

## Research Article

# New Baetidae (Insecta: Ephemeroptera) Records from Venezuela and Nymph Description of an Unnamed *Fallceon* Species

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The Ephemeroptera fauna in Venezuela is poorly known, as is also the case in others areas in South America. Recently, two studies increased from 33 to 50 the number of species recorded in Venezuela. The objective of the present study is to report for the first time in Venezuela the following species: *Baetodes levis*; *Camelobaetidius edmundsi*; *Fallceon* sp.; *Mayobaetis ellenae*. The nymph of *Fallceon* sp. is described, but is not named because adults were not reared to allow species identification; however, description of this nymph indicates the presence of this genus in South America.

## 1. Introduction

The Ephemeroptera of Venezuela is poorly known [1], it has been characterized as mega-diverse based on studies of the flora and fauna of the Caribbean, Andes, Amazon and Guiana regions [2]. Until 2001, mayfly records for Venezuela represented only about 5% of the nominal mayfly species known in South America [3]. The most recent estimate of species richness indicates Venezuela has about 9% of the mayflies in the Neotropics [4]. The gap in faunal composition reflects the history of collecting rather than the actual richness of this taxon [3]. Based on the number of published studies on mayflies in South America, it is obvious that there has been more collecting effort in Brazil and Argentina than in any other country in this region [3]. In the last decades, a few studies have helped to increase our knowledge of Venezuelan mayflies (e.g., [5–7]). Recently, Nieto et al. [1] and Molineri et al. [4] studied Ephemeroptera in Venezuela's Guyana Uplands, and in two articles the number of species recorded in the country increased from 33 to 50, reinforcing the need to increase the sampling area in order to really document the Ephemeroptera diversity in this country.

The lack of information of this nature makes the analysis of biogeographic patterns difficult and precludes the development of regional identification keys and systematic studies. To improve our knowledge of mayflies of Venezuela, the main objectives of this paper are (1) to report for the first time the following taxa from Venezuela: *Baetodes levis* Mayo; *Camelobaetidius edmundsi* Dominique, Thomas & Mathuriau; *Fallceon* sp. and *Mayobaetis ellenae* (Mayo) and (2) to describe the nymph of *Fallceon* sp.

## 2. Material and Methods

Nymphs were collected with an aquatic entomological net and fixed in 80% ethanol.

Descriptions were prepared according to Hubbard [8] with the aid of DELTA (Description Language for Taxonomy) open software by Dallwitz [9].

Formula for denticles of the mandible incisors has the following pattern: Number of denticles of outer incisor + Number of denticles of inner incisor.

Formula for setae of the maxilla medial protuberance has the following pattern: Number of setae on ventral surface + Number of setae on dorsal surface.

Permanent slides were prepared using Euparal as mounting media, and no tissue preparation was used, being dissected and inserted in Euparal immediately.

The drawings were made using a ZEISS Standard 20 microscope with a camera lucida. The examined specimens were deposited in the following institutions: Instituto Nacional de Pesquisas da Amazonia (INPA), Manaus, AM, Brazil and Instituto de Altos Estudios "Dr. Arnaldo Gabaldón"-IAE, Maracay, Aragua, Venezuela.

### 3. Results

**3.1. *Baetodes levis* Mayo 1968.** Mayo [10]: 253; Lugo-Ortiz and McCafferty [11]: 374; Nieto [12]: 19; Zúñiga et al. [13]: 36; Domínguez et al. [14]: 98; Dias et al. [15]: 238.

**3.1.1. Distribution.** Colombia (Zúñiga et al. [13]); Ecuador (Mayo [10]); New Record: Venezuela.

**3.1.2. Material Examined.** Two nymphs (mouth parts, legs, antenna, cercus, terminal filament, paraproct, and gills on slide), Venezuela, Turmero, Paya Arriba, Municipio Mariño, Estado Aragua, rifles, above rocks, N10°18'24.2'' W067°24'54.9'', 765 meters, 17.iv.2011, N. Hamada, H. Frontado, C. Quinto, and U. Neiss leg. (INPA, IAE).

**3.2. *Camelobaetidius edmundsi* Dominique, Mathuriau & Thomas 2001.** Dominique et al. [16]: 19; Domínguez et al. [14]: 129.

**3.2.1. Distribution.** Colombia (Dominique et al. [16]); New Record: Venezuela.

**3.2.2. Material Examined.** One nymph (mouth parts, legs, antenna, cercus, terminal filament, paraproct and gills on slide), Venezuela, Turmero, Guayabita, municipio Mariño, Estado Aragua, rifles, above rocks, N10°18'03.1'' W067°28'24.5'', 634 m, 17.iv.2011, N. Hamada, H. Frontado, C. Quinto, and U. Neiss leg. (INPA).

**3.2.3. Comments.** *Camelobaetidius edmundsi* is closely related to *C. mathuriae* Dominique & Thomas. However, the nymphs of the first species can be distinguished by the presence of thoracic gill at the base of the forecoxa, while in *C. edmundsi*, this gill is absent.

**3.3. *Mayobaetis ellenae* (Mayo 1973)**

*Baetis* sp. 1 Roback [17]: 137.

*Baetis ellenae* Mayo [18]: 285; Berner [19]: 190.

*Moribaetis* (*Mayobaetis*) *ellenae*; Waltz and McCafferty [20]: 240.

*Mayobaetis ellenae*; Lugo-Ortiz and McCafferty [11]: 369; Domínguez et al. [14]: 163; Dias et al. [15]: 238.

**3.3.1. Distribution.** Costa Rica (Waltz and McCafferty [20]); Ecuador (Mayo [18]); Peru (Roback [17]); New Record: Venezuela.

**3.3.2. Material Examined.** Four nymphs (one with mouth parts, legs, antenna, cercus, terminal filament, paraproct, and gills on slide), Venezuela, Turmero, Paya arriba, Municipio Mariño, Estado Aragua, N10° 18' 24.2'' W067° 24' 54.9'', 765 meters, 17.iv.2011, N. Hamada, H. Frontado, C. Quinto, and U. Neiss leg. (INPA, IAE).

**3.3.3. Comments.** The collected nymphs have variations in the external mandible incisors, which are rounded, whereas in the original description they are blade-like. The differences observed in incisors are probably caused by natural abrasion with the substrate, which is probably a result of feeding behavior. Our specimens have classic body color pattern as illustrated by Mayo [18] and darker.

**3.4. *Fallceon* sp. V1 (Figures 1 and 2)**

**3.4.1. Diagnosis.** The nymph examined allowed placing it in the genus *Fallceon* by the following characteristics: (1) frontal keel present or absent; (2) incisors of mandibles fused; (3) right mandibles with a tuft of setae between the prostheca and mola; (4) base of glossa extended, at least, to the half of the base of paraglossa; (5) segment II of labial palp without distomedial process; (6) segment II of labial palp with a dorsal row of spine-like setae; (7) absence of villopore; (8) hind wing pads present; (9) claw with one row of denticles; (10) subapical setae on tarsal claw present or absent; (11) posterior margin of terga with pointed spines; (12) dorsal surface of terga with scale bases; (13) gills present on abdominal segments I to VII.

The *Fallceon* sp. V1 nymph examined differs from the other described species with known nymphs in the genus (e.g., González-Lazo and Salles, [21], Kluge [22], and Lugo-Ortiz et al. [23]) by the following combination of characteristics: Nymphs: (1) frontal keel present; (2) maxillary palp reaching apex of the galea-lacinia (Figure 1(e)); (3) left mandible with incisors completely fused (Figure 1(d)); (4) paraglossa narrow and pointed apically; (5) tarsal claw without subapical setae (Figure 2(a)); (6) abdominal terga I, VIII, IX, and X lighter; (7) gill IV as long as the length of segments V to half VI combined; gill VII as long as the length of segments VIII to IX combined; (8) paraproct with 10–14 marginal spines (Figure 2(d)).

**3.4.2. Mature Nymph Description.** Body length: 3.3 mm ( $n = 1$ ).

**Head Brownish.** Antenna (Figure 1(a)) brownish yellow with spines and fine, simple setae on apex of each segment; lateral branch of epicranial suture sinuous; frontal keel present. Labrum (Figure 1(b)) narrow apically, as broad as long; length about  $0.8 \times$  maximum width; distal margin with shallow medial emargination; lateral and anterolateral margins with long, branched setae; medial margin with robust bipectinate setae; dorsally with long, fine, simple setae scattered over surface; ventrally with row of short, spine-like setae near anterolateral margin. Right mandible (Figure 1(c)) with incisors completely fused; outer and inner set of incisors, respectively, with  $4 + 4$  denticles; prostheca

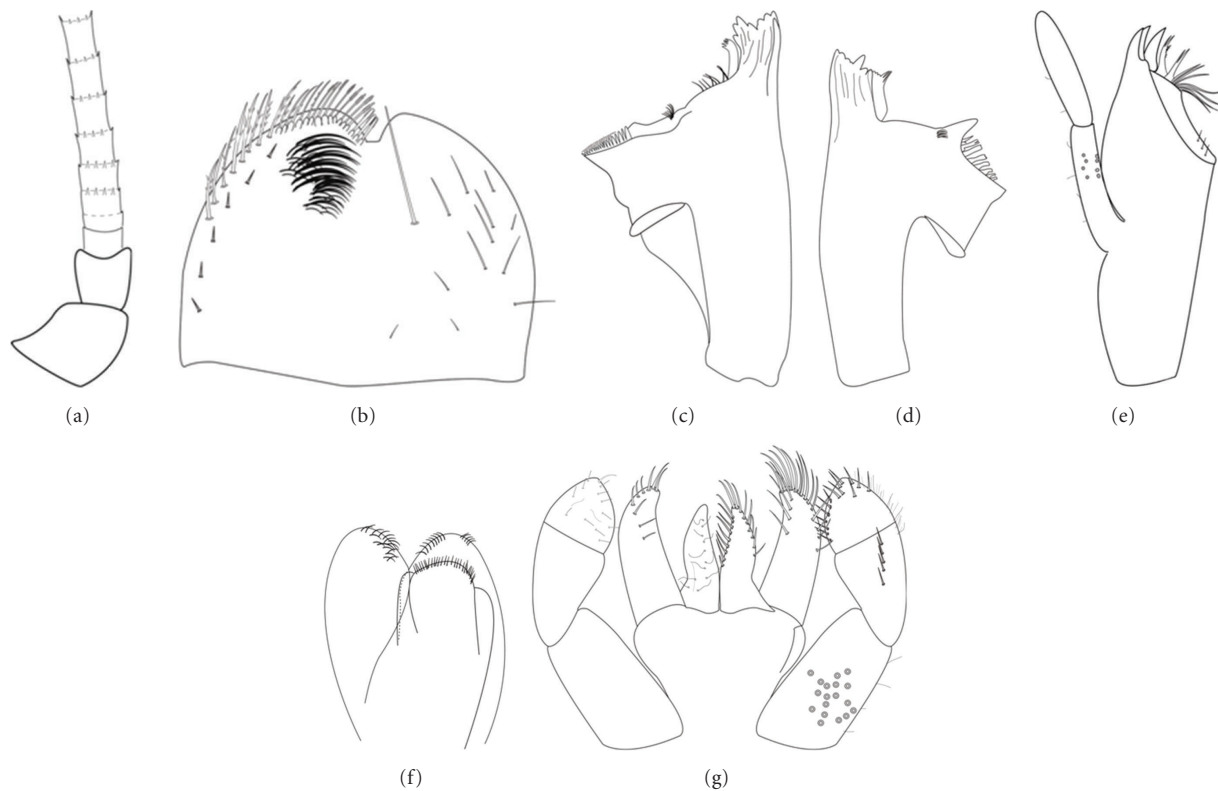


FIGURE 1: *Fallceon* sp. V1. (a) antenna; (b) labrum (dorsal view); (c) right mandible; (d) left mandible; (e) maxilla; (f) hypopharynx; (g) labium (left ventral view and right dorsal view).

robust, apically denticulate; margin between prostheca and mola slightly convex, tuft of setae present; tuft of spine-like setae at base of mola present; tuft of setae at apex of mola present, reduced to a single seta; lateral margins almost straight; basal half bare dorsally. Left mandible (Figure 1(d)) with incisors complete fused; outer and inner set of incisors, respectively with 4 + 3 denticles; prostheca robust, apically denticulate and with comb-shaped structure at apex; margin between prostheca and mola slightly convex, tuft of setae absent; tuft of spine-like setae at base of mola present; subtriangular process narrow, at same level as area between prostheca and mola; tuft of setae at apex of mola absent; lateral margins almost straight; basal half bare dorsally. Hypopharynx (Figure 1(f)), lingua with simple setae distally; superlingua longer than lingua. Maxilla (Figure 1(e)) with crown of galea-lacinia with 4 denticles; double rows of setae with bifid and pectinate denticles. Medial protuberance of galea with 1 + 3 spine-like setae. Maxillary palp reaching apex of galea-lacinia; palp segment II  $0.9 \times$  length of segment I; setae on maxillary palp fine and simple setae scattered over surface. Labium (Figure 1(g)) with glossa basally broad, narrowing apically and shorter than paraglossa; inner margin with eight spine-like setae increasing in length apically; apex with two spine-like setae; outer margin with seven long spine-like setae; ventral surface scattered with short, fine, simple setae; paraglossa curved inward, narrow and pointed apically, dorsally with apex with five long spine-like setae, outer margin with one row of long spine-like setae, inner margin with four long spine-like setae, ventrally with one

row of long spine-like setae. Labial palp with segment I  $0.7 \times$  length of segments II and III combined; segment I covered with microspores and fine and simple setae; segment II without distomedial protuberance, dorsally with row of five spine-like setae; segment III conical, length  $0.9 \times$  width, covered with spine-like simple setae and fine, simple setae along margins, ventral surface covered with short spine-like setae.

**Thorax Brownish.** Hind wing pads present. Foreleg (Figure 2(a)) brownish yellow, femur apically dark. Forefemur length about  $2.7 \times$  maximum width, dorsally with row of long blunt setae (in lateral view they resemble spine-like setae); length of setae about  $0.2 \times$  maximum width of femur; ventrally with micropores and few small, fine, simple setae; anterior surface with robust spine-like setae near ventral margin. Foretibia dorsally with many short, fine, simple setae; ventrally with one row of short spine-like setae, anterior surface with few robust spine-like setae; tibioapatellar suture present at base. Foretarsus dorsally with few, fine, and simple setae; ventrally with one row of spine-like setae. Foretarsal claw with one row of 11 denticles increasing in size distally, without subapical setae. Mid and hind legs are similar to the fore leg except for the dorsal margin with one row of small spine-like setae and hind tarsal claw with 13 denticles.

**Abdomen Brown.** Segments I, VIII, IX, and X lighter. Terga surface (Figure 2(b)) with scale bases, posterior margin with

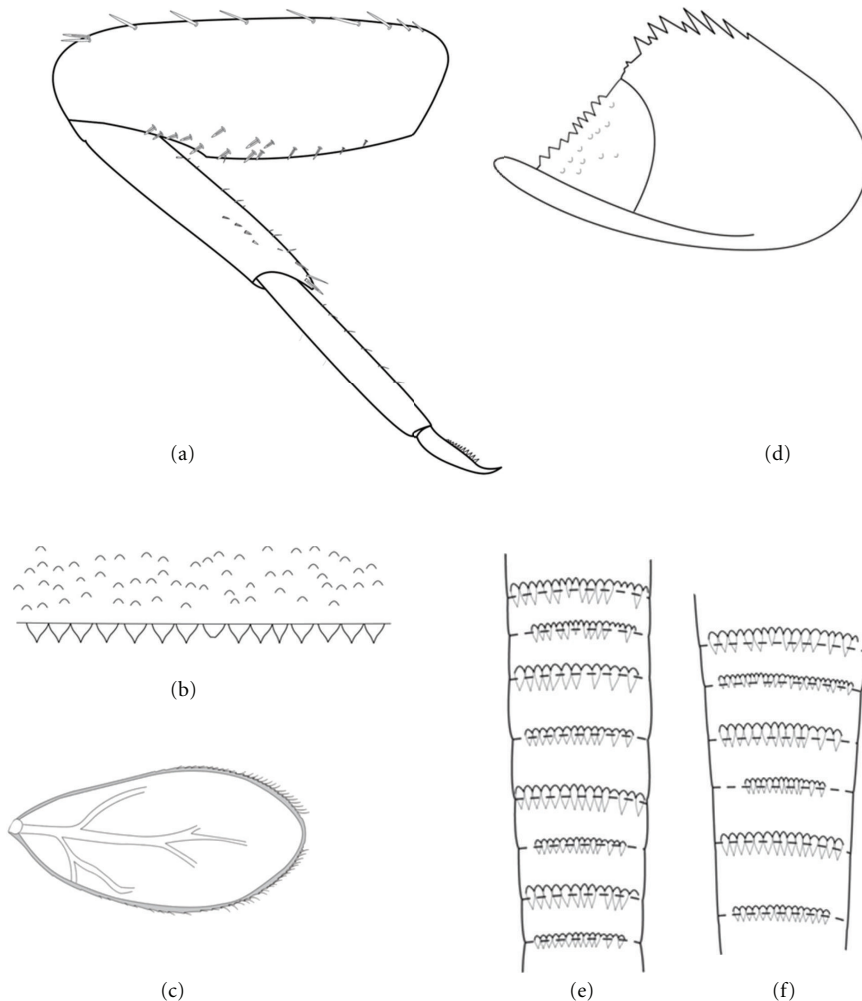


FIGURE 2: *Fallceon* sp. V1. (a) fore leg; (b) posterior margin of segment IV; (c) gill IV; (d) paraproct; (e) detail of cercus; (f) detail of terminal filament.

spines basally broad and apically pointed; posterior margin of segments with spines: II–X. Sterna surface bare. Gills (Figure 2(c)) oval, margin with narrow spines alternating with short, fine, and simple setae; tracheae extending from main trunk to inner and outer margins. Gill I is subequal in length to segment II. Gill IV as long as length of segments V to half VI combined. Gill VII as long as the length of segments VIII to IX combined. Paraproct (Figure 2(d)) with 10 marginal spines; surface with scale or scale-bases; posterolateral extension with marginal spines. Cercus (Figure 2(e)) with spines on all segments. Terminal filament (Figure 2(f)) segments with spines on all segments.

**3.4.3. Material Examined.** One nymph (mouth parts, legs, antenna, cercus, terminal filament, paraproct, and gills on slide), Venezuela, Aragua, Municipio Zamora, Parroquia Magdalena stream 7.5 km after Magdalena, before Guacamaya, fine sediment and leaves on moderate current, stream no more than two meters wide, N10° 04' 08.3" W067° 39' 15.7", 579 m, 10.iv.2011, N. Hamada, H. Frontado, C. Quinto, and U. Neiss leg. (INPA).

**3.4.4. Comments.** Waltz and McCafferty [24] established the genus *Fallceon* for some species previously described in *Baetis* Leach, recorded from North and Central America. Lugo-Ortiz and McCafferty [25] transferred three South American species placed in *Baetis* to *Fallceon* based on the study of subimagos and imagos. Later, McCafferty [26] proposed *Fallceon inops* (Navás) as *nomen dubium*. In all of these papers, the adult character used to place the species in *Fallceon* was the shape of the hook on the costal process of the hind wing. Considering that most of the useful features for taxonomic study in Baetidae are found in the nymphs [27, 28], discussions about species based solely on adults are difficult. In this study, we present the first record and description of a nymph of *Fallceon* from South America. The species was described but not named because we were not able to rule out the possibility that is one of the two species of *Fallceon* that had been previously described based on imagos from South America. However, the collection of this nymph indicates the presence of *Fallceon* in South America. This description will aid in future studies on immature adult associations for the genus in South America.



Fallceon sp. V1 and *F. testudineus* Kluge [22] are similar; *Fallceon* sp. has the labrum narrowed apically and glossa shorter than paraglossa, while *F. testudineus* has labrum not narrowed apically and glossa subequal in length to the paraglossa.

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