

THE SMALL MINNOW MAYFLY GENUS *CLOEODES* TRAVER
(EPHEMEROPTERA: BAETIDAE) IN MADAGASCAR

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Abstract.—*Cloeodes portabilis*, new species, represents the first report of *Cloeodes* from Madagascar. The species is distinguished in the larval stage by the relatively wide anteromedial emargination of the labrum, presence of tufts of fine, simple setae between the prosthecae and molae of the mandibles, slightly distolaterally acute segment 3 of the labial palps, and abdominal color pattern. The presence of *Cloeodes* throughout the Southern Hemisphere suggests a relatively ancient origin among extant Baetidae.

Key Words: Ephemeroptera, Baetidae, *Cloeodes portabilis*, new species, Madagascar

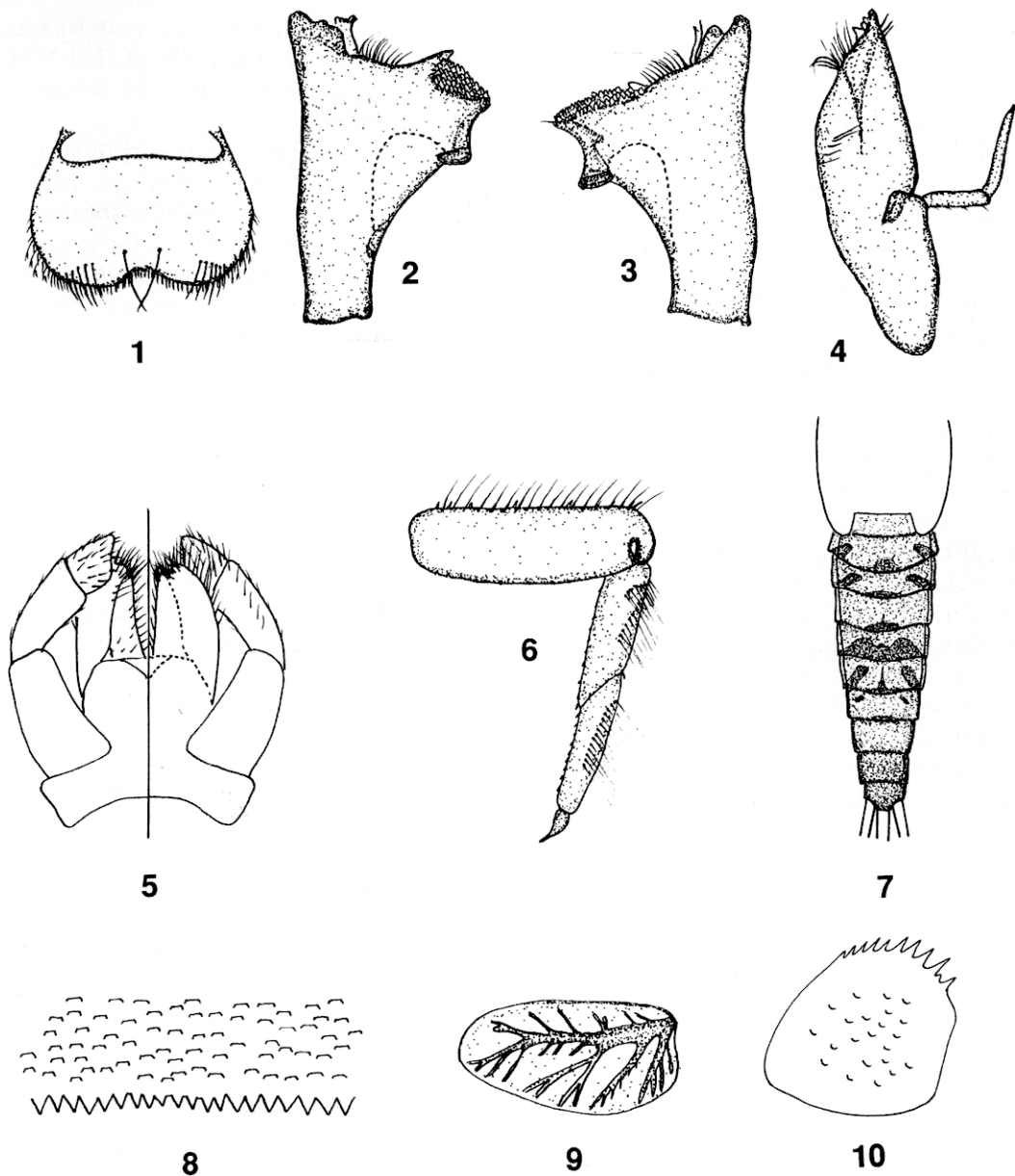
The distinctive small minnow mayfly genus *Cloeodes* Traver (Ephemeroptera: Baetidae) has been known from the Afrotropics, Neotropics, Orient, and southwestern Nearctic (Traver 1938, Waltz and McCafferty 1987ab, 1994, Kluge 1991, Flowers 1991, Lugo-Ortiz and McCafferty 1993, 1994, 1995, McCafferty and Lugo-Ortiz 1995, McCafferty *et al.* 1997). Most recently, Lugo-Ortiz and McCafferty (1998) reported *Cloeodes* from Australia, significantly extending its known range. Three historic biogeographic hypotheses were provided to explain its essentially Pantropical distribution.

That *Cloeodes* was well established throughout Gondwanaland or at least West Gondwanaland (the South American-African-Malagasy-Indian landmass) prior to 100 million years ago, before Madagascar began to separate from Africa and India, were hypotheses that clearly predicted that *Cloeodes* would occur in Madagascar. Herein we report *Cloeodes* from Madagascar for the first time based on a new species described from larvae. An additional spe-

cies of *Cloeodes* from the island will be described elsewhere by one of us (J.-L.G.). The specimens studied are housed in the Purdue Entomological Research Collection, West Lafayette, Indiana.

***Cloeodes portabilis* Lugo-Ortiz and
McCafferty, new species**
(Figs. 1–10)

Larva.—Body length: 3.4–4.4 mm. Caudal filaments length: 1.8–2.0 mm. **Head:** Coloration medium brown, with no distinct pattern. Antenna approximately 1.75× length of head capsule. Labrum (Fig. 1) with wide anteromedial emargination, submedial pair of long, fine, simple setae, and submarginal row of four to six long, fine, simple setae. [Left and right mandibles (Figs. 2, 3) with incisors worn down.] Left mandible (Fig. 2) with one set of incisors; prostheca robust, apically denticulate; tuft of fine, simple setae present between prostheca and mola. Right mandible (Fig. 3) with two sets of incisors; prostheca slender, apically bifid; tuft of fine, simple setae present between prostheca and mola. Maxilla



Figs. 1-10. *Cloeodes portabilis*. 1, Labrum (dorsal). 2, Left mandible. 3, Right mandible. 4, Left maxilla. 5, Labium (left-ventral; right-dorsal). 6, Left foreleg. 7, Abdomen (dorsal). 8, Tergum 3 (detail). 9, Gill 3. 10, Paraproct.

(Fig. 4) with four small, stout denticles on crown of galealacinia; four to five long, fine, simple setae near medial hump; palp not reaching galealacinia; palp segment 1 subequal in length to segment 2; segment 2 apically acute. Labium (Fig. 5) with glossa

and paraglossa equal in length; palp segment 1 approximately 0.80× length of segments 2 and 3 combined; segment 2 approximately 1.6× length of segment 3; segment 3 falcate apically and slightly pointed distolaterally. *Thorax*: Coloration yellow

brown, with complex markings. Hindwing-pads absent. Legs (Fig. 6) pale yellow brown; femora dorsally with row of five to six medium-sized, robust, simple setae intermixed with numerous long, fine, simple setae; tibiae ventrally with 10–12 short, stout, simple setae; tarsi ventrally with eight to nine short, stout, simple setae. *Abdomen* (Fig. 7): Coloration medium to yellow brown; segment 1 yellow brown; segment 2 yellow brown, with submedial medium brown subtriangular marking and oblique medium brown distolateral markings; segment 3 with submedial medium brown crescentlike marking posteriorly and oblique medium brown distolateral markings; segment 4 with submedial medium brown crescentlike marking posteriorly; segment 5 with large, wavy, medium brown marking posteriorly; segment 6 with submedial spikelike medium brown marking and oblique medium brown distolateral markings; segment 7 with small, oblong, medium brown anterolateral markings; segment 8 yellow brown, with no markings; segments 9–10 medium brown, with no markings. Terga (Fig. 8) with abundant scale bases, and with posterior marginal spines triangular, approximately as long as basal width. Sterna yellow brown. Gill (Fig. 9) subtriangular, well tracheated, marginally smooth. Paraproct (Fig. 10) with 10–12 spines, increasing in size apically. Caudal filaments pale yellow brown; medial caudal filament subequal in length to cerci.

Adult.—Unknown.

Material examined.—*Holotype*: Larva, MADAGASCAR, Tamatave (= Toamasina) Prov., stream at Gri-Gri, RN 2, 17-X-1971, G. F. C. H. Edmunds, and F. Emmanuel. *Paratypes*: Two larvae, same data as holotype; five larvae, MADAGASCAR, Antsiranana Prov., Djabala R., 11 km NW of Hell-Ville, Nosy Be, 25-X-1971, G. F. C. H. Edmunds, and F. Emmanuel [mouthparts, left foreleg, tergum 3, gills 3, and paraproct of one larva mounted on slide (medium: Euparal)]. *Additional material*: Four larvae, same data as holotype; twenty

larvae, MADAGASCAR, Antsiranana Prov., Djabala R., 11 km NW of Hell-Ville, Nosy Be, 25-X-1971, G. F. C. H. Edmunds, and F. Emmanuel.

Etymology.—The specific epithet is a Latin word meaning “that which may be carried.” It is an allusion to the species being a drifted representative of the genus.

Discussion.—*Cloeodes portabilis* is distinguished from other members of the genus by the relatively wide anteromedial emargination of the labrum (Fig. 1), presence of tufts of fine, simple setae between the prosthecae and molae of the mandibles (Figs. 2, 3), slightly distolaterally acute segment 3 of the labial palps (Fig. 5), and abdominal color pattern (Fig. 7).

Cloeodes portabilis is unique among Eastern Hemisphere members of the genus because segment 3 of the labial palps is somewhat falcate, being slightly distolaterally pointed (Fig. 5); other species have a bulbous segment 3. Only the South American species *C. hydatation* McCafferty and Lugo-Ortiz has a similar labial palp morphology (McCafferty and Lugo-Ortiz 1995: Fig. 6); we can only assume that it constitutes a homoplasy. In addition, the presence of a tuft of setae between the prosthecae and molae of the mandibles in *C. portabilis* (Figs. 2, 3) is exceptional in *Cloeodes*, possibly indicating a relatively ancestral position within the genus, because that characteristic is generally associated with plesiotypic genera in Baetidae (R. D. Waltz, personal communication).

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LITERATURE CITED

- Flowers, R. W. 1991. Diversity of stream-living insects in northwestern Panamá. *Journal of the North American Benthological Society* 10: 322–334.

- Kluge, N. 1991. Cuban mayflies of the family Baetidae (Ephemeroptera) 1. Genera *Callibaetis*, *Cloeodes*, and *Paracloeodes*. Zoologicheskiy Zhurnal 12: 128–136. [in Russian]
- Lugo-Ortiz, C. R. and W. P. McCafferty. 1993. Genera of Baetidae (Ephemeroptera) from Central America. Entomological News 104: 193–197.
- . 1994. New records of Ephemeroptera from Mexico. Entomological News 105: 17–26.
- . 1995. Annotated inventory of the mayflies (Ephemeroptera) of Arizona. Entomological News 106: 131–140.
- . 1998. First report and new species of the genus *Cloeodes* (Ephemeroptera: Baetidae) from Australia. Entomological News 109: 122–128.
- McCafferty, W. P. and C. R. Lugo-Ortiz. 1995. *Cloeodes hydation*, n. sp. (Ephemeroptera: Baetidae): an extraordinary, drought tolerant mayfly from Brazil. Entomological News 106: 29–35.
- McCafferty, W. P., C. R. Lugo-Ortiz, and G. Z. Jacobi. 1997. The mayfly fauna of New Mexico. Great Basin Naturalist 57: 283–314.
- Traver, J. R. 1938. Mayflies of Puerto Rico. Journal of Agriculture of the University of Puerto Rico 22: 5–42.
- Waltz, R. D. and W. P. McCafferty. 1987a. Generic revision of *Cloeodes* and description of two new genera (Ephemeroptera: Baetidae). Proceedings of the Entomological Society of Washington 89: 177–184.
- . 1987b. Revision of the genus *Cloeodes* Traver (Ephemeroptera: Baetidae). Annals of the Entomological Society of America 80: 191–207.
- . 1994. *Cloeodes* (Ephemeroptera: Baetidae) in Africa. Aquatic Insects 16: 165–169.