

Mites and Miticides: What You Need to Know

Daniel Gilrein
Cornell University Cooperative Extension of Suffolk County
Long Island Horticultural Research and Extension Center
Riverhead, NY

One of the most notable developments in pest management in recent years has been the introduction of many new materials for controlling mites on ornamental plants. Until a few years ago the choices were very limited and even further aggravated by the loss of older products through the re-registration process. Most of the new active ingredients have unique modes of action and some show good compatibility with natural enemies such as mite predators. However, there is understandable confusion about selecting among the many choices and the situation will become even more complicated as new products arrive in the coming years. Expect prices to be higher or much higher than old materials, but this is offset somewhat by better residual control in some cases.

Mite Pests in Ornamentals

Spider mites

Twospotted spider mite is common on many herbaceous (foliage plants, some perennials), deciduous and occasionally evergreen (e.g. *Pieris*, *Ilex crenata*) hosts, particularly during warm, dry conditions. Spruce spider mite is the most common pest mite on conifers (*Chamaecyparis*, *Picea*, *Juniperus*, *Cryptomeria*, etc.) Southern red mite is often seen on azalea, rhododendron, hollies. Other spider mites we see include boxwood spider mite on boxwood, bamboo spider mite on bamboo, linden spider mite on linden and honeylocust spider mite on honeylocust. Lewis mite has been an occasional problem on poinsettia.

Eriophyid mites

Commonly known as rust, bud or gall mites, there are many common species on ornamentals such as maple bladder gall mite, privet rust mite, beech erineum mite, hemlock rust mite, and fuchsia gall mite as well as numerous less common or unnamed species. Eriophyid mites are usually quite host-specific and often cause strange or unusual symptoms, such as small bead-like or felt-like galls on leaves, distortion or bronzing of foliage, or death of buds. One species is becoming notorious of late as the vector of rose rosette (virus) disease. Only certain miticides control eriophyid mites and timing may be important for good efficacy.

Tarsonemid mites

Cyclamen and broad mites are becoming more common in greenhouse ornamentals, possibly related to increased use of vegetatively propagated material. Cyclamen mite overwinters outdoors in much of the northern US and broad mite is mainly an indoor pest except in warmer areas or seasons. Both mites cause similar plant symptoms, distortion and stunting of new growth, that are sometimes mistaken initially for injury due to cultural, environmental, or herbicide problems. Cyclamen mite seems to be more associated with death of terminal buds, but broad mite often also causes a severe bronzing of the undersurface of leaves (e.g. on gerbera, begonia), stems and even flowers or fruit. Broad mite can ‘hitchhike’ on feet of whiteflies to uninfested plants, so controlling whiteflies and possibly other insects may help in containing an outbreak.. Both have wide host ranges, including herbaceous and some woody ornamentals. For example, we have seen bronzing and cupping of foliage on deciduous azalea from broad mite and stunting of new growth on privet associated with cyclamen mite.

Tenuipalpid mites

Also called false spider mites or flat mites, this group includes a couple of species particular to orchids, one on conifers and others on various woody and herbaceous plants. Injury may appear as pale spotting or a gradual bronzing. The life cycle is relatively long, about 7 weeks or more.

Miticides for Nursery, Greenhouse and/or Landscape Ornamentals

Following is a list of miticide products for use in ornamental plant production or landscape maintenance situations. Be sure to check labels to be sure the target pest(s) and site (nursery, greenhouse, landscape) are listed, verify product labels and registrations in your state and follow all label directions. Always test new products on a small scale for plant safety before applying to a larger area and particularly when tank mixing. Insecticide Resistance Action Committee (IRAC) group numbers noted are used to help avoid rotating products with similar modes of action.

Hexygon 50DF

Hexygon is the Gowan Company trade name for hexythiazox, labeled for agricultural/commercial use in nurseries, greenhouses and for 'mature ornamental plantings' to control various spider mites, such as spruce, southern red and twospotted. It does not control rust (eriophyid) mites. The same formulation is also sold as Savey 50DF for use in Christmas trees and certain food crops. For production use, the re-entry interval is 12 hr. The labels carry a CAUTION signal word. Hexygon is in the carboxamide chemical class (IRAC group 10, mite growth inhibitors) and works both on contact and through ingestion but has no systemic activity. The mode of action is similar to Ovation, so the two products should not be used in rotation where miticide resistance is a concern. Although not effective on adult mites, it is ovicidal (kills eggs) and eggs laid by treated females will not be fertile. It also controls immature mites sprayed directly or exposed to treated surfaces. Hexygon is best used early in season or at early stage of infestation, since it will not act quickly to 'clean up' a serious outbreak. Results from trials at the Long Island Horticultural Research and Extension Center (LIHREC) and elsewhere generally support this, although we have had ultimately good control overall. Plants with low-level infestations and those prone to annual mite problems are good candidates for treatment or preventive application. When applying to foliage good coverage to both leaf surfaces is important. Hexygon can be mixed with most adjuvants or spreader-stickers, except not with Plyac or household detergents. A company representative indicates that combinations with an organosilicone wetting agent are particularly effective, however, we have seen damage to tender greenhouse plants from applications of some of these products. Test for compatibility before tank mixing with emulsifiable concentrates or other materials. Some sources suggest not mixing with synthetic pyrethroids (e.g. Talstar, Tempo) or other insecticides.

Sanmite 75WP

Sanmite is the Gowan trade name for pyridaben, in the pyridazinone chemical class (group 21A, METI 1). It is labeled for general use on all greenhouses and outdoor ornamentals to control European red, southern red and twospotted spider mites, tumid mite, broad mite and whiteflies. The 4-oz rate has worked well for twospotted mites on roses in trials at the LIHREC, providing control for at least 4 weeks. Incidental control of at least some kinds of rust mites, cyclamen mite and thrips may also be expected, although Sanmite is not labeled for these pests and should not be used for their control. For commercial nurseries and greenhouses, the re-entry interval (REI) is 12 hr. The label carries a WARNING signal word. The company suggests using Sanmite only once per season, mainly to reduce the risk of resistance. Like Hexygon, it is best where mite populations are still low but increasing, although for more susceptible European red mite it has been used to 'clean up' a problem infestation. Eggs are not usually killed and adult mites are not as susceptible as immature stages, which may die on contact with a treated surface. For heavy infestations, mites should be knocked down with a separate miticide spray or in a tank mix. Adult whiteflies, however, are very susceptible to Sanmite. The company claims mite and whitefly control for 3 – 6 weeks or more with one application. It works primarily by contact with some absorption into leaf tissue, although it is not systemic and coverage to both leaf surfaces is important. When mixing, the water-soluble bag should be completely dissolved before adding any spreader-sticker or other adjuvant and should not be added to sprays containing boron. Do not apply as a low-volume spray. Sanmite will suppress some beneficial mite predators and should not be used around foraging bees.

Akari 5SC

Akari by SePro is a 0.42 lb/gal suspension concentrate formulation of fenpyroximate labeled for use in greenhouses, nurseries, Christmas and non-bearing fruit and nut trees (REI 12 hours) and interiorscapes to control spider, eriophyid and tarsonemid mites. It can also be used to control mealybugs and according to one report has some incidental effects against western flower thrips at highest label rates, though not labeled for this use. Labels now include uses for greenhouse cucumber and tomato for mites and whitefly. The label carries a WARNING signal word. In the pyrazole chemical class and the same IRAC group as Sanmite (21A), it should not be used with it in rotations for resistance management reasons. Like Sanmite, it has a long residual effect against moving stages of mites. Akari has performed very well in LIHREC greenhouse trials against twospotted spider and Lewis mites, cyclamen mite and against rust mites on *Tsuga* and *Celtis*. Good coverage is important for best results.

Avid 0.15EC

Now an 'old standby' for greenhouse use, Avid can be a very effective miticide for outdoor nursery and landscape use under certain conditions. Avid is the Syngenta brand name for their formulation of abamectin, derived from fermentation of the soil microorganism *Streptomyces avermitilis*. Generic versions are now available and some products are labeled for trunk injection. For nurseries and greenhouses the re-entry interval is 12 hr. It has a WARNING signal word on the label. The active ingredient in Avid belongs to the macrocyclic lactone chemical class (IRAC group 6, chloride channel activators) and the product is labeled for control of spider, tarsonemid and eriophyid mites and leafminers on a wide variety of ornamentals, as well as suppression of thrips and aphids. Although it has been generally safe on a wide variety of plants (including open flowers), it should not be used on Shasta daisies or ferns. We have seen some bronzing of white poinsettia bracts only at the 8 oz rate. Avid is effective against adult and immature mites but is not ovicidal, working both on contact and through ingestion. Although not systemic, it is 'translaminar' and will penetrate the leaf surface of young, tender foliage to provide two to three weeks of residual control. Since mites feeding on the undersurface of treated leaves can be affected by treatment to the upper surface, coverage may not be quite as critical as with other materials. However, for best results foliage should be tender and not hardened off when Avid is applied – on apples, for example, optimum results are obtained when trees are sprayed within two weeks of petal fall. An adjuvant (such as 0.5% horticultural oil, where labeled, or non-sticker-type surfactant) may help improve penetration into the leaf surface and residual control. In one LIHREC trial Avid at 16 oz/A provided at least 3 weeks control of spruce spider mite on Douglas fir when applied in late spring (without adjuvant). At 8 oz/A there was about 1 – 2 weeks of control. Trials with 4 oz/100 gal have shown good control on spruce and twospotted spider mites as well as Lewis mite on poinsettia. Avid should not be used for suppression of aphids, whiteflies, and thrips in roses, chrysanthemums, and gerbera. Abamectin is also formulated for use by professional arborists as a trunk injection (Vivid II, Abacide, Abasol, Aracinate, Greyhound) and several 'generic' versions of Avid are now available (Timectin, Lucid Ornamental Miticie, Merlin, Abamectin SPC, etc.).

Floramite 2SC

Now marketed through OHP for use on all greenhouse, nursery and landscape ornamentals, non-bearing fruit trees, and greenhouse tomatoes, the active ingredient, bifenazate shows good selectivity against spider mites (e.g. twospotted, southern red, spruce) and compatibility with predatory mites. It carries a CAUTION label and 12-hour REI for greenhouse and nursery use. It has been very effective in several trials against twospotted and other mite species such as spruce spider mite, primarily targeting active stages (immatures and adults) but also has some ovicidal effect. A contact miticide, good coverage where mites are present is also important. It is not effective against broad, cyclamen, flat and rust (eriophyid) mites. Bifenazate belongs to the carbazate class, a new group and its mode of action is uncertain (IRAC group UN). Plant safety has been very good with this material. In several trials we have seen long-residual control, at least four weeks, on indoor potted roses infested with twospotted spider mites. EPA has classed this as a 'reduced-risk' material for use on ornamentals. Floramite is rapidly degraded in alkaline solutions, so spray water should be adjusted

to pH 5.5 – 6.5 for best results. A maximum of 2 applications per crop per year can be made. #

APPLICATIONS

Ovation SC

Now marketed by Everiss from Makhteshim, this formulation of clofentezine, in the tetrazine class, can be used on all production ornamentals including greenhouses, saran and shade houses, outdoor container and field-grown nursery stock. Current labeling does not allow use on landscape or interiorscape plants. Though chemically distinct, it is placed with Hexygon/Savey in IRAC group 10A as the mode of action is similar. The REI is 12 hours and the label bears a CAUTION signal word. To minimize the risk of developing resistant mite populations application is recommended only once per crop cycle. It has activity against immature spider mites – i.e. eggs and young stages - so works best when applied early in an infestation before many adult mites are present. Where mite numbers are high, a product with a quick knockdown should be added. It has been very effective against overwintering eggs of European red mite on apples applied around egg hatch, so may perform well against spruce spider and southern red mite eggs that also overwinter on host plants. Good coverage is important, since it works mainly through contact and has no systemic activity. Ovation provides long residual control, usually several weeks. It reportedly has only limited or no direct effect on beneficial insects and predatory mites. The formulation is a magenta color and may leave noticeable residue on light-colored flowers or foliage.

Pylon 2SC

Pylon is labeled by BASF only for greenhouse use; it has no outdoor uses. The active ingredient is chlorfenapyr, the first in the pyrrole chemical class (IRAC group 13, uncouplers of oxidative phosphorylation). The label carries a CAUTION signal word and a 12-hour re-entry interval. It has some translaminar activity and is highly effective against twospotted spider mite, but has not been quite as effective against Lewis mite on poinsettia. Pylon is also labeled for control of eriophyid (bud, rust or gall) mites, broad mite and cyclamen mite, as well as fungus gnat larvae (as a drench), caterpillars, thrips, and foliar nematodes. A greenhouse trial at the LIHREC found very good results against cyclamen mite on African violet and cabbage looper on salvia. Some plants are sensitive (dianthus, kalanchoe, poinsettia, rose, salvia, zinnia noted on label), so check the label before applying and conduct a small-scale test as with any new product or new crop before using on the entire crop. Addition of a surfactant or other tank additives is not recommended. It is also available in an aerosol formulation for greenhouse use (Pylon TR). A maximum of 2 applications are allowed before rotation.

TetraSan 5WDG

TetraSan (etoxazole) miticide by Valent represents the first entry in the new 2, 4-diphenylaxazoline derivative (or oxazoline) class (IRAC group 10B). It is labeled for controlling spider mites on ornamental plants in greenhouses, shade and lath houses, non-bearing fruit and nut trees, Christmas trees and landscape ornamentals, and on indoor tomatoes. Labels bear a CAUTION signal word and a 12-hour REI. Immature mite stages are the most susceptible, including eggs. Adult mites will not be controlled so initial activity appears slow, although eggs laid by treated mites will not be viable. In LIHREC trials we have found TetraSan to be highly effective and long-lasting against twospotted spider mites, but results were not apparent for about a week and it is best used early in an infestation. Like Avid, it has translaminar activity, penetrating into the leaf, so coverage is not quite as critical as with contact miticides. It is also relatively 'soft' on beneficial mites and insects. I am not aware of any crop sensitivity at label rates, but labels restrict against application to poinsettia after bract formation. A maximum of two applications per crop or within a six-month period (once per growing season for Christmas trees) is allowed. Do not include an adjuvant when applying to greenhouse tomatoes. An aerosol formulation, Beethoven TR, is also available for commercial greenhouse use.

Shuttle O 15SC

Acequinocyl is the active ingredient of this miticide marketed by OHP. EPA granted it 'reduced-risk' status for use on greenhouse and many outdoor field ornamentals. It is in the quinoline class of chemicals and IRAC group 20B and can be rotated with all other miticides for resistance management. It has no systemic activity and is mainly effective against mobile stages of spider mites through contact, but also to a lesser extent by ingestion. It has some effect against eggs, although less than on other stages. It is currently labeled for use against twospotted and some other spider mites; it was not effective against cyclamen mite in one Long Island study. It appears to be compatible with beneficial insects and predatory mites. Some minor sensitivity in impatiens and mini-roses has been noted, particularly at higher application rates. Do not tank mix with products containing fosetyl-Al (Aliette, etc.). Labels specify a minimum of 14 days between treatments and a maximum of 25.6 oz/A/year.

Judo 4F/Forbid 4F

This is the first of a new miticide/insecticide class, the tetrionic acids, with a unique mode of action inhibiting lipid biosynthesis. The active ingredient is spiromesifen, in IRAC group 23 (Inhibitors of acetyl CoA carboxylase). Judo, marketed by OHP, is labeled for use on greenhouse and nursery ornamentals to control spider, tarsonemid, tenuipalpid, and eriophyid mites as well as whiteflies including the difficult-to-control Q-biotype *Bemisia tabaci*. Forbid is marketed by Bayer Environmental Science for outdoor landscapes. Some phytotoxicity has been reported on impatiens, *Peperomia*, *Dracaena*, some roses, and geranium (*Pelargonium* spp) as well as others; use on ferns, English ivy, alstroemeria, Mexican heather, croton, fuchsia, *Schefflera*, *Cordyline* is not recommended. See the Judo label and Technical Bulletin at <http://www.ohp.com> for a list of sensitive plants. Labels carry a CAUTION signal word and the REI is 12 hr. Activity is reportedly faster than some growth regulators but slower than 'knock down' miticides. It is translaminar and appears to affect all stages including eggs, though is slightly less active against adults. It was noted in Bayer literature as 'slightly harmful' to predatory mites, but non-toxic at tested levels to honeybees and ladybeetles. Judo can be applied up to 3 times per season.

Ultiflora EC

This miticide/insecticide from Gowan Co. can be used on outdoor field-grown ornamentals, non-bearing fruit and nut trees and vines for control of spider mites. The label bears a CAUTION signal word, although it is a federally restricted-use pesticide. The REI is 12 hr. It is toxic to bees exposed to direct treatment or residues. The formulation contains 0.0775 lb milbemectin per gallon, described as a "mixture of natural endotoxins derived from soil microorganisms" according to Gowan literature. It is in the same macrocyclic lactone chemical class as Avid and with a similar mode of action (IRAC group 6), although the company reports it has shown good results even in areas where resistance to Avid is suspected and it has ovicidal activity. Unlike Avid, it somewhat less effective at label rates against cyclamen, broad and eriophyid mites and dipterous (fly) leafminers, although it has been effective against spotted tentiform leafminer (a small moth). It has been very effective in Long Island and other trials against twospotted spider mites. The company warns against mixing with spray oils before testing for plant sensitivity. Allow at least 3 days between applications on most crops and a maximum of 128 fl oz per acre per year.

Magus/Magister 1.6SC

These products from Gowan Co. contain the active ingredient fenazaquin in the quinazoline chemical class (IRAC group 21A) with a similar mode of action to Akari, Sanmite, and Engulf. Labels include uses for spider, broad, flat and eriophyid mites as well as a few other pests such as scales and whiteflies. Magus is labeled for use in greenhouse, shadehouse, Christmas trees and other field-grown ornamentals, ornamental landscape plantings, and on non-bearing tree fruit and nuts. Magister labels include only for mites in Christmas trees and non-bearing fruit and nuts. It may benefit from including a penetrating surfactant in the tank; see label. The spray is highly toxic to bees exposed to direct application and should not be applied to roses. The REI is 12 hours. One application per crop is permitted.

Kontos 2SC

A formulation of spirotetramat, the active ingredient is a tetramic acid derivative in the ketoenol chemical class, IRAC group 23, with a mode of action similar to Judo and Forbid. Kontos is marketed by OHP for use in greenhouses, nurseries and landscapes on ornamentals and vegetable transplants and for non-bearing fruit and nut trees as a foliar spray or drench application. It has unique systemic quality, able to translocate downwards from a foliar application and is one of the few truly systemic miticides available. It acts mainly by ingestion. We have had very good control of spider and broad mites from a drench application but efficacy may be impacted by plant size, type, infestation level, and application timing. Eriophyid mites are also labeled, as well as other pests such as whiteflies and mealybugs. Honeybees may be indirectly impacted by residues in pollen and nectar. It is not recommended for use on geraniums (*Pelargonium* spp.), orchids, hoyo, dracaena, cordyline, schefflera, neanthebella palm, and ferns and no more than one application per season to hydrangea, *Impatiens* spp., crotons (*Codiaeum* spp.), fuschia hybrids, petunia, peperomia, stock, or cyclamen. Maximum 25 fl oz/A/season (5 fl oz to veg. transplants) can be applied. REI is 24 hr (0 for drench).

Coming Soon

Engulf 3EC

This tebufenpyrad formulation from Cleary/NuFarm recently received federal registration and will initially be labeled for use on greenhouse non-food crops with a 12-hr REI. In the pyrazole chemical class, it shares the same IRAC group (21A) with Akari, Sanmite and Magus. Despite having similar modes of action at least one report found strong variation in levels of resistance among these materials in one resistant twospotted spider mite strain. It is quickly active against all motile forms of mites and is relatively non-toxic to at least some mite predators. It is translaminar though labels note mainly contact activity; Cleary claims residual activity up to 3 weeks. It should not be applied as a smoke or aerosol. There are a few sensitive plants, including begonia, geranium, impatiens, New Guinea impatiens, poinsettia, hybrid tea roses, and salvia. Labels included uses on spider mites, tarsonemid mites, and several aphids with suppression of other listed pests. We have seen very good control of twospotted spider mite in one Long Island trial. A maximum of 2 sequential applications can be used before rotating to another material.

Sultan SC

Coming soon, this cyflumetofen miticide from BASF, the first here in the benzoylacetone nitrile class (group 25, METI II), has been very effective in LIHREC trials for twospotted and spruce spider mite and may also include uses for false spider mites. Expect it to be labeled in production nurseries, greenhouses, outdoor landscapes, interiorscapes, and forest and conifer nurseries and plantations. It is active against all stages of mites including eggs. Company literature suggests the product is tolerant to washoff after drying, though application should be avoided before a heavy rainfall. Residual control for 2 – 3 weeks is claimed. It is ‘practically non-toxic’ to bees and compatible with predatory mites.

Other Miticides

Some older miticides are still available and widely used. Pyrethroid insecticides (group 3) are also used for spider mites and include products containing bifenthrin (Talstar, Bifenthrin, Menace, others), fenpropathrin (Tame), cyhalothrin (Scimitar), and fluvalinate (Mavrik). These products tend to be very hard on natural enemies but remain somewhat popular in professional landscaping due to the broad spectrum of uses. Watch for possible resurgence of spider mites following use or include a specific miticide. Horticultural oils such as SuffOil-X, PureSpray, Damoil, Sunspray Ultra-Fine (petroleum-based) and Triact 70 (neem oil) continue to be widely used and present little or no risk of resistant populations developing. The same is true for insecticidal soap (M-Pede, e.g.). With good coverage these materials can be effective for controlling mites, however some plants show sensitivity, they can’t be used during periods of drought stress, and they provide

no appreciable residual control. Oils are usually labeled for dormant-stage use to control overwintering stages and some labels allow for growing-season uses. Where mite populations are extremely high they can be a useful part of an urgent control plan and for the most part are organic-compatible. Other older miticides still in use include Vendex, a formulation of fenbutatin-oxide, relatively easy on predator mites that can be used in greenhouses, nurseries and landscapes. Note labels carry a 'DANGER signal word and a 48-hr REI; and mention minor sensitivity in some plants. Sevin (carbaryl) is still an effective and inexpensive material for eriophyid mite control providing coverage is very thorough. It is not effective against spider mites and use can lead to flaring of twospotted spider mite infestations on some plants. Avoid use on blooming plants or drift to blooming weeds. Dimethoate is among the few systemic miticides for use on ornamental plants. Formerly known as Cygon, it can be used outdoors to control mites on certain labeled plants in nurseries and Christmas trees – there are no landscape uses. Some plants are sensitive and the REI ranges from 48 hr to 14 days.

IRAC – Insecticide Resistance Action Committee. Poster with mode-of-action groups and active ingredients at: <http://www.irac-online.org/documents/moa-structures-poster-english/?ext=pdf>