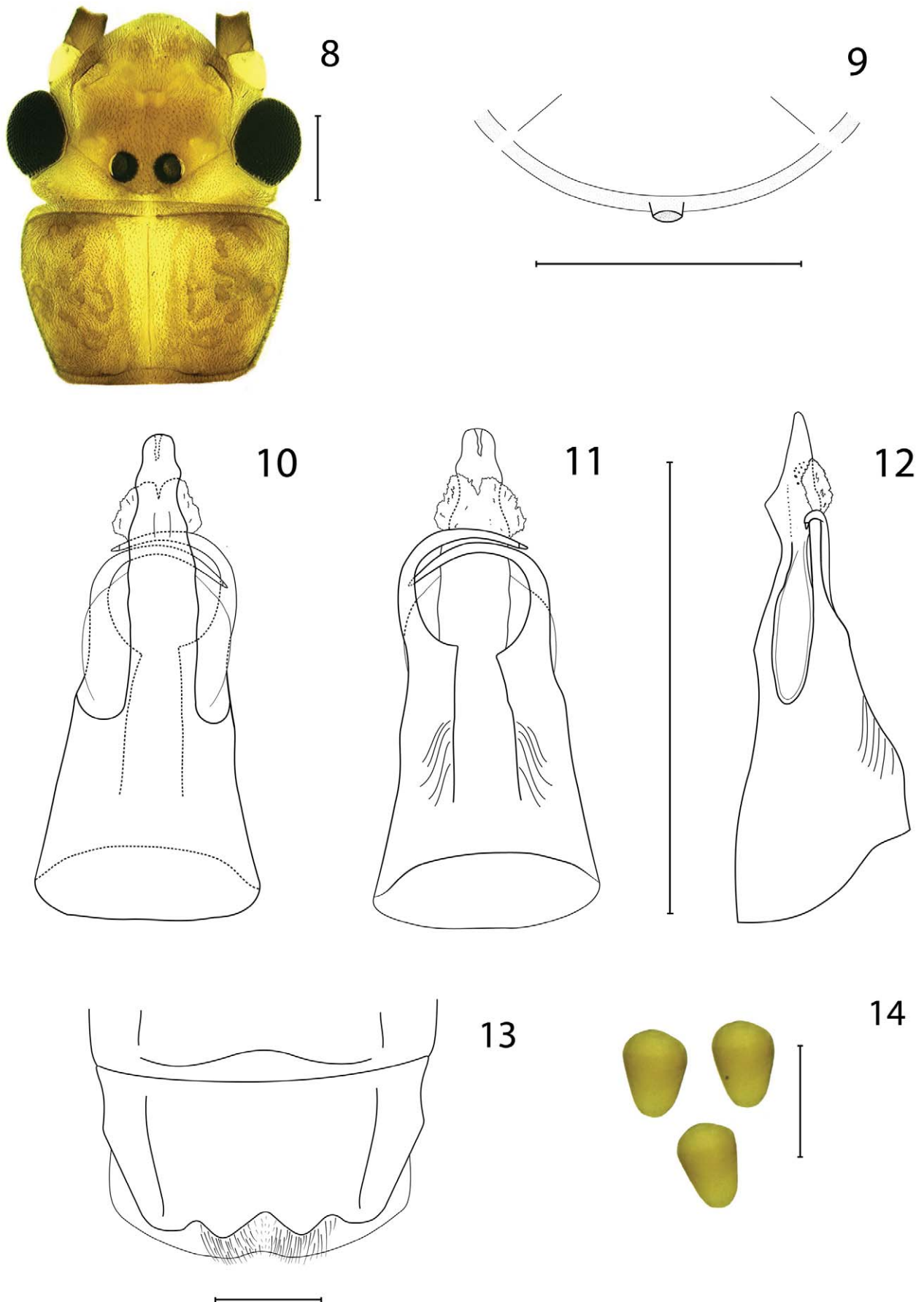
Description of nymph: General color brownish. Head brown with lighter areas near post-frontal suture and in frontoclypeal region (Fig. 2); M-line incomplete, slightly visible and with diffuse limits; eyes and ocelli black. Pronotum brownish with median line and scattered areas ochraceous (Fig. 2). Mandibles, maxillae, and labium as in Figs. 3, 4, and 5. Forefemur with lateral surface covered by sparse bristles (Fig. 6); dorsally and ventrally with higher density of thick bristles; dorsally, with translucent fringe of hairs, difficult to detect. Tibia ventrally with sparse thick bristles, and dorsally with a row of thick bristles and a well-developed band of hairs. Cerci light brown with thick bristles; segments differ in shape and size from base to apex (Fig. 7). Thoracic gills: ASC1, PSC1, AT2, AT3 and PT3 (*sensu* Shepard & Stewart 1983; Stewart & Stark 2002). *Measurements* (n=2): head width 2.5–3 mm; head length 2–2.5 mm; antennae length 6–6.5 mm; pronotum width 2.5–3 mm; pronotum length 1.5–2 mm; cercal length 4–5 mm; total length 14–17 mm.

Remarks: Froehlich (2007) based the description of *A. ofaye* on the holotype male and three paratype females collected in Mato Grosso do Sul State, Brazil. The adults of this species collected from Maringá measured: male forewing length 8.5–10.5 mm; female forewing length 12.5–14.5 mm. These are similar to Froehlich (2007) reported wing lengths. The adults of *A. ofaye* from Maringá have the head ochraceous with central part of frons darker; tentorial scars, parietalia and M-line lighter; lappets brownish; postfrontal line U-shaped; two ocelli; clypeal area setose (Fig. 8); scape and pedicel brownish, flagellum light brown to ochraceous; palpi ochraceous; pronotum ochraceous with darker rugosities and with broad yellowish median band (Fig. 8); legs yellowish to ochraceous, tibia and tarsi darker; wing membrane and veins ochraceous; cerci ochraceous. The male hammer conical, and truncate apically (Fig. 9); penial armature with hooks regularly curved, apices pointed (Figs. 10–12); pair of distal ventral vesicles present; dorsal keel slightly elevated in lateral view, in dorsal view, like two parallel short lines (Fig. 10), weakly developed in some individuals. This keel in dorsal view is slightly different from that of specimens from Mato Grosso do Sul State, in which the keel resembles a square bracket (Froehlich 2007). The female subgenital plate is 4-lobed, median notch relatively deeper (Fig. 13); sternum 9 with field of long hairs, strongest in laterally. The egg is elongate oval, ca. 0.18 x 0.38 mm (Fig. 14).

The nymphs of eight species of Brazilian Perlidae have been described: *A. debilis*, *A. otafroehlichii* Righi-Cavallaro & Lecci 2010, *Kempnyia gracilentia* (Enderlein 1909b), *K. neotropica* (Jacobson & Bianchi 1905), *K. reticulata* (Klapálek 1916), *K. colossica* (Navás 1934), *K. tijucana* Dorvillé & Froehlich 1997, and *Macrogynoplax veneranda* Froehlich 1984 (Froehlich 1984; Dorvillé & Froehlich 2001; Bispo & Froehlich 2008; Righi-Cavallaro & Lecci 2010; Avelino-Capistrano et al. 2011a, 2011b; Bispo et al. In press). The head and pronotal color pattern of the nymphs of *A. ofaye* resembles that of *A. debilis* (Avelino-Capistrano et al. 2011a); however, the nymphs of *A. ofaye* differ by the translucent and poorly visible dorsal fringe hairs on forefemora (in *A. debilis*, this fringe is well developed and easily visible). Mouthparts do not differ as described for the genus (Froehlich 1984).



FIGURES 2–7. *Anacroneuria ofaye*, nymph: (2) head; (3) right mandible; (4) right maxilla; (5) labium; (6) prothoracic left leg; (7) cerci (proximal view, medial view and distal view). Scales: Figures 2, 6, 7—0.5 mm; Figures 3, 4, 5—0.1 mm.



FIGURES 8–14. *Anacroneuria ofaye*: (8) head and pronotum; (9) hammer; (10–12) penial armature (10 dorsal view, 11 ventral view, 12 lateral view). Female: (13) subgenital plate and sternum 9; (14) eggs. Scale: 0.5 mm.

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