

## A new species of *Caenis* (Ephemeroptera: Caenidae) from Florida, USA

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### Abstract

*Caenis eglinensis* new species is described from nymph and adults, and its relationships with other North American species of the genus are discussed.

**Key words:** *Caenis*, Ephemeroptera, Caenidae, Eglin Air Force Base, new species

### Resumen

Se describen la ninfa y los imagos de *Caenis eglinensis* especie nueva y se discute su relación con otra especies Norteamericanas del genero.

### Introduction

Provonsha (1990) provided a comprehensive taxonomic review of North American *Caenis* and recognized 11 species. The addition of *C. arwini* McCafferty and Davis, based on mature nymphs and eggs from Texas (McCafferty & Davis, 2001) yields a total of twelve *Caenis* species presently known in North America. Of the twelve species, five [(*C. amica* Hagen, *C. diminuta* Walker, *C. hilaris* (Say), *C. macafferti* Provonsha, and *C. punctata* McDunnough)] occur in Florida (Pescador & Richard, 2004). In this paper, we describe a new species of *Caenis* based on mature nymphs and adults collected from streams in the western panhandle of Florida, USA.

**Materials and methods**

Nymphs were collected by standard aquatic dipnet and hand screen and preserved in ethanol. Adults were collected by both blacklight pan trapping and mercury vapor lamp. Pan traps consisted of a lightweight sealed 15-watt Uv-blacklight placed over a white pan containing ethanol, with the traps installed at sunset at the edge of the water and retrieved two to three hours later. Mercury vapor collecting was performed by hand picking specimens for a period of two hours after sunset. Male genitalia for scanning electron microscopy were dehydrated through a graded series of ethanol, critical point dried, stub mounted and sputter-coated with gold palladium. The genitalia mounts were examined with a JEOL JSM-840 scanning electron microscope. Terminology and format used in the descriptions follows Provonsha (1990). Type specimens are deposited at Florida A&M University (FAMU) and the Purdue Entomological Research Collection (PERC).

***Caenis eglinensis* Pescador and Richard, new species**

(Figs. 1–9)

**Nymph** (in alcohol) (Fig. 1). Body length 3.5–4.5 mm. Head (Figs. 1, 2): light brown; vertex with a pair of black markings near mid-posterior margin, posterolateral corners dark brown to black; pale yellow between lateral ocelli, bases of antennae and eyes. Ocelli black at base, remainder pale. Scape and proximal 4/5 of pedicel dark brown, remainder of antennae pale yellow. Thorax (Fig. 1): pronotum with a pair of small black submedian spots near posterior margin, and dark brown sublateral dashes; pronotum strongly divergent anteriorly with anterolateral corners somewhat pointed (Fig. 2). Mesonotum with a pair of prominent irregular dark brown to black dashes near base of wing pads. Sterna pale tan, faintly shaded with light brown around base of coxae and sternal sutures. Legs (Fig. 3): cream colored, basal 1/3 of femora and tibiae faintly washed with light brown; coxae with dark brown markings; small anteroapical spot on trochanters; femora with a prominent dark brown to black subapical band almost encircling entire segment; margins of femora with short and long setae, the setae on outer margins longer and thicker than those on inner margins; dorsal surface of forefemur with short, simple setae; hind tarsi with 12–14 spurs along inner margin, and row of 10–12 fimbriate spurs ventrally; hind tarsal claws with 12–18 denticles, basal 3–4 slightly broader than subsequent denticles (Fig. 4). Abdomen (Fig. 1): terga pale tan; terga I–VI shaded with dark grayish black; shading submedial on tergum II; tergum VII anteriorly shaded with grayish black; terga VII–X faintly shaded sublaterally with grayish black; terga IX and X each with triad of black spots. Posteromedian projection of tergum II (Fig. 5) triangular, moderately long, projecting upward with apex pointed in both lateral and dorsal views; with posterolateral projections on abdominal segments III–IX, those on middle segments (IV–VII) larger (Fig. 6). Sterna cream colored shaded with grayish black spots, with pattern of pigmentation

similar to Figure 6; posterior margin of sternum IX rounded (Fig. 6). Operculate gills II brown; with 3 short spine-like setae at base of medial fork of Y-ridge and with longer setae on remainder of ridge (Fig. 7). Caudal filaments uniformly pale, middle portion with whorls of setae on every 2<sup>nd</sup> or 3<sup>rd</sup> segment, setae shorter to subequal the length of space between whorls.

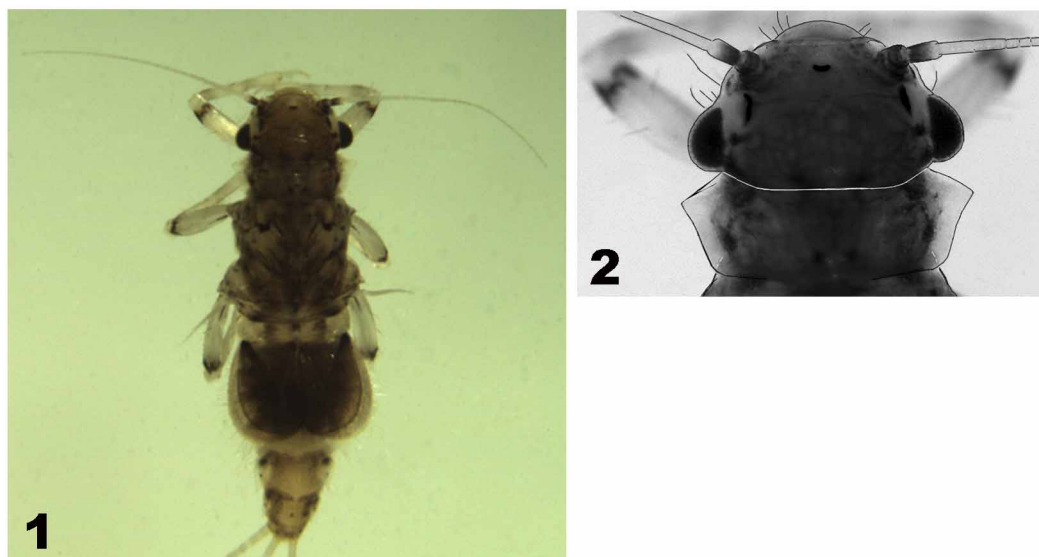


PLATE I. *Caenis eglinensis*. Fig. 1, Nymph. Fig. 2, Detail of pronotum and head.

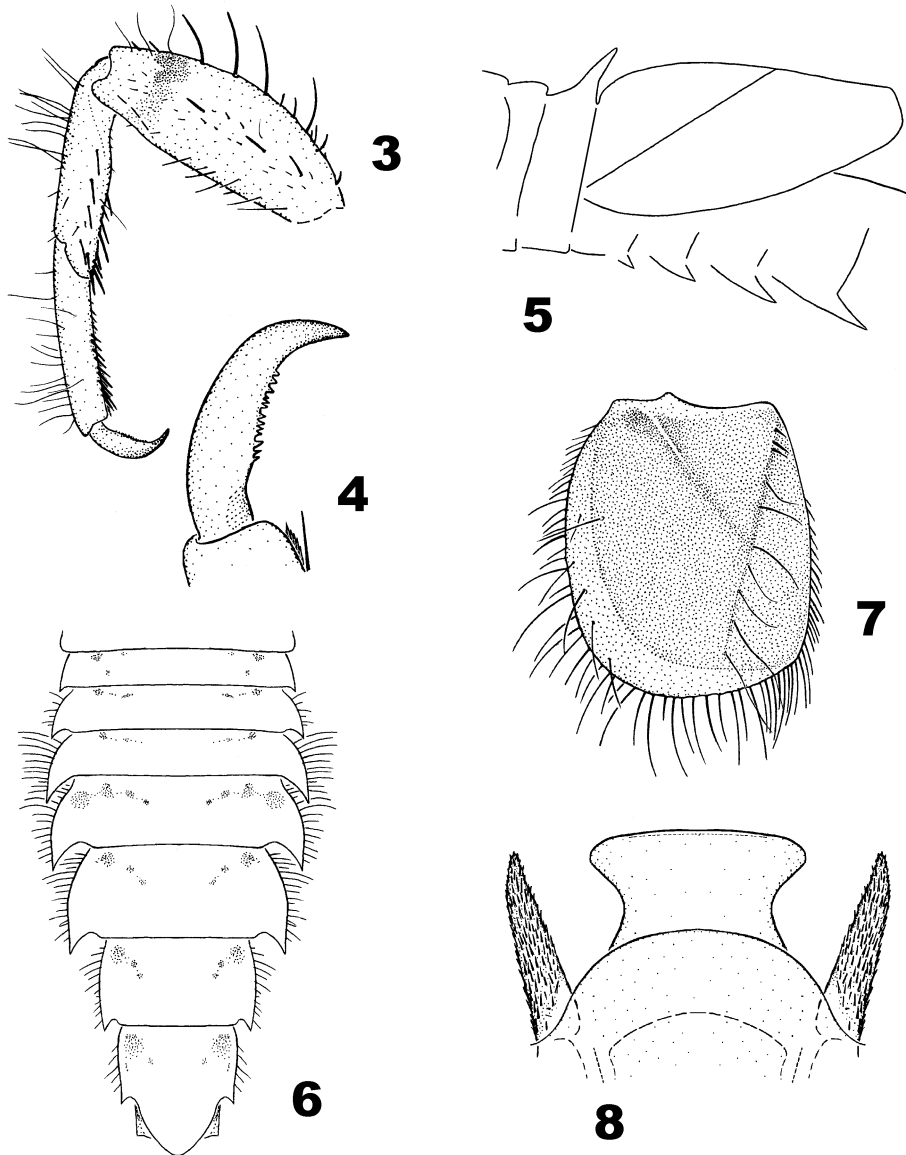
**Male imago** (in alcohol). Body length 3.3–3.7 mm. Head: vertex tan shaded with grayish black, margins dark brown to black. Venter of head pale medially, with grayish black shading laterally and posteriorly, and with a pair of black submedian spots. Base of ocelli black, remainder pale. Scape and base of pedicel grayish black, remainder of antennae pale. Thorax: pronotum tan, faintly shaded with grayish black. Mesonotum tan laterally, brown dorsally, medionotal membrane pale, scutellum faintly shaded with grayish black, median notal and parapsidal sutures dark brown to black, grayish black dash near base of forewings. Pleura tan, faintly shaded with grayish brown, pleural ridges dark brown. Sterna tan, faintly washed with grayish brown, brown to black dash near base of coxae. Wing vein ICuA1 forked with CuA1 basad of ICuA1-CuP crossvein. Legs: subcoxa, coxa, trochanter and femur of foreleg with smoky brown shading, remainder of segments pale. Middle and hind legs cream colored, femora with broad black subapical band almost encircling entire segment; trochanters with small anteroapical black spot. Abdomen: terga cream colored; terga I and II faintly shaded laterally with grayish black; terga III–VII faintly shaded with grayish black, shading on tergum VII confined to narrow anterior area; posterolateral corners of terga dark brown to black; terga IX–X each with triad of black dots. Sterna pale, fine black stripe on anterolateral corners; grayish black spots near anterolateral corners. Genitalia (Fig. 8) with penes truncate apically; forceps

tan, relatively short, straight, and densely covered with overlapping microspines (Fig. 9). Caudal filaments uniformly pale.

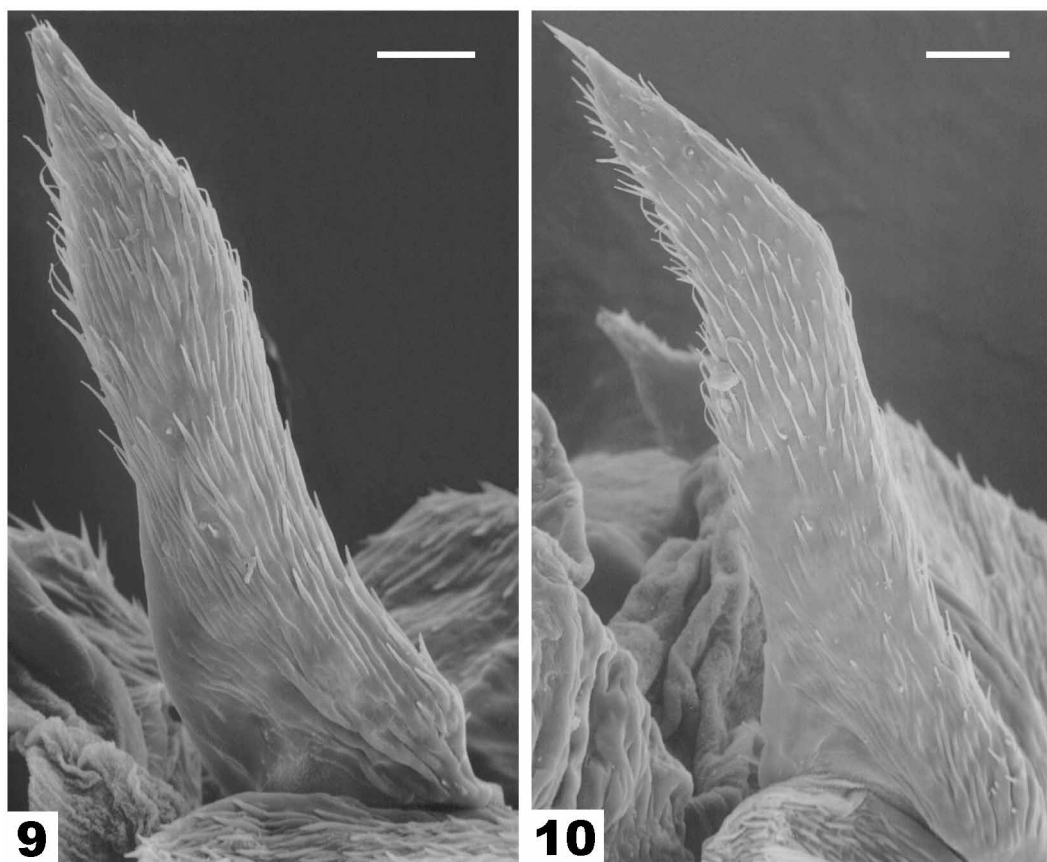
**Female imago** (in alcohol). Body length 4.5 mm. Similar to male except: larger body size, overall shading darker, and caudal filaments shorter and pilose.

The association of nymphs and adults is based on similarity of size, color pattern, and pigmentation and the collection of both stages at the same locality on the same date.

**Etymology.** The species is named after Eglin Air Force Base, a military base in the panhandle of Florida, where the type locality, Boiling Creek, is located.



**PLATE II.** *Caenis eglinensis*. Fig. 3, Hind leg. Fig. 4, Hind tarsal claw. Fig. 5, Lateral view of abdominal segments I–VI. Fig. 6, Ventral view of abdominal segments II–IX. Fig. 7, Operculate gill II. Fig. 8, Male genitalia.



**PLATE III.** Figs. 9–10, SEM detail of genital forceps: 9, *Caenis eglinensis*; 10, *C. diminuta*. Scale bar = 10  $\mu$ m.

**Specimens examined.** (21 nymphs, 24  $\sigma$ , 3  $\text{♀}$ ): nymph HOLOTYPE, FLORIDA, Santa Rosa County, Boiling Creek at Base Road 211, Eglin Air Force Base, N30°33'55" W86°52'08", 20-IV-2006, L. Donelan, R. W. Flowers, A. K. Rasmussen, D. Ray, B. A. Richard (FAMU). PARATYPES: 3 nymphs, 17  $\sigma$  imagos, 2  $\text{♀}$  imagos, same data as holotype (FAMU), 2 nymphs, 5  $\sigma$  imagos, 1  $\text{♀}$  imago, same data as holotype (PERC); 2  $\sigma$  imagos, 27-V-2004, M. L. Pescador, A. K. Rasmussen, B. A. Richard (FAMU); 5 nymphs, 23-II-2005, A. K. Rasmussen, B. A. Richard (FAMU); 8 nymphs, 12-I-2006, A. K. Rasmussen, B. A. Richard, W. Tate, M. Tongue (FAMU); 2 nymphs, FLORIDA, Walton County, Open Branch Creek at Base Road 374, Eglin Air Force Base, N30°38'33", W86°19'31", 13-VII-2000, D. Ray (FAMU).

**Diagnosis.** *Caenis eglinensis* can be distinguished from other North American species of *Caenis* by the following combinations of characters. In the nymph: (1) pronotum strongly divergent anteriorly (Fig. 2); (2) posteromedian projection of abdominal tergum II moderately long, and projected almost vertically with apex pointed in both lateral and

dorsal views (Fig. 5); (3) femora with a prominent dark brown to black subapical band almost encircling entire segment (Fig. 3); (4) abdominal terga IX and X each with triad of black dots; (4) posterior margin of sternum IX rounded (Fig. 6); and (5) caudal filaments uniformly pale. In the adults: (1) wing vein ICuA1 forked with CuA1 basad of ICuA1-CuP crossvein; (2) forefemur smoky brown, middle and hind femora pale with broad black subapical band almost encircling entire segment; (3) genitalia with penes truncate apically and forceps tan, relatively short, straight, and densely covered with overlapping microspines (Figs. 8, 9); (4) abdominal terga IX and X each with triad of black dots and (5) abdominal color pattern similar to Fig. 72 in Provonsha (1990) with lighter pigmentation. We note that in both the nymphs and adults that we examined there was minor variation in the expanse and intensity of the previously described color patterns.

Based on the definitions of the two species groups of North American *Caenis*, the *diminuta* group and *hilaris* group (Provonsha, 1990), *C. eglinensis* belongs to the *diminuta* group which includes *C. amica*, *C. candida*, *C. diminuta*, *C. latipennis*, *C. punctata* and *C. youngi*. *Caenis eglinensis* can be distinguished from the other species of the *diminuta* group by the following combinations of characters. In the nymph: (1) pronotum strongly divergent anteriorly (Fig. 2); (2) posteromedian projection of abdominal tergum II moderately long and projected almost vertically (Fig. 5) with apex pointed; (3) posterior margin of abdominal sternum IX rounded; and (4) abdominal color pattern similar to Fig. 1. In the adults: (1) femora with broad black subapical band almost encircling entire segment; (2) abdominal color pattern similar to *C. diminuta* but lighter; and (3) genitalia with penes truncate apically and forceps relatively short and densely covered with overlapping microspines (Figs. 8, 9).

The nymphs of both *C. eglinensis* and *C. youngi* have a strongly divergent pronotum and long posteromedian projection of abdominal tergum II, but in the nymphs of *C. eglinensis*, the posteromedian projection of abdominal tergum II is apically pointed, while broadly rounded in *C. youngi*. The absence of a fleshy finger-like projection on abdominal tergum II of *C. eglinensis* which is well developed in *C. youngi* easily distinguishes the adults of the two species. Additionally, the known distribution of *C. youngi* is limited to northern latitudes, including the northern Rocky Mountains and the north central United States. The adults of *C. eglinensis*, *C. diminuta*, and *C. punctata* are all similar in overall color pattern, though the pigmentation of *C. eglinensis* adults is generally lighter. The genital forceps of *C. eglinensis* and *C. punctata* are relatively short, straight, and densely covered with overlapping microspines (Fig. 9), distinguishing them from *C. diminuta*, whose forceps are comparatively longer, incurved, and sparsely covered with microspines (Fig. 10). Adults of *C. eglinensis* and *C. punctata* can be distinguished by the color of the antennae and pigmentation of the legs. The antennal scape and pedicel of *C. eglinensis* are shaded grayish black, while in *C. punctata* the scape and pedicel are entirely pale. The black pigmentation of the middle and hind legs of *C. eglinensis* is restricted to the black subapical band of the femora, while *C. punctata* have black speckling along the femora

and on the tibiae, in addition to the black subapical band. In the nymphs, the anteriorly divergent pronotum and long, upright projection of abdominal tergum II distinguish *C. eglinensis* from both *C. diminuta* and *C. punctata*. Presently, *C. eglinensis* is known only from a small area of the western panhandle of Florida, while *C. diminuta* is found throughout eastern North America and *C. punctata* is known from all regions of North America. In Florida, *C. diminuta* is found throughout the state and *C. punctata* is known from the eastern half of the panhandle.

### Description of type locality

Boiling Creek, located in Santa Rosa County, Florida is a tributary of the Yellow River. Fed from seepage springs arising in steephead ravines of headwater tributaries, Boiling Creek has characteristics of a large spring-run stream and flows through a wide valley with extensive marshy areas in its upper reaches and on the floodplain of the Yellow River in its lower reaches. Lowland areas of the watershed are largely undeveloped and most of the sandhill uplands are forested with longleaf pine (*Pinus palustris* Miller), although some large tracts of land in the upper part of the watershed have been cleared. Hillside erosion is affecting two of the main tributaries, Little Boiling Creek and Indigo Creek.

The sampling site is approximately 8 km upstream from the Yellow River. The area sampled is marshy along the stream margins with the presence of two species of titi [*Cliftonia monophylla* (L.), *Cyrilla racemiflora* (Torrey and Gray)], Atlantic white cedar [*Chamaecyparis thyoides* (L.)], blackgum [*Nyssa sylvatica* var. *biflora* (Walter)], cypress [*Taxodium distichum* (L.) and *T. ascendens* Brongniart], and sweetbay magnolia [*Magnolia virginiana* L.]. Aquatic macrophytes, including *Eleocharis* sp., *Sagittaria* sp., *Juncus* sp., *Scirpus etuberculatus* (Steudel), *Sparganium americanum* Nuttall, and *Orontium aquaticum* L., are abundant at the sampling site and appear to be major habitats for aquatic invertebrates in the large open shifting sand creek. Stream width ranges from 10–15 m, stream depth from 1.0–2.5 m, and stream velocity averages about 0.25 m sec<sup>-1</sup>. The stream is clear, acidic (mean pH value of 4.7), and has low conductivity (14 µmhos cm<sup>-1</sup>). Water temperatures taken in the winter and spring were between 18.6°C. and 21.1°C.

The nymphs of *Caenis eglinensis* were collected in aquatic vegetation found along the sides of the stream channel. Other mayfly species collected at the site included: *Baetisca obesa* (Say), *Leptophlebia* sp., *Paraleptophlebia volitans* (McDunnough), *Hexagenia* sp., *Eurylophella doris* (Traver), *Pseudocloeon ephippiatum* (Traver), *P. frondale* (McDunnough), *Siphloplecton* sp., *Maccaffertium mexicanum integrum* (McDunnough), *M. smithae* (Traver), and *Stenacron floridense* (Lewis).

Nymphs were also collected in Open Branch Creek, a second order, sand bottom stream originating in steepheads west of DeFuniak Springs, in Walton County. The

nymphs were found in roots along undercut banks. When collected, water velocity was 0.3 m sec<sup>-1</sup>, stream width averaged 2.3 m, depth ranged from 0.2–0.7 m, water temperature was 27.2°C., pH was 4.84, and conductivity was 36 µmho cm<sup>-1</sup>. The riparian overstory was dominated by titi.

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### References

- McCafferty, W.P. & Davis, J.R. (2001) Texas Caeninae (Ephemeroptera: Caenidae), with description of a new species. *Proceedings of the Entomological Society of Washington*, 103, 349–355.
- Pescador, M.L. & Richard, B.A. (2004) *Guide to the Mayfly (Ephemeroptera) Nymphs of Florida*. Florida Department of Environmental Protection, Tallahassee, 115 pp.
- Provonsha, A.V. (1990) A revision of the genus *Caenis* in North America (Ephemeroptera: Caenidae). *Transactions of the American Entomological Society*, 116, 801–884.