Mites of Floriculture Crops

Biology & Control

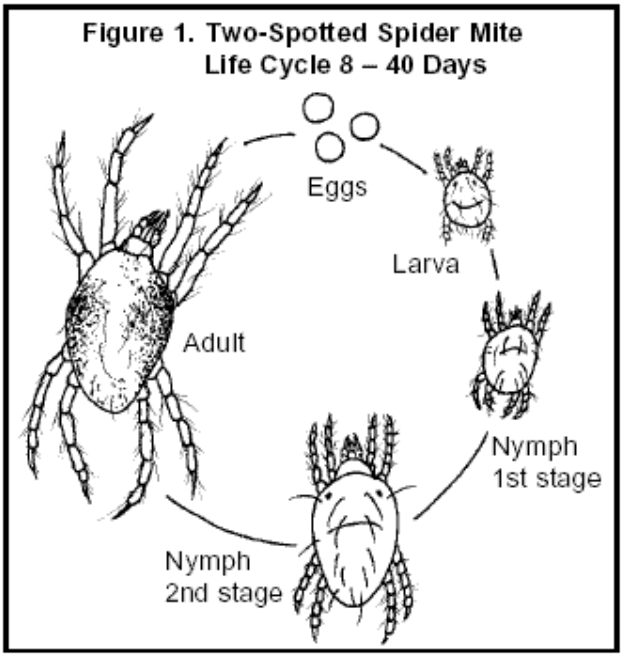
Revised October 2006

Introduction

Mites are not insects. They are arachnids, the same class as spiders. Several mites attack greenhouse and field floriculture crops. Economically important species include the two-spotted spider mite, Lewis mite, bulb mite, cyclamen mite, broad mite and false spider mites.

Two-Spotted Spider Mite

The two-spotted spider mite, *Tetranychus urticae*, is often called the "red spider mite" because of its red colour during the diapause or hibernation stage. Almost all broadleafed plants are susceptible to attack by two-spotted mites. They are known to attack over 300 plant species and thrive under greenhouse conditions. The adult reproductive stage is greenish with two dark feeding spots on the back and is about 0.5 mm long. Females lay an average of 100 eggs. The round, pearly white eggs are too small to be seen with the unaided eye. The newly hatched mites go through a larval and two nymphal stages before becoming adults. (See Figure 1.) The time from egg to adult is dependent mainly on temperature. Numbers build up quickly under hot, dry conditions when it can take as little as 8 days at temperatures of 25 to 35°C. Diapause is induced by decreasing temperatures and day length, causing the now reddish mites to seek out cracks and crevices to stay in until more favourable conditions in the spring. This stage cannot be controlled by pesticides.



Damage

Eggs are laid on the undersurfaces of leaves and all stages feed there. These mites prefer young, tender leaves where they suck out plant juices. A chlorotic spot or stipple develops at each feeding site as chloroplasts are sucked out along with the plant sap. Leaves eventually develop a stippled appearance. Severe infestations can result in leaves becoming brittle and parchment-like. Foliage can drop off and plant death may occur. As numbers build-up, mites form webs of fine silk on plant terminals leading to further aesthetic injury. There is some evidence that even low levels of mite feeding causes plant stomatal closure, resulting in decreased CO_2 uptake and reduced transpiration and photosynthesis.

Scouting

Mites won't be found in sticky traps. Their detection depends upon the regular scouting of tender, new growth and the underside of leaves. Look for stippling on the upper leaf surface as signs of mite feeding. Control efforts are more effective when applied at low infestation levels, so early detection is crucial. Be especially vigilant under hot, dry conditions that favour spider mite population explosions. A 10 power hand lens will help confirm the presence of mites on the lower leaf surfaces. A quick inspection method suitable for some plants is to place a white sheet of paper under the foliage and tap the plant. If mites are present some will drop on to the paper.

Management

Sanitation is the first step in managing mites. Weeds are common host plants, so ensure that weeds inside and adjacent to greenhouses are eliminated. New plants should be inspected for mites before placing them in greenhouses or planting them in fields. Do not have any "pet plants" inside the greenhouse. Spider mites thrive on plants that are under stress. Be sure to keep plants watered, give them adequate light and fertilize properly. Orient holes in overhead poly tubes so that plants are not under a direct blast of hot dry air by having the holes point upward. Heavily infested plants should be discarded. Bag or box plants before carrying them through the greenhouse.

Biological Control

The most successful biological control agent for two-spotted mites is the predatory mite *Phytoseiulus persimilis*. This mite is widely available from producers of biological control agents. Tropical in origin, this predator is well adapted to greenhouse conditions, but is not effective outdoors in British Columbia. Adult *P. persimilis* are shiny orange, while immature stages are a pale salmon colour. They can be distinguished from the "red" phase of the two-spotted mites by the lack of spots, the smooth pear-shaped body, and their faster movement over leaf surfaces. Each female predatory mite lays about 50 eggs. At favourable temperatures (20 to 30°C), the life cycle is about a week, twice as rapid as two-spotted spider mites. *P. persimilis* consume 5 to 50 spider mite eggs, nymphs, or adults a day.

Predatory mites are most effective at relative humidities greater than 70% and temperatures of 20 to 30°C. Very hot, bright conditions favour spider mites and can result in pest outbreaks. Ideally the plants should be in close contact, allowing the predators to move easily through the crop. They are not affected by day length and will remain on the crop as long as pest mites are present. Unlike some predacious mites, they only feed on mites and do not eat pollen. They will not survive between crops in an empty greenhouse and will disappear from the greenhouse if mites are not present on the crop.

The most successful biological control programs are based on pre-releasing predators monthly or even twice a month on the assumption that the crop is likely to become infested. Introduction rates range from 2 to 20 per plant, depending on infestation levels and the crop involved. Suppliers can recommend more precise rates after inspecting the crop. The most effective and economical introduction system is to apply *P. persimilis* at the first sign of spider mites or their feeding (stippling on leaves) at a rate of two per infested plant and to every fifth plant in the rest of the crop. Subsequently treat any "hot-spots" that develop. Releasing some predatory mites into areas outside outbreaks encourages them to disperse to look for food. At very high spider mite levels it is often advisable to apply insecticidal soap or other non-residual miticide.

For field crops, *Neoseiulus fallacis*, a predatory mite of temperate origin, is promising for two-spotted mite control but has not been fully evaluated. A naturally occurring small, black ladybug beetle, known as the spider mite destroyer (*Stethorus* spp.), is also being developed as a commercial biological mite control agent for both greenhouse and outdoor crops.

When using beneficials in a crop, it is often necessary to apply pesticides for other insects or diseases. Select chemicals that will have the least negative impact on the biological agents. (Refer to Table 1.5, page 15 in the 2004 Floriculture Production Guide.) If possible, treat only hot-spots or spray only the part of the crop that is primarily under attack, such as the upper parts of roses for aphid control.

Chemical Control

Two-spotted spider mites breed rapidly, so the potential for resistance development is high. The primary method of minimizing the development of resistant mite populations is to avoid using the same miticide for more than three consecutive sprays. Tank-mixing pesticides with different modes of action is also thought to promote resistance. Because spider mites are very small, relatively immobile, and occur mainly on leaf undersurfaces, thorough

spray coverage is essential for adequate control. Most pesticides will not kill the egg stage, so at least two applications are necessary. A spreader-sticker or wetting agent will improve the effectiveness of most miticides, particularly on waxy leafed plants. However, that may increase the possibility of phytotoxicity; do a test spray before doing any large-scale applications. Product labels have information on the use of adjuvants.

Table 1 lists currently registered products for mite control on commercial flower crops. It also lists mode of action, residual activity, and the target life cycle stage for each miticide, three factors to consider when deciding which miticide to use. Check labels for specific crop registrations and possible phytotoxicity. (Post this table in your pesticide mixing area for easy reference.)

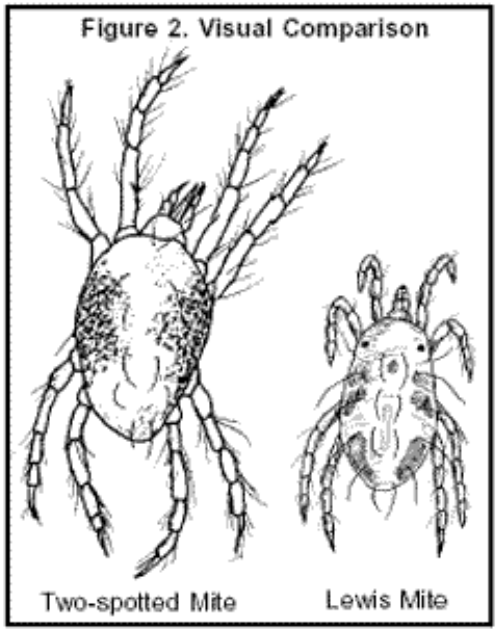
Lewis Mite

The Lewis mite, *Eotetranychus lewisi*, is primarily a pest of poinsettias in British Columbia. Lewis mites are similar in appearance to two-spotted mites, but are slightly smaller and have several small spots rather than two large spots when viewed under a microscope. (See Figure 2.) The damage they inflict on crops is similar to that of two-spotted spider mites. They feed on the undersurfaces of leaves, piercing the epidermis and removing cell contents. This results in a stippled appearance on the upper leaf surface. Eventually the entire leaf becomes bleached and falls off. Heavy infestations will produce webbing, but not as extensive as that of two-spotted spider mites. Lewis mites do not enter a diapause or hibernation stage. The developmental time from egg to adult is 12 to 14 days at 21°C. Females oviposit 2 to 3 eggs per day for about 30 days.

Lewis mite is not a common pest in British Columbia, but poinsettia growers should be vigilant for it. Plants that appear to loose colour or have bleached foliage should be closely inspected for Lewis mites. Scouting for Lewis mites is especially important if you have applied Impower 60 WP (imidacloprid) because while it controls aphids and white flies, it does not control spider mites.

Scouting, management, and control methods for Lewis mites are similar to those for two-spotted mites.

Figure 2. Visual Comparison



Bulb Mites

Bulb mites, *Rhyzoglyphus* spp., are slow moving and relatively large (0.5 to 0.9 mm long). They are pearly-white and smooth, with short reddish legs. From their origin in Europe, bulb mites have spread throughout the world presumably via shipments of infested bulbs. Bulb mites occur as large colonies, not as individuals. Females produce at least 100 eggs that are deposited near injured or decaying tissue. The time from egg to adult can be as short as 12 days at 25°C. Factors affecting development time are temperature, humidity, and host species.

Damage

Bulb mites are usually considered secondary pests of bulbs, but can be responsible for serious loses. They invade bulbs at points of mechanical injury and, once established, they spread rapidly and destroy large areas of the bulb. In addition to feeding damage, the mites provide access to fungal root pathogens, such as *Pythium*, *Rhizoctonia*, and *Fusarium*. Infested

bulbs may rot or produce stunted, distorted, or off-colour plants. Host crops include dahlia, freesia, gladiolus, hyacinth, iris, narcissus, orchid and tulip. Vegetable bulbs can also be infested.

Scouting
Bulbs with apparent physical damage or rotted spots should be examined for bulb mites. They are easily seen with a low power hand lens.

Management
Careful handling of bulbs to avoid the damage that provides access to mites is important. In storage, maintaining low relative humidities will reduce the potential for mite infestations. Steam pasteurization will eliminate bulb mites from soil.

Biological Control
A predacious mite, *Cosmolaelopss claviger*, readily feeds on bulb mites, but is not commercially available. There is evidence that *Hypoaspis* mites, predatory soil-dwelling mites sold for fungus gnat control, may feed on bulb mites, but not to the extent that control is achieved.

Chemical Control
Consult with floriculture extension staff for current recommendations.

Cyclamen Mite

The cyclamen mites, *Stenotarsonemus pallidus*, is tiny (0.13mm) and colourless. It does best at cooler temperatures and requires high humidity. Under optimal conditions, the time from egg to adult is about 10 to 14 days.

Damage
Symptoms of cyclamen mite feeding often resemble disease symptoms. Cyclamen mites feed on all parts of the plant, but young foliage is most often affected. These mites avoid light, so they feed mainly on unopened leaflets and buds, resulting in wrinkled, deformed leaves and buds that do not open or produce distorted blooms. New growth is deformed and distorted. Leaves may be thickened, strap-like, and reduced in size. As leaves unfurl they may show signs of scarring or bronzing. Favoured host plants include African violet, azalea, begonia, chrysanthemum, cyclamen, dahlia, delphinium, exacum, fuchsia, gerbera, geranium, gloxinia, kalanchoe, New Guinea impatiens and snapdragon.

Scouting
Recognition of the damage caused by these very small mites is the best way to determine the presence of an infestation. Especially characteristic are plants that have ceased blooming and have shortened internodes, distorted leaves and stems, and blasted buds. Infestations tend to be localized. Dissecting tissue under a microscope may be necessary to confirm the presence of cyclamen mites.

Management
If only a few plants are affected, the best way to deal with the problem is to discard them. Workers should be careful not to spread mites throughout the greenhouse on their hands or clothing. Cyclamen mites on nonblooming plants can be killed by immersion, pot and all, for 15 minutes in water heated to 43°C. Decreasing humidity can also reduce infestation levels.

Biological Control
No reliable biological controls have been identified for cyclamen mites, although the predatory mite *Amblyseius cucumeris* is known to feed on tarsonomid mites and may contribute to their control.

Chemical Control
Two or three applications at 5 to 7 day intervals of dicofol (Kelthane) or endosulfan (Thiodan) will control cyclamen mites. Use sufficient spray volume and pressure to thoroughly cover all surfaces of the plants. Several applications at weekly intervals are required because all stages are usually present and are generally well protected from sprays.

Broad Mites

Broad mites, *Plyphagotarsonemus latus*, are very small (0.1-0.2 mm) and colourless. Under optimal conditions the time from egg to adult is about 5 days.

Damage

Broad mites attack a wide range of commercially important plants, including gerbera, African violets, cyclamen, begonias, impatiens, verbena and gloxinia. Broad mite damage is usually expressed as distorted and downward curling leaves resulting from a toxin secreted by the feeding mites. As well, internodes and petioles of flowers become shortened, and flowers may fail to open. Severely infested plants become stunted and may die.

Scouting

Broad mites are too small to be seen with a hand lens. A microscope is needed to confirm their presence. Broad mites prefer high relative humidity and therefore hide in growing points, flower buds and overlapping surfaces of developing leaves. Although similar in appearance to cyclamen mites, broad mites can be differentiated by the whitish bumps on their eggs compared to the smooth eggs of cyclamen mites.

Management

Control of this mite is difficult. Ideally, infested plants should be identified quickly and carefully removed from the greenhouse before the mites spread. Imported cuttings should be examined to prevent introduction into a non-infested greenhouse. Growers with broad mite problems one year should be especially vigilant the next spring for the possibility of a carry-over population.

Biological Control

No reliable biological control agents have been identified for broad mites, although the predatory mite *Amblysius cucumeris* is known to feed on tarsonemid mites and may contribute to their control.

Chemical Control

Sprays applied to control spider mites will result in broad mite control. A power sprayer is necessary to achieve adequate penetration. Repeated applications at five day intervals may be required in warm weather.

False Spider Mites

False spider mites or flat mites (Family *Tenuipalpidae*) are flattened, very small, reddish, and slow moving. The main pest species are in the genus *Brevipalpus*. Adult false spider mites are about 0.3 mm long. The eggs are red, somewhat flattened, and take up to 3 weeks to hatch. The immature stages feed and develop for 5 to 6 weeks before becoming adults. The life cycle is about 5 times longer than the two-spotted mite life cycle. *Brevipalpus* species attack a wide variety of greenhouse plants, but are most commonly found on orchids.

Damage

False spider mites are not common in BC greenhouses. When present, they feed first along the midribs of leaves and then disperse outwards. They puncture the epidermis of the leaf and suck out the plant juices. This results in the leaves having first a mottled and later a silvery appearance. Under conditions of severe infestations, plant tissue turns brown and dies. Stems are also attacked. False spider mites do not produce webbing.

Biological Control

Studies have not been done to evaluate biological control agents for *Brevipalpus* mites, but it seems probable that *Phytoseiulus persimilis* would feed on them.

Chemical Control

Pesticides that control two-spotted mites will also control false spider mites. Because they feed on the undersides of the leaves, the pesticide must be directed upwards for best control.

Table 1. Miticides for Ornamental Crops

Trade Name	Active Ingredient	Registration	Type of Mite Controlled	Mode of Action	Residual Activity**	Life Cycle Stage Effective Against
Avermectins						
Avid	avermectin	greenhouse	two-spotted	contact/ translaminar	long	all stages except egg; takes 3-4 days for kill
Organophosphates						
D.D.V.P.	dichlorvos	greenhouse	two-spotted	contact	knock-down	all stages except egg
Dibrom	naled	greenhouse & field	two-spotted	contact	knock-down	all stages except egg
Lagon	dimethoate	field	all mites	systemic	moderate	all stages except egg
Malathion	malathion	greenhouse & field	two-spotted	contact	knock-down	all stages except egg
Orthene	acephate	field	spider mites	systemic/ contact	moderate	all stages except egg
Organochlorines						
Endosulfan/ Thiodan	endosulfan	greenhouse & field	cyclamen	contact	moderate	all stages except egg
Kelthane	dicofol	greenhouse & field	all mites	contact	high	adult
Pyridazinones						
Dyno-mite/ Sanmite	pyridaben	greenhouse	two-spotted	contact	moderate	larval & nymphal
	use only when adult stage is less than 15% of population; use a quick knock-down spray first					
Soaps & Oils						
Insecticidal Soap	potassium salts of fatty acids	greenhouse & field	two-spotted	contact	knock-down	all stages except egg
Other						
Vendex	fenbutatin oxide	greenhouse & field	two-spotted	contact	moderate	all stages except egg
Floramite	bifenazate	greenhouse	two-spotted, Lewis mite	contact	moderate	all stages except egg

** check label for specific crop registrations and for phytotoxicity warnings*
*** varies with crop and environmental conditions*

For further information, contact:

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Revised October 2006