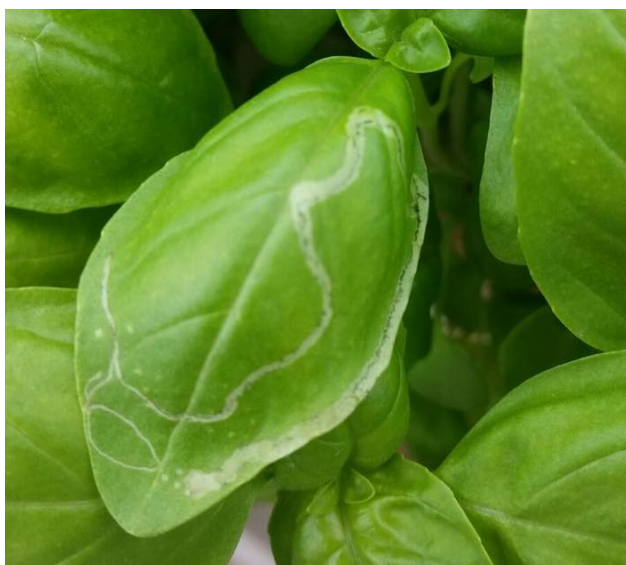


Leaf Miners of Green House Crops



Two types of immature insects cause most common leaf mining in green house crops. The insects burrow inside leaves of many crops where they are largely protected from the action of contact insecticides.

The most common insects with the widest host range, in most locations, belong to the Diptera or Flies. The small adults are similar to common Vinegar Flies with large bulging eyes. First noticed will be the leaves with tunnels which have the immature larvae that eat and burrow their way around inside the leaf. The immature larvae are small and under a low power microscope appear like small maggots inside older leaves. They pupate and adults emerge. When numbers

have been high the adults can be seen laying their eggs on the host plants. Plants affected include green house brassicas (e.g. Pak Choy), lettuce, spinach, other greens and many ornamentals. Life Cycles may occur inside the green house or the adults may arrive from outside weeds and alternate host plants. A life cycle may take about a month. Many have natural or introduced predators that include small wasps. These deposit their eggs into the larvae in the leaves. If these are present, or introduced, insecticides must be carefully selected to avoid harm to these predators. Use of insecticides is complicated since the miners develop resistance to groups of insecticides which are applied frequently. Correct choice and timing of the insecticides can assist control. This can be done by removing infested leaves with larvae, placing them in a jar covered with a cloth and observing when adults appear. Residual insecticides to kill adults can be applied at that time. If adults arrive from outside the green house this is of lesser value. Some insecticides can penetrate the leaf and kill larvae inside. (See *details below re MoA)

A larger and generally less common insect leaf miner is a moth, belonging to the Lepidoptera Order. These can be very destructive to longer term crops such as tomatoes, capsicum, chillies and eggplants and can result in crop loss if they are present. They may burrow into leaves or fruits. Inspection of the tunnelling insect will reveal a caterpillar. This pupates (forms a chrysalis) in soil/media under the plant and eventually an adult moth emerges to lay eggs on the expanded leaves and fruit. Control methods are similar to above but different groups of insecticides may be required.

Delaying and Avoiding Resistance to insecticides.

Because effective control may require repeated use of insecticides most leaf miners can rapidly develop resistance to groups of insecticides with a similar mode of action (MoA) The Insecticide Action Committee (IRAC) have published information listing groups of insecticides with similar MoA. (<http://www.ircac-online.org/modes-of-action/>) In the listings below the numbers* refer to the groups with similar MoA. Where repeated applications are required, after a period, change to an insecticide from a different group. Information on suggested numbers of applications, or periods of use on a crop, are given in the use directions on the label. If IPM suitable methods are in use select insecticides that do not harm predators.

Effective Insecticides:

All Group 1B include the most poisonous cholinesterase inhibitors (**Red Type**) but are very effective on adults and larvae inside leaves. It is suggested that, where permitted, stocks on hand are used but not replaced. All will require adequate full protective clothing and respirator hoods for use inside green houses. Observe keep out periods, as detailed on labels. Due to their toxicity using Group 1B is being phased out in most countries. Check for local restrictions.

Effective Insecticides: Diptera (Flies)

Most Toxic to use:

acephate 1B* (Orthene®, Lanate®).
Systemic/adults.

dichlorvos 1B (DDVP). Fumigant/adults, translaminar.

dimethoate 1B (Rogor®). Fumigant/Adults, systemic.

naled 1B, Fumigant, Adults, local systemic.

Effective safer less toxic products:

abamectin 6* (Avid® Verdex®) Slow acting. Translaminar action. Some IPM advantages.

alpha cypermethrin 3A (adults)
Translaminar action.

cyromazine 17 (Slow acting growth regulator) Translaminar. IPM suitable.

deltamethrin 3A Adults, local systemic

pirimicarb 3A. Systemic and fumigant-short residual life for adults

pyrethrins 3A . Adults only.

imidacloprid 4A (Confidor®, Gaucho®)
Water on one application the day before transplanting seedlings. Gives systemic control of larvae for a week or more. IPM suitable. Systemic

spinosad, spinetoram and related 5 (Success®) slow acting, translaminar. IPM suitable.

Care in Use, Toxicity.

Caution: Read the labels and observe precautions.

The **IRAC Group 1B** materials are **cholinesterase inhibitors** and are subject to limitations so exposure of persons applying and working in treated areas is avoided. Consult local restrictions.

Best to avoid use if possible. Persons routinely using these products in large areas should establish their cholinesterase levels and undergo routine testing. Seek advice from medical advisors. If in remote localities obtain an Atropine (antidote) pen and use if poisoning occurs.

Effective Insecticides: Lepidoptera.

Most Toxic to use:

acephate 1B* (Orthene®, Lanate®). Systemic/Adults, caterpillars

dichlorvos 1B (DDVP). Fumigant/Adults, translaminar, caterpillars

dimethoate 1B (Rogor®). Fumigant/Adults, systemic, caterpillars.

naled 1B, Fumigant, Adults local systemic.

Effective safer less toxic products:

BT Insecticides 11*-adults only. Repeat frequently. Use locally effective formulations.

carbaryl 1A-Adults

cartap 4C (Dartriz®) New. Systemic. IPM suitable.

deltamethrin 3A Adults, local systemic

imidacloprid 4A (Confidor®, Gaucho®)
Apply, where permitted (not NZ), as a foliar spray. IPM suitable. Systemic control where permitted.

indoxacarb 22A. (Advion®, Arilon®)
Caterpillars. New product.

pyrethrins 3A . Knock down, adults only.

spinosad, spinetoram and related. 5 (Success®) slow acting within leaf. IPM suitable, translaminar

Note: Abamectin is effective on some Lepidoptera leaf miners. See under Diptera notes (similar).

Important Note:

Some of the Pesticide listed are no longer available/permitted in some regions. The pesticides listed may have restrictions placed on their use, on crops they can be used on and other limits. Waiting periods between application and use may vary from area to area. Keep out periods may also apply. Where crops treated are for export the limitations imposed in the importing country usually apply. Please read all labels before use.

Definitions:

Cholinesterase. An enzyme that disrupts muscular control in insects and animals in general (including humans). Antidote: Atropine.

Fumigant. After application released as a gas to kill insects. (i.e. Are 'Vapour active') May also poison humans entering treated areas. Read labels for information on use precautions and keep out periods. The gas may also penetrate leaves to kill insects in and on the leaf.

Adults. Will control any adult insects following contact. Can be residual or systemic with short life on surface of plants, longer action as systemic in plants.

Residual. Leaves an active residue, generally on the plant. Materials with long residual action have little vapour activity. In relation to residues for plants, used as foods, the total residue both in and on the plants at time of sale is used in determining the 'Residue Limit' established for the pesticide and crop that must not be exceeded.

Systemic. A pesticide that can enter and be translocated in the plant. Most move up towards the growing tip. A few move, including phosphites, move in both directions. Kills insects feeding **on and within** the leaf. Contact action may be short.

Translaminar. Move across the leaf killing insects **within the leaf**. Same as **locally systemic**. Not translocated within the plant. Contact action may be short or not present.

References include:

John C. Palumbo, 2016. Leaf miner Management on Desert Vegetables, Department of Entomology, Yuma Ag Centre, University of Arizona VegIPM suitable Update, Vol. 7, No. 7 – Mar 30, 2016 University of Arizona

Eileen A. Buss, 1993 (Rev 2006) Assistant Professor, Department of Entomology and Nematology, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, USA. ENY-326 (MG006), Date first printed: October 1993. Revised: June 2006. Please visit the EDIS Website at <http://edis.ifas.ufl.edu>

Horticultural Week, Pest and disease factsheet - Leaf miners, 19 June 2014

Grower experience in NZ, gratefully acknowledged

Steve Whitta, Rarotonga for Photo of Leaf Miner on Basil.

Personal Observations.

* Insecticide Mode of Action, (MoA). See www.irc-online.org for groups and more information.

® Registered Trade names are the property of the pesticide manufacturers or suppliers concerned. They are used here solely to aid identification of common named products and no endorsement of these or non-endorsement of unlisted similar products is implied.