MITES

Lance S. Osborne (University of Florida), Ronald D. Oetting (University of Georgia) and Juang-Horng Chong (Clemson University)

Description and Biology

There are four major groups of mites that attack ornamental plants. They are the spider mites, the false spider or flat mites, the tarsonemid mites, and the gall or eriophyid mites. Mites are not insects, but more closely related to spiders and ticks. After hatching from the egg, the first immature stage (larva) has three pairs of legs. The following nymphal stages and the adult has four pairs of legs except for the Eriophyidae.

Spider mites are the most common mites attacking plants. The tarsonemid mites, such as broad and cyclamen mites, are common but not as common as the spider mites. False spider mites and eriophyid mites are less common but are experiencing a significant increase in grower complaints about damaging levels of both groups. Eriophyid mites exhibit great modification of body structure. They have only two pairs of legs; the four rear legs are absent. They are microscopic, elongate, spindle-shaped and translucent, and the abdomen usually has transverse rings present.

Important Species. The most common spider mites found in Florida infesting ornamental plants are the two-spotted spider mite (*Tetranychus urticae*), Glover mite (*Tetranychus gloveri*), Lewis mite (*Eotetranychus lewisi*), southern red mite (*Oligonychus ilicis*), six-spotted spider mite (*Eotetranychus sexmaculatus*), and the spruce spider mite (*Oligonychus ununguis*). The most common tarsonemid mites are the broad mite (*Polyphagotarsonemus latus*), cyclamen mite (*Phytonemus pallidus*), and the 'maranta' mite (*Steneotarsonemus furcatus*). The predominant false spider mites are the privet mite (*Brevipalpus obovtus*), *B. californicus* (no common name), *B. phoenicis* (no common name), and *Tenuipalpus* spp. There are hundreds of species of eriophyid mites. Many species attack foliage plants, bedding plants and woody plants. Some of the most common are *Eriophyes buceras* on black olive, *Acaphylla steinwedeni* on camellia, *Trisetacus quadrisetus* on juniper, *Paracalacarus podocarpi* on podocarpus, *Phytoptus canestrinii* on boxwood, and an unidentified species severely impacting Loropetalum in Florida.

The two spotted spider mite (TSSM) is a very common pest of greenhouse crops and is found throughout the United States. This pest has often been referred to as 'a red-spider'. The TSSM is soft bodied, oval-shaped, the back arched and bearing bristles, measuring about 0.3 to 1 mm. in length and has two dark spots (sometimes four), one on either side of the top. The color can vary from greenish or yellowish, pearly amber, to red depending upon the host plant and environment. Developmental rate is significantly determined by temperature. The developmental threshold, or the temperature above which development begins, is approximately 51.6 °F (10.9 °C). The number of degree days needed to develop from egg to egg (1 generation) is approximately 265.3 (147.4 above 10.9 °C). Under greenhouse conditions, the average development time from egg to adult is 14-21 days. However, mites develop quickly under hot, dry conditions and may mature in as few as 7 days during these periods. It has been estimated that in a month's time one female and her progeny are capable of producing: 20 mites at 60 °F, 13,000 mites at 70 °F, and well over 13 million mites at 80 °F average temperature. Thus, it is easy to understand why mites can be such a problem in the hot days of summer.

Eggs are laid singly on the surface of leaves. The eggs are spherical and found on the underside of the leaf often where mite feeding is noticeable. The color of eggs varies from transparent to opaque straw yellow. The immature is lighter in color than the adult, usually pale green or yellow. Young mites only have six legs. The older immature is slightly smaller than the adult and pale green to brownish green and has eight legs.

Feeding Damage and Symptoms

When two-spotted spider mites remove the sap, the mesophyll tissue collapses, and a small chlorotic spot forms at each feeding site. An estimated 18 to 22 cells are destroyed per minute. Continued feeding causes a stippled, bleached effect and later, the leaves turn yellow, gray or bronze. Complete defoliation may occur if the mites are not controlled.

Southern red mites first attack the lower leaf surface. As the population increases, the mites move to the upper surface. Injured leaves appear gray. Six-spotted mites feed along the midrib on the underside of the leaf. The upper surface has yellow spots. When heavy infestations occur, the entire leaf becomes yellow, distorted and drops prematurely. Spruce spider mite feeding causes the plants to appear off-color and eventually turn completely brown when high numbers are present.

False spider mites produce no webbing. Damage from these mites varies considerably, ranging from faint brown flecks to large chlorotic areas on the upper leaf surface to brown areas on the lower leaf surface, depending on the host.

Eriophyid mite feeding results in the following damage symptoms: (1) russeting of leaf and fruit (citrus); (2) leaf galls (juniper); (3) leaf blistering on top with hairy growth underneath (black olive); (4) discolored and stunted terminal growth (podocarpus); and (5) discolored bud scales, floral parts and leaves (camellia).

These mites are thought to possess chemicals in their salivary secretions that act as growth regulators. When the mites feed, these chemicals are injected into the plant. Leaves may become discolored or plant growth patterns may be changed. On foliage growth, modifications are initially more readily found on embryonic plant tissue. Russeting, or discoloration, occurs on mature leaves and fruits.

Eriophyid mites induce plant galls developed from epidermal cells that are infected by injected growth regulators. Each species of mite has particular chemicals that cause galls to form which are of specific benefit to the mite. After the induced change has altered the behavior of the affected cell or cells, the mite does not have to remain on the site to insure continuation of gall growth. Eriophyid galls occur on soft plant parts, usually on green tissue that was infested when the plant was young. Galls occur in many different shapes. These include pouch or purse galls, bladder galls, nail galls, finger galls and head galls.

Detection and Sampling

Spider mites form a protective webbing over their eggs and themselves. Although they feed and leave cast skins on the underside of the leaf, first look for the presence of mites as evidenced by stippling on the upper side of leaves. To sample for mites, sharply tap an affected leaf over a sheet of white paper and look for green, red or yellow specks the size of a grain of pepper crawling on the paper. When checking plants for presence of mites, wash hands thoroughly after checking plants to prevent transferring mites to uninfested plants.

Fine strands of silk are spun by spider mites, although these webs may not be detected until large numbers are present. Small mites can use this webbing to balloon and migrate from one place to another. When the infestation is severe,

parts of the plant may be completely covered in sheets of webbing, and masses of mites can be detected in the webbing and clustered on tips of leaves and on flowers. Eriophyid (0.1) and tarsonemid (0.15mm) mites are so small, they are virtually impossible to see without a microscope and a trained eye. If damage symptoms indicate a possible infestation, take the affected plant parts to your county extension office.

Management

Chemical Control. Mite control is a constant battle and requires vigilance. Mites are very key pests for many ornamental crops and, according to Dr. Hudson, responsible for a significant portion of all pesticides used on ornamentals. Seldom are mites ever eradicated once they are present but they can be reduced and managed at levels that are almost undetectable even by the best of scouts. Scouting is essential in order to reduce/prevent fluctuations in mite densities, enable detection of poor coverage or lack of control, reduce chances of resistance development, and increase the efficiency of the entire pest management program. A scouting program can be as simple or complicated as one desires. However, scouting a given crop should take place and be as thorough as possible. Plants should be inspected by turning over leaves and viewing them with the aid of a hand lens. Leaves from within the center of the plant often harbor low level infestations. You should look for signs of damage (yellow speckles), active adult and immature mites as well as eggs. If mites are found, it is often necessary to blow on them or prod them with your fingernail to determine if they are alive. Some compounds kill mites, but they look alive until they fall over when prodded. (Note: Plants with live mites should be tagged so that you can return to that exact plant and determine the impact of any control measures. Don't mark the plant in such away that the plant receives "EXTRA" attention by the spray crew!). It also helps to determine the sex of two-spotted spider mites. Males have pointed abdomens and are more slender than the rounded and plump females. If most of the surviving mites are male, it could be an indication that you have a developing resistance problem.

Resistance management is critical for all the pests we are addressing in this conference. Alternating compounds, along with using biological controls, is one method to help reduce the potential of resistance development. The exact method of alternating between compounds is open for some discussion - alternate every time you spray, make a couple of applications of the same compound before changing, or changing materials at a rate or frequency which is dictated by the length of the pests generation. For mites, I feel that the first alternative is the most feasible - change chemistry every time you make an application. This is because the generation time of mites can be as short as 5-7

days and many compounds have limitations on how many applications can be made during a given period or to a single crop, i.e., Hexygon® is limited to one application per crop per year.

There are several miticides registered for use on ornamentals. In the last few years Akari™, Floramite®, Hexygon®, Ovation™, Pylon®, Sanmite®, Tetrasan™ and Vendex® have been introduced or reintroduced to the greenhouse market. Pesticide resistance can develop quickly with repeated use of the same chemical. The use of insecticides to control insect pests (on a crop infested with mites) can induce spider mite outbreaks by killing the beneficial arthropods that normally feed on mites. In addition, there are natural fungi that attack mites during cool, damp weather and these natural agents are killed when using fungicides against plant pathogens.

Keep it clean! Discard severely infested plants and prune infested tissue from remaining plants. Keep greenhouses clean by maintaining a constant weed control program removing unwanted host plants. Segregate new plants before introducing them to make sure they are clean before placing them with existing plants. Segregate infested plants in one area for treatment.

Be proactive, find them first. Scout greenhouses using random sampling techniques. Use this information as a decision basis for the timing of chemical applications. Start any control practice early, when the first mites are detected. Spot sprays can be used at this time. Control is difficult once populations have increased to high levels. When spraying for mites you should always pay close attention to coverage, water quality and phytotoxicity.

Biological Control. Several biological agents are available, including predatory mites (i.e., *Mesoseiulus* (*=Phytoseiulus*) *longipes, Neoseiulus (=Amblyseius*) *californicus, Neoseiulus* (*=Amblyseius*) *fallacis, Phytoseiulus macropilis,* and *Phytoseiulus persimilis*) which can be introduced into the greenhouse to attack mites. Florida growers have experienced excellent results using either *P. persimilis* or *N. californicus* depending on the crop. I prefer *N. californicus* for most crops. This species is very mobile and is used to control spider mites in peppers, roses, strawberries, and ornamental crops. Relative to *P. persimilis,* it tolerates lower relative humidity, and it can survive longer without food, making preventive releases possible. Even though it attacks all stages of prey mites and it develops twice as fast as *T. urticae* at some temperatures, *N. californicus* reduces dense populations of spider mites more slowly than *P. persimilis*. Many growers use both mites together, *N. californicus* as the primary control agent and *P. persimilis* applied to plants with high mite densities. In Florida, it is also an effective predator of broad

mite, *Polyphagotarsonemus latus*. The development of *N. californicus* is greatly influenced by temperature as it is for the two-spotted spider mite. The developmental threshold, temperature above which development begins, is approximately 50.6 °F (10.3 °C). The number of degree days needed to develop from egg to egg (1 generation) is approximately 187.6 (104.2 above 10.3 °C).