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Revision of the genus *Melanagromyza* in California, with descriptions of three new species (Diptera: Agromyzidae)

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Abstract

The 27 Californian species of the genus *Melanagromyza* Hendel (Diptera: Agromyzidae) are reviewed, including descriptions of three new species (*Melanagromyza californiana* sp. nov., *M. chemsaki* sp. nov. and *M. gonzalesina* sp. nov.) and the first record for one species (*Melanagromyza martini* Spencer) for California and the USA. All species in California are described or redescribed, with illustrations and photographs, and a key to the species is presented. Maps for the species in California, along with host distributions, are provided, with comments on biology and host plants.

Key words: Diptera, Agromyzidae, new species, California

Introduction

The agromyzids are phytophagous flies that can be potential pests of agricultural crops and bioresources. Although most species in the family are leaf miners, the species of the genus *Melanagromyza* Hendel (Diptera: Agromyzidae: Agromyzinae) are internal feeders in roots, stems, pods, seeds and flower heads (Spencer 1990). Most agromyzid research has focused on several other economically important genera such as *Phytomyza* Fallén,

Phytobia Lioy and *Liriomyza* Mik rather than *Melanagromyza*, in part because of the comparative difficulty in rearing due to the more cryptic feeding habits in comparison with mostly leaf mining genera. Therefore, relatively few data are available about host plants and their economic impact, and more extensive work on this genus in the Nearctic Region has been lacking. The present work revises this genus for California, with discussion of biology, host plants and their distributions. As a resource for identifying species of this genus in California, this work seeks to improve on the resources provided by Spencer (1981) and Spencer & Steyskal (1986), by describing new species, redescribing the previously described species, recording one species new to California and the USA, providing a key to species, illustrating the male genitalia for all species, and adding clear diagnostic characters to recognize and separate species based on study of the type specimens and additional materials.

The genus *Melanagromyza* is one of the largest genera of the subfamily Agromyzinae, being distributed worldwide with more than 380 species. Of these, about 160 are known from the New World, including 73 in the Nearctic Region. Among the Nearctic species, 37 are known in the USA, 27 of which occur in California (see Appendix for list).

Melanagromyza belongs to the *Ophiomyia* genus group (Dempewolf 2005), which was recently redefined by Lonsdale (2014). In that work, Lonsdale (2014) proposed several generic synonymies and described one new genus, leaving the *Ophiomyia* genus group to include *Euhexomyza* Lonsdale, *Melanagromyza*, *Ophiomyia* Braschnikow and *Tropicomyia* Spencer. Lonsdale (2014) further discussed the historical context of this group and its constituent genera and synonyms. With very limited sampling of *Melanagromyza* species, Scheffer *et al.* (2007) found the genus to be monophyletic relative to the other genera of Agromyzinae, but there is still much research necessary to assess the monophyly of the whole genus and to establish phylogenetic relationships among species, and among agromyzine genera.

The genus *Melanagromyza* is similar to other Agromyzinae, but can be distinguished based on characteristics presented in Lonsdale (2014). Generally, they can be separated from other agromyzine genera by the following characteristics: the halteres are black (white in *Agromyza*); the mesonotum has two pairs of strong *dc* except for several species with a presutural *dc* or with 3–4 pairs of postsutural *dc* (there are generally at least 3 pairs of *dc* in *Agromyza*); the *prsc* are absent (always present in *Agromyza* and in some *Japanagromyza*); the mesonotum and abdomen are often shiny metallic black, blue, green or coppery (generally dark in *Ophiomyia*, except for a few species); the facial keel is narrow, usually not raised from the base of the antenna, but if raised and widely dividing the antennal bases (Fig. 248), then no spherical bulbous process is present (the facial keel is wide, raised and forms a spherical bulbous process between the bases of the antenna in *Ophiomyia*, except for a few of species having a narrow flattened facial keel that can only be separated from the species of *Melanagromyza* by examination of the male genitalia); the fronto-orbital setulae are in 2–4 rows (usually a single row in *Ophiomyia*, except for a few species with 2–3 rows); the eyes are usually pilose dorsally; the fronto-orbital plate is wide at the middle with a larger distance between the anterior two *ori* than *ors* in some species (usually with the same distance between *ori* and *ors* in *Ophiomyia*); the vibrissal fasciculus is absent and there is rarely (e.g., in *Melanagromyza buccalis* Spencer) a vibrissal angle (most species of *Ophiomyia* have a vibrissal fasciculus and a distinct vibrissal angle); the gena is often highest at the middle (the gena is usually distinctly highest near the anterior angle in *Ophiomyia*); the mid tibia usually has 2 posteromedial setae (often 0–1 posteromedial setae in *Ophiomyia*); in the male genitalia, the basiphallus is short and U- or V-shaped (circular in few species) and the distiphallus is symmetrical (in *Ophiomyia*, the basiphallus is elongate and asymmetrically U- or V-shaped, and the distiphallus is usually asymmetrical (except symmetrical in five species of the *Ophiomyia jacintensis* species group)).

Although much about their host plants is unknown, host plant use for many species appears to be generally restricted to a single plant family or tribe, rather than displaying polyphagy, so data regarding host plants may be important for assessing sister-species relationships and lineages (Boucher 2010; Braun *et al.* 2009; Gaimari *et al.* 2004; Spencer 1966a, 1973a, 1981, 1990), although Lonsdale (2014) suggested that among Agromyzinae, particular feeding categories (e.g., leaf mining, stem mining/boring, gall forming) likely occurred independently multiple times. Across the species of *Melanagromyza* in California, the majority of reported host plants are members of the Asteraceae, although some species also attack Apiaceae, Boraginaceae, Cucurbitaceae, Fabaceae, Salicaceae, Scrophulariaceae, and/or Urticaceae. Some species have been collected in association with (but not reared from) plant species in the Hydrangeaceae, Rosaceae and/or Rutaceae, so their statuses as host plants are not known.

The 27 Californian species of *Melanagromyza* are described or redescribed, illustrated and photographed, and