

## Description of the adult stage of *Cercobrachys peruanicus* (Ephemeroptera: Caenidae)

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### Descripción del estado adulto de *Cercobrachys peruanicus* (Ephemeroptera: Caenidae)

■ **RESUMEN.** Se describen por primera vez los adultos de ambos sexos de *Cercobrachys peruanicus* Soldán. El género y la especie son registrados por primera vez para Bolivia. Se proveen diagnónisis, ilustraciones y datos ambientales. Los adultos de *C. peruanicus* pueden distinguirse de las otras especies del género por la presencia de numerosas (8–16) venas transversas en las alas anteriores, completa fusión de los lóbulos peneanos, penes con margen posterior recto, placa estilígera con una emarginación mediana ancha en el margen posterior, entre otros caracteres.

**PALABRAS CLAVE.** Caenidae, *Cercobrachys*, taxonomía, Bolivia, Pilcomayo.

■ **ABSTRACT.** Adults of both sexes of *Cercobrachys peruanicus* Soldán are described for the first time and the genus and species are reported from Bolivia. Diagnoses, illustrations, and environmental data are provided. Adults of *C. peruanicus* can be distinguished from the other species of the genus by the following combination of characters: many (8–16) cross veins in the fore wings, penes lobes completely fused, with posterior margin straight, and styliger plate with a broad median emargination posteriorly.

**KEY WORDS.** Caenidae, *Cercobrachys*, taxonomy, Bolivia, Pilcomayo.

### INTRODUCTION

The genus *Cercobrachys* Soldán (1986) is known from seven species: *C. colombianus* Soldán, *C. cree* Sun, Webb and McCafferty, *C. etowah* Soldán, *C. minutus* (Tshernova), *C. peruanicus* Soldán, *C. petersorum* Soldán, and *C. serpentis* Soldán. All the species are known from the nymphal stage; additionally *C. minutus* and *C. etowah* are known from male adults. Distributional records for the genus are rare and scattered. One species is widely distributed in the Palearctic (*C. etowah*), another is Oriental (only known from Thailand, *C. petersorum*), 3 species are Nearctic (*C. cree*, *C. etowah*, and *C. serpentis*) and 2 are Neotropical (*C. colombianus* and *C. peruanicus*).

In this paper we describe the previously

unknown adults of both sexes of the Neotropical species *Cercobrachys peruanicus*, record the genus and species for the first time from Bolivia, and give illustrations and diagnostic characters to separate this species from the others of the genus. Also, environmental data for the collecting locality are provided.

### MATERIAL AND METHODS

One male nymph was collected with a kicknet, removing the river substrate. The density of benthos in this stream was very low compared with other rivers of the region (personal observation), and in spite of extensive collecting efforts, additional

nymphs were not found. Adults were caught in a light trap located near the river bank at dusk and dawn, but adults of *C. peruanicus* only arrived at dawn. Association with adults was possible because the nymph was about to molt to a subimago and adult structures were easily seen beneath the hyaline nymphal cuticle.

Keys in Domínguez *et al.* (2001) were used for generic determination, and the original description and key in Soldán (1986) were followed for species identification. Genitalia and legs of adults were mounted in glycerin-jelly and drawn with a camera-lucida under magnification; later these parts were permanently mounted in Canada balsam. Wings were mounted dry. The nymph was not dissected. Names for male genital sclerites are from Malzacher (1991); names for thoracic structures are from Kluge (2004).

## RESULTS

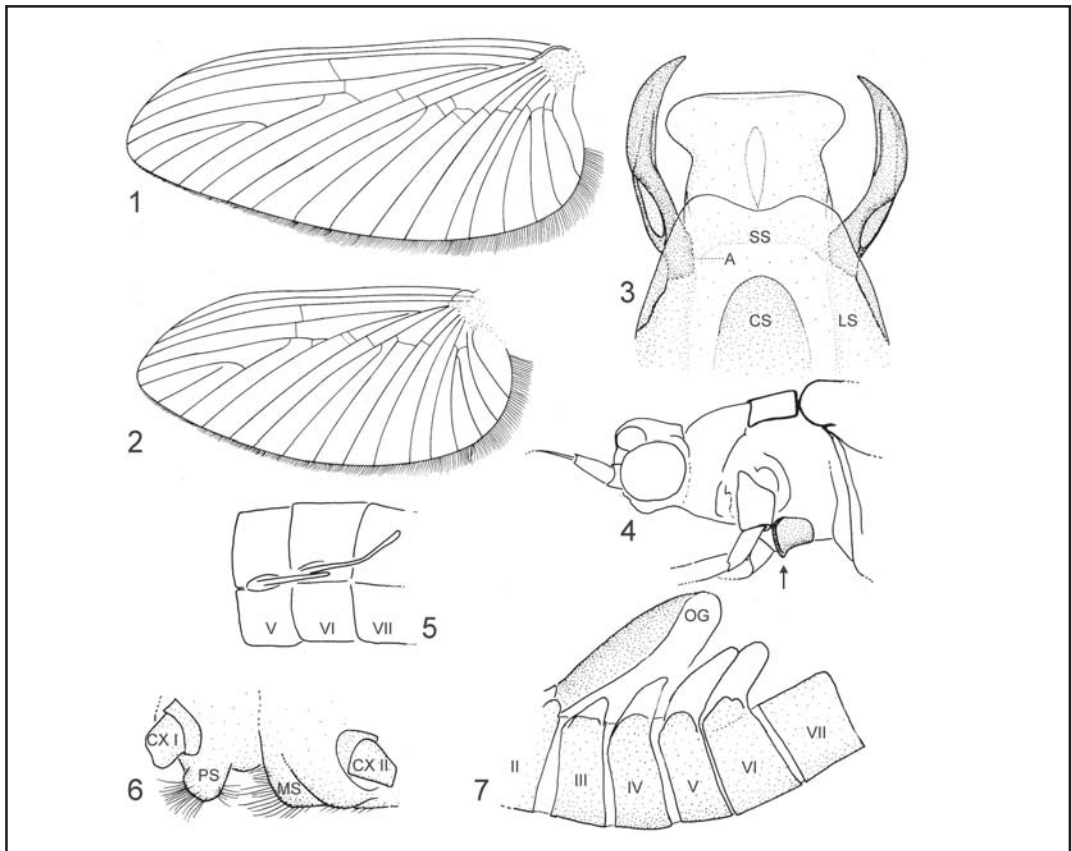
### *Cercobrachys peruanicus* Soldán, 1986

(Figs. 1-7)

*Brachycercus* nymph Edmunds *et al.*, 1976: 266

*Cercobrachys peruanicus* Soldán, 1986: 343 (nymph)

**Male imago.** Length: body, 3.3–4.0 mm; forewings, 3.1–4.4 mm. General coloration yellowish. Head brownish except submedian lighter marks on occiput, ventrally paler, antennae yellowish; pedicel 1.5–1.8 times the length of scape. Thorax. Pronotum yellowish translucent with grayish mark; prosternum quadrangular, wide, with ventrally protruding fore margin (arrow in Fig. 4). Mesonotum



**Figs. 1-7.** *Cercobrachys peruanicus*. Imago: 1, female fore wing; 2, male fore wing; 3, male genitalia, ventral view; 4, male head and prothorax, lateral view; 5, male abdominal segments V-VII, lateral view. Nymph: 6, pro- and mesosternum, lateral view; 7, abdominal segments II-VII, lateral view. Abbreviations, A: apophysis of styli; CS: central sclerite; CX I-II: coxae I and II; LS: lateral sclerite; MS: mesosternum; OG: operculate gill; PS: prosternum; SS: styli.

yellowish brown with two pairs of darker lateral marks and darker mesoscutellum; medioparapsidal suture shaded with gray; medionotal membrane whitish. Metanotum and pterothoracic pleura and sterna with yellowish sclerites, membranes whitish shaded slightly with gray; metanotum with a small posteriorly directed median projection. Legs. Coxae and trochanters yellowish, femora whitish yellow, tibiae and tarsi whitish; apex of fore tibia with a gray spot. Wings (Fig. 2) hyaline, longitudinal veins yellowish shaded gray, darker on C, Sc and R; cross veins whitish translucent. Abdomen whitish yellow, slightly paler ventrally, except tergum X distally yellowish; lateral filaments present on segments III–VI, directed posteriorly, short on III but long and thin on IV–VI (Fig. 5); pleural membranes on segments II–VI with a light grayish longitudinal line (tracheae). Genitalia (Fig. 3): styliger plate whitish except lateral margins and central sclerite yellowish, hind margin of styliger plate with broad median emargination; forceps yellowish, heavily sclerotized, apically pointed and grooved; penes whitish with a slightly darker mediolongitudinal oblong mark, lobes completely fused, laterally expanded and rounded; penes with straight hind margin and concave lateral margins (Fig. 3)

**Male subimago.** As in male except foreleg darker and lateral filaments of abdomen directed more dorsally.

**Female imago.** Length: body, 4.4–4.6 mm; forewings, 4.0–4.3 mm. General coloration yellowish brown. Antennae: pedicel 1.3–1.7 times the length of scape. Head and thorax as in male but darker. Prosternal sclerites weakly marked, fore margin not protruded as much as in male. Mesonotum yellowish brown except medionotal membrane whitish; median projection on metanotum relatively larger than in male. Legs yellowish. Fore wings as in male, except cross veins more numerous (Fig. 1). Abdomen yellowish brown except intersegmental membranes whitish; terga VII–IX with submedian lighter lines. Caudal filaments 1/3 of body length, translucent

yellowish white.

**Mature male nymph.** Length of body: 4.0 mm. Since the only nymph collected coincides almost exactly with Soldán's (1986) description, it is unnecessary to include a redescription here. Nevertheless, two figures are provided to help in the identification of this stage. The first figure (Fig. 6) depicts a lateral view of the prosternum and mesosternum, showing the protruded nature of the prosternum and the position of the long setae on both sterna. The second illustration (Fig. 7), also in lateral view, shows abdominal segments II–VII, especially the dorsal projections of segments III–VI. The antennae present pedicel 1.4–1.7 times the length of scape.

**Diagnosis.** *Cercobrachys peruanicus* can be distinguished from the other species of the genus by the following combination of characters. In the imago: 1) scape and pedicel yellowish, without dark brown ring near the base of flagellum; 2) mesonotum yellowish brown; 3) penes with straight posterior margin, lobes of penes laterally projected and rounded (Fig. 3); 4) lateral margins of penes concave (Fig. 3); 5) penes with a mediolongitudinal oblong mark (Fig. 3); 6) fore wings with 8–10 cross veins in male (Fig. 2), and 13–16 cross veins in females (Fig. 1); and 7) hind margin of styliger plate with broad median emargination (Fig. 3). In the nymph: 1) prosternum with pronounced anteriorly directed protuberance (Fig. 6); 2) operculate gill 1.6 times longer than wide; 3) posterolateral spines of abdominal segment VI not touching dorsally.

**Material examined.** One mature male nymph, 9 male imagos, 1 male subimago, and 2 female imagos from **BOLIVIA**: Dpto. Tarija, prov. O'Connor, S 20° 54' 51.5"–W 64° 06' 59.9", río Pilcomayo, near cerro Alto Isiporenda, 790 m, 8–X–2004, light trap 4–6 am, C. Molineri, V. Manzo, E. Goitía cols. All the material is housed at the Instituto-Fundación M. Lillo (Argentina, Tucumán), except 2 male imagos at the Universidad Mayor de San Simón (Bolivia, Cochabamba) and 1 male imago at the Florida A&M

University (USA, Florida, Tallahassee).

**Habitat.** Samples were collected in Río Pilcomayo, near Chuquisaca – Tarija border. The Pilcomayo basin is located in the «Tucumano–Boliviana» or «Yungas» biogeographic province, and is characterized by a xeric environment (Navarro & Maldonado, 2002). The river substrate is mainly composed of sand, with abundant pebbles and cobbles, water pH is 8.3, the water is meso- to hypermineralized, and suspended solid content is high. Ionic composition is sulfated–chlorinated calcic–sodic. Water temperature at 17 h was 28°C, conductivity was 1580  $\mu\text{S}/\text{cm}$ , and DO saturation was 98%. Water depth at the collecting site was 0.5–1.0 m. Mean annual discharge is 207  $\text{m}^3/\text{s}$ .

## DISCUSSION

The anteriorly directed protuberance of the nymphal prosternum is not mentioned in the Soldán's (1986) original description of *C. peruanicus*. This structure appears to be present in the damaged holotype nymph housed in FAMU (Janice Peters, pers. comm.). Adults of *Cercobrachys peruanicus* agree with the generic description from Soldán (1986: 336). However, the length of male fore wings is slightly larger (4.4 mm) than the 4.0 mm reported by Soldán, and the «pair of sclerotized formations near the base of penis» (Soldán, 1986: 337), are apparently absent in *C. peruanicus*; instead, in a similar position we found the apophyses of the styliger sclerite very weakly marked (Fig. 3). Malzacher (1991) suggested that the distorted or twisted appearance of the forceps might be a generic character of *Cercobrachys*, a suggestion reinforced by the material described here (Fig. 3).

The relative length of basal antennal segments (scape and pedicel) is commonly used to distinguish *Cercobrachys* from other related genera (mainly the other caenid with ocellar tubercles known to occur in South America, *Brachycercus*). The material here studied showed large variations in scape–pedicel length ratios, between different stages

and sexes, and even between different individuals. In the nymphal stage, *Cercobrachys* has been defined by having pedicel 1.1–1.3 times the length of scape (Soldán, 1986). The nymph studied here show larger values (1.4–1.7). The same applies to male imagos previously distinguished by having scape and pedicel of subequal length, while the males studied here show pedicel 1.5–1.8 times the length of scape. For these reasons one must be careful when determining these genera and emphasize on other characters than scape–pedicel length ratios. In South America, *Cercobrachys* should be distinguished from *Brachycercus* by the following characters, in the nymphs: 1) pre- and mesosternum with prominent anterior margin bearing cranially directed long bristles (Fig. 6); 2) spines on abdominal segment VI considerably bent medially nearly touching dorsally. Both characters are also useful for adults, since the presternum retains some of its protuded nature (Fig. 4) and the abdominal spines are also visible in this stage (Fig. 5).

Male adults of only two *Cercobrachys* species are known: the Palearctic *C. minutus* and the Nearctic *C. etowah*. Male genitalia of *C. peruanicus* resembles that of *C. minutus* in the straight hind margin of the penes and in the concave lateral margins of penes. The nymphal stage of the genus is better known, but (in addition to *C. peruanicus*) only *C. colombianus* has been described from the Neotropics (from Colombia and Brazil). The nymphs of the genus can be recognized by the following combination of characters: small ocellar tubercles present, maxillary and labial palpi 2–segmented, prosternum broad, mesosternum with prominent anterior margin bearing setae (see Fig. 6), legs long and slender with very long setae, posterolateral spines of abdominal segment VI bent medially, and «gill basket» present (see Fig. 7).

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#### LITERATURE CITED

1. DOMÍNGUEZ, E., M.D. HUBBARD, M.L. PESCADOR & C. MOLINERI. 2001. Ephemeroptera. *In*: Fernández, H. R. & Domínguez, E. (eds.), *Guía para la determinación de los artrópodos bentónicos sudamericanos*. EUDET, UNT, Tucumán, pp. 17–53.
2. EDMUNDS, G.F., Jr., S.L. JENSEN & L. BERNER. 1976. *The Mayflies of North and Central America*. University of Minnesota Press, Minneapolis, 330 pp.
3. KLUGE, N. JU. 2004. *The Phylogenetic System of Ephemeroptera*. Kluwer Academic Publishers, Boston, 442 pp.
4. MALZACHER, P. 1991. Genital-morphological features in the Caenidae. *In*: Alba–Tercedor, J. A. & Sánchez–Ortega, A. (eds.), *Overview and Strategies of Ephemeroptera and Plecoptera*. Sandhill Crane Press, Gainesville, Florida, pp. 73-85.
5. NAVARRO, G. & M. MALDONADO. 2002. *Geografía ecológica de Bolivia, Vegetación y ambientes acuáticos*. Centro de Ecología Simón I. Patiño, Santa Cruz, 719 pp.
6. SOLDÁN, T. 1986. A revision of the Caenidae with ocellar tubercles in the nymphal stage (Ephemeroptera). *Acta Universitatis Carolinae–Biologica* 1982–1984: 289–362.

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