Parasitoids of Dipteran leafminers, *Diglyphus* spp.  
(Insecta: Hymenoptera: Eulophidae)\(^1\)

Jian Li and Dakshina R. Seal\(^2\)

**Introduction**

*Diglyphus* spp. wasps are promising biological control agents for agromyzid leafminers (Diptera: Agromyzidae). The species occurring in North America are *Diglyphus isaea* (Walker), *D. begini* (Ashmead), *D. websteri* (Crawford), *D. intermedius* (Girault), *D. pulchripes* (Crawford) and *D. carlylei* (Girault) (Lasalle and Parrella 1991, Stegmaier 1972).

**Distribution**

This genus of leafminer parasitoids occurs widely in Asia, Europe, North America, New Zealand and Northern Africa (Minkenberg 1989).

**Description**

**Adult**

The adult parasitoid is a tiny wasp 1.5–2 mm long, depending on the species. The head, thorax and dorsal abdomen are generally metallic green in color, while the eyes are red. The scutellum has two pairs of setae, a submarginal vein with more than two dorsal setae, and the funicle is 2-segmented (Lasalle and Parrell 1991).

**Egg**

The adult female *Diglyphus* parasitoid stings the dipteran host larva to paralyze it. Then the female may lay one or more eggs on the late instar leafminer larva (Minkenberg 1986).

**Figure 2.** Adult *Diglyphus* sp. on a bean leaf. Larvae in this genus are external parasitoids of dipteran leafminers. Photograph by: Jian Li, University of Florida

**Larva**

The parasitoid larva has three instar stages. The first instar larva is transparent, whereas second and third instars are yellowish. The parasitoid larva feeds externally on the leafminer larva, eventually killing the host. The parasitoid larva then pupates in the leaf mine before emerging as an adult. The development time is temperature dependent. *Diglyphus isaea* takes about 10 days at 25°C for complete development on both the American serpentine leafminer, *Liriomyza trifolii*; and the pea leafminer, *L. huidobrensis* (Bazzocchi et al. 2003).

**Figure 3.** *Diglyphus* sp. larvae, 1st, 2nd and 3rd instar respectively left to right. The larvae were removed from the mine of a bean leaf. Larvae in this genus are external parasitoids of dipteran leafminers. Photograph by: Jian Li, University of Florida

**Pupa**

The third instar larva pupates in the leaf mine. The pupa is initially both transparent and light green, but eventually turns black.

**Figure 5.** Two parasitoid *Diglyphus* sp. larvae (one is feeding horizontally on top, the second is positioned vertically to the right side of the larger host larva) feeding on a leafminer larva. The larvae were removed from the mine of a bean leaf. Larvae in this genus are external parasitoids of dipteran leafminers. Photograph by: Jian Li, University of Florida

**Figure 4.** Parasitoid *Diglyphus* sp. larva (top) feeding on a leafminer larva. The larva was removed from the mine of a bean leaf. Larvae in this genus are external parasitoids of dipteran leafminers. Photograph by: Jian Li, University of Florida

**Hosts**

*Diglyphus* spp. are primary ectoparasitoids of dipteran leafminers in the family Agromyzidae. However, a *Diglyphus* sp. was also recorded parasitizing Lepidoptera (Lyonetiidae) larvae (Boucek and Askew 1968).

**Economic Importance**

Augmentative release of commercial *Diglyphus* spp. is used for controlling leafminers in greenhouses in North America and Europe. Bazzocchi et al.
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Figure 7. Late stage of pupae of Diglyphus spp. turn black in color. In this image the head is to the right. Larvae in this genus are external parasitoids of dipteran leafminers. Photograph by: Jian Li, University of Florida

(2003) indicated that D. isaea parasitized at least 18 different agromyzid species. Diglyphis isaea is the most effective commercial biological control product for controlling the American serpentine leafminer, Liriomyza trifolii; the pea leafminer, L. huidobrensis; L. bryoniae; and the chrysanthemum leafminer, Phytomyza syngenesiae (Syngenta-bioline). Lasalle and Parrella (1991) indicated that D. begini also parasitizes L. trifolii, L. huidobrensis and L. bryoniae in North America. Kaspi and Parrella (2005) reported that the insecticide Abamectin has little impact on D. isaea adults or the larvae within the leaf mines of chrysanthemums.

Selected References


