

# Mites on Cultivated Orchids

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Yellow speckles or browning of leaves on your orchids? Webbing of silk on various plant parts and no spiders to be seen? Consider mites as possible culprits. Mites are tiny creatures related to spiders and ticks, and are not insects. Plant-feeding mites can be thought of as plant parasites and are often amongst the most serious pests of cultivated orchids. Common orchid cultural conditions in homes and hobby greenhouses can favor mites, and the use of pesticides removes natural predators and allows development of resistant populations.

## Sources and Identification



Mite species that are pests on cultivated orchids generally fall into two main categories, spider mites, and flat mites. The latter are also called false spider mites, but the name flat mite is preferred as it is accurately descriptive and avoids confusion with spider mites. There are other pest species of mites, but they are generally of less importance.

The most common spider mite recognized as a persistent pest of orchids is the common two-spotted spider mite (*Tetranychus urticae*), but the carmine spider mite (*Tetranychus cinnabarinus*) may be an unrecognized pest species in North America. The spider mites are a yellowish-green and usually with two large dark areas on either side of the body at about midlength. They are active species that is easily seen wandering the plants. Spider mites received their name because of the silk webbing that they produce, not because they may appear like small spiders. The two-spotted is also known by other common names, including the “red spider mite” because of an orange-red over-wintering form. However, it is possible that in some cases the red form of the two-spotted may actually be the carmine spider mite. Both species are global, feed on many kinds of plants (polyphagous), and are easily transported on many kinds of plants.

Flat mites recognized as pests on orchids are the orchid mite (*Tenuipalpus orchidarum*), the phalaenopsis mite (*Tenuipalpus pacificus*) and the oncidium mite (*Brevipalpus oncidii*). *Tenuipalpus orchidifilo* was described recently and was reported as a pest of

*Arundina graminifolia* in Brazil, but there are apparently no reports of this species elsewhere. Three other species are recorded from orchids, *Brevipalpus phoenicis* (red and black mite), *B. californicus* (omnivorous mite), and *B. russulus*, but these reports are not verified and may represent misidentifications. Flat mites are native to tropical and subtropical habitats and hosts, and are moved globally by the plant trade. There are probably more species on orchids, but the taxonomy of tenuipalpid mites is poor as is accurate information about their occurrence on orchids. Flat mites are smaller than two-spotted spider mites, difficult to see without magnification, and move very slowly.



Other mites frequently found associated with orchid culture include predatory mites that feed upon pest mites. There are many innocuous mite species that feed on fungi, bacteria, and decaying organic materials. There are also a number of beneficial mites that are predators on plant-feeding mites, insect pests, and other critters. Oribatid mites that look like tiny round, dark-colored beetles feed on fungi on plant parts and decaying organic materials. A large diversity of yellowish to light brown mites are frequent in potting media and may occasionally be found on plants. These are usually large, >1.0 mm in length and easily seen.



The two-spotted spider mite is probably the most important mite pest of cultivated orchids in all areas, but flat mites are very common and are often not diagnosed properly. Both two-spotted and flat mites can become problems in greenhouses and homes. Because of the small size of these mites, and great similarity among related species, their accurate identification is difficult and often requires the help of an experienced entomologist with a high quality microscope. In general, two-spotted's and flat's are small sized, with two-spotted's reaching a grand 0.5 mm in length and flat's reaching a mere 0.3 mm in length. All of these mites are pale yellowish-green to

orange-red color and often with two or more black areas visible through their integument. All bear conspicuous pale hairs. Two-spotted spider mites spin networks of silk webbing that protects their colonies from predators and helps maintain high humidity near the leaf surface. This webbing is also protective against pesticide sprays. Flat mites do not spin this webbing.

Typically, mites are always present in low numbers. This makes managing cultural conditions important for mite control. Mites will readily move between plants, float on air currents, be introduced on new plants or those brought indoors from the garden, and the eggs or resting stages may be in potting media. Colonization of your plants by mites

can be done at any time, but severe problems may not show themselves until favorable environmental conditions are present. In the home and hobby greenhouse spider mites will readily move to orchids from other plants.

### **Damage**

All of these mites may be found on a wide variety of orchids. In addition, the two-spotted spider mite is known to feed on hundreds of different plant species. The larvae, nymphs, and the adults all feed by puncturing cell walls and sucking cell contents, particularly chloroplasts. The killing of individual cells or groups of cells produces the transparent, yellow, or tan patchwork of damage that indicates mite infestation. Feeding may be done on many plant tissues, but mostly on leaves and buds and can cause these to drop prematurely. Heavy feeding produces a patchy chlorotic appearance to leaves, and portions of or the entire leaf may turn dry and brown. This damage generally reduces the vigor of plants and may kill plants. Mites may also transmit certain viruses.



Flat mites often feed on the upper surfaces of leaves and this will create a pock-marked appearance from empty and collapsed leaf cells. This type of damage is particularly easy to see on infested *Phalaenopsis* leaves. Flat mite feeding on thin leaves, especially the underside, is similar to the stippling caused by spider mites, but there is no webbing. Mite damage is permanent, so it is best to manage mites at low populations than to experience heavy infestations. Thin or soft-leaved orchids are more susceptible to mite damage than those with thicker leaves, but no species or variety is immune.

### **Life Cycle**

Both two-spotted spider mites and flat mites have five life stages: egg, larva, protonymph and deutonymph (or nymphs), and adult. The larva has only six legs, but the nymphs and adults have eight legs. Eggs are laid by females on the surface of plant structures and are often hidden in crevices. Eggs and larvae are very tiny and are nearly impossible to discern without magnification. A good hand lens is useful for seeing even the adults.

Developmental rates of mites are dependent upon temperature. In general, the higher the temperature the shorter the life cycle. The egg may take upwards of three weeks to hatch for flat mites, but only 1-2 days for two-spotted spider mites, at standard indoor temperatures. While larval and nymphal stages usually take 5-6 weeks to reach adulthood for flat mites, it may take only 1-3 weeks for two-spotted spider mites. Optimum temperatures for development are 30-32°C (86-90°F). Both kinds of mites will have many generations per year under favorable conditions. While flat mites may take 6-9 weeks to complete a generation, the two-spotted spider mite can complete a generation in as little as 5 days in optimum conditions. Like other orchid pests the overlapping of generations creates a significant mite management problem.

### **Management and Control**

Pesty mites tend to increase in numbers during “rain-less” periods due to the lack of rain, fog-drip or other sources of free water on plants. It is the physical presence and force of impact of water that help keep plant-feeding mite populations low. Spider and flat mites require high relative humidity and occupy a thin static air layer next to plant integument.

Under `normal' conditions the mites are widely dispersed on and among plants. In dry conditions, the mites concentrate in the most protected areas in the static air layer next to the plant and between hairs. Further, the silk spun by spider mites acts as a tent to deflect air flow and hold humidity close to the plant. Low humidity and lack of free moisture is also bad for predatory mites and insects, important natural control factors for spider and flat mites. In-doors and in greenhouses, spider and flat mites become serious problems during the winter under the combination of reduced overhead watering and absence of predators, and use of insecticides. In the home, typical gentle misting methods simply are not effective on mites when dry air is circulating from furnaces and heaters. Overall, it is a rather delicate balance between high relative humidity, free moisture, a dry air source, breeziness, temperature, and the presence of predators that keeps mites well managed.

Two-spotted spider mites and flat mites are small and relatively delicate creatures. The easiest method for keeping mites under control is to regularly spray, or syringe, the plants with water. In the home placing your plants in a shower or using a sink sprayer is very effective. Mites are readily washed from the plants or are damaged by a heavy spray. In a greenhouse regular spraying and misting is effective.

Biological control of mites is feasible even in small hobby greenhouses. Numerous predatory insects attack mites, including lacewings, ladybeetles, and wasps. The use of predatory mites is particularly successful in greenhouses. Most of the predator mites that are sold by suppliers are from several genera. *Phytoseiulus persimilis* is a commonly used and readily available species. Of course, the use of insecticides and miticides when biological control agents are active is self-defeating, and mite problems can be exacerbated by use of general insecticides.

### **Rubbing Alcohol**

Light infestations restricted to one or a few plants can usually be treated with household products. When possible, immediately isolate infested plants from others to prevent the mites from moving amongst them. Probably the most popular home remedy is to spray plants with a mixture of isopropyl (rubbing) alcohol and liquid mild dish detergent, such as Ivory. Do not use other alcohols, such as ethanol or methanol, as these will penetrate the plant tissues and cause considerable damage! The concentration of the isopropyl seems to make little difference, the common 70% concentration available in stores is satisfactory. Alcohol treatment is effective against all the life stages of mites, except eggs.

A potential problem with alcohol treatment is the rapid evaporation of alcohol causing cooling of plant tissues. Especially with air movement that increases evaporative cooling, this chilling may over-cool tissues and create zones of dead cells that can become necrotic with bacterial or fungal infection. On warm days or in a breeze consider blotting residual alcohol with a tissue instead of permitting it to evaporate off the

plant. Alcohol and detergent solutions can also damage delicate buds and blooms, so caution is urged for prized plants.

Repotting is not very effective against mites. However, with an extreme infestation it may be worth repotting a plant as eggs and resting adults may be in the growing media.

Horticultural oil, neem oil, mineral oil, and insecticidal soaps are readily available, inexpensive, and effective against mites. Oil solutions smother the mites so a complete coverage of all sprayed plants is essential. These oils are mixed with water and usually a plant-safe detergent or commercial spreader-sticker should be used for enhancing the effectiveness of the oil. The main caution with these oil solutions is that they should never be applied to plants on hot days (>85°F/29°C) or in direct sunlight, as to prevent burning of tissues. Leave the plant in shade until the application has dried. Some plants or parts, such as buds and blooms, are sensitive to oils so due care and consideration is urged.

Insecticidal soaps are usually solutions of a synthetic pyrethrin and potassium salts of fatty acids, otherwise known as soaps. Pyrethrins are synthetic analogs of pyrethrum, the natural extract from certain Asteraceae, particularly certain species of *Chrysanthemum*. Caution is urged with so-called “safe” insecticidal soaps as some plants are sensitive, particularly tender new tissues. Piperonyl butoxide is a common enhancer of pyrethrins but can cause allergies in some people and may affect plants, too. Some non-orchid ornamentals will drop leaves and abort flowers when sprayed with insecticidal soaps, so again caution is urged with prized orchids.

Because the life cycle of mites is so short and there are overlapping of generations, to bring a serious problem under control you may need to do treatments every 1-3 weeks. The time period between control efforts will depend upon the growing conditions, especially temperature: greater frequency in a warm greenhouse, less inside a house. As with any pest, persistence is a key to success and correlating the control method to the mite species is important for effective management. Cultural conditions are a key to managing mite populations.

### **Insecticides and Acaricides**

Persistent populations of mite or infestation in many plants usually demand the need for synthetic pesticides. Mites are unrelated to insects and most common insecticides are not effective against mites. Pesticides designed for mite control are called miticides or acaricides. There are few miticides specifically registered for use on orchids, but there are many miticides for ornamental plants in general and several are available as inexpensive home-and-garden solutions. Miticide formulations not labeled for ornamental plants are often mixed with solvents that aide in the application of the active ingredient for specific purposes. These solvents, not necessarily the miticide itself, often produce phytotoxicity and may seriously damage or kill plants. Thus, never use any chemical that is not specifically labeled for ornamental plants.

Common insecticides are not effective against mites, though some do have some weak suppressive action, but will kill mite predators. Acephate (Orthene), malathion, and disulfoton (Di-syston) are labeled for mites but are not very effective. Resistance by mites to pesticides is a serious problem and is in part due to the excessive use and weak action from common insecticides. Dimethoate, diazinon, and chlorpyrifos were recently removed from the market in the U.S. for non-commercial applications due to excessive and careless use causing some serious health and environmental problems.

There are many miticides available for ornamental plants, but some are not tested on orchids, and others are generally too expensive or otherwise not readily available for the small-collection grower. Effective miticides for ornamental use include avermectin (Avid), bifenthrin (Talstar), dinofenothol (Pentac), fenbutatin-oxide (Vendex), and fluvalinate (Mavrik). Fenbutatin-oxide is mixed with acephate and sold in home-and-garden formulations. Avermectin is probably the least toxic of these chemicals to people and pets.

Of course, always follow label directions and never exceed the minimum recommended concentration given in mixing directions! Recommended solutions are based on extensive testing for selected pests and plants. Orchids are sensitive to many chemicals, particularly under direct sunlight or high heat, and while certain species may not react to a given formulation others may, so your own testing on plants before general application is recommended.

Home orchid keepers that need to apply miticides during inclement weather need special care for applications. If you cannot spray out of doors, place your plant(s) inside a large plastic bag (remove the bag after the spray has settled!) and let the plant ventilate where the fumes will not be wafted around the house or work area.

#### **Final Considerations**

Heavy infestations of mites, especially on many plants may require extensive control methods. Since the damage done by mites is permanent, constant management of the population more effective than control of a major infestation. On the extreme side if you have a plant showing signs of severe change or general decline from mites you may have to seriously consider destroying that plant, as the likelihood of rejuvenating that plant may not justify the expense and effort of continued treatments. Too, destruction of a sick plant can be used to justify the purchase of a new and healthier plant!

If you are battling mites for long periods of time (e.g., >2 months) and have been using the same miticide then you likely developed a resistant population of mites. Remember the short generation times of mites. The best resolution to this is to change methods and chemicals frequently; that is do not use the same chemical mix more than 3-4 times sequentially. After isolating infested plants give them a thorough application of something different from what you have been using. Resistance is not a problem with alcohol, oils, and soaps as these suffocate or dessicate the mites.

Generally, never use a miticide not labeled for ornamental plants. Be thorough.

Prophylactic use of miticides is tempting but does little good as it is a waste of chemical and money, and allows resistant mites to develop.

Orchid growers with an entomological penchant and desiring detailed information are referred to the excellent book *Mites of Greenhouses: identification, biology and control*, by Zhi-Qiang Zhang (2003), CABI Publishing, Oxon (UK) and Cambridge (USA), ISBN 0 85199 590 X.

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