

A new species of *Camelobaetidius* Demoulin, 1966 (Ephemeroptera: Baetidae), from the Colombian Orinoco River basin

LUIS GONZALO SALINAS-JIMENEZ^{1,4}, R. BOLDRINI², DIANA PAOLA OSORIO-RAMIREZ³,
CLARA INES CARO³ & JOSE ISMAEL ROJAS-PENÑA³

¹Universidad del Quindío, Laboratorio de Ictiología, Grupo de Investigación Diversidad Faunística. P.O. Box.2639, Armenia, Quindío, Colombia.

²Universidade Federal de Roraima (UFRR), Campus Paricarana, Centro de Estudos da Biodiversidade (CBio), CEP 69310-000, Boa Vista, Roraima, Brasil. E-mail: rafaelboldrini.2@gmail.com.

³Grupo de Investigación en Gestión Ambiental Sostenible, Instituto de Ciencias Ambientales de la Orinoquia Colombiana—Universidad de los Llanos, km 12 vía Puerto López, Meta, Colombia.

⁴Corresponding author. E-mail: biobaetodes@gmail.com

Abstract

Three species of *Camelobaetidius* Demoulin, 1966 have been reported from Colombia until now, based on nymphs. We describe a fourth species based on nymphs from the Colombian Orinoco river basin. The new species can be recognized by: 1) labrum narrowly rounded anteriorly; 2) segment II of labial palp with a short rounded distomedial projection; 3) incisors of right mandible with eleven denticles; 4) gills absent from the bases of coxae; 5) tarsal claws with ten denticles; 6) outer margin of forefemur with a row of about 23 long, spine-like setae; 7) posterior margin of tergum IV with truncate spines, and 8) terminal filament almost as long as cerci. [Zoobank URL: urn:lsid:zoobank.org:act:500CF998-8EF3-43E3-BA8B-F062B92768F3]

Key words: freshwater, mayfly, Neotropics, taxonomy

Introduction

Camelobaetidius Demoulin, 1966 (Ephemeroptera: Baetidae) is a genus of small minnow mayflies in which nymphs are found mainly on rocks of mountain rivers with strong currents (Lugo-Ortiz & McCafferty, 1999). To date this genus is composed of 44 species (Jacobus & McCafferty, 2005; Salles & Serrão, 2005; Domínguez et al. 2006; Boldrini et al. 2012a, b; Boldrini et al. 2013; Boldrini & Pes, 2014; Sibajaya-Araya & Esquivel, 2018), distributed in the Western Hemisphere from Argentina and Uruguay in the south (Traver & Edmunds, 1968) to Saskatchewan, Canada, in the north (Lehmkuhl, 1976).

In Colombia three species have been reported until now based on nymphs: *Camelobaetidius edmundsi* Dominique, Thomas & Mathuriau, 2001; *Camelobaetidius mathuriae* Dominique & Thomas, 2001; *Camelobaetidius patricki* Dominique & Thomas, 2001 (Dominique, Mathuriau & Thomas, 2001; Salinas et al. 2012; Salinas et al. 2017). The aim of the present paper is to describe a new species of *Camelobaetidius* based on nymphs from the Colombian Orinoco River basin.

Materials and methods

Nymphs were collected by using an aquatic entomological net and fixed in 96% ethanol. The drawings were made from photographs, using Adobe Illustrator ®CS6 and Adobe Photoshop ®CS6 programs as proposed by Coleman (2003, 2006). The pictures were taken with the help of optical microscope OLYMPUS CX31. Photographs of the nymph were taken using a stereoscopic LEICA EZ4; the pictures were combined using the COMBINEZ5 (Hadley 2010) open software. The slides were prepared with Euparal®. The material examined was deposited in

the Entomological Collection of the Biology program at Universidad de Caldas (CEBUC) in Manizales, Colombia and Collection of invertebrates from the laboratory of Ichthyology at Universidad del Quindío (MIUQ), Armenia, Colombia. The new species is based on a morphological species concept.

Results

Camelobaetidius metae Salinas-Jimenez & Boldrini, sp. nov.

(Figs. 1–11)

Diagnosis. Nymphs: 1) labrum narrowly rounded anteriorly (Fig. 2); 2) incisors of right mandible with eleven denticles (Fig. 5a); 3) segment II of labial palp with a short rounded distomedial projection (Fig. 7); 4) gills absent at the bases of coxae; 5) outer margin of forefemur with a row of about 23 long, spine-like setae (Fig. 8); 6) tarsal claws with ten denticles (Fig. 8a); 7) posterior margin of tergum IV with truncate spines (Fig. 9); 8) terminal filament almost as long as cerci.

Description. Nymph. Length of body: 3.5–4.0 mm; length of antennae: 1.0–1.2 mm; length of cerci: 1.0 mm; length of terminal filament: 0.8 mm.

Head (Fig. 1). Light brown. Antennae light brown. Lateral branch of epicranial suture sinuous.

Labrum (Fig. 2). Narrowly rounded anteriorly, broader than long. Length about $0.6\times$ maximum width; lateral and anterolateral margins with long, fine, bifid and pectinate setae; medially with fine, bifid and pectinate setae. Dorsally with three short, fine, simple setae scattered over basal area; dorsolateral arc of setae with two long, fine, apically pointed setae in lateral region.

Hypopharynx (Fig. 3). Lingua shorter than superlingua, apex rounded, with tuft of short, fine, simple setae. Superlingua not expanded, with fine, simple setae scattered over lateral and distal margins.

Left mandible (Fig. 4). Incisors with seven denticles (Fig. 4a). Prosthema robust, apically denticulate. Margin between prosthema and mola without setae; subtriangular process wide; setae absent from apex of mola.

Right mandible (Fig. 5). Incisors with eleven denticles (Fig. 5a). Prosthema slender, apically denticulate; margin between prosthema and mola with two fine simple setae; setae present at apex of mola.

Maxilla (Fig. 6). Inner dorsal row of setae with three denti-setae; two pectinate denti-setae and one apical denti-seta at same orientation of canines. Medial protuberance of galea with 2 long, fine and simple setae. Maxillary palp $1.1\times$ length of galea-lacinia. Palp segment II length subequal to length of segment I. Fine and simple setae scattered over segment II of maxillary palp.

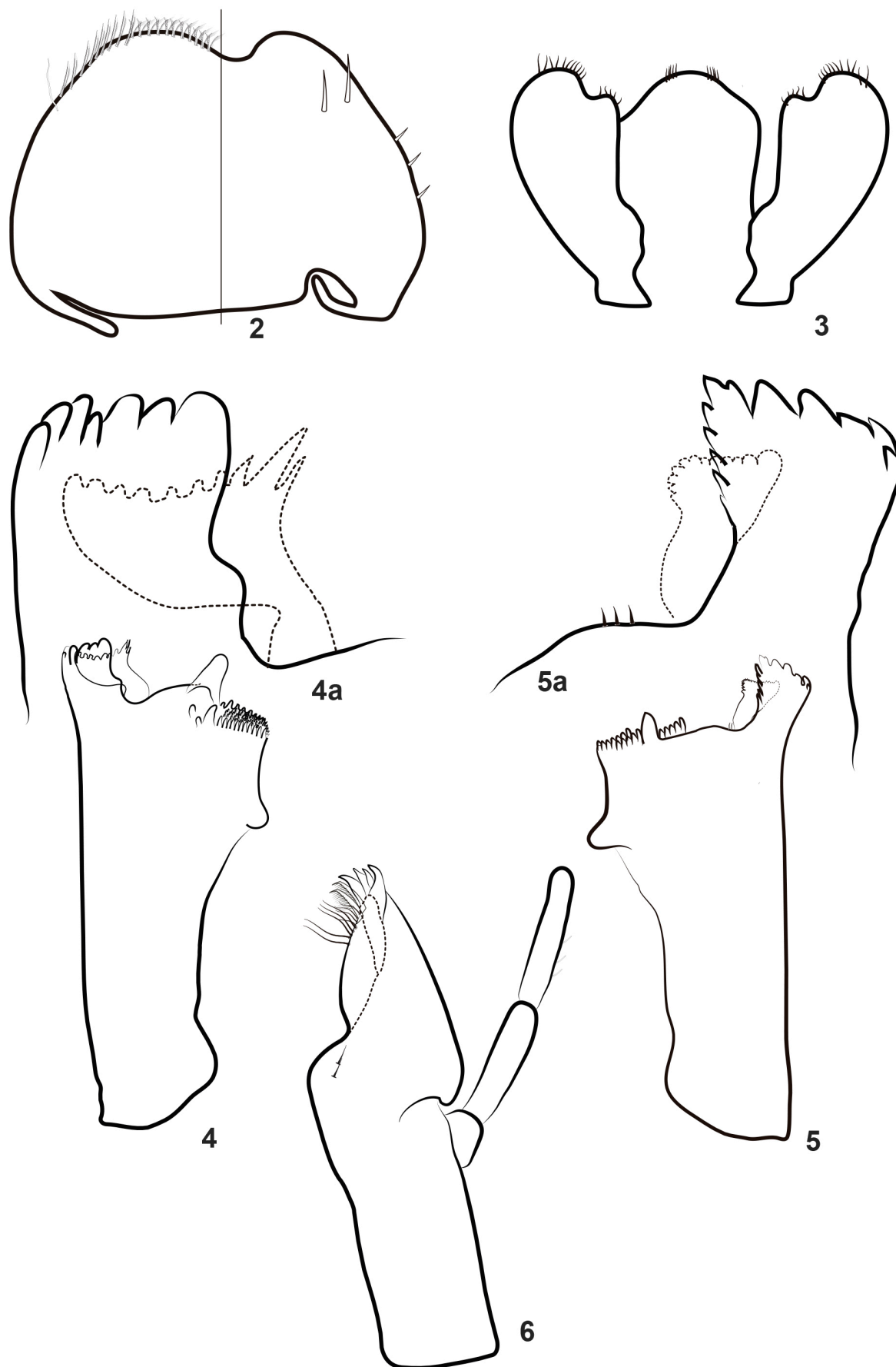
Labium (Fig. 7). Glossa shorter than paraglossa; inner margin with nine spine-like setae increasing in length distally; apex with two long, spine-like setae; outer margin with three long, spine-like setae; ventral surface with three short, fine, simple setae. Paraglossa sub-rectangular, curved inward; apex with two rows of long, fine, simple setae; ventral surface with row of four long, fine, spine-like setae; dorsal surface with two fine, spine-like setae near apex. Palp segment II with distomedial projection short and rounded; dorsally with row of three long, spine-like setae; ventrally with three simple spine-like setae. Palp segment III oblong, length $1.3\times$ width, with scattered simple setae and spine-like setae.

Thorax (Fig. 1). Light brown; metanotum with anterior region brown. Hind wing pad present. Gills absent from bases of coxae. Femur, tibia and tarsi light brown. Tibia I $0.9\times$ length of femur I; tibia II $0.8\times$ length of femur II; tibia III $0.8\times$ length of femur III. Tarsi I and II each $0.5\times$ length of respective femur; tarsi III $0.4\times$ length of femur III. Forefemur (Fig. 8) length about $3.4\times$ maximum width; outer margin with row of about 23 long, spine-like setae; inner margin with three short, fine, spine-like setae. Foretibia outer margin with few fine, simple setae; inner margin with three short, spine-like setae; anterior apex with two spine-like setae; patella-tibial suture present. Tarsal claws with 10 denticles each (Fig. 8a). Mid femur length about $2.6\times$ maximum width; outer margin with row of about 9 long, spine-like setae. Hind femur length about $3\times$ maximum width; outer margin with row of about 14 long, spine-like setae.

Abdomen (Fig. 1). Coloration light brown, but segment VIII lighter. Segment X with cross-like color pattern. Posterior margin of tergum IV with truncate spines (Fig. 9). Gills oval. Gills IV (Fig. 10) light brown; margins with narrow spines intercalating short, fine, simple setae; tracheae pigmented. Gill I $1.4\times$ length of segment II; gill IV $1.8\times$ length of segment V; gill VII $1.4\times$ length of segment VIII. Paraproct (Fig. 11) with two spines near inner



FIGURE 1. *Camelobaetidius metae* **sp. nov.**, nymph.



FIGURES 2–6. *Camelobaetidioides metae* **sp. nov.**, nymph. 2, labrum (left v.v., right d.v.). 3, hypopharynx. 4, left mandible. 4a, incisors and prosthema of left mandible. 5, right mandible. 5a, incisors and prosthema of right mandible. 6, maxilla.



FIGURES 7–11. *Camelobaetidius metae* **sp. nov.**, nymph. 7, labium (left v.v., right d.v.). 8, foreleg. 8a, detail of tarsal claw. 9, posterior margin of terga IV. 10, gill IV. 11, paraproct.

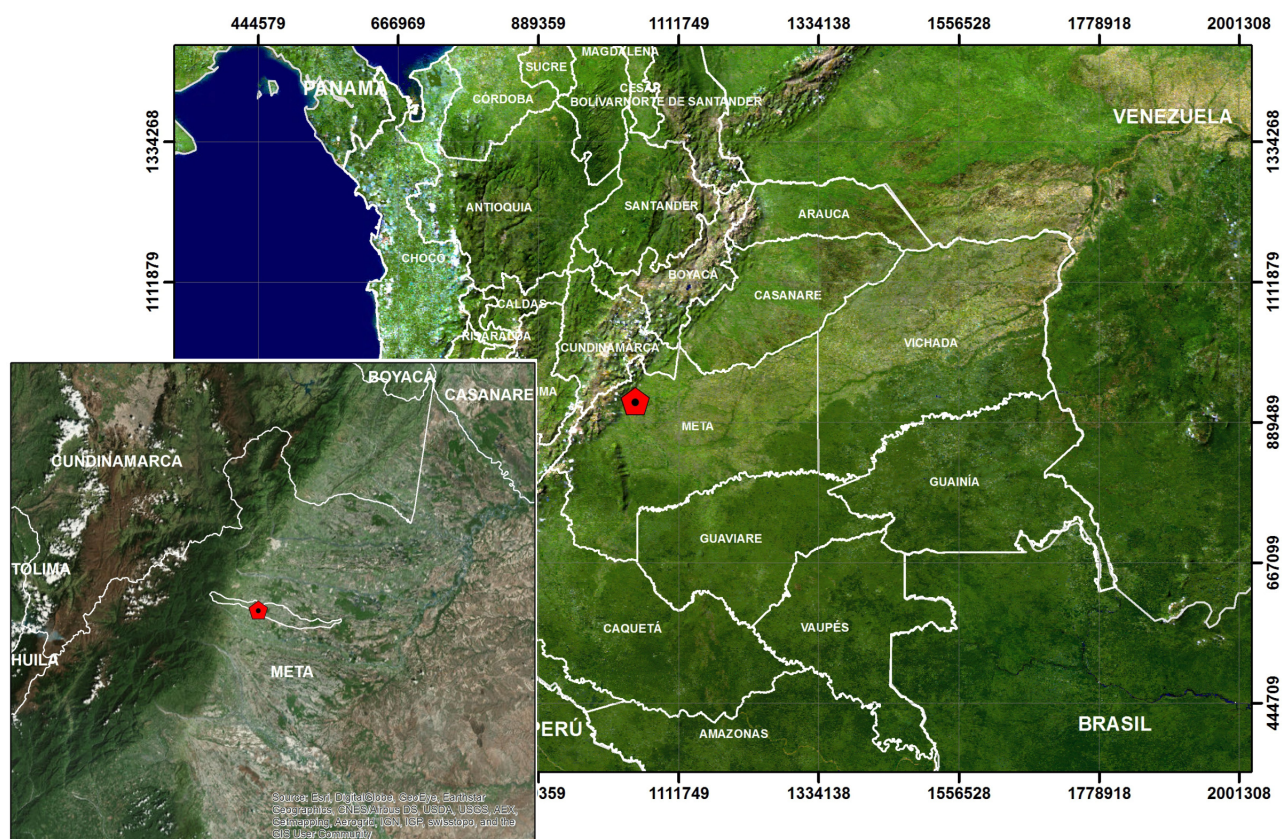


FIGURE 12. Geographic distribution of *Camelobaetidius metae* sp. nov. in Colombia.



FIGURE 13. General aspect of *Camelobaetidius metae* sp. nov. habitat.

margin; without shagreened area. Cerci light brown with brown band at mid length; outer and inner margins of terminal filament and inner margins of cerci with tufts of long, simple setae; outer margins of cerci with spines at apex of each segment.

Etymology. The specific epithet is an arbitrary combination of letters referring to Meta, the Colombian state where this species was found.

Distribution. Thusfar, the species has been found only in the Río Orotoy, in the Orinoco River basin of Meta, Colombia (Fig. 12).

Comments. The general shape of the labial palp of *Camelobaetidius metae* is similar to that found in *C. carolinae* Boldrini & Pes, 2014, *C. cruzi* Boldrini & Pes, 2014 and *C. matilei* Thomas & Péru, 2003. *Camelobaetidius metae*, however, can be distinguished from *C. carolinae* by the size of the denticles on the tarsal claws, with the latter species having the first denticle distinctly longer than others, while the denticles in *C. metae* are all similar in length. *Camelobaetidius metae* is distinguished from *C. cruzi* by the shape of labial palp segment II, which is subquadrangular in *C. cruzi* versus oblong in *C. metae*. *Camelobaetidius metae* is distinguished from *C. matilei* by the hind wing, which is present in *C. metae* but absent in *C. matilei*. Furthermore, *C. metae* presents an outer margin of the forefemur with a row of 23 clavate setae and a posterior margin of tergum IV with truncate spines, while *C. carolinae* presents an outer margin of the forefemur with a row of 18 long, spine-like setae and a posterior margin of tergum IV with rounded spines; *C. cruzi* presents an outer margin of the forefemur with a row of nine long, spine-like setae and the posterior margin of tergum IV with rounded spines, and *C. matilei* presents an outer margin of the forefemur with a row of three long, spine-like setae and a posterior margin of tergum IV with truncate spines.

Material examined. Holotype: Male mature nymph (mounted on slides, medium Euparal), Colombia, Meta, Castilla La Nueva, Vereda Cacayal, Río Orotoy, 3°52'9.0" N, 73°38'18.6" W, 419m, 02/vi/2011, Osorio D, Caro C, cols (CEBUC). Paratypes: fourteen mature nymphs (four specimens mounted on slides, medium: Euparal), same data as holotype (seven specimens deposited in CEBUC and seven specimens deposited in MIUQ).

Additional material: 35 nymphs, same data as holotype deposited in MIUQ.

Habitat (Fig. 13). The nymphs were collected from the Río Orotoy, which is in the Orinoco River basin. The stream is meandering and open, with clear water. It is 20 m wide, has an average depth of 0.68 m and discharge of 2.7 m³/s for the sampling season (high water). The stream bed is composed of boulders and sandy clay substrate. The riverbank presents secondary vegetation, typical of a foothill forest. The water temperature was 25°C; pH was 6.4 units; dissolved oxygen content was high (9.0 mg/l), conductivity was low (16 µS/cm).

Acknowledgements

The Environmental Science Institute of Colombia Orinoquia (ICAOC) of the University of the Llanos facilitated the biological material collected in the agreement DHS 169-09 subscribed between the University of the Llanos and the Colombian Petroleum Company (ECOPETROL).

References

- Boldrini, R., Pes, A.M.O. & Salles, F.F. (2012a) Review of the genus *Camelobaetidius* Demoulin (Ephemeroptera: Baetidae) with reduced terminal filament. *Journal of Natural History*, 46, 2033–2073.
<https://doi.org/10.1080/00222933.2012.708447>
- Boldrini, R., Pes, A.M.O., Francischetti, C.N. & Salles, F.F. (2012b) New species and new records of *Camelobaetidius* Demoulin, 1966 (Ephemeroptera: Baetidae) from Southeastern Brazil. *Zootaxa*, 3526 (1), 17–30.
<https://doi.org/10.11646/zootaxa.3526.1.2>
- Boldrini, R., Jacobus, L.M., Salles, F.F. & Pes, A.M.O. (2013) The adults of *Camelobaetidius janae* Dominique & Thomas, 2001 and *C. yacutinga* Nieto, 2003, with a new synonym for *C. leentvaari* Demoulin, 1966 (Ephemeroptera: Baetidae). *Zootaxa*, 3702 (2), 150–158.
<https://doi.org/10.11646/zootaxa.3702.2.4>
- Boldrini, R. & Pes, A.M.O. (2014) Five new species of *Camelobaetidius* Demoulin, 1966 (Ephemeroptera: Baetidae), and redescription of *Camelobaetidius mexicanus* (Traver & Edmunds, 1968). *Zootaxa*, 3796 (3), 545–567.
<https://doi.org/10.11646/zootaxa.3796.3.8>
- Coleman, C.O. (2003) “Digital inking”: How to make perfect line drawings on computers. Organism, Diversity and Evolution, Electronic Supplement. Available from: <http://senckenberg.de/odes/03-14.htm> (accessed 20 June 2019)

- Coleman, C.O. (2006) Substituting time-consuming pencil drawings in arthropod taxonomy using stacks of digital photographs. *Zootaxa*, 1360, 61–68.
<https://doi.org/10.11646/zootaxa.1360.1.4>
- Domínguez, E., Molineri, C., Pescador, M.L., Hubbard, M.D. & Nieto, C. (2006) *Ephemeroptera of South America*. In: Adis, J., Arias, J.R., Rueda-Delgado, G. & Wantzen, K.M. (Eds.), *Aquatic Biodiversity of Latin America*. Vol. 2. Pensoft, Sofia-Moscow, pp. 1–646.
- Hadley, A. (2010). CombineZ software. Available from: <http://www.hadleyweb.pwp.blueyonder.co.uk/CZP/Installation.htm> (accessed 20 June 2019)
- Jacobus, L.M. & McCafferty, W.P. (2005). A new species and new synonym in *Camelobaetidius* Demoulin (Ephemeroptera: Baetidae). *Journal of the Kansas Entomological Society*, 78, 153–157.
<https://doi.org/10.2317/0409.20.1>
- Lehmkuhl, D.M. (1976) Mayflies. *Blue Jay*, 34 (2), 70–81.
- Lugo-Ortiz, C.R. & McCafferty, W.P. (1999). An unusual new species of *Camelobaetidius* (Ephemeroptera: Baetidae) from Paraguay. *Entomological News*, 110 (4), 221–224.
- Salinas, L.G., Dias, L.G., Bacca, T., Zúñiga, M.C. & Rodríguez, M. (2012). Primeros registros de Ephemeroptera (Insecta) para el departamento de Putumayo, Colombia. *Boletín Científico. Centro de Museos. Museo de Historia Natural. Universidad de Caldas*, 16 (2), 198–208.
- Salinas-Jiménez, L.G., Rojas-Peña, J.I., Osorio-Ramírez, D.P. & Caro-Caro, C.I. (2017). New records of Ephemeroptera from the Colombian Orinoco river basin of the Meta department. *Revista Colombiana de Entomología*, 43 (2), 271–276.
<https://doi.org/10.25100/socolen.v43i2.5958>
- Salles, F.F. & Serrão, J.E. (2005) The nymphs of the genus *Camelobaetidius* Demoulin (Ephemeroptera: Baetidae) in Brazil: new species, new records, and key for the identification of the species. *Annales de Limnologie*, 41, 267–279.
<https://doi.org/10.1051/limn/2005014>
- Sibaja-Araya, F. & Esquivel, C. (2018). *Camelobaetidius guaycara*, a new species of Baetidae (Ephemeroptera) from Costa Rica, Central America. *Zootaxa*, 4434 (1), 89–98.
<https://doi.org/10.11646/zootaxa.4434.1.5>
- Thomas, A., Perú, N. & Horeau, V. (2003) Les Ephémères de la Guyane Française. 8. Description de *Camelobaetidius matilei* n. sp. et clé de détermination de espèces guyanensis de ce genre (Ephemeroptera: Baetidae). *Ephemera*, 3 (2), 123–133.
- Traver, J.R. & Edmunds, G.F., Jr. (1968) A revision of the Baetidae with spatulate-clawed nymphs (Ephemeroptera). *Pacific Insects*, 10, 629–677.