When mites make right

How to control spider mites in the nursery biologically by using predatory mites

These *Skimmea* leaves show the difference predatory mites can make. The leaves on the right come from a plant treated with predatory mites, while the leaves on the left were left untreated and suffered mite damage as a result.

By Robin Rosetta

Do you want a reliable worker who can maintain your plant quality while reducing the use of chemicals? One that's willing to work long hours and has many years of experience in Oregon nurseries?

One of the best candidates for the position is versatile, native to the Northwest, and pear-shaped. It also has eight legs and stands about a quarter micron tall.

Predatory mites are tiny little animals whose appetite for spider mites makes them a great tool for suppressing and managing mite outbreaks. Growers in Oregon have been using predatory mites for control of spider mites in field and container nurseries since the mid-1990s, and have found them both affordable and efficacious.

Spider mites are an ideal pest to manage with biological control. They are commonly occurring, with a short life cycle and many generations. This allows damaging populations to build quickly. To control them, it often takes multiple

42 ▶

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applications of miticides. This is costly, and can also lead to pesticide resistance.

What's more, spider mites often reside in difficult-to-spray locations, usually on the leaf underside or deep within the plant canopy.

Predatory mites reduce or eliminate the need for miticides. Mites don't subject workers to chemical exposure, and they don't require re-entry intervals for workers. Predatory mites don't cause phytoxicity, and they can eliminate spider mites before any plant damage occurs.

The mites can disperse on their own, reaching under the leaves and into tight spaces. They can increase their populations over time, and they can overwinter in nurseries, providing pest control perhaps for seasons to come.

Predator selection

The types of predatory mites most commonly used in biological control of spider mites are in the family Phytoseiidae. There are many different species commercially available. Some Phytoseiid mites are specialists, such as *Phytoseiulus persimilis*, which feeds exclusively on spider mites. Others, such as *Amblyseius (Neoseiulus) fallacis*, are adaptable feeders, utilizing alternative prey, even pollen.

Both types have their benefits. *P. persimilis* can increase its population rapidly in response to surging spider mite populations, but is susceptible to population crashes as its food source becomes scarce. *A. fallacis* does not control high spider mite populations, but does well at low spider mite levels, and survives on alternate food. Growers can use it early in a crop cycle to suppress mite outbreaks.

Given these and other attributes, research in Oregon has shown *A. fallacis* to be one of the best species for managing mites in nurseries. It is native to the region and can overwinter. It has controlled a range of spider mites in Northwest nurseries, including bamboo spider mite, citrus red mite, southern red mite, and two-spotted spider mite.

44 ▶

DIGGER Marketplace

Although there has been some success establishing *A. fallacis* on conifer crops targeting spruce spider mite, consistent, acceptable suppression of this pest has been elusive. *A. fallacis* will eat cyclamen mites based on research on strawberry plants and will also feed on eriophyid mites such as the tomato russet mite.

Growers in other regions or in specific sites might benefit from other Phytoseiid species. Adapted to hotter, drier conditions are *Galendromus occidentalis*, the western predatory mite, and *N. californicus*. One greenhouse cut flower rose grower in the Pacific Northwest uses both *A. californicus* and *P. persimilis* on the same crop, using the former to suppress outbreaks and the latter, to work on hot spots. *Amblyseius andersoni* is popular in Europe, where it is available in slow release sachets embedded in long ribbons easily applied to crops.

Life cycle

A. fallacis naturally occurs in many agricultural fields. They overwinter in dead leaves, on stems, and on green foliage. Research on overwintering by Dr. Paul Pratt and Brian Croft at OSU found that *A. fallacis* was most abundant on conifers; intermediate on evergreen shrubs; and minimal on herbaceous perennials, deciduous shrubs, and shade trees. Covering plants with protective plastic negatively affected overwintering survival.

The lower temperature threshold of *A. fallacis* is near 50°F (10°C). At 70°F (21°C), A. fallacis eggs hatch in two days, and adults develop in seven days. At cooler temperatures (55°F) adults develop more slowly, in 16 days. The female predatory mite produces about 30-60 mites, about the same as spider mites. *A. fallacis* prefers humid environments, such as under a dense plant canopy.

Around October in the Pacific Northwest, females enter diapause in response to short days (day length at 14 hours or shorter). A time of hibernation, they suspend activity and move into overwintering sites. Indoors, diapause may not occur if temperatures remain 18 degrees C (64 degrees F) or above.

Sampling

Monitoring for spider mites in the early season is critical. Those using predatory mites want to catch spider mite activity early in the season. This extra vigilance allows growers to act before the pests can breed and cause damage.

Use a 10X or stronger hand lens to look at the leaf underside, particularly on older leaves or on plants with prior infestations. It is useful to note the presence of the round spider mite eggs (seeds of the future) and also to distinguish the oval eggs of the predatory mites (a sign they are reproducing). Sampling should occur more frequently with warmer temperatures. Bi-weekly or weekly sampling is recommended once mite activity resumes in the spring, shifting to weekly once temperatures are warm.

Many growers skip actual counting of spider mites. Instead they monitor regularly and act promptly at first sight (presence/absence sampling) of spider mite activity. They order their mites and make releases immediately upon arrival of the predators. This reduces some of the labor required for monitoring but also ensures availability of prey for the newly released predators.

Release guidelines

Several factors should be considered when determining the number to release. More rapid control can be expected with relatively high (innundative) release rates (7000–10,000 predators per acre) but another strategy is low (inoculative) release rates from 1,500–4,000 predators per acre. Release rates as low as 1,400 predators per acre have been used in apple tree nursery stoolbeds. This allows the predators to build up and disperse over time.

This approach is more affordable, but also requires releasing the predators at lower spider mite populations. The actual release rate depends on the density of two-spotted mites, the density of foliage in the block, the time of year and temperatures, the period of time

46 ▶

allowable before control is desired, and prior use of the mites (slow build up of resident predators over time). A mite release calculator developed for strawberries allows growers to explore different release rates, dates, and other factors that affect control (see Resources).

Based on OSU research trials in a variety of ornamental production systems beginning in 1995, the best cropping situations for successful releases were deciduous and evergreen shrubs and herbaceous plants. In particular, a continuous canopy seemed to aid dispersal. This is because one of the main ways mites disperse is by wind.

Should predators blow onto a nearby plant, the landing spots provided by the leaf canopy aids establishment. When mites land on soil or gravel, they usually will not survive.

Less successful were trial releases with tall vertical growing plants with little foliar canopy such as shade trees. In that situation, limited humidity may be a factor and as well as reduced dispersal success.

If beginning spider mite populations are high, a knock-down spray with a compatible miticide prior to predator releases may be necessary to reduce the spider mites to a manageable level for the predatory mites.

Obtaining and handling predators

There are several insectaries that raise *A. fallacis*. Quality control has improved over time, but it is still important to inspect the shipment with a hand lens. Look for live versus dead mites, and size of the predators sent (adult mites and larger females). Most insectaries will stand by their product and work with the customer if a shipment is not satisfactory.

Predator mites will not survive storage well, and should be released as soon as possible (refrigerate only for a short time, at around 50 degrees F). It is best to avoid high temperatures when making releases (try early morning or in the evening). In general, space release sites evenly throughout the field, especially towards the upwind side and wherever spider mite densities are highest.

If possible, scout the field and flag spider mite hot spots just before releases.

Predators will build up slightly faster wherever spider mite eggs are abundant. Predators will move more quickly wherever spider mites are sparse. Release sites with more restricted air flow benefit from more release points as dispersal of the mites is slower without wind movement.

Follow up releases with regular monitoring. Be patient. It may take several weeks to find released predators after inoculative releases. Flag release sites to track the predators' dispersal.

Pre-planning and communication at the nursery site is essential for success of the program. Decide where you will order predators prior to needing them, and check on availability.

Post signs to highlight release areas so employees know not to spray incompatible pesticides. Have contingency plans for compatible pesticides should another pest show up. Start small with a new program. Expand with success.

Many original cooperators in the predatory mite research trials have continued using them to this day. They have found the program affordable and effective, often seeing increases in plant quality while reducing or eliminating use of pesticides and re-entry restrictions.

Sometimes, a little mite makes right.

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RESOURCES:

Guides

Applied Bionomics Technical Manual: http://www.appliedbio-nomics.com/technical-manual.html

L.S. Osborne, L. E. Ehler, and J. R. Nechols . 1999. *Biological Control of the Twospotted Spider Mite in Greenhouses*: http://www.mrec.ifas.ufl.edu/lso/SpMite/b853a1.htm

Pratt, P. Croft, B. and J. DeAngelis. 1999. *Biological Control of Spider Mites in Ornamental Nurseries*: http://www.ent.orst.edu/prattp/introduction.html

Pratt, P. and Croft, B. 1999. *Biocontrol of Spider Mites by* Neoseiulus fallacis *in Ornamental Plants that Represent a Range of Morphological Types*: http://www.ent.orst.edu/prattp/plant.html

Pratt, P.D., R. L. Rosetta, and B.A. Croft. 2002. *Plant-Related Factors Influence the Effectiveness of* Neoseiulus fallacies *(Acari: Phytoseiidae), a Biological Control Agent of Spider Mites on Landscape Ornamental Plants*: http://www.ars.usda.gov/SP2UserFiles/person/11988/Prattdocs/Pratt%20et%20al%202002%20plant%20factors.pdf

Coop, L., R. Rosetta, and Brian Croft. 1997. *Release Calculator and Guidelines for using* Neoseiulus fallacis *to Control Two-Spotted Spider Mites in Strawberry*: http://uspest.org/ipm/mcalc.html

Mite Calculator: http://uspest.org/ipm/mitecalc.html

Chemical compatibility

Pratt, P. and B. Croft. 1999. *Compatibility of the Predatory Mite* Neoseiulus fallacis *with Pesticides Registered for Use in Ornamental Nurseries*: http://www.ent.orst.edu/prattp/pesticides.html

Koppert Side Effects website: http://side-effects.koppert.nl/

Suppliers

The Association of Natural Biocontrol Producers: http://www.anbp.org/

Bugwood Wiki: Spider mite predatory mites as a Biological Control: http://wiki.bugwood.org/Spider_mite_predatory_mites

Suppliers of Beneficial Insects in North America: http://www.cdpr.ca.gov/docs/pestmgt/ipminov/bensuppl.htm