



Differentiation of larvae and pupae of aquatic genera of Nearctic Hemerodromiinae (Diptera: Empididae)

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Abstract

Larvae and pupae representing four genera of aquatic dance flies, *Chelifera* Macquart, *Hemerodromia* Meigen, *Metachela* Coquillett, and *Neoplasta* Coquillett (Diptera: Empididae: Hemerodromiinae) are differentiated, diagnosed, illustrated, and keyed. Results are based on: limited rearing associations of larvae, pupae, and adults; external morphology of larvae, pupae, and pupal exuviae; and fragment sizes of ribosomal DNA extracted from larvae, pupae and adults of Nearctic Hemerodromiinae. Fragment size of ribosomal DNA is diagnostic at the generic level.

Key words: *Chelifera*, *Hemerodromia*, *Metachela*, *Neoplasta*, pupal exuviae, ribosomal DNA, PCR

Introduction

Adults of species assigned to four Nearctic genera of the subfamily Hemerodromiinae (Diptera: Empididae) are associated with aquatic habitats with immature stages either known or presumed to develop in water, primarily flowing water. The genera involved are *Chelifera* Macquart, *Hemerodromia* Meigen, *Metachela* Coquillett, and *Neoplasta* Coquillett. Adults have been described by Melander (1928), MacDonald (1989, 1994, 1998), and MacDonald and Turner (1993), but inability to differentiate larvae and pupae of all genera has hindered their inclusion in ecological research and in calculations of biotic indices based on diversity of insect taxa in streams.

Larvae of aquatic Hemerodromiinae possess seven pairs of abdominal prolegs, including one pair on the last abdominal segment (Steyskal & Knutson 1981; MacDonald & Harkrider 1999), distinguishing them from larvae of known Clinocerinae (Sinclair 1995; Sinclair & Harkrider 2004) and *Oreogeton* Schiner (Courtney *et al.* 1996) which possess eight pairs of abdominal prolegs, including one pair of the last abdominal segment.

Hemerodromia larvae are the most structurally distinct of the Hemerodromiinae and are well illustrated (McCafferty 1981, Steyskal & Knutson 1981). Larvae of *Metachela* and *Neoplasta* are described, illustrated, and keyed by MacDonald and Harkrider (1999). The first published account of a larva of *Chelifera* (Brocher 1909) pertains to a Palearctic species, but it lacked a detailed illustration and is of no diagnostic value. The first published account of larvae of *Chelifera* accompanied by detailed illustrations are based on two Palearctic species (Vaillant 1965), and appear to be the basis for distinguishing larvae of *Chelifera* in identification keys subsequently developed for the Nearctic region (Steyskal & Knutson 1981; Courtney *et al.* 1996).

Pupae of aquatic Hemerodromiinae are characterized by the presence of a pair of long, lateral processes on each of seven abdominal segments (Figs. 5–8) (Steyskal & Knutson 1981), structures that are lacking on pupae of known aquatic Clinocerinae (Steyskal & Knutson 1981; Sinclair & Harkrider 2004) and *Oreogeton* (Sommerman 1962).