

Control of Two-Spotted Mite by Predatory Mites

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INTRODUCTION

The Two-Spotted Mite (TSM)—*Tetranychus urticae*. Two-spotted mite belongs to a group of eight legged plant-eating mites. The young and older mites are pale green with two dark patches on their backs. The adults are about half a millimeter in length and are best viewed with a hand lens. Their eggs are round and pearly white. Two-spotted mites suck out the cells in the leaf, causing minute, yellowish, feeding marks which may join together causing leaves to shrivel and die. Once damage occurs, it will remain, as the leaf cannot repair itself.

Two-spotted mite is a major pest of a wide range of horticultural crops. Nurserymen can suffer serious losses due to the leaf scarring and stunted growth that these mites cause. Chemical controls have been the norm until the last few years. These are becoming less reliable as mites have developed high levels of resistance to some, and at least some resistance to most, chemicals. This process has been accelerated in recent years with the withdrawal from sale of some useful miticides and the consequent higher pressure placed on the remaining chemicals. Further, some chemicals are phytotoxic to some species, so that mite control can become a nightmare. Added to the difficulties of chemical control is the increasing dislike of using chemicals by both workers and owners. The use of the predatory mite, *Phytoseiulus persimilis*, for the control of two-spotted mite has enabled many nurserymen to escape from this "no-win" situation. This paper will outline the use of predatory mites in the nursery situation.

PREDATORY MITES

The Predatory Mite—*Phytoseiulus persimilis*. This predator has been commercially produced overseas for more than 20 years and in Australia for over 10 years. It feeds voraciously on two-spotted mite. Its effectiveness has enabled its use in a wide range of crops. These include strawberries, cut flowers, hops, pawpaws, glasshouse and field vegetables, deciduous fruits, and ornamental. It is now not uncommon for it to appear in a nursery where it has never been introduced. For all the crops mention above, the environment of the nursery is the most favorable to the predator, it thrives in warm, humid, and semi-shaded conditions.

The adult predatory mite is orange, while the young are colorless. Both are pear shaped and fast moving. The oval-shaped, orange-tinged predator eggs are much larger than mite eggs. Adult predators feed on mite eggs, young, and adults. They pierce the body and suck out the contents. Even though predators are only slightly larger than mites, an adult can destroy 20 young or 7 adults per day and at 25°C will multiply twice as fast as TSM. Predators will feed and multiply in an area until mites have been almost eliminated. They will then disperse in search of more mite colonies. Continuous foliage will therefore assist their movement through the nursery. It is worthwhile grouping mite-susceptible plants into one or several

areas. This will provide the predators with more opportunities for survival and persistence than would numerous small areas. This practice also simplifies monitoring and spraying procedures.

How to Use Predatory Mites. Small- to moderate-sized nurseries order predators as they require them, but larger nurseries are beginning to adopt the regular-release technique used by many cut flower growers. This latter method ensures that predators are always in the nursery ready to move in on new mite infestations. It also encourages the identification of mite infestations by employees and the subsequent early dosing with predators before any significant damage occurs. Either way, an initial general predator release into the mite infested areas is recommended.

Chemical Residues Toxic to Predatory Mites. Chemicals toxic to the predatory mite must have had time to disperse before predators are released. The most toxic are the synthetic pyrethroids (Mavrik[®], Ambush[®], Decis[®], Ripcord[®], etc) which may need up to 8 weeks to disperse. Folimat[®], Phosdrin[®], Orthene[®], Monocrotophos[®], Supricide[®] will need 2 weeks, and Kelthane[®] and Rogor[®] will need 1 week. Guidelines for the use of chemicals are available from predatory mite suppliers.

Inspecting the Nursery for Two-Spotted Mites. Unfortunately, many nurserymen use predators as a last resort after they have been unable to adequately control mites by chemical means. The preferred timing for the introduction of predators is before mites have caused significant damage. In this way, miticide spraying can be completely avoided. Mites must be present in low numbers or the predators will be unable to establish in the crop. If mites are easy to find, or more precisely, if 30 lower, older leaves were inspected and 3 to 5 were found to have mites (any mites at all) then predators could be introduced. Predators should be released into mite infestations soon after they are discovered in the nursery. It is therefore important, particularly in larger nurseries, that workers be taught to identify mites (and other pests) and the damage they cause.

Introducing Predatory Mites. If overhead irrigation is required, then it should be applied before introducing predators rather than soon after. Apply any necessary insecticide sprays several days before the anticipated release of predators. Likewise, if mites are beginning to cause significant damage, a predator friendly miticide should be applied to knock down the mite numbers before the introduction of predators.

Predators are despatched in packs of various sizes but the standard is the "Commercial Pack" which contains a minimum of 10,000 predators (all life stages) and is enough to treat about 200 square meters of lightly-infested plants. The predators are despatched on bean leaves. These are packed into a cardboard cylinder and sent via Australia Post Express Courier. Each cylinder contains 100+ bean stalks, each with three leaves. Gently separate the leaves and tuck them into the foliage at the level of the mite infestation. Place more bean leaves in those areas with more mites.

What to Expect. Expect predators to be hard to find for two weeks after release. Mark a few sites where bean leaves were placed and regularly check these areas to help assess the predators' development. Mite numbers will continue to increase after predator release, but predators will soon appear amongst most mite colonies

and be easily found after 3 to 4 weeks. Mite numbers will then level off and then suddenly fall to very low, if not undetectable, levels. The predators will also disappear and may move into the surrounding vegetation. This can help provide a barrier against future infestations. Reinfestations are likely from time to time. The predators may have missed a few mite eggs, so that these will gradually develop into another outbreak. Predators will often return and quell the outbreak, unnoticed by the nurseryman. But this cannot be taken for granted. Regular checks should be maintained, as, mites can move readily on the wind, come in on new plants, or be unwittingly transported by workers who have been in a mite infested area.

Environmental Factors Affecting Mite and Predator Populations. Predators thrive in warm to hot and humid conditions while TSM do best in very hot, dry conditions. Nursery conditions are normally in the most favorable range for the predator, which will therefore be able to breed much faster than the TSM. Plants close together or with dense foliage automatically provide the microclimate desirable to predators. Plants with less dense foliage or plants just after pruning have lower localized humidity levels, so these areas should be checked regularly for mites, especially during hot, dry conditions. Windbreaks or roll-down screens should be used to prevent hot dry winds from blowing through the nursery. Screening the sides of shade and plastic houses can also significantly reduce the movement of moths and grasshoppers into the nursery.

CONTROLLING OTHER PESTS

With Chemicals. Care should be taken with the use of chemicals. Predators will establish faster in an unsprayed situation than when pesticides are used. Study the chemical guidelines provided (see Table 1) and avoid the application of insecticides until at least 2 weeks after predator release. Predators are very effective and quick-acting in the nursery environment so it should not be difficult to withhold insecticides for a few weeks after predator release. Carbaryl is the safest chemical insecticide to use with predators and should be used in preference to those which are more hazardous, and especially until predators have become well established. If more "hazardous" sprays need to be applied before the predators have controlled the mites then spray penetration should be minimized. This minimisation enables the maintenance of a safe haven for predators in the lower foliage. It should be noted that in warm, humid conditions predators will recover very quickly from setbacks due to chemical sprays, while in cool or dry conditions recovery will be much slower.

If TSM reaches damaging levels after predator release, a predator-compatible miticide can be applied to reduce mite numbers. This enables the predator to catch up and eliminate the remaining mites.

Most fungicides are safe to use with the predator. There are a few notable exceptions—Mancozeb is "partly hazardous" and should not be used repeatedly. Benomyl and Morestan are "hazardous" and should not be used. By spraying only those areas that need to be sprayed, there will be minimal disruption to the resident predators and other beneficial species. In addition, this limited spraying minimises the chances of mites developing resistance to chemicals. In this way, a longer useful life will be obtained from chemicals and those such as Torque[®] and Omite[®] which are relatively safe to predators can remain a useful tool in the future.

With Beneficial Species. The chemicals recommended for use with predatory mites are also less harmful to many other beneficial species. The synthetic pyrethroid group and some of the more residual organophosphates are particularly hazardous to beneficial species. The removal of the synthetic pyrethroid group and organophosphates from the spray schedule will enable the movement of beneficial species into your nursery. Occasional use of the synthetic pyrethroid group and organophosphates may be necessary if “less toxic” means are ineffective against a specific pest.

The adoption of predators for TSM control often leads growers to reduce overall chemical inputs and to the consideration of other biological and minimum-chemical control techniques. Growers express interest in knowing more about both naturally occurring and commercially available biological control agents. To this end, some key pests and their common natural enemies are listed below.

Key Pests and Their Predators.

Aphids.

- *Aphidius colemani* (and other similar species) - parasitic wasp, about 3 mm long, lays eggs which hatch into larvae and develops to mature stage inside the aphid, forming a shell called a “mummy” in the process. Each female can sting 60 aphids. Feeds on nectar.
- *Syrphus* spp. - hover fly larvae, about 6 mm long, feed on aphids.
- *Harmonia conformis* - common spotted ladybird.
- *Coccinella repanda* - transverse ladybird, both adults and larvae feed on aphids.
- *Micromus* spp. - lacewing larvae.

Two-Spotted Mite (Tetranychus urticae) and Close Relatives.

- *Stethorus fenestralis* - small black ladybird beetle; a voracious feeder which usually does not appear until infestation is well advanced.
- *Phytoseiulus persimilis* - predatory mite, time of introduction into Australia unknown but now virtually naturalized. Adult is about 0.6 mm long, orange, pear shaped, a voracious feeder of all life stages of TSM. Commercially reared for use in wide range of crops.
- *Amblyseius* spp. - native predatory mites feed on eggs and adults.
- *Syrphus* spp. - hover fly larvae, about 6 mm long, feed on mites and eggs.
- *Micromus* spp. - lacewing larvae.
- unidentified, small fly larvae.

Lepidopteran pests.

- *Trichogramma* species - tiny egg parasites which in unsprayed situations can destroy high numbers of moth eggs. At present being commercialized.
- Various parasitic wasps which attack the larval stages.
- *Micromus* spp. - lacewing larvae feed on eggs and small larvae
- Assassin and damsel bugs are general predators which feed on moth eggs and grubs

Table 1. Chemicals for use in conjunction with predatory mites.

Chemical ¹ (Trade names only)	Targeted pest	Toxicity to predators ²	Safe to spray	
			Days before release	Days after release
Insecticides				
Dipel, Thuricide	Caterpillars	Safe anytime	0	0
Carbaryl, Bugmaster	CP, thrip, Mealybug	Safe	2	4
Pirimor	Aphids	Safe	2	14
Lorsban, Dursban	CP, Scale, Grasshoppers	Partly hazardous	6	21 see note 1
Maldison	CP, Thrip, mealybugs	Partly hazardous	7	21 see note 1
Thiodan, Endosan	CP, thrip, aphid	Partly hazardous	7	28 see note 1
Natural Pyrethrum	CP, thrip, aphid	Hazardous	3	28 see note 2
Lannate, Nudrin	CP, thrip	Hazardous	3	28 see note 2
Miticides				
Torque	Mites	Safe	2	7
Apollo	Mite eggs	Safe	2	7
Calibre	Mite eggs	Safe	2	7
Tedion	Mite eggs	Safe	2	7
Wettable sulphur	Mites	Safe	2	7
Omite	Mites	Partly hazardous	2	14
Fungicides				
Most fungicides		Safe	2	4
Mancozeb	Powdery mildew	Partly hazardous	2	1 see note 1
Benlate, Moresten	Powdery mildew	Hazardous	7	42 see note 3

¹ Check chemical registrations and phytotoxicity before spraying.

² Avoid insecticides for as long as is practical after introducing predators.

Notes:

- 1) Avoid these insecticides until predators are easy to find in mite colonies.
- 2) Lannate and natural pyrethrum although hazardous to predators break down quickly. They can be used occasionally if predators have controlled mites and prey penetration is minimized.
- 3) Benlate and Morestan should not be used.

Glasshouse White Fly.

- *Encarsia formosa* - tiny parasitic wasp which lays its egg into the whitefly scales. At present being commercialized.

Scale.

- Ladybirds - some species feed on scale.
- *Aphytis* spp. - small parasitic wasps, some species commercially available.

Mealybug.

- *Cryptolaemus montrouzieri* - predator of mealybug, very effective when mealybug populations are high. Commercially available.
- *Leptomastix dactolopyii* - wasp parasite which attacks only citrus mealybug, *Planococcus citri*, which is the most common species found in southern Queensland. Commercially available.

CONCLUSIONS

A prerequisite for the successful use of predatory mites (and other biological agents) is a commitment from the nursery manager to adhere to the recommendations for use. There must be a willingness to venture into the unknown; to change chemical spray regimes, and to find predator-compatible ways of overcoming problems. The adoption of a biological pest-control method invariably achieves the desired and very satisfying result of controlling a pest without using chemicals. As the use of predatory mites clearly has many advantages over chemical controls, it is obviously a technique that is here to stay. Further, success with predatory mites encourages growers to search for and adopt other minimum-chemical, pest-control methods.