

Pest Management of Hemp in Enclosed Production

Twospotted Spider Mite

(*Tetranychus urticae*)

Damage and Diagnosis. Spider mites feed by puncturing surface cells and sucking the released sap. This results in patches of killed cells that typically turn white following removal of cell contents. White flecked areas of the leaves, known as stippling injury, are characteristic of spider mite injury. However, when large numbers of spider mites are present large areas of the leaf may be affected and may die.

Twospotted spider mites will produce webbing for several purposes. When populations are high webbing may be seen on foliage or bridging across different parts of the plant. This may superficially resemble powdery mildew. However, close inspection will show active stages of mites, their eggs and old discarded skins.

The adult twospotted spider mite is quite small, about 0.4 mm, and is usually straw color to green. There is a pair of large darker spots on the side of the body.

Biology Notes. The twospotted spider mite is the most damaging spider mite species in Colorado. Outdoors it is damaging to an extremely wide range of plants, from corn to pears. In yards/gardens it may be present on plants such as eggplant, beans, raspberries, roses, marigolds, and several deciduous shrubs. It is very common on indoor-grown plants and is almost always the species damaging houseplants, certain indoor-grown vegetables (e.g., cucumbers, tomatoes), and herbs.

Twospotted spider have sexual reproduction (males and females are present) and females lay eggs. The eggs quickly swell after being laid and are very large in relation to the body of the mother. Within a day or two after being laid, a minute six-legged stage (larva) emerges from the egg and begins to feed. It subsequently sheds its exoskeleton (molts) to a slightly larger 8-legged stage. Two molts follow and the adult form is produced which soon mates and begins to produce eggs. Up to 500 eggs may be laid by a female twospotted spider mite.

Under optimum conditions of high temperature and low humidity the entire life cycle is completed in just over a week. A life cycle of 12-15 days is more likely to occur under the conditions of indoor-grown *Cannabis*. Regardless, the life cycle is short and numerous generations will be produced in a 2-3 month period, potentially resulting in many thousands of spider mites. Reproduction also may accelerate after flowering begins due to changes in the nutritional quality of plants that are favorable to spider mites.

Spider mites get from plant to plant either by walking or through wind-blown dispersal. The latter is known as “ballooning” and tiny, young spider mites that wish to disperse in this manner collect along leaf margins and tips of plants to catch drafts.

Outdoors, twospotted spider mites can survive winter under leaf litter and other protective cover. Prior to overwintering they become semi-dormant and slow their metabolism, a behavior known as diapause. The spider mites in this condition usually are orange-red, rather than the yellow-green color of twospotted spider mites during their active feeding periods. Changes in day length (short days) and cooler temperatures are most important in causing spider mites to go into diapause. Under continuous conditions of warm temperature and suitable light/dark periods the twospotted spider mite will not undergo a dormant period.

Management of Spider Mites

Prevention and Quarantine. Plantings become infected with spider mites when living mites are introduced into a growing area. This can most easily occur if infected cuttings or seedlings are brought into a growing area. Spider mites may also occur on hands or clothing if infested plants are handled. Quarantine steps, as for powdery mildew, should be taken to prevent introduction of spider mites.

Spider mites can migrate some distance from outdoor plants that they feed on during the growing season. These may move behind walls and into building cracks when seeking shelter and a few could incidentally enter living areas. Isolation of the growing area from migrating spider mites will prevent this source of infestation.

Cultural Control. Growing conditions can impact spider mite reproductions and development. In particular, plants under drought stress are often more suitable hosts for spider mites; they will reproduce faster on drought-affected plants.

There also seems to be some significant differences among Cannabis cultivars in their inherent susceptibility to spider mites. This suggests that future breeding for spider mite resistant Cannabis may be a possibility. (If growers have any observations on specific cultivars that appear to have spider mite resistance, please send an email note to the address at the beginning of this document.)

Twospotted spider mites thrive under conditions of low humidity and warm temperatures. If humidity can be substantially increased spider mite feeding may be slowed as evaporation of excess waste water is slowed. Higher humidity also is favorable to natural enemies of spider mites. (See biological control section, below.)

Spider mites may also be suppressed if plants can be washed with a forceful jet of water. This can remove many mites and, if done repeatedly, may allow sufficient suppression to allow completion of a crop cycle.

Biological Controls. Quite a few organisms are commercially available to help control spider mites on various crops. About a half dozen species of **predatory mites** are most widely used but specialized lady beetles known as “**spider mite destroyers**” (*Stethorus* spp.) and a small fly larva known as the **spider mite predator midge** (*Feltiella acarisuga*) are also sold to control spider mites.

Each of these biological controls has specific requirements of food, temperature and humidity that allow them to survive and thrive. The bright, and often hot, lighting of indoor *Cannabis* culture and the very low humidity of the region limit the use of many potential biological controls that cannot survive under those conditions. For example, the most widely available predatory mite, *Phytoseiulus persimilis*, requires high relative humidity (sustained above 60% RH) to thrive. This can be a challenge in a dry climate such as Colorado. However, this species can be an effective for spider mite control if relative humidity is suitably high.

Three other predatory mites are somewhat less sensitive to low humidity and may also be considered for used in twospotted spider mites in enclosed systems:

Mesoseiulus longipes. This species prefers 60%+ RH, but can tolerate somewhat lower humidity.

Neoseiulus californicus. This species has a moderate requirement for humidity, between 40-80% RH, depending on temperature. Higher humidity is needed with higher temperatures.

Galendromus occidentalis. This species does well under hot conditions (above 80°F) and is fairly tolerant of lower humidity - but humidity must be above 30 percent.

All of the above must be mail ordered and used promptly upon delivery as they do not store well and should not be refrigerated. A list of suppliers is listed elsewhere in website.

An additional potential problem with biological controls is the presence of sticky glandular hairs on the leaves and buds. These may inhibit and trap some surface active insects and mites. The impact of Cannabis surface hairs/glands on predators has not been studied.

Sprays. The most effective treatments for spider mite management that are presently allowed are sprays of various types of oils. Two kinds of oils are marketed: 1) horticultural oils that primarily act by smothering eggs and young stages of mites; and 2) essential oils that may act as nerve poisons, often by blocking the neurotransmitter octopamine.

The most widely used of the horticultural oils are highly refined mineral/paraffinic oils. Some other plant derived oils from sources such as cottonseed, neem seed, soybean or sesame seed can also work in a similar manner. All of these horticultural oils include some emulsifier that allows them to be mixed with water and are typically used at around 2% dilution.

Oils primarily act by smothering and can kill not only young stages but also kill some eggs. However, they have no residual effects on plants after the immediate application. Therefore, oils must be applied very thoroughly, particularly to the underside of leaves, and used repeatedly during incipient outbreaks.

Also available are some “essential oil” products, usually sold as ready-to-use sprays, which contain oils of rosemary, thyme, peppermint or clove, or other natural products. Some mite control can be expected with at least some of these products but there has been very little testing of these products under conditions similar to those that occur in Cannabis production. Furthermore, since testing of these types of insecticides is often minimal, it is strongly suggested

that they initially be applied only to a small area to determine if there are any problems with plant injury (phytotoxicity).

Phytotoxicity Notes: Oil sprays can cause plant injury under certain growing conditions. *Plants that are stressed by drought and sprayed with oils under hot, dry conditions are most likely to be damaged.* Do not apply oils under these conditions. *Oils can also become more injurious if there are sulfur residues on leaves;* the oils combine with sulfur to produce plant damaging compounds. Oils should not be used on plants that have received recent sulfur applications.

A few other pesticides are sold for control of mites. Insecticidal soaps make claims for spider mite control, although often they perform more poorly than do horticultural oils. Pyrethrins, sometimes mixed with oil, are also sold for spider mite control. Since twospotted spider mite is highly resistant to most insecticides, including pyrethrins, its use can be expected to have marginal effectiveness, at best, and may worsen control. Pyrethrins will adversely affect natural enemies of spider mites and has irritating action that may cause mites to disperse.

Eradication of Spider Mites. Once established in a growing area, spider mites can be extremely difficult to eradicate. Disinfestation requires an extended plant-free period of the growing area - several weeks or even months. No plants can be growing in the area during the disinfestation period, including weeds or houseplants, as twospotted spider mite has a very wide host range.

Twospotted spider mite can produce stages that withstand starvation for considerable periods. These are more likely to be produced during short day lengths and/or with cool temperatures. Therefore it is recommended that the growing facility remain warm and well lit during the plant-free period. This should help hasten the period for spider mites to succumb to starvation.