Guidelines for Managing Western Flower Thrips in California Lettuce

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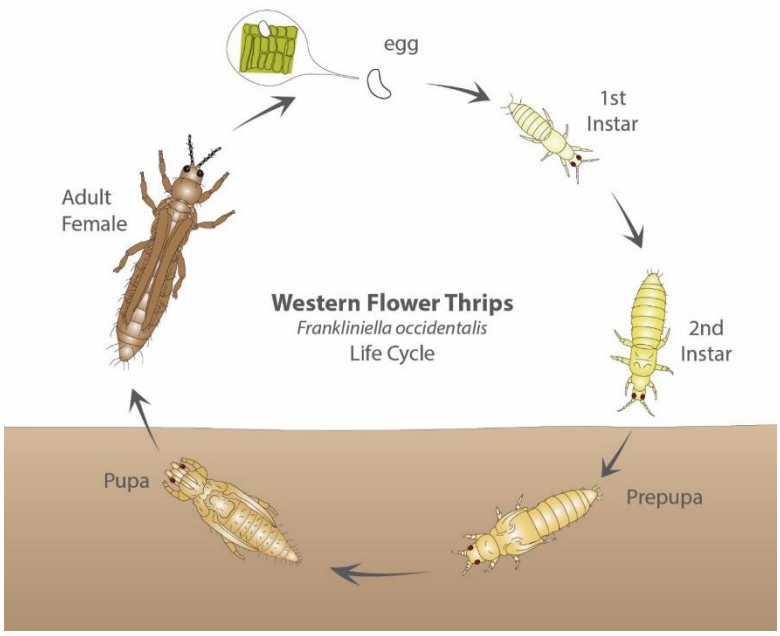
Western flower thrips adult (Photo courtesy: Jack Kelly Clark, UC IPM)

The western flower thrips, *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae) is one of the major pests of lettuce in California. It has a wide host range including several vegetable, ornamental, and other cultivated or wild plants. Native to North America, the western flower thrips is also known as alfalfa thrips, California thrips, and maize thrips among others. This article provides a general overview of the pest, its biology, damage, and management.

Biology:

Eggs are small, oval, and inserted into plant tissue. Nymphs are slender and have four instars. The first two - larva I and II – feed on plant tissues while the latter two - prepupa and pupa – are non-feeding stages that are often found in the soil. Larvae are wingless and white initially and turn yellow or orange once they start feeding. Adults are small (< 2 mm), slender, and have two pairs of long, narrow wings with a fringe of hairs. The western flower thrips can occur in different color morphs such as yellow or orange, brown, and black.



Life cycle of the western flower thrips (Graphic courtesy: Biobee Biological Systems)

Damage:

The western flower thrips prefers flowers, but also feeds on developing buds, fruits, and foliage. Larvae and adults rupture the leaf surface with their rasping mouthparts and feed on plant juices. Feeding damage results in silvery appearance of the leaf surface, which later turns brown. The presence of dark fecal specs indicates thrips occurrence. In lettuce, the western flower thrips transmits *Tomato spotted*

wilt virus and is the sole vector of *Impatiens necrotic spot virus*. Only the larval stages acquire these tospoviruses and the adults transmit the viruses to other plants as they spread in the field.

Management: Integrated pest management approach is critical for successful pest management. It involves regular monitoring, exploring the potential of multiple options including cultural and biological solutions, and proper timing and application of various strategies among others. The western flower thrips is one of the pests where insecticide resistance is a common problem. To reduce the risk of resistance development, it is necessary to explore the potential of multiple control options and rotate insecticides with different modes of action. This is essential to suppress pest populations to desired levels and also to maintain control efficacy of existing pesticides.

Cultural control – Remove weed and other hosts that harbor thrips or viruses. Sprinkler irrigation can help reduce thrips populations. Plow down lettuce crop residue to destroy surviving stages. In general, maintaining good plant health with optimal nutrition and irrigation practices helps plants withstand pest damage. Silicate products can improve the structural strength of plant tissues and reduce pest damage and/or populations. Several biostimulants or biological soil amendments can also help activate plant's natural defenses against pest infestations. Consider using them to improve overall plant health and yields, and to protect plants from biotic and abiotic stresses.

Biological control – Predators such lacewings (*Chrysopa* spp. and *Chrysoperla* spp.), minute pirate bugs (*Orius* spp. and *Anthocoris* spp.), predatory mites (*Amblyseius swirski*, *Ablyseius andersoni*, *Neoseiulus cucumeris* and *Stratiolaelaps scimitus*), and rove beetles (*Dalotia coriaria*) attack thrips. Conserve natural enemies with insectary plants and applying safer pesticides, and augment natural populations by releasing commercially reared species.

Microbial control – Entomopathogenic fungi such as *Beauveria bassiana* and *Cordyceps* (*Isaria*) *fumosorosea*, products based on bacteria such as *Burkholderia rinojensis* and *Chromobacterium subtsugae*, and entomopathogenic nematodes such as *Heterorhabditis* spp. and *Steinernema feltiae* can be used against one or more life stages. Entomopathogenic nematodes are more effective against pupae in soil because they actively search for and infect their hosts. Entomopathogenic fungi can be used against all life stages.

Botanical control – Azadirachtin alone or in combination with entomopathogenic fungi or insecticides can also be used against multiple life stages. Azadirachtin is an insecticide, antifeedant, and a growth regulator. Similarly, pyrethrins derived from chrysanthemum flowers can be used alone or with other biological or synthetic insecticides. Pyrethrins are nerve poisons. Other botanical insecticides that contain soybean oil, rosemary oil, thymol, and neem oil (which also has a low concentration of azadirachtin) also provide control against thrips through insecticidal, repellency, and antifeedant activities.

Other control options – Insecticidal soaps and mineral oils can be used against different life stages of thrips. Spinosad, a popular insecticide of microbial origin and a mixture of two chemicals spinosyn A and spinosyn D, is very effective against thrips. However, overuse of spinosad can lead to resistance issues in thrips and other insects.

Chemical control – There are several synthetic insecticides that are effective against thrips. It is important to rotate chemicals among different mode of action groups to reduce the risk of insecticide

resistance. The following are some synthetic active ingredients and their mode of actions groups in parenthesis that can be used for thrips control: methomyl (1A), bifenthrin (3A), lambda-cyhalothrin (3A), zeta-cypermethrin (3A), clothianidin (4A), spinetoram (5), and cyantraniliprole (28).

Depending on the level of control needed, combinations of products from different categories can improve control efficacy. For example, a combination of entomopathogenic fungi and nematodes can be applied to the soil for controlling prepupae and pupae. While the soil-dwelling predatory mite *S. scimitus* and the rove beetle, *D. coriaria*, can be used against pupal stages, other natural enemies can be used against nymphs and adults. A combination of entomopathogenic fungi and azadirachtin can be applied both to the soil or foliage for controlling different life stages. Similarly, various biological and synthetic insecticides can be applied in combination or rotation to obtain desired control.

The categories presented above are based on the source or nature of the active ingredients and do not indicate their organic or conventional label status. Please check the product labels for their appropriateness for managing thrips in lettuce, for use in organic farms, and guidelines for storage, handling, and field use. Entomopathogenic nematodes, fungi, and other biologicals are compatible with several synthetic agricultural inputs, but verify the label guidelines for specific instructions.

Broad categories of control options for managing western flower thrips

Cultural Solutions	• Removal of the crop residue and weed hosts. • Providing insectary plants for natural enemies. • Nutrient and irrigation management. • Silicates and biostimulants to improve plant strength and health.
Biological and Natural Solutions	• Biological control with natural enemies. • Entomopathogenic fungi, entomopathogenic nematodes, and microbe-based pesticides. • Botanical extracts and oils, and mineral oils. • Insecticidal soaps
Synthetic Solutions	• Chemical pesticides from different mode of action groups.

These guidelines can be used for thrips management in multiple crops depending on the label status.

Additional resources:

Dara, S. K. 2019. The new integrated pest management paradigm for the modern age. JIPM 10: 1-9. https://doi.org/10.1093/jipm/pmz010

Dara, S. K. 2021. Biopesticides: categories and use strategies for IPM and IRM. UC ANR eJournal of Entomology and Biologicals. https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=46134

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