TECHNICAL SHEET

Dacnusa-System

Leafminer infestations can occur early in the season. For a good biological pest management it is important to control the leafminer population on time. Therefore the parasitic wasp *Dacnusa sibirica* is an indispensable beneficial.

LEAFMINERS

Leafminers (*Lyriomyza spp.*) are dipterous insects, just like the common housefly. In Europe three species of Lyriomyza occur: the tomato leafminer (*Lyriomyza bryoniae*), the serpentine leafminer (*L. trifolii*) and the pea leafminer (*L. huidobrensis*). In these three species adult females measure about 2 to 3 mm. They are black with yellow, having a conspicious yellow spot on their back. Only specialists are able to distinguish the three leafminer species. Males are a little bit smaller (1.5 mm). With her barbed ovipositor, a female leafminer pierces holes in the upper surface of the leaf to extract plant sap (feeding spots). Males do not have an ovipositor, so they make use of the feeding spots made by females for their food. In such a puncture a female can also deposit an egg. Feeding spots are round and egg spots are oval. The egg hatches into a tiny fly larva (maggot), that immediately starts eating its way through the leaf. There are three larval stages. In the first stage, the larva is transparent, but later, depending on the species, it turns dirty-white to yellow-ocre (*L. trifolii*).
Just before pupation, the larva cuts a sickle shaped hole in the leaf cuticle and wiggles its way out. It usually lets itself fall off the leaf to pupate in the soil or between the folds of the plastic in case of substrate culture. Sometimes, however, the pupae stay hanging on the leaf. Depending on the species, the pupa is yellow to (reddish) brown. The development time from egg to adult depends largely on temperature. For the serpentine leafminer, it takes 12 to 14 days at 30°C (86°F) and 54 to 61 days at 15°C (59°F). The first generations at the beginning of the cropping season often come in waves. An adult female lives for 1 to 2 weeks. The number of eggs she deposits depends on the species, the host plant and on temperature. It can vary from several tens to some hundreds.
Leafminer damage occurs on many vegetables and ornamentals. In ornamental crops, the feeding spots already reduce the aesthetic value of the plant. Leafmines do not only reduce photosynthesis of the leaves, but can also cause withering or early shedding of the leaves. Finally, feeding spots can also be an entrance for all kinds of diseases.

DACNUSA SIBIRICA

The parasitic wasp *Dacnusa sibirica* occurs naturally in Europe and North-America. The adult is dark brown to black and is 2 - 3 mm long. It can be easily distinguished from *Diglyphus isaea* by its long antennae. As an adult, it differs from *Opius pallipes*, another beneficial against leafminers, only in the front wing venation.
The female deposits her egg in a leafminer larva, preferably of the 1st or 2nd instar. As the egg is laid in the larva, and not beside the host as *Diglyphus* does, *Dacnusa* is called an endoparasite. Only if there are too few hosts, *Dacnusa* may deposit more than one egg per larva (superparasitism), but eventually only one parasitic wasp develops in the leafminer larva.
The parasitised leafminer larva does not die, but keeps on feeding. The first instar of *Dacnusa* evolves in the leafminer larva. Only when the leafminer larva pupates, the *Dacnusa* larva mutates to the 2nd instar. Further

development into the 3rd instar and the pupa also takes place in the leafminer pupa. Finally not a leafminer, but an adult parasitic wasp leaves the pupa. So the different development stages are not visible without opening the leafminer larva or pupa.
The development of *Dacnusa* takes 17.5 to 19.4 days (depending on the host development stage) at 20°C (68°F). For the leafminer *L. bryoniae* it takes 26.5 days at this temperature. At lower temperatures, the parasitic wasp benefits an even more pronounced difference in development speed with the leafminer. At 25°C (77°F) an adult wasp lives for 7.4 days and deposits an average of 48 eggs, while at 15°C (59°F) this mounts up to respectively 20.2 days and 225 eggs.
Dacnusa can hibernate in leafminer pupae. In this way the wasp can occur simultaneously with its host already early in the season.
Adult parasitic wasps do not feed on hosts as *Diglyphus* does.
Dacnusa sibirica is able to locate mines at very low densities. It looks mainly low in the crop. Once it has found a mined leaf, it searches for larvae with its antennae. The wasp can distinguish parasitised from not-parasitised leafminer larvae (host discrimination).

Application

Dacnusa sibirica is used in a wide range of crops to prevent leafminer damage, both on vegetables (tomato, sweet pepper, lemon, lettuce, ...) and on ornamentals (gerbera, chrysanthemum, ...).
Dacnusa efficiently controls the tomato leafminer, the serpentine leafminer and the pea leafminer. In this regard it differs from the closely related *Opius pallipes*, of which the eggs are encapsulated by the serpentine leafminer. Therefore control of this leafminer species is poor.
Thanks to the ability to hibernate in leafminer pupae, *Dacnusa sibirica* can occur in the early season together with its host. The importance of this spontaneous parasitation differs from case to case, but is seldom sufficient for a good control.

For early detection of the first leafminers yellow catch plates (BUG SCAN) are a useful tool. Research has shown that more leafminers are caught if catch plates are placed horizontally close to the ground level than when hung vertically. At first signs of mines or feeding spots on the leaves, Biobest advises to introduce weekly Dacnusa-System (90 % *Dacnusa* + 10 % *Diglyphus*) at 0.25 wasps/m² until sufficient parasitation. As parasitation is not directly visible, one should take some pupae samples in a glass jar or bottle, and wait and see if a leafminer or a parasitic wasp comes out. By counting the number of emerged wasps and leafminers, one knows the parasitation percentage.
Later in the season or in Mediterranean climates it is recommended to release *Diglyphus isaea* only. This parasite controls leafminers better at higher infestation levels and higher temperatures.

Dacnusa-System

Biobest offers Dacnusa-System in a mixture with *Diglyphus isaea* at a ratio of 9:1. It is packed by 250 adult parasitic wasps in a tube. When introducing the wasps, remove the lid and hold the tube low in the crop to allow the adult wasps to escape. They will immediately start looking for leafminer larvae.
Dacnusa should be released in the greenhouse soon after arrival. Only if necessary, it can be stored for a short time at 6 - 10°C (42.8 - 50°F).

Benefits

- **Applicable on many crops;**
- **Parasitises the three common leafminer species;**
- **Good parasitation at low temperatures;**
- **Excellent ability to search when infestation is low.**

Biobest N.V. - Ilse Velden 18 - 2260 Westerlo (Belgium) - Tel : +32.14.25.79.80 - Fax : +32.14.25.79.82 - E-mail:info@biobest.be - www.biobest.be