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Greenhouse Thrips Emerging as Number One Avocado Pest

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The greenhouse thrips, *Heliothrips haemorrhoidalis,* has been causing an alarming amount of damage in coastal avocado-growing areas of southern California in recent years. Severe infestations have been reported in San Diego, Ventura, and Santa Barbara counties. Thrips-damaged fruit, though usually unblemished under the skin, are downgraded by packing houses and thus result in tremendous monetary losses to growers. Packing houses vary in their treatment of thrips-damaged fruit, but most automatically drop the price by at least 50%. When combined with a damage level which may reach 50-80%, this represents a loss of thousands of dollars of income to growers.

The greenhouse thrips (GHT) obtains its name from the fact that it is often found in greenhouses. However, it has a very broad host range including citrus, cherimoya, guava, mango, sapote, and many ornamentals, as well as avocados. On avocados, the location of damage is related to the race or variety. On trees of Mexican origin, including Bacon and Zutano, the GHT feeds primarily on the leaves and rarely on the fruit. On Guatemalan varieties including Hass, however, the primary feeding site is the fruit. The latter is considered of much greater economic importance. Leaf feeding is not generally severe enough to be likely to cause a decrease in tree vigor. The GHT is primarily a pest of humid coastal areas, within 15 miles of the ocean. The most severe fruit damage has been reported in Santa Barbara, Ventura, and San Diego counties.

Biology

The eggs of the GHT are laid singly, just under the epidermis of the leaves or fruit. The areas in which eggs are laid are often referred to as "blisters" because of the expansion which occurs just before hatching. The two larval stages, known as first and second instars, can be identified by the yellowish or reddish drops of fecal material that they carry above their elevated abdomens. These drops gradually increase in size as the thrips feed, then drop off to the leaf or fruit surface, after which a new drop begins to form. These drops turn black in color once they reach the leaf or fruit surface, and become an excellent indicator of the thrips' feeding.

The greenhouse thrips goes through two pupal stages, known as the "prepupal" and "pupal" stages. Although the mouth parts are non-functional in these stages, the thrips remain mobile. These stages can be recognized by their pale whitish color, more sluggish movement, the presence of wing buds, and the fact that they no longer carry a drop of excrement on their abdomens.

The adult greenhouse thrips is white in color when it first emerges, then turns black

within a few hours except for the legs and wings, which remain white. All of the adults are female, and reproduction is by parthenogenesis. Each female lays about two eggs per day, and approximately 60 in a lifetime. Because there is no need to mate, one adult thrips can produce an entire colony.

All stages of the GHT are very small, and barely visible with the naked eye. The adults are only 2-3 mm in length, and may be very difficult to identify on the surface of a fruit. Identification of the larval and pupal stages requires the use of a hand lens. All stages are slow-moving, and the adults are not known to fly. Spread of GHT populations is most likely by wind, birds, and equipment. Populations of GHT may exist in all stages throughout the year, though survival through the winter seems to be primarily in the adult and egg stages. Reproduction occurs whenever a period of warm weather occurs, and drastic population reductions as a result of extreme weather conditions are common.

Damage and Feeding

The injury of the GHT consists of a "sandpapering" effect to the leaves or fruit, caused by their rasping-sucking mouthparts and the removal of chlorophyll. On the fruit, these areas gradually become hardened, thick, and may crack open in places. The damage usually begins in a small, rounded area on the bottom or side of a fruit, often in the protected area where two fruits touch or a leaf is in contact with a fruit. "Colonies" of thrips developing in these spots gradually move out over undamaged areas of the fruit, and may scar the entire surface by the time that it is picked. Areas on which thrips have been feeding are brown in color and covered with the black specks of their excrement. Frequently these damaged areas are a better indicator of the thrips' presence than the thrips themselves, which may be difficult to find. Damage by the brown mite, a common pest of avocado leaves, may be distinguished from GHT damage by the absence of the black specks of excrement, presence of cast skins, and the concentration of damage along the veins of the lower side of the leaf.

Natural Enemies and Biological Control

Although several natural enemies of the GHT have been identified, none of these has been specific enough or easy enough to rear to be useful in biological control. Predators that have been found in avocado groves in southern California include green lacewings, lady beetles, and two species of predatory thrips. *Franklinothrips* sp. has a reddish, swollen appearance and a red band across the center of its body. The black hunter, *Leptothrips mali,* is a fast-moving black thrips considerably larger than the GHT. None of these predators has been found in significant numbers to be likely to have an impact on GHT populations. Lacewings and lady beetles are available from many insectaries and occasionally found in the field, but their rapid dispersal and lack of specificity of prey has made them of questionable value in most agricultural situations.

Three parasites have been introduced by Dr. Jim McMurtry of the University of California, Riverside, with only marginal success. The first, *Megaphragma mymarpenne,* has parasitized up to 40-50% of eggs in caged situations. The culturing of this tiny wasp

has been extremely difficult, however, and preliminary releases in Santa Barbara and Orange counties have not become established. The second, *Goetheana parvipennis,* is a parasite of early-stage larvae and pupates in fully-grown larvae. This parasite is also difficult to culture; and releases in Santa Barbara, Orange, and San Diego Counties have not become established. A third species, *Thripobius semilutus,* also parasitizes early-stage larvae and pupates in fully-grown larvae. Some cases of recovery of this parasite from orchards where it was released have been reported, and we are optimistic that it may become established. The impact that this parasite will have, if it becomes established, is unknown at this time. Dr. McMurtry reports that efforts to import, rear, and release additional species of parasites will continue. These efforts will probably be concentrated in northern South America, which is believed to be the point of origin of the GHT as it is the only place where males have been found.

Chemical Control

Malathion is currently the only chemical registered in California for the GHT. Pyrenone Crop Spray®, a pyrethin-containing material, has also been available on a Special Local Need registration for the past two years. The increase in the use of malathion in avocados over the past 6 years has been dramatic. In Santa Barbara County, alone, 239 acres were treated in 1980 and 2000 in 1984. There is circumstantial evidence that these treatments are causing flare-ups of the avocado brown mite, due to their detrimental effect on native predator mite and *Stet horns* beetle populations. In a research plot in Summerland (Santa Barbara County). a malathion application in July caused a total suppression of predator mite populations on monitor trees which did not recover until the following January. Unfortunately, this period is precisely the time that avocado brown mite populations usually become a problem. Concern over the possibility of a "pesticide treadmill" taking place on avocados as it has on other crops has led to an intensive research effort funded by the California Avocado Commission. Six different pesticides (organophosphates, botanicals, and other materials) have been tested for their efficacy against the GHT and their effects on predator populations. Data from these studies will be available shortly.

Management

In the long term, we hope to have a biological control and/or a selective insecticide for GHT. Until then, a few hints can be offered to growers:

—Watch for hot, dry, windy spells. These can result in drastic drops in thrips populations so that chemical control may not be necessary.

—Catch populations early, and spot-treat from the ground. A monthly walk through the grove may allow you to identify and control "hot-spots" before all of the trees are affected.

—If you have a high population of thrips and don't plan to spray, pick early. Higher prices later in the season may easily be offset by a loss of revenue from downgrading in the packinghouse.