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Morphology of preimaginal stages of *Lauxania* and *Calliopum* (Diptera: Lauxaniidae)

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Abstract

Scanning electron microscopy (SEM) analysis of all preimaginal stages of the following lauxaniid species is presented for the first time: *Lauxania cylindricornis* (Fabricius), *L. minor* Martinek, *Calliopum aeneum* (Fallén), *C. elisae* (Meigen), *C. splendidum* Papp and *C. simillimum* (Collin). Detailed images of the pseudocephalon, antenna, maxillary palpus, facial mask, cirri, mouth hooks, body segments and anterior and posterior spiracles of all larval instars are provided along with illustrations of the cephaloskeleton for all three instars. Eggs bear longitudinal ridges and a perforated tubercle on the posterior end. Larvae have several rows of cirri, a pair of abdominal ambulatory lobes and the distal part of Malpighian tubules is filled with white matter. Identification of species or genera is problematic especially in the second instar. Puparia are barrel-shaped, while the calcareous deposit over the puparium typical for other lauxaniids is missing. The morphology of the immature stages supports the notion that *Lauxania* may be not monophyletic.

Key words: Diptera, Lauxaniidae, *Lauxania cylindricornis*, *L. minor*, *Calliopum aeneum*, *C. elisae*, *C. simillimum*, *C. splendidum*, egg, larva, puparium, morphology

Introduction

Lauxaniidae is a common and species rich family of acalyptrate flies. Adults often occur on vegetation in shaded habitats and near streams (Papp & Shatalkin, 1998). Only a negligible proportion of the described species have known larvae and larval biology, although larvae may represent a valuable source of phylogenetic data (Meier 1995, 1996, Meier & Lim 2009, Pape 2001, Szpila & Pape 2007, 2008). Larvae of lauxaniids are saprophagous, usually occurring in decaying vegetation such as fallen leaves or bird nests (Miller & Foote 1976). Immature morphology and biology of some lauxaniid species were briefly studied by Meijere (1909), Hennig (1952) and Sasakawa & Ikeuchi (1982, 1983). More detailed records of immature biology were given by Miller (1977a, 1977b, 1977c) and Miller & Foote (1975). Miller & Foote (1976) studied morphology of eggs, all three larval instars and puparia for eight common North American species. Gaimari & Silva (2010) summarized recent knowledge of lauxaniid larval morphology and biology.

The genus *Lauxania* Latreille is commonly considered to be related to the genus *Calliopum* Strand. Both these genera share metallic black coloration, yellowish wings and a transverse depression on the lower part of face, though in *Calliopum* the last character is less pronounced. Pérusse & Wheeler (2000) suggest that based on the structure of the genitalia, *Lauxania* and *Calliopum* are not monophyletic in relation one to another.

The genus *Lauxania* is represented by 11 species in Palearctic region (Shatalkin 2000, Merz 2001). Species of *Lauxania* share an elongated third antennal segment, a white arista and usually black knob of the halter (Shatalkin 2000). The genus is morphologically heterogeneous and currently is divided into three subgenera. Papp (1978) erected the subgenus *Callixania* Papp for *L. minor* Martinek 1974, which differs from the nominate subgenus by having a protruding facial angle, the short scape, inclinate anterior fronto-orbital setae, and by the male genitalia. Later, Papp & Shatalkin (1998) proposed that *Callixania* should be considered as a genus, which currently has two species (Shatalkin 2000).

Lauxania s. str. is the most species rich subgenus of *Lauxania*, with most of the included species described only in the last three decades (Shatalkin 2000, Merz 2001).

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