THRIPS

Integrated Pest Management for Landscape Professionals and Home Gardeners

Thrips, order Thysanoptera, are tiny, slender insects with fringed wings. They feed by puncturing their host plant or animal prey and sucking up exuding contents. Certain thrips species are beneficial predators that feed only on other insects and mites. Beneficial species include black hunter thrips and the sixspotted thrips. Pest species are plant feeders that scar leaf, flower, or fruit surfaces or distort plant parts. Other species of thrips simply feed on fungal spores and pollen.

IDENTIFICATION

Most adult thrips are slender, minute (less than 1/20 inch long), and have long fringes on the margins of both pairs of their long, narrow wings (Fig. 1). Nymphs are similarly shaped with a long, narrow abdomen but lack wings. Most thrips range in color from translucent white or yellowish to dark brown or blackish, depending on the species and life stage. A few species are more brightly colored, such as the distinctive reddish orange abdomen of nymphs of the predatory thrips, *Franklinothrips vespiformis*.

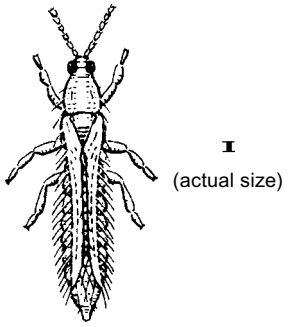

Figure 1. Western flower thrips.

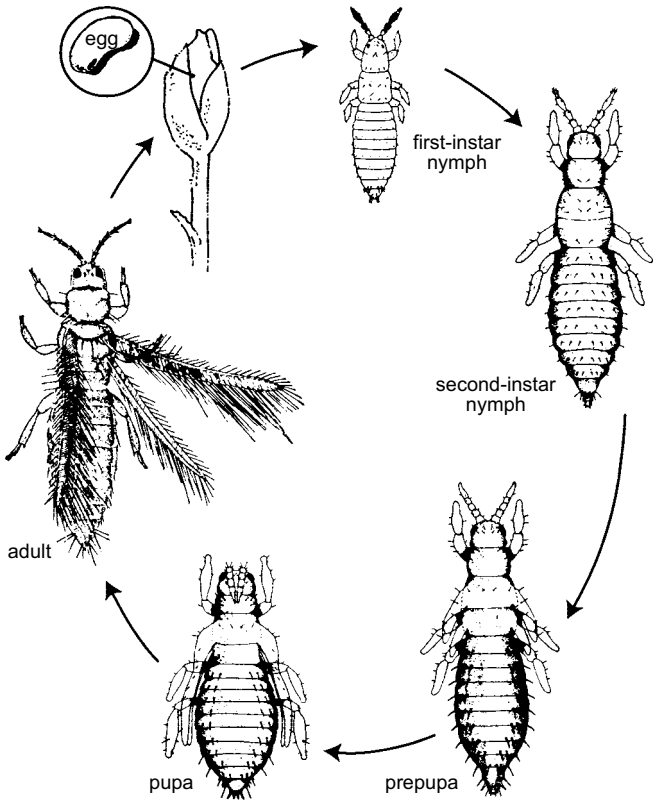

Figure 2. Life cycle of thrips.

Many thrips species feed within buds and furled leaves or in other enclosed parts of the plant. Their damage is often observed before the thrips can be seen. Discolored or distorted plant tissue or black specks of feces around stippled leaf surfaces are clues that thrips are or were present. However, some abiotic disorders, pathogens, and certain other invertebrates can cause damage resembling that of thrips. For example, lace bugs, plant bugs, and mites also stipple foliage and lacebugs and certain plant bugs produce dark, watery fecal specks. Look carefully for the insects themselves to be certain that pest thrips are present before taking control action.

Behavior, body appearance, and host plants help to distinguish among thrips species (Tables 1 and 2). For example, three dark spots on each forewing distinguish the adult predaceous sixspotted thrips from pest thrips. Adults of western flower thrips and onion thrips are noticeably larger than avocado and citrus thrips adults, so

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Table 1. Some Common Pest Thrips and Their Host Plants

THRIPS		HOSTS	
Common name (Scientific name)	**Color[1]**	**Plants**	**Primary Damage**
avocado thrips (*Scirtothrips perseae*)	pale yellow	avocado	scabby brown scars on fruit and leaves
bean thrips (*Caliothrips fasciatus*)	adult – blackish with white wing bands; nymphs – yellow to orangish	beans, occasionally other legumes	brown, distorted leaf and seedling terminals
citrus thrips (*Scirtothrips citri*)	light orangish yellow to white	citrus, generally not damaging to its many other hosts	scabby silvery scars on fruit
Cuban laurel thrips (*Gynaikothrips ficorum*)	adults – blackish; nymphs – yellowish to white	laurel fig or Indian laurel (*Ficus retusa*)	rolled, podlike, dark-scarred terminals; galls
greenhouse thrips (*Heliothrips haemorrhoidalis*)	adults – black with pale wings; nymphs – yellowish	many perennials (usually those with harder leaves) including avocado, azalea, hypericum, laurel (English and Grecian), photinia, rhododendron, and toyon	leaves bleached and black excrement present on undersides; scabby fruit; most severe where plant parts touch
onion thrips (*Thrips tabaci*)	adult – yellow to dark brown; nymphs – yellow to orangish	vegetables including garlic, onion, and pepper; also many herbaceous ornamentals where it's usually not damaging	stippled and scarred petals, leaves, and other plant parts; distorted terminals
toyon thrips (*Rhyncothrips ilex*)	adult – black with pale wings; nymphs – yellow	Christmas berry or toyon	crinkled, undersized, sometimes blackened terminal leaves
western flower thrips (*Frankliniella occidentalis*)	adult – yellow to dark brown; nymphs – yellow to orangish	many herbaceous ornamentals (impatiens, petunia), vegetables (cucurbits, pepper), fruits (grape, strawberry), and some shrubs and trees (rose, stone fruit)	stippled and scarred petals, leaves, and other plant parts; distorted terminals; vectors tospoviruses that infect herbaceous plants

[1] Color does not reliably distinguish among thrips, which can be accurately identified to species only by an expert examination of microscopic characteristics.

Table 2. Some Characteristics Helpful in Distinguishing Among Thrips Species.[1]

Hosts	Thrips comparisons		
avocado, citrus	avocado and citrus thrips	vs.	western flower thrips
	fruit-scarring pests; mostly on young leaves and under calyxes of small fruit; adults and larvae very active and have no obvious spines or very small, pale spines on abdomen barely visible with hand lens		not an avocado or citrus pest; found mostly on flowers and disperse when bloom ends; adults and larvae slow-moving and have long, stout abdominal end hairs clearly visible with hand lens
herbaceous ornamentals, vegetables	onion thrips	vs.	western flower thrips
	relatively unimportant as ornamental plant virus vector; only short hairs on head between compound eyes and ocelli; four long setae along rear of pronotum but no long hairs along front of pronotum; row of hairs near the base and tip of forewing, but row is not continuous		important herbaceous ornamental virus vector; one pair of long setae (hairs) and some short hairs on head between compound eyes and ocelli; four long hairs on both the front and rear of pronotum (top of first thoracic segment, the segment containing first pair of legs); continuous row of short hairs behind forewing main vein
perennial ornamentals and some fruit trees	greenhouse thrips	vs.	most other pest thrips
	feed openly in groups on the underside of leaves; usually on relatively hard-leafed plants; readily controlled by thorough spraying with contact insecticides such as oil		feed on flower pollen and hidden within plant parts such as buds; frequently difficult to control with insecticides
many plants	sixspotted thrips	vs.	pest thrips
	beneficial insect predator; three dark spots on each forewing; unusually long hairs (setae) extending well beyond margins of head and thorax		wings may have broad alternating dark and light bands, but not three distinct dark spots on pale forewings; head and thoracic setae shorter (e.g., onion and western flower thrips) or indistinct (e.g., avocado and citrus thrips)

[1] The above characters can be very helpful, but thrips can be accurately identified to species only by an expert examining its microscopic characteristics.

mature body size helps to distinguish them when they occur together on the same host plant. However, thrips can be positively identified to species only by an expert. Fortunately, most thrips are controlled by the same management methods. Still, it is important to distinguish among thrips species when using natural enemies that are specific to certain thrips species (Table 3). Also, in avocado and citrus where avocado and citrus thrips, respectively, and greenhouse thrips are pests, it is important to distinguish these species from western flower thrips, which is often present in the flowers but is not a pest in these crops.

LIFE CYCLE

The thrips life cycle includes the egg, two actively feeding nymphal stages, nonfeeding prepupal (propupal) and pupal stages, and the adult (Fig. 2). Thrips have a metamorphosis that is intermediate between complete and gradual. Thrips nymphs are often called larvae; last-instar nymphs change greatly in appearance, and they are often called pupae even though thrips do not have a true pupal stage.

Thrips eggs are elongate, cylindrical to kidney shaped, and relatively large in relation to the female. Females of most species insert their tiny eggs into plants, commonly into leaves or buds where nymphs feed. The pale prepupae and pupae of most species drop to the soil or leaf litter or lodge within plant crevices. Greenhouse thrips pupate openly on lower leaf surfaces while pupae (and eggs) of some gall-making species, such as Cuban laurel thrips, occur on leaf surfaces but are enclosed within distorted plant tissue. Thrips have several generations (up to eight or more) a year. The life cycle from egg to adult may be completed in as short a time as 2 weeks when the weather is warm.

DAMAGE

Feeding by thrips causes tiny scars on leaves and fruit, called stippling, and can stunt growth. Damaged leaves may become papery and distorted. Infested terminals may discolor, become rolled, and drop leaves prematurely. Petals may exhibit "color break," which is pale or dark discoloring of petal tissue that was killed by thrips feeding before buds opened. Avocado, citrus, and greenhouse thrips cause silvery to brownish, scabby scarring on the avocado and citrus fruit surface, but this cosmetic damage does not harm the internal fruit quality. Feces may remain on leaves or fruit long after thrips have left. Where thrips lay eggs on grapes, dark scars surrounded by lighter "halos" may be found on the fruit. Thrips feeding on raspberries, apples, and nectarines can deform or scar developing fruit; sugar pea pods may be scarred or deformed.

Western flower thrips are primarily pests of herbaceous plants, but high populations occasionally damage continuously or late-blossoming flowers on woody plants such as roses. When thrips populations are high on roses, flower buds may become deformed and fail to open. Petals may be covered with brown streaks and spots. Western flower thrips also vector certain tospoviruses including impatiens necrotic spot virus and several strains of tomato spotted wilt virus. Some plant-feeding thrips are also predaceous on other pests, such as spider mites. In some situations western flower thrips is considered beneficial because it feeds on spider mites.

Thrips prefer to feed in rapidly growing tissue. They are poor fliers but can spread long distances by floating with the wind or being transported on infested plants. Herbaceous ornamentals and certain fruit and vegetable crops are generally more susceptible to thrips; infestations may reduce the aesthetic quality of landscapes but usually do not seriously harm or kill woody plants.

MANAGEMENT

Healthy woody plants usually tolerate thrips damage; however, high infestations on certain herbaceous ornamentals and developing fruits or vegetables may justify control. If control is necessary, use an integrated program of control strategies that combines the use of good cultural practices and conservation of natural enemies with the use of least toxic insecticides, such as narrow range oils. Greenhouse thrips biology differs some from that of most other pest thrips; special management information, which is in addition to that given for all thrips, is discussed in a separate section.

Monitoring

Monitor thrips adults and nymphs by branch beating or shaking foliage or flowers onto a sheet of paper, a beating tray, sheet, or clipboard. Adult thrips can also be monitored using bright yellow sticky traps. Blue sticky traps are most effective for capturing western flower thrips, but thrips are harder to discern on this darker background. *Remember that the presence of thrips does not mean that damage will result from their feeding.* Even large numbers of thrips in traps or adults at flowers feeding on pollen do not necessarily indicate that control action is needed. Plants suspected of being infected by thrips-vectored viruses such as impatiens necrotic spot virus or tomato spotted wilt virus can be reliably diagnosed only by a laboratory test of plants with symptoms or, in certain instances, by using specialized test kits discussed in the publication, *Easy On-Site Tests for Fungi and Viruses in Nurseries and Greenhouses*, listed in "References."

Biological Control

Beneficial insects and mites including minute pirate bugs and predaceous mites help to control certain plant-feeding thrips species (Table 3). Although certain predators and parasites of thrips are produced commercially and can be purchased through the mail, little or no research has been conducted on the effectiveness of releasing thrips predators or parasites in landscapes and gardens. Conserving naturally occurring populations of beneficials by controlling dust and avoiding persistent pesticides is the most important way to encourage biological control of thrips.

Cultural Control

Thrips often move into gardens and landscape plantings when plants in weedy areas or grasslands begin to dry in spring or summer, so it is wise to avoid planting susceptible plants next to these areas or to control nearby weeds

Table 3. Some Natural Enemies of Pest Thrips.

Natural enemy	Prey
Chrysopa and *Chrysoperla* spp. predatory lacewings[1]; *Orius* spp. and other predatory minute pirate bugs[1]; *Amblyseius*, *Euseius*, *Neoseiulus* spp. and other predatory mites[1]; tiny wasps, species-specific parasites	many thrips species and other pests
Anystis agilis predatory mite; *Euseius tularensis* predatory mite	citrus thrips
Franklinothrips orizabensis predatory thrips	avocado thrips, greenhouse thrips
Franklinothrips vespiformis predatory thrips[2]	avocado thrips, greenhouse thrips
Macrotracheliella nigra predatory minute pirate bug	Cuban laurel thrips
Scolothrips sexmaculatus predatory sixspotted thrips	mites primarily, but feeds some on thrips and other pests
Thripobius semiluteus nymphal endoparasitic wasp[3]	greenhouse thrips

[1] Commercially available for purchase and release, but effectiveness in gardens and landscapes is uncertain and undocumented for most situations. Mail-order sources include those listed in the free pamphlet *Suppliers of Beneficial Organisms in North America* available from the California Department of Pesticide Regulation, 830 K Street, Sacramento, CA, 95814-3510, phone 916-324-4100, or on the World Wide Web at: http://www.cdpr.ca.gov/docs/ipminov/bensuppl.htm.

[2] Known to be effective in California only in south coastal areas of the state.

[3] Known to be effective outdoors in California only in south coastal areas of the state and when released in greenhouses.

that are alternate hosts of certain thrips. In small gardens, thrips can be knocked off plants with a spray of water. Vigorous plants normally outgrow thrips damage; keep plants well irrigated, but avoid excessive applications of nitrogen fertilizer, which may promote higher populations of thrips. Remove and dispose of old, spent flowers. Investigate the availability of resistant cultivars. For example, western flower thrips damage to roses is less of a problem in cultivars with sepals that remain tightly wrapped around the bud until just before blooms open.

Pruning. Prune and destroy injured and infested terminals when managing a few small specimen plants in the landscape. Regular pruning of infested parts can be especially effective with the gall-making Cuban laurel thrips. Avoid shearing plants. Shearing, which is clipping dense foliage to maintain an even surface on formal hedges, stimulates susceptible new growth. Prune by cutting plants just above branch crotches and nodes instead of shearing off terminals. Pruning the interior of citrus trees can increase predaceous mite populations in the exterior canopy, thereby reducing fruit-scarring by citrus thrips. Regular removal of old blossoms and disposing of them away from host plants may help reduce populations of certain thrips, such as western flower thrips on roses, by removing some immature stages before they complete development and move as adults to other flower buds.

Row Covers. Row covers, hot caps, and other types of cages can exclude thrips and other pests from vegetables and other young herbaceous plants (Fig. 3). Any type of covering that excludes insects but allows light and air penetration can be used. Wood, wire, or plastic frames covered with muslin, nylon, or other mesh can be used for several years. Floating row covers can be placed on top of beds with no frames or hoops. The crop itself lifts the fabric as it grows. Vented polyethylene, spunbonded polyester, point-bonded polypropylene, and woven plastics are available for this use. Floating row covers are useful on sturdy crops that do not grow too tall. Use hoops, plastic tunnels, or wire strung between posts to hold up covers on plants that grow upright or have sensitive tips that might be damaged when pushing against covers (Fig. 4).

Apply row covers during planting or before crops emerge. Plants are normally covered or caged only while they are young and most susceptible to damage. Once plants get larger or temperatures get warmer, remove covers to provide enough growing space and to prevent overheating. A drip or furrow irrigation system is necessary when using row covers.

Reflective Mulch. Reflective mulch or mesh confuses and repels certain flying insects searching for plants, apparently because reflected ultraviolet light interferes with the insects' ability to locate plants. Most uses of reflective mulch have been against winged aphids, but infestation of young plants

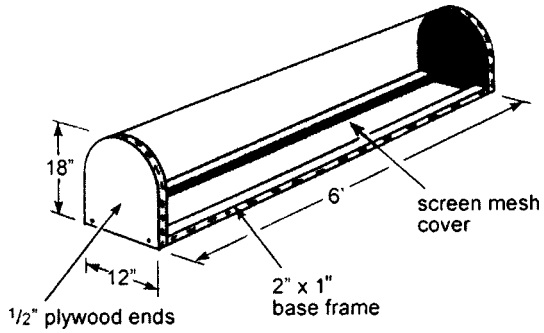

Figure 3. Plant cages for keeping insects out of establishing plants. Cover frames with any type of covering that excludes insects but allows light and air to penetrate.

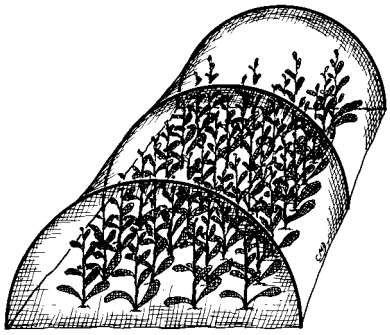

Figure 4. Wires or plastic hoops can be arched over young plants to hold up covers made of mesh or other material that excludes insects during the period of plant establishment.

by other pests including leafhoppers, thrips, and whiteflies has also been prevented or delayed. In flower and vegetable crops that are especially sensitive to viruses, the added cost of reflective mulch may be justified because the mulch can be significantly more effective than insecticides in preventing the spread of viruses and other diseases vectored by insects. It is most effective during early growth when plants are small; as plants grow larger, it is less effective, and other methods may be needed. Reflective mulches cease to repel insects when the plant canopy covers more than about 60% of the soil surface.

Transplant through holes in the mulch or apply the mulch before plants emerge from the soil by leaving a thin mulch-free strip of soil along the planting row. Liquid reflective mulches are also available that can be sprayed on the soil and plants emerge through them. Reflective mesh is also available for application over the top of a crop that can lift this lightweight material as it grows. Various materials, such as polyethylene plastic film, can be used. Silver or gray are the most effective colors for reflective mulch or mesh, but white also works. Commercially available products include aluminum-metalized polyethylene and silver-embossed polyethylene from suppliers listed at the end of this publication. Aluminum foil is also effective but is expensive, delicate to handle, and probably not feasible on a large scale but may be fine for a home garden.

Reflective mulch may improve crop growth beyond that provided by pest control, possibly due to warmer night soil temperatures, more even soil moisture, and increased light levels. Certain mulches have other beneficial or negative effects, such as weed control, water conservation, or increasing crop susceptibility to root diseases, so investigate which material is likely to work best in your situation.

Disposing of plastics can often be a problem because most recyclers will not accept plastics with soil on them; consequently, most plastic mulches in California are disposed of in landfills. If they are handled carefully, however, plastic mulches may be usable for more than one season.

Chemical Control

Although thrips damage to leaves is unsightly, thrips activity does not usually warrant the use of insecticide sprays. For instance, while thrips damage on citrus or avocado fruit may look unpleasant, it does not harm trees or affect the internal fruit quality. Also, by the time damage is noticed on ripening fruit, the thrips that caused the injury are usually gone. While viruses vectored by thrips may cause plant loss, insecticide sprays are not recommended to prevent viruses because thrips are not killed fast enough to prevent the transfer of the virus to new plants. Furthermore, most thrips are difficult to control effectively with insecticides because they are protected within plant parts that surround them as they feed. If insecticides are used, they will only be partially effective and must be combined with appropriate cultural practices and conservation of natural enemies.

Narrow-range oil, neem oil, and other low-toxicity insecticides such as insecticidal soaps or pyrethrins can be somewhat effective for temporary reduction of thrips populations if applied when thrips and damage first appear. These materials have the benefit of allowing at least a portion of the natural enemy populations to survive because they don't leave toxic residues. Sprays must be applied to thoroughly cover susceptible plant tissue, such as new leaf growth and buds. On plants with a history of severe, unacceptable damage, begin treatment early when thrips or their damage is first observed. Repeat applications (usually 5 to 10 days apart, depending on temperature) are usually required because these insecticides only kill newly hatched thrips and recently emerged adults. With most thrips species, eggs are protected within plant tissue and prepupae and pupae are in the soil and will not be killed. No pesticide treatment will restore the appearance of injured tissue; plants will remain damaged until leaves drop or injury is pruned off.

For ornamental nonfood plants, several applications of a systemic insecticide such as the organophosphate acephate (Orthene) can provide temporary control of thrips, but this product can be highly toxic to natural enemies. Another systemic insecticide, imidacloprid (Bayer Advanced Garden, Marathon, and Merit), is also available. This material will provide some suppression of foliage-feeding thrips only. Other materials available to licensed pesticide applicators include the microbial-derived materials abamectin (Agri-Mek and Avid) and spinosad (Conserve and Success), which have low to moderate impact on natural enemies. None of these materials, however, provides complete control of thrips. Avoid the use of organophosphate insecticides (e.g., malathion), carbamates (carbaryl), or pyrethroids (e.g., cyfluthrin, fluvalinate, and permethrin) because all these materials are highly toxic to natural enemies, will cause dramatic increases in spider mite populations, and are not particularly effective against thrips.

Greenhouse Thrips

Greenhouse thrips infests many perennial plants, usually those with harder leaves. It occurs primarily on the underside of leaves, on touching fruit clusters, and on plant parts that touch

each other. Greenhouse thrips is a sluggish species with adults that tend not to fly. Populations usually begin in a limited part of the plant and spread slowly, so pruning off colonies can be effective if the undersides of leaves on susceptible plants are regularly inspected to allow early detection and removal of new infestations. In addition to the materials listed above for the control of thrips on ornamental nonfood plants, greenhouse thrips is readily controlled with thorough application of contact sprays such as oil or pyrethrins (plus piperonyl butoxide) to the underside of infested leaves where it feeds. However, because populations rapidly resurge, repeat applications may be necessary.

A parasitic wasp, *Thripobius semiluteus*, that attacks only greenhouse thrips has been effective in controlling this pest in greenhouses and southern California avocado orchards. There is no information on the effectiveness of *Thripobius* in landscapes, and this parasite may not be commercially available.

Observe whether any greenhouse thrips are parasitized and, if *Thripobius* is present, conserve parasites whenever possible. The tiny, black and yellowish female *Thripobius* lays its eggs in young thrips nymphs. Parasitized thrips become swollen around the head, and about 2 weeks before the wasp's emergence, the parasitized nymphs turn black, in contrast to the yellow color of unparasitized nymphs. Unlike healthy black mature thrips, the black parasitized nymphs are smaller and do not move. *Thripobius* develops from egg to adult in about 3 weeks when temperatures average 70°F.

Suppliers of Reflective Mulch

Adcock Manufacturing Corp.
1550 W. 132nd Street
Gardena, CA 90249
(310) 532-4350, (800) 523-2625
http://www.adcockmfg.com

Blake Enterprises
1810 13th St., Suite 9
Reedley, CA 93654
(559) 638-2200
www.bcag.net

Sonoco
North Second Street
Hartsville, SC 29550
(843) 383-3203
www.sonoco.com

SUGGESTED READING

Dreistadt, S. H., J. K. Clark, and M. L. Flint. 1994. *Pests of Landscape Trees and Shrubs: An Integrated Pest Management Guide.* Oakland: Univ. Calif. Agric. Nat. Res. Publ. 3359.

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To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

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