

**FIRST ADULT AND EGG DESCRIPTIONS OF
CAUDATELLA EDMUNDSI (EPHEMEROPTERA:
EPHEMERELLIDAE) FROM MONTANA (U.S.A.),
WITH HABITAT OBSERVATIONS¹**

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ABSTRACT: Series of reared material from Montana provide the bases for the first descriptions of the adults of *Caudatella edmundsi*. Male adults are differentiated from congeners based on their having abdominal sterna with dark anterior corners and penes with the gonopores subparallel and projected dorsally. The first description of *Caudatella* eggs shows them to have a chorion without reticulations. Larvae of *C. edmundsi* usually are associated with moss in moderate to slow current regions of cool, clear, shaded streams.

KEY WORDS: *Caudatella edmundsi*, Ephemeroptera, Ephemerellidae, Montana, U.S.A., habitat

The genus *Caudatella* Edmunds (Ephemeroptera: Ephemerellidae) was described originally as a subgenus of *Ephemerella* Walsh (Edmunds 1959) and included the species of McDunnough's (1935) "heterocaudata group." Larvae and alates of these species are distinguished from other Ephemerellidae by having the median filament stouter and longer than the cerci. Allen and Edmunds (1961, 1968) revised the subgenus, and Allen (1980) subsequently raised *Caudatella* to generic status. *Caudatella* is part of the Ephemerellidae subfamily Ephemerellinae (McCafferty and Wang 2000), and the genus is endemic to western North America. Jacobus and McCafferty (2003) recently provided additional revisions to the genus, and it now includes four species: *C. edmundsi* (Allen), *C. heterocaudata* (McDunnough), *C. hystrix* (Traver), and *C. jacobi* (McDunnough).

Caudatella heterocaudata, *C. hystrix*, and *C. jacobi* each are known as larvae and male adults. The adults of *C. edmundsi*, however, have remained unknown. *Caudatella edmundsi* was described originally for larvae (Allen 1959) differentiated from other *Caudatella* species by having a vestigial maxillary palp (Allen 1959: Fig. 5; Allen and Edmunds 1961: Fig. 20) and claws with two rows of more than ten stout denticles each (Allen 1959: Fig. 6; Allen and Edmunds 1961: Fig. 21). Jensen (1966: Fig. 157) later described *C. edmundsi* subimagos based on specimens reared from larvae collected in the state of Washington. Herein, we provide the first *C. edmundsi* egg and adult descriptions based upon laboratory reared material collected from western Montana. Material examined is deposited in the Purdue University Entomological Research Collection, West Lafayette,

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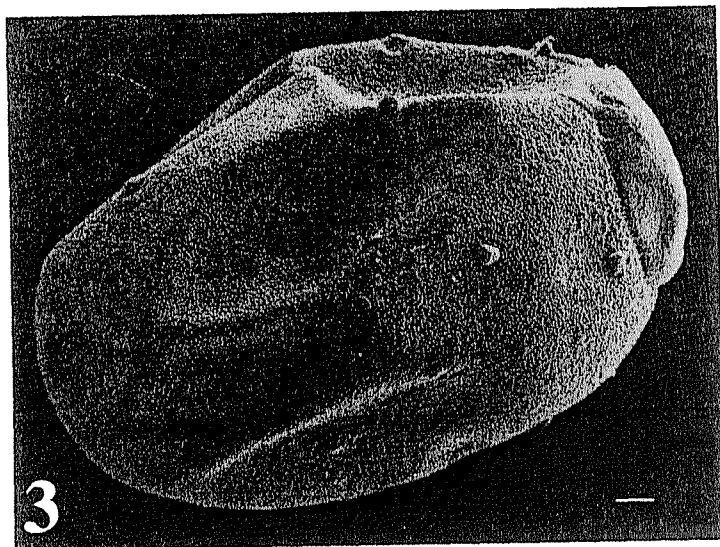
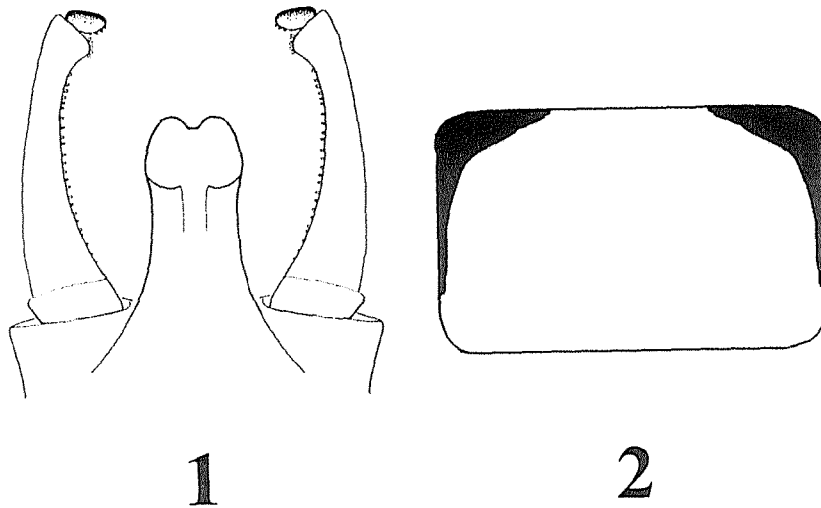
Indiana, and additional material is available from the aquatic invertebrate collection at the University of Montana Flathead Lake Biological Station, Polson, Montana. The present study represents further contributions to the descriptive biology and morphology of western Nearctic Ephemerellinae (Jacobus and McCafferty 2004, Jacobus et al., 2004). Phylogenetics and identification will be treated in the near future (Jacobus and McCafferty, in preparation).

Caudatella edmundsi (Allen, 1959)

(Figs. 1-3)

Male adult (in alcohol).—Length (mm): body 6.4–7.0, fore wing 7.1–8.0, hind wing 1.4–2.0, plumidium (axillary cord) 0.1–0.2, cercus 6.5–7.2, median caudal filament 7.1–8.1. Head golden with pair of longitudinal brown stripes between compound eyes and with various pale yellow markings on occiput and between compound eye and lateral ocellus; pair of large dark maculae on frontal shelf. Antennal scape and pedicel pale yellow, flagellar segments brown proximally, white distally. Ocelli white; base brown and ringed with black. Compound eyes round and contiguous medially; upper portion pink, lower portion black. Thorax golden, with variable brown and white markings; pronotum with extensive brown markings, median longitudinal ridge pale golden; mesonotum with few brown and white markings; metanotum brown laterally, white medially. Mesoscutellar hind projection length 2x width; plumidium recurved inwards. Forewing hyaline, sometimes with translucent milky tinge along costal margin; stigmatic area translucent, sometimes nearly solid white; costa and subcosta pale; longitudinal veins, intercalaries, and crossveins hyaline. Hindwing hyaline; all veins and intercalaries hyaline, some veins with brown tinge basally; costal projection at one-third wing length from base, gently rounded. Foreleg golden, coxa and trochanter with white markings, tibia and tarsal segments smoky brown, claw purple; total length 6.1–7.0 mm; approximate lengths (in mm) of segments: trochanter = 0.2, femur = 1.3, tibia = 2.7, tarsal segment I = 0.1, tarsal segment II = 0.8, tarsal segment III = 0.9, tarsal segment IV = 7, tarsal segment V = 2. Mid- and hind legs yellow with purple claws. Abdomen translucent golden anteriorly and medially, pale yellow and white posteriorly, with brown shading throughout. Terga with shading darkest laterally and anteriorly; medial longitudinal line pale, sometimes bordered with brown; unmarked median region sometimes trilobed anteriorly; posterior margin with thin dark brown line. Sterna (Fig. 2) with dark brown markings in anterolateral corners. Genitalia (Fig. 1) smoky brown. Penes brown distally; lobes subparallel, broadly rounded apically, with dorsal gonopores subparallel. Forceps segment 2 outer margin relatively straight, inner margin slightly concave; segment 3 length approximately 1.25x width, dark brown distally. Cercus and median caudal filament pale, with dark annulations on proximal half of length; segments with short, hairlike setae.

Female adult (in alcohol).—Length (mm): body 6.8–7.2; forewing 7.6–7.9; hindwing 1.6–1.8; plumidium 0.2; cercus 6.4–6.6; median caudal filament 6.5–6.7. Coloration similar to male, except generally paler, with shading slightly more diffuse, and pale yellow regions on head much more extensive.



Figs. 1–3. *Caudatella edmundsi*. 1. Male genitalia, dorsal view. 2. Abdominal sternum, adult. 3. Egg (scale bar = 10 μ m).

Egg (Fig. 3) (from reared female adult in alcohol).—Single polar cap pale, sometimes slightly enlarged but not nipplelike. Chorion light brown, surface with no ridges or reticulations; few knob-terminated coiled threads distributed relatively evenly over surface; sperm guides situated around equator.

Adult Diagnosis. Adults may be differentiated from other *Caudatella* species by the darkened anterolateral corners of the abdominal sterna (Fig. 2). The male penes (Fig. 1) have gonopores that are oriented dorsally and subparallel to one another, most similar to the penes of *C. heterocaudata* (Traver 1935: Fig. 156). In contrast, the gonopores are proximally divergent on *C. jacobi* (McDunnough 1939: Fig. 1; Allen and Edmunds 1961: Fig. 4) and convergent on *C. hystrix* (Allen and Edmunds 1961: Fig. 2). The ventral abdominal coloration and the presence of cerci that are only slightly shorter than the median caudal filament will differentiate *C. edmundsi* from *C. heterocaudata*.

Remarks. The figure of *C. heterocaudata* penes given by Allen and Edmunds (1961: Fig. 3) is a ventral view, in contrast to the other male genitalia figures (Allen and Edmunds 1961: Figs. 2, 4), which are dorsal views. Thus, these figures might be misleading if used in a comparative manner. Traver (1935: Fig. 156) provided a better illustration of the penes of *C. heterocaudata*. In her figure, the outermost oblique dash indicates the proximal margin of each gonopore.

The egg of *C. edmundsi* (Fig. 3) is similar to the eggs of other *Caudatella* species we have examined by Scanning Electron Microscopy (Jacobus and McCafferty, unpublished).

Distribution. *Caudatella edmundsi* has been reported from Idaho (Jensen 1966, Gilpen and Brusven 1970), Montana (Hansen 1994), Oregon (Allen 1959; Jensen 1966; Hawkins 1984, 1985; Porter and Meehan 1987; Parsons et al., 1991), and Washington (Jensen 1966; Landa et al., 1982).

Material Examined. MONTANA: Sanders Co., Vermilion R., approximately 2 miles north of Noxon Reservoir, 47°50'20"N, 115°31'10"W, 6–15/VI/2005, RL Newell, six male adults, three female adults (one dissected and eggs examined), one female subimago, and all associated exuviae (emerged 18–19/VI/2005 in lab, from 10°C recirculating water). OREGON: McKenzie R., 9-III-1939, JED, one larva (paratype, parts on slide).

Biology. Most of the *C. edmundsi* larvae examined as part of our study were collected from mosses, about 30–35 cm below the water's surface, in slow to moderate current edgewater. Gilpen and Brusven (1970) noted that *C. edmundsi* usually was collected from pebble and cobble riffles that supported mosses and green macroalgae, and Hawkins (1984) investigated further, observing that *C. edmundsi* occurred in these habitats only in the moss *Fontinalis* Linnacus (Fontinaiaceae). Hawkins (1985) indicated that *C. edmundsi* feeds on diatoms, detritus, and moss, with diatoms making up the largest component of its gut contents. Our observations indicated that the larvae are very poor swimmers, using slow undulations of the body to move when disturbed. At the Montana study site, the alate stages emerge during middle to late June.

The Vermilion River in western Sanders County, Montana, is a medium order stream with a gravel, rubble, and boulder substrate. The stream flows rapidly in the main channel, and it is heavily shaded. The water temperature was 8°C during April, 9.5°C on June 8, 12°C on June 21, and 13°C during the August visits. Other mayfly genera collected from this stream include *Baetis* Leach (Baetidae), *Drunella* Needham, *Ephemerella*, *Serratella* Edmunds (Ephemerellidae), *Cinygmula* McDunnough, *Epeorus* Eaton, *Rhithrogena* Eaton (Heptageniidae), and *Paraleptophlebia* Lestage (Leptophlebiidae).

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