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First description of imago and redescription of nymph for *Cloeodes irvingi* Waltz & McCafferty, 1987 (Ephemeroptera: Baetidae)

LUCAS R. C. LIMA^{1,3}, LUKE M. JACOBUS² & ULISSES PINHEIRO¹

¹Centro de Ciências Biológicas, Laboratório de Porifera, Universidade Federal de Pernambuco, Brazil, CEP 50670-420, Recife, Pernambuco. E-mail: uspinheiro@hotmail.com

²Division of Science, Indiana University Purdue University Columbus, 4601 Central Avenue, Columbus, Indiana 47203, USA. E-mail: luke.jacobus@gmail.com

³Corresponding author. E-mail: lucaslima_86@hotmail.com

Abstract

The male imago of *Cloeodes irvingi* Waltz & McCafferty, 1987 is described for the first time based on reared nymphs collected from the state of Pernambuco, northeastern Brazil. It is differentiated from Neotropical congeners, among other characteristics, by the marginal intercalary veins being paired, except between veins ICu1–ICu2 and ICu2–CuP where they are single and between Sc–R1 and CuP–A where they are absent; segment II of forceps with a medial constriction; and the posterior margin of the subgenital plate being rounded. The nymph of this species is redescribed based on new and original specimens. It is differentiated from Neotropical congeners, among others characteristics, by having a labrum with a dorsal arc composed of 2 + 0 + 2 long, spine-like setae, a labial palp segment III that is subquadrangular, and the fore femur with an apex that is not projected, with 2 blunt setae.

Key words: aquatic insects, mayflies, taxonomy, Brazil, Neotropical Region

Introduction

Cloeodes Traver (1938) has a widespread pantropical distribution with representatives in Africa (Waltz & McCafferty 1994; Jacobus *et al.* 2006), Madagascar (Lugo-Ortiz *et al.* 1999), Southeast Asia (Soldán & Yang 2003) and the Americas (e.g., Traver 1938; McCafferty & Lugo-Ortiz 1996; Wiersema & Baumgardner 2000; McCafferty *et al.* 2004; Nieto & Richard 2008; McCafferty *et al.* 2012). In South America, there are 23 species known: eight from nymphs, five from adults, and ten from both nymphs and adults (Nieto & Richard 2008; Gonçalves *et al.* 2010; Massariol & Salles 2011; Nieto & Emmerich 2011; Massariol *et al.* 2013). In Brazil, 11 species are reported (Salles *et al.* 2014).

Cloeodes irvingi Waltz & McCafferty, 1987 was described based only on nymphs from Paraguay, and later reported from Brazil (Salles *et al.* 2003, 2004, 2010; Boldrini *et al.* 2012; Lima *et al.* 2012). With the increase in knowledge about species diversity within *Cloeodes*, the original description of *C. irvingi* has become inadequate for differentiating it from other congeners in South America, which led us initially to misidentify some recently collected specimens of *C. irvingi*. However, the comparison of these specimens with *C. irvingi* type material deposited at the Purdue University Entomological Research Collection, West Lafayette, Indiana, USA (PERC), revealed them to be *C. irvingi*.

The aim of this paper, therefore, is to describe for the first time the male imago of *C. irvingi*, which we have associated through rearing, and to redescribe the nymph based on the original material and an expanded collection of materials from several localities in state of Pernambuco, northeastern Brazil.

Departamento. Amambay, Parque Nacional, Cerro Cora, Arroyo Panamy, riffle sample, 05.xi.1983, Bonace RT (PERC).

Discussion

There are 15 South American species of *Cloeodes* with adult stages described, however only three species, *Cloeodes aymore* Massariol & Salles, 2011, *Cloeodes hydatation* McCafferty & Lugo-Ortiz, 1995, *Cloeodes itajara* Massariol & Salles, 2011, and *Cloeodes jaragua* Salles & Lugo-Ortiz, 2003 share similar characteristics with the imago of *C. irvingi*: segment II of forceps with constriction (Fig. 4); and hind wing with costal process hooked, located on basal third and with two longitudinal veins (Fig. 3). The male imago of *C. irvingi* can be distinguished from *C. aymore* by the posterior margin of the subgenital plate being rounded (Fig. 4) instead of truncate. In relation to *C. hydatation*, *C. irvingi* has a medial constriction on segment II (basal in *C. hydatation*) (Fig. 10) and does not have small spines on the costal margin of the forewing. *Cloeodes itajara* can be distinguished from *C. irvingi* by the abdominal color pattern of anterolateral triangular black marks on terga V–VII and a body size that is almost the double that of *C. irvingi*. Finally, the imago of *C. jaragua* can be readily distinguished from *C. irvingi* by the presence of a distolateral projection adjacent to the constriction at the second segment and by its brownish abdominal coloration.

The nymphs of *C. irvingi* together with *C. incus* (Waltz & McCafferty 1987) from Bolivia, *C. hydatation* from Brazil, and *C. penai* (Moriyama & Edmunds 1980) from Argentina do not have an apical projection on the fore femora. However, *C. irvingi* can be distinguished from *C. incus* because the latter has a tarsal claw with minute denticles basally. *Cloeodes irvingi* is distinguished from *C. hydatation* by the length of the antennae being about 1.5 × length of the head capsule (as compared to two times the length in *C. hydatation*), by the absence of spines on posterior margin of terga I–II (as compared to terga I–III with spines in *C. hydatation*), and by the maxilla with last segment not constricted (as compared to maxilla with last segment constricted in *C. hydatation*). Finally, *C. penai* can be distinguished from *C. irvingi* by the length of the antennae being 3 × length of head capsule, the apex of the femur having pointed spines, and the paraproct having 20–30 marginal spines (compared to 10–13 in *C. irvingi*).

We observed seemingly significant morphological variation on the nymphal armature in type material of *C. irvingi*. The holotype has spines only on segments II–X, with segment II having only a few weakly developed spines. One paratype, however, has spines on the posterior margins of abdominal terga I–X (with many distinctly developed spines on tergum I). We note that our newly reported material all corresponds to the holotype variant. We do not know yet whether the apparently aberrant paratype variant falls within a wider range of variation of *C. irvingi*, or whether this variant represents a different species. This question can be explored only when more specimens are available for study.

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