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Larval taxonomy of *Macrothemis* Hagen, 1868 (Odonata: Libellulidae), with descriptions of four larvae and a key to the fourteen known species

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Abstract

The ultimate larval stadia of *Macrothemis declivata*, *M. hemichlora*, *M. imitans imitans* and *M. tenuis* are described and illustrated for the first time, based on material from Brazil. Six of the most used keys to larvae of libellulid genera of the New World are evaluated with respect to the correct identification of the 27 known larvae of *Macrothemis*, *Brechmorhoga*, *Gynothemis* and *Scapanea*. *Macrothemis* species were wrongly identified in more than 50% of the trials, being keyed as *Brechmorhoga*, *Gynothemis* and even *Dythemis*. The genus *Macrothemis* and its relatives need to be reevaluated and adequately diagnosed based on larvae. A key to the 14 known larvae of species currently included in *Macrothemis* is presented.

Key words: dragonflies, immature forms, *Macrothemis*, taxonomy, South America, Neotropical Region

Introduction

The genus *Macrothemis* Hagen, 1868, is widely distributed in the Neotropical Region, with records from far southern United States of America to Uruguay and central Argentina, consisting of 42 species (Garrison *et al.* 2006; Daigle 2007; De Marmels 2008). The adults commonly fly over creeks and streams, sometimes landing on sand banks, rocks or shrubs nearby. They can also be found in swamps, open grasslands or clearings in the forest (Garrison *et al.* 2006).

The larvae of the genus are poorly known, and only 10 species have the ultimate stadium described to date: *M. aurimaculata* Donnelly, 1984 (Ramírez & Novelo-Gutiérrez 1999), *M. celeno* (Selys, 1857) (Klots 1932), *M. hahneli* Ris, 1913 (von Ellenrieder 2007), *M. heteronycha* (Calvert, 1909) (Costa *et al.* 2010), *M. inacuta* Calvert, 1898 (Novelo-Gutiérrez & Ramírez 1998), *M. meurgeyi* Daigle, 2007 (Meurgey 2009), *M. musiva* Calvert, 1898 (Santos 1970), *M. pseudimitans* Calvert, 1898 (Limongi 1989), *M. inequiunguis* Calvert, 1895 (Ramírez & Novelo-Gutiérrez 1999) and *M. ultima* González-Soriano, 1992 (Novelo-Gutiérrez 2006). They are found mainly among small pebbles, gravel, sand or mud in shallow areas of lotic environments with moderate water flow (*e.g.* Novelo-Gutiérrez 2006), but also in lentic situations, at the shores of small pools with aquatic vegetation (*e.g.* Novelo-Gutiérrez & Ramírez 1998). Commonly they are collected covered with fine sediment of depositional zones (Carvalho & Nessimian 1998).

Macrothemis is one of the more unstable genera of New World Libellulidae, shifting species mainly with *Brechmorhoga* Kirby, 1894, and *Gynothemis* Calvert *in* Ris, 1909. Garrison & von Ellenrieder (2006) proposed new diagnoses based exclusively on adults for these three genera and their relative *Scapanea* Kirby, 1889, and in parallel new arrangements of species were considered for each genus. But, as warned by the authors, some species of *Macrothemis* do not fit perfectly in the presented diagnosis, especially the females, admitting that in future studies it may prove to be a paraphyletic group, with some species more closely related to *Gynothemis*.