

Spider mites and their management in strawberries

Two-spotted spider mite (*Tetranychus urticae*) is a major pest on strawberries in coastal California. A closely related species, *T. turkestanii*, which resembles *T. urticae*

may also be present among spider mite populations, but prefers warmer conditions. Both these species look very similar and are yellow or greenish with dark spots on either side of the body. Carmine spider mite (*T. cinnabarinus*) is bright red and is found at low densities. Spider mite feeding reduces the strawberry size and its quality.

Biology

Mites are not insects. They are closely related to ticks and spiders. While insects have three body parts (head, thorax and abdomen) and three pairs of legs, mite's body is divided into two major parts and they have four pairs of legs.

Life cycle of spider mites includes egg, larva, protonymph, deutonymph and adult. Larvae have three pairs of legs while other mobile stages have four pairs. Duration of the life cycle depends on the temperature. Under favorable conditions, one generation can be completed in one week. Adult females are larger than males. The ratio between male and female mites depends on various factors, but it is usually 1 male for every 2 or 3 females.

Due to favorable conditions in the strawberry growing regions of the California coast, spider mites can stay active throughout the strawberry season.

Damage

Spider mites feed on the underside of the leaves and cause reduction in fruit size and yield. Damage starts as stippling of yellow spots on leaves, which advances to scarring and bronzing of leaves. Webbing can also be seen on infested leaves. Severe infestation stunts plant growth and can result in plant death. Strawberry plants are very sensitive to mite damage within 2 to 5 months after transplanting. Infestation of 1 mite per leaflet can result in measurable yield reduction during this period. Plants are less sensitive to mite damage after initial berry set. However, substantial losses can occur with 15-20 mites per mid-tier leaflet during this



period. Highest infestations can be seen after peak spring harvest after which populations rapidly decline.



Risk factors: Early build up of mite populations results in season-long damage. Fall plantings are generally more susceptible than summer plantings. Day-neutral cultivars are also more susceptible than short-day cultivars. High carbohydrate and leaf nitrogen or low phenol content is known to increase mite numbers in some hosts. Proximity to second year plantings with mite infestation,

presence of infested fields upwind, inadequate chilling of day-neutral varieties, dusty conditions and water stress are some other factors that contribute to mite problems.

Sampling

Depending on the region and time of the year, monitor for mites every week or every other week. When populations are low or when monitoring a small acreage field, check for the presence or absence of mites by randomly sampling 10 leaflets per acre. When infestation is high, 5-10 leaflets per acre can be randomly sampled for counting mites. Economic threshold during the first four months is 5 mites/mid-tier leaflet for fall planting and 10 mites for summer planting.

Management options

- Thorough and regular monitoring is important to make treatment decisions.
- Promote vigorous plant growth through adequate chilling, water and nutritional management.
- Avoid excessive nitrogen as it may increase mite infestations.
- Use low fences, drive slowly and water roadways to prevent dusty conditions.
- Avoid practices that disrupt natural enemy populations and use miticides that are safe to natural enemies.

- Alternate chemicals with different modes of action to reduce the risk of resistance development where strawberries are continuously grown.
- If you suspect mite resistance to a particular chemical, do a simple test before spraying. Prepare a small quantity of the chemical to be sprayed at a concentration equal to the field application rate. Dip a mite-infested leaf in the liquid, let it dry and then keep it in a container or a bag. For comparison, dip another mite-infested leaf in plain water and keep it separately. Observe the leaves one and two days after the treatment. Depending on how many mites are dead on treated leaf compared to the control (water treatment), the effectiveness of the chemical can be determined.
- Conserve or release natural enemies like predatory mites. *Phytoseiulus persimilis* is a specialist predator and is effective early in the season. *Neoseiulus californicus*, which tolerates warmer temperatures and a wide range of humidities, is a generalist predator and a predominant species later in the season. There are several other natural enemies like minute pirate bug (*Orius tristicolor*), a small, black lady beetle (*Stethorus* spp.), a small, black rove beetle (*Oligota oviformis*), big-eyed bugs (*Geocoris* spp.), brown lacewings (*Hemerobius* spp.), green lacewings (*Chrysopa* spp.), six-spotted thrips (*Scolothrips sexmaculatus*), damsel bugs (*Nabis* spp.), a cecidomyiid fly maggot (*Feltiella acarivora*), and a predaceous midge.



Predatory mites

If predatory mites are released after a chemical spray, wait until residual toxicity diminishes. If releasing *P. persimilis*, use 40,000-60,000/acre when spider mite populations are limited to localized areas and 30,000/acre when spider mites are well distributed, but present at low numbers. If spider mite populations are increasing 100,000 or more *P. persimilis* may be released per acre. This predator is effective early in the season when temperatures are cool. Later in the season, *N. californicus* becomes a predominant

species whether or not released and is better suited for warmer temperatures.

Chemicals and their modes of action

Chemicals are placed in different groups based on their modes of action.

Affect nervous system: *Acetylcholinesterase (AChE) inhibitors—Organophosphates (1B):* Chlorpyrifos (Lorsban), diazinon-foliar, malathion, naled (Dibrom)

GABA-gated chloride channel antagonists (2)—Cyclodiene organochlorines (2A): Endosulfan (Thionex, Thiodan)

Sodium channel modulators (3): Bifenthrin (Capture, Brigade), fenpropathrin (Danitol)

Chloride channel activators (6): Abamectin (Agri-Mek)

Non-specific mode of action: *Mite growth inhibitors (10):* Etoxazole (Zeal), hexythiazox (Savey)

Neuronal inhibitors (25): Bifenazate (Acrامة)

Affect metabolic processes and respiration: *Mitochondrial complex III electron transport inhibitors (20):* Acequinocyl (Kanemite)

Inhibitors of lipid synthesis (23): Spiromesifen (Oberon)

Other modes of action: Cinnamaldehyde (Cinnacure), insecticidal soap (M-Pede), paraffinic oil (JMS Stylet Oil), petroleum oil, rosemary oil (Hexacide)

Additional information:

- For a quick reference about spider mites and their management, check UC IPM website at: <http://www.ipm.ucdavis.edu/PMG/r734400111.html>

- UC ANR manual, "Integrated pest management for strawberries" (Publication number 3351) has detailed information about strawberry production and various management practices.

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