

***Cloeodes* (Ephemeroptera: Baetidae) in Africa**

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The South African species *Cloeodes inzingae* (Crass) is redescribed as adults and larvae based on newly found material. This species is most closely related to far eastern Palaearctic (China) and Oriental (Sri Lanka) species rather than Neotropical species. The presence of *Cloeodes* in the Subsaharan region of Africa supports the opinion that it is basically a pantropical genus. *Cloeodes inzingae* possesses a median tubercle between the forceps bases, a character not known in any other *Cloeodes*.

Key words: Ephemeroptera, Baetidae, *Cloeodes*, redescription, zoogeography.

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INTRODUCTION

The genus *Cloeodes* Traver historically was known from only a few records from Middle America. Waltz and McCafferty (1987a, b), however, showed that the genus is more widespread in the Western Hemisphere and in the far eastern Palaearctic and Oriental regions. New species continue to be discovered in Middle America (Kluge, 1991) and South America (McCafferty and Lugo-Ortiz, pers. comm.). Based on its primarily tropical distribution pattern and the presence of unnamed but morphologically similar species reported in the world literature, *Cloeodes* was hypothesized to be pantropical by McCafferty et al. (1992).

In 1990 one of us (WPM) had the opportunity to conduct field work in South Africa and to study various institutional collections of South African Ephemeroptera. Larval exuviae and several adults of *Pseudocloeon inzingae* Crass (1947) were discovered in material belonging to the South Africa Museum (SAM), Cape Town, but temporarily held by the Albany Museum (ALB), Grahamstown, South Africa. This material was evidently collected and identified by Crass at the same time he established his syntypes, but was not included in the syntype series (Crass, 1947). This was an important discovery because the Crass types of this species and others at the Natal Museum in Pietermaritzburg had been inadvertently lost or destroyed (McCafferty and deMoor, 1994). Although probably not a part of the Crass (1947) type series, the specimens serve as the basis for our redescription of the species.

The discovery of the *C. inzingae* material was even more important from the standpoint of the uncovering world relationships in the family Baetidae because

the species represents the first known member of the genus *Cloeodes* in Africa. The correct assignment of *C. inzingae* was recognized by McCafferty and deMoor (1994), who recombined the species with *Cloeodes*. They also recombined the South African species *Pseudocloeon saxophilum* Agnew with *Cloeodes* on the basis of its obvious similarity to Crass's species (see Agnew 1961).

Cloeodes inzingae (Crass)

Pseudocloeon inzingae Crass, 1947.

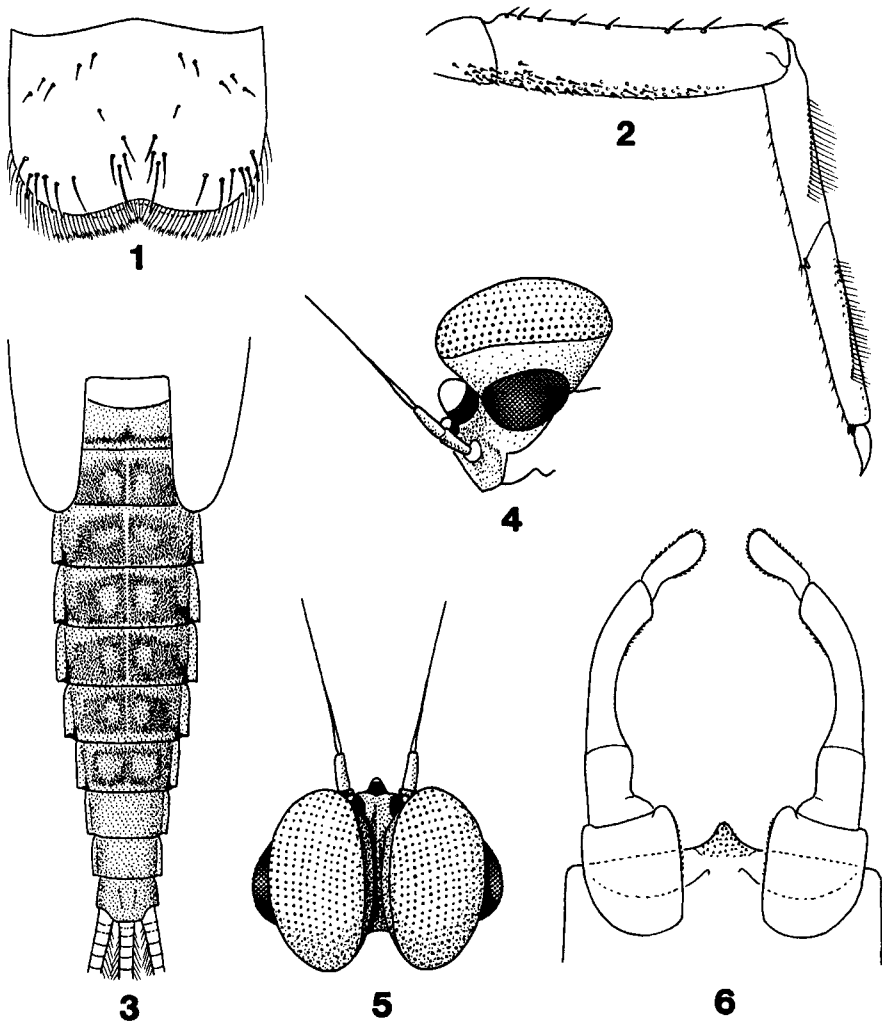
Cloeodes inzingae (Crass), McCafferty and deMoore, 1993.

Material examined: The syntypes of *C. inzingae* were deposited in the Natal Museum by Crass. Because these are no longer available and because there fortunately is authentically determined material from the same locality and date, it is incumbent on us to redescribe this material, thus ensuring the integrity of the name. The locality from which our material was collected is "South Africa, Natal, Furth Stream, December 1944." Crass (1947) also indicated the locator "Dargle" in his publication, but this name does not appear on the hand-written label accompanying the specimens. Specimens on which our redescription is based are deposited as follows: one male larval exuviae, slide mounted in Euparal (solvent: absolute alcohol), one male adult and one female adult are deposited in SAM; two female adults are deposited in ALB; and one male adult and one larva are deposited in the Purdue Entomological Research Collection, West Lafayette, Indiana.

Larval description: Body ca. 6 mm in length; cerci ca. 3 mm. Head capsule [as in Fig. 38, of Waltz and McCafferty (1987b)] without narrow intra-antennal process. Antennae longer than head capsule; scape subequal to pedicel. Labrum (Fig. 1) with cluster of four lateral setae and eight to ten weakly developed ventral marginal spines. Left mandible with mandibular molar process broadly triangulate. Right mandible similar to Fig. 3 of Waltz and McCafferty (1987a). Maxillary palps two segmented and attaining apex of galea laciniae; galea laciniae with 1+5-6 setal formula. Labium with segment 2 of palp with five to six dorsal setae; segment 3 ovoid with slightly squared margins; paraglossae with five to six ventral interomarginal setae, and two to three dorsal medioapical setae. Hind wingpads absent. Legs (Fig. 2): femora with eight to 10 dorsal bristles (each subequal in length to distance between them) and with two to three distal bristles; subtending bristle of tibiae elongate and blunt; tibial arc of long, fine setae extending to ca. 0.6-0.7 times length of tibia; tarsi with arc of long, fine setae extending approximately 0.75 times length of tarsi.

Abdominal color pattern (Fig. 3) of female larva (in alcohol): tergum 1 brownish without apparent pattern, terga 2-6 (?) with relatively large, pale, paired maculae submedially and with a pale median stripe, remaining terga brownish. Tergum 3 with 25-30 posterior marginal spines on either side of middle; basal spine width ca. 0.5 times spine height. Paraprocts with 12-15 marginal spines. Distal margin of sternum 9 without medial spines.

Adult male. [based on Crass's (1947) original comments, especially regarding coloration of live specimens, in addition to our own observations]: Turbinate eyes (Figs. 4, 5) in alcohol yellowish, situated on short stalks, nearly touching



Figs. 1-6. *Cloeodes inzingae* (Crass). Figs. 1-3. Larva: 1. Labrum (dorsal). 2. Leg. 3. Abdominal color pattern. Figs. 4-6. Adult male: 4. Head capsule (lateral). 5. Head capsule (dorsal). 6. Genitalia.

blackish colored compound eyes. Turbinate eyes, in life, deep brownish pink, compound eyes olive. Thorax, in life, dark brown throughout; ventral joinings of head and prothorax, and prothorax and mesothorax, bright orange. In life, abdominal tergum 1 sepia, with pale convergent stripes; terga 2-5 sepia with relatively large maculae and pale median stripe; terga 6-7 with maculae as in previous terga but without median stripe. Terga 8-9 bright green, with sepia lateral and posterior borders.

Male genitalia (Fig. 6) with median protuberance between forceps bases, truncate, appearing scabrate; forceps with slightly but distinctly swollen segment 2, lacking apparent setae, segment 4 elongate, length ca. 3 times width.

DISCUSSION

Cloeodes inzingae is most closely related to *C. soldani* (Müller-Liebenau) and *C. longisetosus* (Braasch and Soldán) described from Sri Lanka (Ceylon) and China, respectively. This conclusion is based on the common possession in the three species of well-developed setal arcs on the larval tibiae and tarsi (Fig. 2) that extend beyond half the length of the tibiae and tarsi. In all Western Hemisphere species known, these arcs of setae extend for very short distances down the tibiae and tarsi, often less than one-quarter the length of the leg segments.

The male of *C. inzingae* is unique among described species of *Cloeodes* with respect to the presence of a relatively elongate segment 4 of the forceps (Fig. 6), turbinate eyes that are on short stalks nearly touching the compound eye, and paired marginal intercalaries in the R_1 - R_2 cells. We interpret all of these traits as plesiomorphic among *Cloeodes* species. An additional unique characteristic of this species is its possession of a median protuberance between the forceps bases (Fig. 6). This characteristic is not known in other described species of *Cloeodes*. Discovery of this variation in a *Cloeodes* species requires a slight modification of the adult concept for the genus. The character state is reminiscent of similar protuberances reported in *Centroptilum* Eaton, *Baetopus* Keffermüller, and *Rapto-baetopus* Müller-Liebenau.

Available observations indicate a rather broad spectrum of flowing-water habitats for *Cloeodes* larvae. Although Crass (1947) reported *C. inzingae* "from fairly deep, slow flowing water," others have found *Cloeodes* spp. in shallow temporary pools in the Neotropics (McCafferty, unpublished), in shallow rivers of the Orient and eastern Palaeartic (Soldán et al., 1987), in small mountainous streams of southwestern North America [e.g., Oak Creek Canyon (Waltz and McCafferty, 1987b)], and in stony pools and backwaters (Agnew, 1961).

The discovery of *Cloeodes* in a subtropical region of Natal corroborates the conclusion of McCafferty et al. (1992) that the genus is basically pantropical. We predict that the genus will be found in subsaharan regions throughout the African continent. We do not know, however, if it will prove to be a pervasive baetid genus in subsaharan Africa, as indeed it is proving to be in the Neotropics.

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