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CAMELOBAETIDIUS (EPHEMEROPTERA: BAETIDAE) IN INDIANA AND IOWA: NEW SPECIES AND RANGE EXTENSION

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Abstract.—***Camelobaetidius waltzi*** McCafferty, n. sp., is described from larvae taken in the lower Wabash River of southwestern Indiana and the lower Des Moines River of southeastern Iowa. It differs from other species of *Camelobaetidius* primarily in having a unique combination of a medially pointed second segment of the labial palps and six or seven claw denticles. The new species significantly extends the known range of this mainly southwestern and Neotropical genus into the humid midwestern United States. Relationships among species of *Camelobaetidius* remain unknown.

Key Words: Ephemeroptera, Baetidae, *Camelobaetidius,* new species, distribution

The Western Hemisphere genus *Camelobaetidius* Demoulin is striking among the Baetidae because of the remarkable spatulate and multidenticulate tarsal claws possessed by the larvae (e.g. Fig. 7). Such mayflies were first noted from Brazil by Traver (1944) as Baetine No. 1, and more regularly in the 1950's and 1960's by workers collecting mayflies in California, Utah, and Wyoming. While still uncommonly taken except at specific river sites where they may be abundant (e.g. the Virgin River in southern Utah), the genus has proven to be one of the most commonly taken baetids in a variety of streams in Texas (McCafferty and Davis 1992).

The single major study of *Camelobaetidius* was made by Traver and Edmunds (1968), wherein 13 species, considered at that time under the name *Dactylobaetis* Traver and Edmunds, were treated and compared. McCafferty and Waltz (1990) synonymized *Dactylobaetis* with *Camelobaetidius* and discussed the generic classification. The 13 species originally described by Traver and Edmunds (1968), the type species of *Camelobaetidius* originally described by Demoulin (1966), and four more species subsequently described by Allen and Chao (1978) and Allen and Murvosh (1987) include all nominal species heretofore recognized in *Camelobaetidius*.

The genus has been known from western North America as far east as far western Kansas (Liechti 1982) and central Texas (Lugo-Ortiz and McCafferty 1993) and as far north as Saskatchewan (Lehmkuhl 1976), from throughout Mesoamerica, and from South America as far south as Uruguay and central Argentina. McCafferty et al. (1992) hypothesized that the most recent center of dispersal of *Camelobaetidius* was Neotropical. Traver and Edmunds (1968) had concluded earlier that the taxon was of Neotropical origin. Since no phylogenetic study of the species of the genus has been conducted, it is not known whether species relationships will corroborate Neotropical affinities or indicate to what extent vicariance and dispersal have influenced present species distributions.

In July of 1977, the first author and A.

V. Provonsha of Purdue University unexpectedly collected a mature larval specimen of *Camelobaetidius* from the Wabash River in southwestern Indiana near New Harmony, an area of some taxonomic note because Thomas Say had described many of his species of aquatic insects and mussels from there. Upon sorting samples, it was clear that this larva represented an unusual new species in the genus. Additional specimens could not be found on subsequent collecting trips to the same area, and the fact that only one specimen was available belated publication of the new species.

In August of 1991, the second author collected, also unexpectedly, a series of young larvae of *Camelobaetidius* from the Des Moines River at Farmington, Iowa, in the extreme southeastern area of that state. Comparisons with the Indiana larva showed them to be the same species. More mature Iowa larvae were taken from the Des Moines River in the same general area in 1992. A description and discussion of this new species follows. The terminology applied generally follows that used by Traver and Edmunds (1968).

Camelobaetidius waltzi McCafferty, New Species

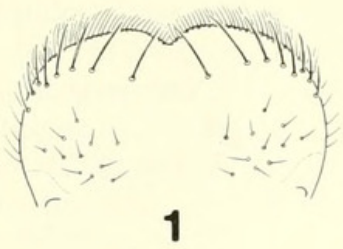
Figs. 1–10

Larva (in alcohol).—Mature length excluding caudal filaments: 6.0 mm (male) to 6.3 mm (female).

Head: Vertex with paired light brown longitudinal markings variously developed; frons usually with broad inverted V-shaped brown marking between lateral ocelli. Antennae nearly white. Labrum (Fig. 1) with submarginal row of elongate spines consisting of two relatively widely separated central spines, no intermediary spines, and six to eight lateral spines on each side arranged in curved line with three or four most lateral ones set off slightly from line of medial ones; no folds or ridges apparent on labral surface. Mandibles as in Figs. 2, 3; incisors fused and more-or-less truncate apically (somewhat more oblique in younger larvae), with denticles nearly completely fused and six in number on each mandible; prostheca well developed on both mandibles, serrate apically on right mandible and with variably developed tuft medial to it (Fig. 2); prostheca greatly enlarged on left mandible and with acute apicomedial process (Fig. 3); thumblike projection adjacent to molar region of left mandible well developed and robust (Fig. 3); on right mandible (Fig. 2) molar region in same plane with apices of body of mandible, and with small branched seta at medial margin of molar region. Maxillae (Fig. 4) with basal and apical portions of galealacinia subequal in length; palpi relatively short and thick with second segment slightly narrower than first. Labium (Fig. 5) of short, robust variety; second segment of palpi distinct with convex apicomedial margin and concave basomedial margin meeting at medial angular point; medial point sometimes slightly more produced than shown in Fig. 5.

Thorax: Pronotum and mesonotum variously suffused with light to medium brown patterning (darkness increasing with age in most individuals). Coxal gills absent. Forelegs slightly longer than hindlegs. Femur and tibia of forelegs subequal in length; forefemora without spines on anterior surface; apices of foretibiae with one to five robust spines (Fig. 6); foretarsi with five to eight short spines, two bristlelike long spines arranged as in Fig. 6 (one bristlelike spine subapical and one at about one-fifth length of tarsus from apices), and up to six additional minute spines along concave margin. Spatulate tarsal claws (Fig. 7) with six to seven denticles (number sometimes varying from right to left legs) and with sensory seta arising from claw tip and extending medioapically to about same distance as claw tip.

Abdomen: Color pattern (Figs. 8–10) more-or-less consistent with other species of genus, with tergal markings consisting of pairs of subanterolateral to sublateral or lat-



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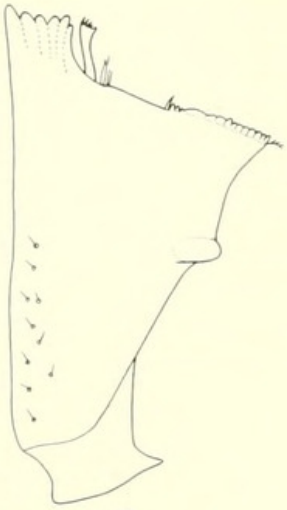

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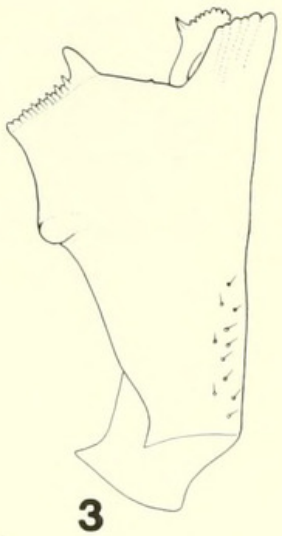

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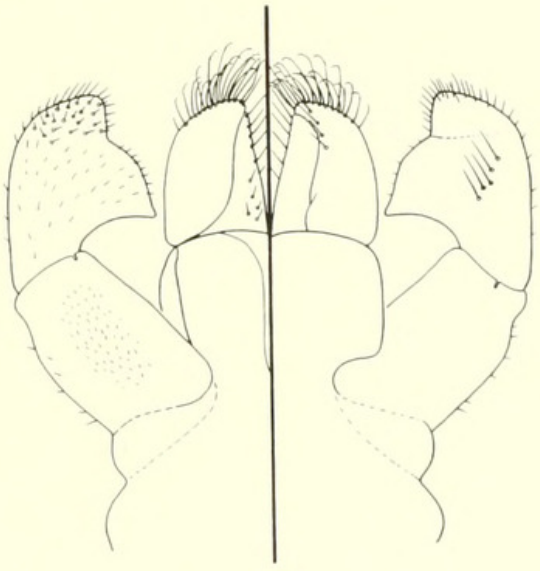

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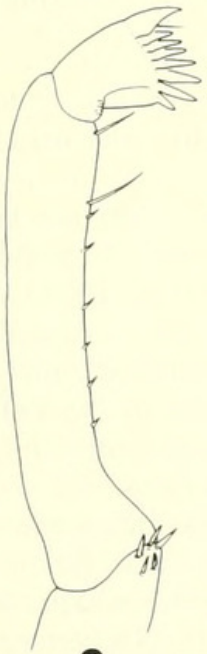

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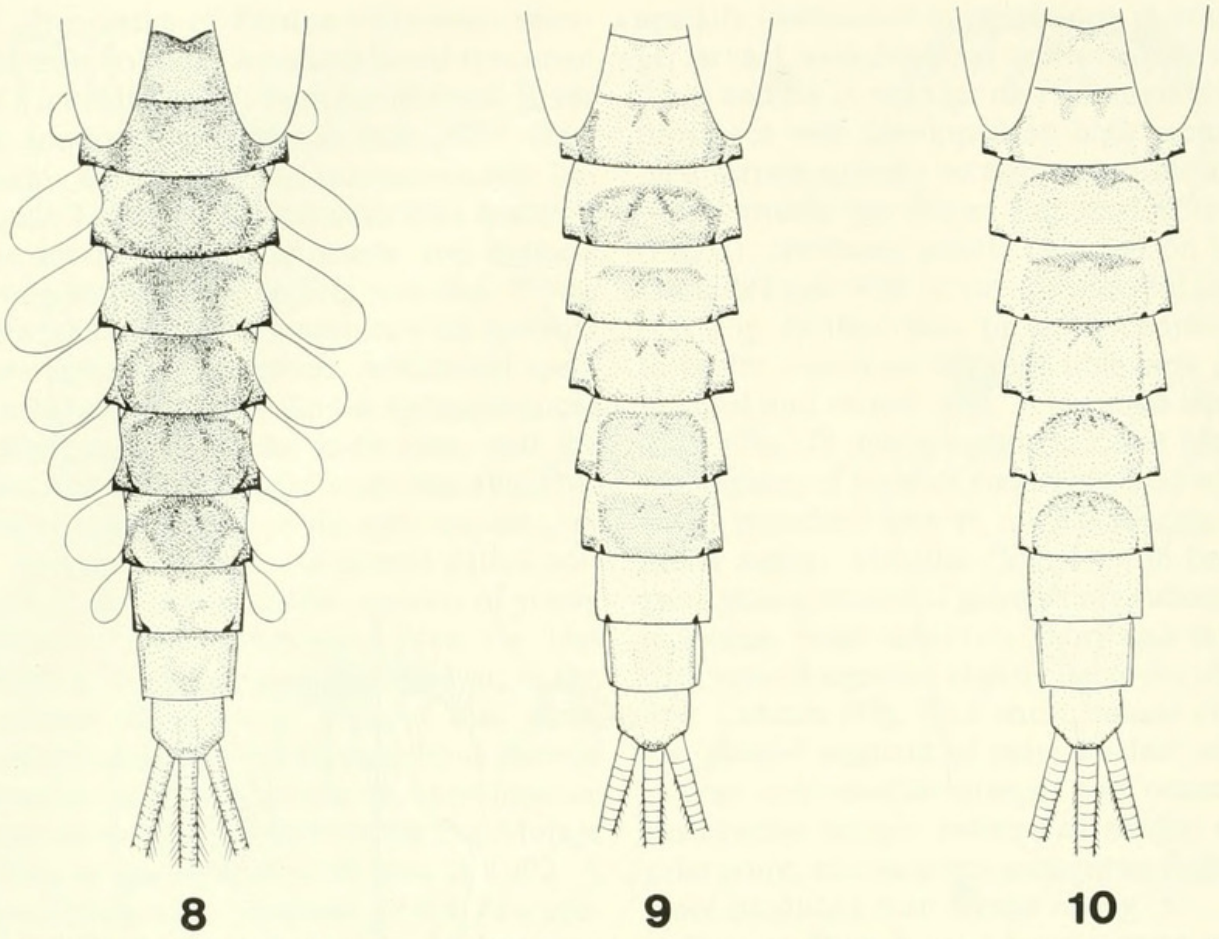
Figs. 1–7. *Camelobaetidius waltzi,* holotype larva. 1, labrum; 2, right mandible; 3, left mandible; 4, maxilla; 5, labium; 6, partial foreleg; 7, foretarsal claw.



Figs. 8–10. *Camelobaetidius waltzi*, larva. 8, dorsal abdomen, holotype; 9, abdominal tergal pattern variation; 10, abdominal tergal pattern variation.

eral concentric markings and submedial longitudinal markings, and terga 8–10 much lighter than other terga; degree of tergal pigmentation generally increasing with age (Fig. 8); short black oblique submarginal marks on posterior margin of terga 4–8; anterolateral corners of terga not dark margined; some individuals with more marked abdominal pattern as in Fig. 10, having relatively lighter tergum 5 and relatively darker terga 6–7; sterna unmarked except some individuals with brown transverse penciling at medium third of anterior margin of sterna 2–6 or 2–7 (more developed on more anterior sterna). Terga 3–7 with very minute single spine at posterolateral corners (best seen on tergum four). Gills (Fig. 8) with moderately sclerotized anterior and posterior margins (more sclerotized anteriorly), gills not marginally sclerotized in some young larvae.

Holotype.—Mature female larva, Indiana: Posey Co., Wabash R. at Old Dam near New Harmony, VII-20-1977, W. P. McCafferty and A. V. Provonsha, mouthparts and foreleg slide mounted, other parts fluid preserved, deposited in the Purdue Entomological Research Collection (PERC), West Lafayette, Indiana.

Paratypes.—Eight mature and nearly mature larvae, Iowa, Van Buren Co., Des Moines R. at Lacy Keosauqua State Park, VIII-29-1992, T. H. Klubertanz, six with same deposition as holotype, two deposited in United States National Museum, Washington, D.C .

Additional material examined.—Nineteen middle to late instar larvae (some parts

on slides), Iowa, Van Buren Co., Des Moines R. at Farmington, VIII-19-1991, T. H. Klubertanz; seven larvae and two female subimagos, Iowa, Van Buren Co., Des Moines R. at Lacy Keosauqua State Park, VIII-29-1992, T. H. Klubertanz, deposited in PERC.

Etymology.—This species is named after R. D. Waltz in recognition of his numerous contributions to our knowledge of the classification and relationships within the family Baetidae.

Discussion.—Couplet 2 of the key to *Camelobaetidius* species provided by Traver and Edmunds (1968) divides species into those that have claws with five to 17 denticles and rounded second segments of the labial palps and those that have claws with 20 to 40 denticles and second segments of the labial palps that are truncate or pointed. *Camelobaetidius waltzi* would not fit either of these groupings because it has the unique, and diagnostic, combination of a small number of claw denticles and a distinctively pointed second segment of the labial palps.

After considering all apparent species specific larval characteristics, neither phenetic nor phylogenetic relationships of *C. waltzi* could be determined with any confidence. However, the labial palps of the new species are most similar to those of Neotropical species, particularly *C. penai* (Traver and Edmunds) from Argentina and *C. anubis* (Traver and Edmunds) from Brazil. If the pointed second palpal segment proves to be apomorphic, a phylogenetic relationship with these species may exist. The new species shares labral and mandibular characteristics, the small number of claw denticles, and a general lack of pigmented tracheation in the abdominal gills with the North American *C. mexicanus* (Traver and Edmunds). The latter species is common throughout Texas and Mexico. *Camelobaetidius warreni* (Traver and Edmunds) is the only other common species currently known in North America, where it occurs throughout the West from Arizona to Saskatchewan. The new species shares relatively few characteristics with *C. warreni.*

Our study of individual and age variability indicated that certain characteristics used for species discrimination by Traver and Edmunds (1968) may not be valid. These include color patterns of the abdominal terga, condition of the incisors of the mandibles, and thickness of the maxillary palps, all of which we found to be highly variable in *C. waltzi,* mainly due to age differences in larvae. The number of claw denticles increases with age, and this may account for the range of numbers described for many of the species that Traver and Edmunds (1968) studied. Although no individuals of *C. waltzi* had coxal gills, we would caution that it may be possible for species of *Camelobaetidius* to be individually variable in this respect as, for example, has been found in the genus *Baetodes.* Characters of potential value in species discrimination that have not been used previously include form of the prostheca and the presence or absence of a complex seta on the medial edge of the molars of the right mandible. Traver and Edmunds (1968) did not mention or figure the sensory seta found at the tip of the claw (Fig. 7) or the terminally hooked apical setae of the paraglossae (Fig. 5). Our examination of larvae of all species available to us indicates that these characteristics are generic.

The areas where the new species was found in Indiana and Iowa are only a little over 300 miles apart. All known larvae were taken at large river sites—either the Wabash River relatively near its confluence with the Ohio River or the Des Moines River very near its confluence with the Mississippi River. Although the lower Wabash River basically possesses a silt/clay substrate, the type locality there consists of a natural rocky outcrop giving rise to a small fall that becomes visible and accessible when the river is very low. The exact microhabitat of *C. waltzi* larvae at this site was not recorded at the

time of collection because it was not realized *Camelobaetidius* was being taken until after the fact.

Larvae were taken on the Des Moines River at two sites in 15–130 cm depth, where either small sized stones or concrete rubble (13–26 cm diameter) were present. The majority of substrate of the river in this region consists of silt and mud. Larvae were found crawling among filamentous algal mats associated with the stones and rubble. The only other species taken in abundance with *C. waltzi* was *Baetis longipalpus* Morihara and McCafferty. *Baetis longipalpus,* however, occurred on larger stones and driftwood. Other species of mayflies taken either as larvae or adults at the general site included *Baetis intercalaris* McDunnough, *Caenis hilaris* (Say), *Centroptilum* sp., *Heptagenia flavescens* (Walsh), *Hexagenia limbata* Serville, *Isonychia sicca* (Walsh), *Leucrocuta* sp., *Stenonema mexicanum* (Ulmer), and *S. terminatum* (Walsh).

The specimen of *D. waltzi* taken on 20 July, 1977, from the Wabash River was relatively mature; those taken on 19 August, 1991, from the Des Moines River were mainly middle instar larvae with a few of them more mature; and several of those taken on 29 August, 1992, from the Des Moines River were mature. Some of the latter unsuccessfully attempted to emerge while being held in temporary containers. In addition, many baetid subimagos were seen along the shore at the collecting site, but these could not be correlated positively with the *C. waltzi* larvae.

McCafferty et al. (1992) hypothesized that *Camelobaetidius* had a most recent center of dispersal in the Neotropics because the genus demonstrated an arid-favored distribution in North America. In the absence of cladistic data for species, this at least fit the pattern shown by most Neotropical mayfly groups in North America. The new species described herein clearly has a humid distribution pattern in the Midwest, perhaps weakening the previous inferential evidence. On the other hand, it is becoming apparent that many of the other described North American species of *Camelobaetidius* may fall into synonymy (see McCafferty and Waltz 1990), and thus, the genus may be much more diverse in the Neotropics. This also is proving to be a predictable pattern for most Neotropical mayfly groups (McCafferty et al. 1992).

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