



Larval morphology and biology of three European species of *Megastigmus* (Hymenoptera, Torymidae, Megastigminae) parasitoids of gall wasps, including a comparison with the larvae of two seed-infesting species

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Abstract

The morphology of the terminal larvae of three species of *Megastigmus* parasitoids of gall-wasps (Hym., Cynipidae) in Europe, *M. dorsalis*, *M. stigmatizans* and *M. dumicola*, is described for the first time based on SEM images. Larvae of two phytophagous, seed-infesting species of this genus, *M. pistaciae* and *M. aculeatus*, are also described and compared with the larvae of the parasitoid species. The morphological characters that differentiate larvae of *Megastigmus* from other torymid larvae include: strong mandibles bearing four or five teeth, labrum fringed on the anterior margin, and reduced pilosity on the body and head. A key for the identification of the larvae of the five study species is presented. The larvae of the entomophagous *Megastigmus* species share an important diagnostic character, a deep medial frontal pit not present in the larvae of the seed-infesting species. Biological data of the species studied are discussed and illustrated with digital photographs. While the larvae of *M. dumicola* are parasitic in twig galls of species of *Plagiotrochus* on ever-green oaks of the section *Ilex*, *M. dorsalis* and *M. stigmatizans* are associated with galls of many cynipid genera induced on *Quercus* of the section *Quercus*.

Key words: Chalcidoidea, Torymidae, larva, parasitoids, cynipid-galls, seed-infesting, *Quercus*, *Pistacia*, *Rosa*

Introduction

Megastigmus Dalman (Hym., Torymidae, Megastigminae) includes 130 species distributed in all zoogeographic regions, although the majority of species (about 75%) have been described from the Holarctic and Australasian regions (Bouček 1988; Grissell 1999; Roques & Skrzypczynska 2003). The larvae of *Megastigmus* species display a great variety of feeding strategies; most species are seed feeders, but the genus also includes species which are either parasitoid or gall-inducers, and some species even have a mixed carnivorous and phytophagous behaviour (Roques & Skrzypczynska 2003). While 16 of the 21 nominal European species are seminivorous on Pinaceae, Cupressaceae, Anacardiaceae and Rosaceae, five species are entomophagous parasitizing Cynipidae which induce galls on *Quercus* (Fagaceae) (Table 1).

The taxonomy of *Megastigmus* adults is relatively well known from studies by Bouček (1970), Milliron (1949), and more recent contributions by Grissell (1995, 1999) and Roques and Skrzypczynska (2003). However, there are comparatively few comprehensive references dealing with the morphology and biology of the larva (Parker 1924; Askew 1966; De Stefani 1917; Seitner 1916). The body and head morphology of the larvae of the oak gall associated species *Megastigmus dorsalis* (Fabricius) was described and illustrated by Parker (1924), and was later expanded upon by Askew (1966), while Sellenschlo (1984a, 1984b) published descriptions of the larvae of *M. stigmatizans* (Fabricius). With respect to the phytophagous species, there is extensive information on the biology of immature stages. The biology of larvae has been investigated for *M.*