Recognition of eggs and larvae of the parasitoids of *Liriomyza* spp. (Diptera: Agromyzidae; Hymenoptera: Braconidae and Eulophidae)

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Abstract: The differences between the eggs and larvae of the parasitoids of *Liriomyza* spp. in greenhouses in The Netherlands are described and illustrated.

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Introduction

Biological control of leafminers is conducted on a practical scale in commercial greenhouses planted with vegetables, especially tomatoes. In The Netherlands the native leafminer species on tomato is *Liriomyza bryoniae* Kaltenbach, the tomato-leafminer. The American serpentine leafminer, *Liriomyza trifolii* (Burgess) was introduced by accident on *Chrysanthemum* cuttings in 1976. In Dutch greenhouses three native species of parasitoids occur regularly: *Dacnusa sibirica* (Telenga) (Braconidae, Alysiinae), *Opius pallipes* Wesmael (Braconidae, Opiinae), which are endoparasitoids, and *Diglyphus isaea* Walker (Eulophidae, Eulophini), which is an ectoparasitoid. Moreover, *Chrysocharis oscinidis* Ashmead (syn.: *C. parksi* (Crawford)) (Eulophidae, Entedontinae) and *Opius dimidiatus* (Ashmead) (Braconidae, Opiinae), which are endoparasitoids, were imported from the USA for experimental purposes. *O. pallipes* does not develop with *L. trifolii* as a host. The other parasitoids occur on both *Liriomyza* spp.

For pest prognosis, especially in integrated pest management programmes, it is necessary to count the mines of each generation and to establish the degree of parasitism. Recognition of the parasitoid species present, for which this paper describes a method, improves the quality of this prognosis.

Methods

For this prognosis, we dissected a sample of leafminer larvae under the microscope. Each leafminer larva is removed from the leaf and put in a droplet of water. At a magnification of 8-40 × the larvae were opened with a pair of minute tweezers. The contents of the larvae, with or without parasitoid eggs or larvae, spread in the droplet of water. The parasitoid species can be recognized by the shape of their eggs and larvae. To illustrate the differences in shape of eggs and larvae of *Liriomyza* leafminer parasitoids, illustrations were made with the help of a light microscope. The dissection method is much faster than rearing the parasitoids, which takes about 14 days. The average time to dissect one leafminer is about one minute (including removing the leafminer from the leaf, etc.). A sample consists of 50 third instar leafminer larvae. If more leafminer clusters are present, separate samples have to be taken. Repeated sampling is necessary to predict further development of pest and parasitoids.

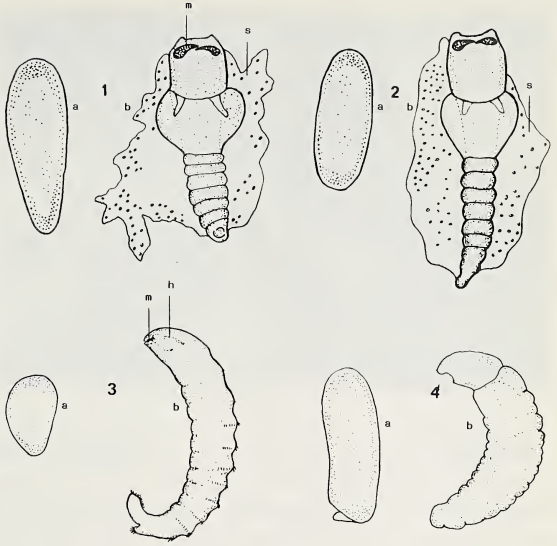

Fig. 1. *Opius pallipes* Wesmael. The egg (a) is elongated, the larva (b) has a blunt head with large mandibles (m); s = serosa cells. Length of the larva: 0.55 mm. *O. pallipes* is an important parasitoid of *L. bryoniae* in Europe.
Fig. 2. *Opius dimidiatus* (Ashmead). The egg (a) and the larva (b) look very similar to those of *Opius pallipes*; s = serosa cells. Length of the larva: 0.50 mm. *O. dimidiatus* occurs in North America.
Fig. 3. *Dacnusa sibirica* (Telenga). The egg (a) is oval, the larva (b) has a pointed head; m = mandibles, h = hypostoma. Length of the larva: 0.60 mm.
Fig. 4. *Chrysocharis oscinidis* Ashmead. The egg (a) is more or less cylindrical. At one end there is a small projection. The head of the larva (b) is flexible in relation to the body. Length of the larva: 0.35 mm.

Braconidae

Čapek (1973) presents a classification of final instar larvae of Braconidae. For the Alysiinae the key runs up to the genus *Dacnusa*. Characteristic of this genus, as well as of the genera *Chorebus* and *Laotris*, is that the hypostoma is longer than the mandible. No key is given for the Opiinae due to the heterogeneity of the larvae of the large genus *Opius* sensu Fischer. Fischer (1973) gives more details of eggs and larvae of a few Opiinae, although not of *O. pallipes* and *O. dimidiatus*. Hopkins (1977) gives descriptions and drawings of different parasitoid larvae, including a *Dacnusa* sp. and an *Opius* sp., from the chrysanthemum leafminer *Chromatomyia syngenesiae* Hardy (Diptera: Agromyzidae). A description and drawings of the immature stages of a *Dacnusa* sp., a parasitoid of the alfalfa blotch leafminer *Agromyza frontella* Rondani (Diptera: Agromyzidae), is given by Guppy and Meloche (1987).

The eggs and larvae of *O. pallipes* are very similar to those of *O. dimidiatus*. So far this has not been a problem for identification, because *O. dimidiatus* does not seem to have established permanently in Dutch greenhouses. The eggs of these *Opius* spp. are cylindrical, thin, and white shortly after oviposition (fig. 2a). Soon after oviposition the eggs swell; most prominently at the anterior end (fig. 1a). They are 2.7 to 4 × longer than broad. The swollen eggs are translucent. Before the larvae hatch from the eggs, the embryos of the *Opius* spp. uncurle themselves inside the eggs. The larvae of the *Opius* spp. have a blunt head with red mandibles. The larvae are translucent, sometimes slightly white, and usually covered with serosa cells at the dorsal side. This gives them a hazy appearance (figs. 1b and 2b). The eggs of *D. sibirica* are more or less oval (2 × longer than broad). Shortly after oviposition the eggs show some white on the inside, but soon they swell and become translucent. Before the larvae hatch from the eggs, the embryos of *D. sibirica* are curved inside the eggs. The larvae of *D. sibirica* have a pointed head with red mandibles. The larvae are translucent, sometimes slightly white (fig. 3).

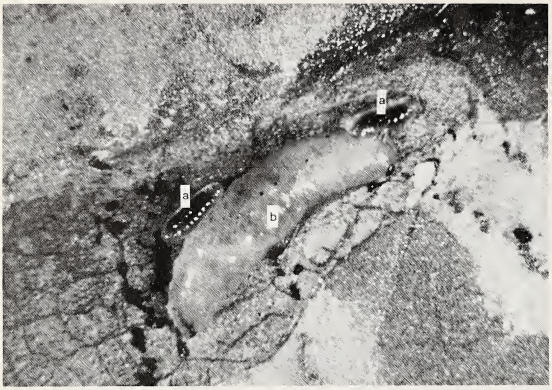

Fig. 5. *Diglyphus isaea* Walker. Larvae (a) (0.5-1.5 mm) on third instar grub of *L. bryoniae* (b) (2.5 mm). The epidermis of the leaf has been removed.

Eulophidae

Hopkins (1977) gives figures of the immature stages of *D. isaea* and a *Chrysocharis* sp., parasitoids of the chrysanthemum leafminer *Chromatomyia syngenesiae* Hardy (Diptera: Agromyzidae). *Diglyphus isaea* is an ectoparasitoid: the eggs and larvae develop in the mine, outside the leafminer larvae. As *D. isaea* is the only ectoparasitoid found in Dutch greenhouses, this species can be recognized by the position of eggs and larvae outside the hosts (fig. 5). The eggs of *C. oscinidis* are almost cylindrical with a small projection at one end, and are white. The embryos, however are translucent and difficult to see inside the eggs. The larvae are easily distinguished from the larvae of the Braconidae because their head is flexible in relation to their body. The larvae of *C. oscinidis* are translucent and their mandibles are not conspicuously coloured (fig. 4).

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