Pest Management of Hemp in Enclosed Production

Thrips

Thrips tabaci, Frankliniella occidentalis

Damage and Diagnosis. At least two species of thrips are regularly associated with outdoor-grown hemp, **onion thrips** (*Thrips tabaci*) and **western flower thrips** (*Frankliniella occidentalis*). On indoor grown cannabis onion thrips has been confirmed in multiple samples and appears to be the primary pest species. However, western flower thrips is a well known pest of many greenhouse crops grown in the state and likely also is present on some indoor grown cannabis crops.

Both of these to thrips species are very small insects with an elongated body, typically about 1.2-1.5mm (about 1/15-inch) in length. The wingless immature stages are pale yellow. Winged adults may be light brown.

Thrips feed by piercing surface cells of leaves and sucking out the cell contents. This results in a small light area, known as a **stippling injury**, at the feeding site. Small dark spots of fecal droppings also are scattered through the damaged area. The overall pattern of injury, with the light stippling, is somewhat similar to that produced by twospotted spider mite. However thrips tend to more often feed on the upper leaf surface of plants than do spider mites.

Outdoors, under normal field conditions such injuries are widely dispersed through the plant and attract very little, if any, attention. However, in indoor plantings, where natural controls are largely absent, high thrips populations can develop and be sustained. This results in cumulative injuries can cause extensive leaf scarring. Also, thrips that feed on expanding immature leaves may cause some leaf distortion.

Note on virus transmission: Both onion thrips and western flower thrips are known to transmit certain viruses to plants. All of the viruses that thrips are capable of transmitting between plants are in the virus group known as tospoviruses, which include viruses that produce the diseases tomato spotted wilt and impatiens necrotic spot. These are very important plant diseases on many kinds of crops. However, no viruses that thrips can transmit (tospoviruses) are known to affect cannabis.

Biology Notes. Both onion thrips and western flower thrips are among the most common and widely distributed insects that occur in Colorado. Both have a very wide host range of plants on which they can develop. Of the two species, western flower thrips is more commonly associated with flowers, but may also develop on leaves of plants such as winter wheat and legumes such as alfalfa and beans. Western flower thrips also will feed on pollen. Onion thrips develops on leaves of a great many kinds of plants, including many common weeds and vegetable crops.

Regarding the life cycle of these thrips, eggs are inserted into plant tissues. The egg will normally hatch within a couple of days after being laid and the stage that follows (Instar I) is tiny and wingless. It feeds on the leaves and within a few days will molt to a larger second stage (Instar II) that feeds more extensively on the plant. After this stage is completed it molts again,

but to a non-feeding form (Instar III) that may occur in soil or, less commonly, in leaf axils and other above ground crevices. Another molt occurs (Instar IV) with the thrips in the same site, that also is non-feeding stage, which further transitions its development. Ultimately, after the next molt, a winged adult form emerges to repeat the cycle.

The time required to complete a single life cycle of both onion thrips and western flower thrips is dependent on temperature. Under normal temperatures during a growing season thrips can complete a generation in about 2-3 weeks. Multiple generations are produced annually and reproduction is continuous year-round on indoor plants. Outdoors thrips can continue to survive and develop (at a slowed rate) on available living plants that are present through the cold months (e.g., winter annual mustards, certain hardy perennials).

Management of Thrips

Prevention and Quarantine. The thrips associated with cannabis are the same species that occur on a wide variety of crop plants, weeds and other plants which occur in Colorado. Furthermore, winged forms regularly move between plants and, due to their small size, can penetrate small openings.

During the warm months when thrips are active outdoors they may move into greenhouses or other indoor production through vents, fans and other openings. These sites can be screened to exclude thrips, but thrips-proof screening must be of very fine mesh. Screening for this purpose is commercially available but often some structural modifications need to be done so that the screening does not too severely restrict air flow. Indoor facilities that can sustain positive pressure may also be able to prevent thrips from entering, as they are weak fliers. Outdoor areas around vents and fans should also be maintained so that plants which can support thrips are not located immediately near these possible points of entry.

Thrips can be starved out if a host-free period is maintained. This would require that no living plants, are kept in the growing area for a period of at least 3-4 weeks, which should be sufficient for any residual thrips to die-out. This host free period must also include weeds, as many common weeds that occur in greenhouses can support thrips.

As with mites and aphids, thrips can be carried on live plants and cuttings that are introduced into a new site. These should be treated to kill all thrips and maintained in a quarantine area for at least a month before introducing them into areas that are thrips free. During this quarantine period the new plants should be regularly inspected and thrips traps used to identify if thrips are present.

Traps. Adult stages of thrips can be attracted to and will be captured on colored sticky traps. The standard yellow traps used to capture many kinds of greenhouse insects can be effective. However, blue colored sticky traps are more attractive to thrips. These traps also have the advantage of being better able to see the thrips that are captured. Thrips are also more visible on traps that do not have an excessively thick coating of adhesive.

Traps are normally used as a monitoring tool. Checked regularly with the number of captured insects recorded, they can be used to detect changes in abundance of thrips, so that control efforts can be evaluated and guided. When a very large number of traps are used, or lines of sticky colored tape are placed throughout the crop significant numbers of thrips may be captured on traps so that they can retard develop of thrips populations. Traps do not capture the wingless stages that occur on plants and in the soil.

Biological Controls. Quite a few organisms are commercially available to help control thrips on various crops. On above ground parts of the plant certain predatory mites are most commonly used. These are different species than are used for control of spider mites (above) and include: *Neoseiulus cucumeris, Amblyseius swirskii,* and *Iphisieus* (=*Amblyseius*) *degenerans*.

Each of these biological controls has specific requirements of food, temperature, and humidity that allow them to survive and thrive. Day length can also be important as some strains of *Neoseiulus cucumeris* may go into a dormant condition (diapause) with short days. Predatory mites that feed on thrips also may survive better where there are alternate foods, such as pollen and fungi. These are unlikely to be common on indoor cannabis.

Minute pirate bugs (*Orius* species) are also highly effective thrips predators and are often the most important predators of thrips on outdoor grown crops. The species *Orius insidiosus* is most widely available through commercial suppliers. These insects may go into a dormant diapause condition when day lengths get too short, which can limit their establishment and reproduction in the crop.

Other natural enemies can kill thrips stages that occur in soil (the immobile Instar III and IV stages). A soil dwelling predator *Stratiolaelaps scimitus* (formerly *Hypoaspis miles*), is a generalist predator of mites and insects that spend part of their life cycle in the soil, including fungus gnat larvae and pupae of thrips. Insect predator/parasitic nematodes, such as *Steinernema feltiae*, can be applied as soil drenches and may kill some thrips as well as fungus gnat larvae. These are described in more detail in the fungus gnat discussion that follows. Stages of thrips that occur above the soil will not be attacked by these organisms.

Chemical Controls. A few pesticides allowed for use in cannabis can provide some control of thrips stages on above ground portions of plants. One is the fungus *Beauveria bassiana*, which produces disease in susceptible insects - including thrips - and can kill them. Relatively high humidity is important in the effectiveness of these products. Presently allowable pesticides that contain *Beauveria bassiana* (Botanigard Maxx, Xpectro OD) are combination mixtures with pyrethrins; pyrethrins likely have very little effect on thrips which are usually resistant to this type of insecticide.

Azadirachtin-containing insecticides also can kill some thrips, by disrupting their growth. Numerous azadirachtin containing insecticides are allowed for use an specific products can be identified through the Colorado Department of Agriculture website
CDA web page https://www.colorado.gov/pacific/agplants/pesticide-use-cannabis-production-information Horticultural oils that can cover and smother thrips may also have some benefit.

Very thorough coverage is essential for thrips control. Thrips will often concentrate in tight crevices on the plant that can be difficult to reach. Also, it must be kept in mind that at any one point in time much of the population is in sites where sprays will not reach them - the eggs inserted into leaves and the late stage larvae (Instars III, IV) that usually occur in soil. Repeat applications will always be necessary to control thrips if they have been allowed to increase to damaging numbers.