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Bean Thrips *Caliothrips fasciatus* (Pergande, 1895) (Insecta: Thysanoptera: Thripidae)[1]

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The Featured Creatures collection provides in-depth profiles of insects, nematodes, arachnids and other organisms relevant to Florida. These profiles are intended for the use of interested laypersons with some knowledge of biology as well as academic audiences.

Introduction

Caliothrips fasciatus (Pergande, 1895), is commonly known as bean thrips (Figure 1). *Caliothrips fasciatus* is in the thrips family Thripidae characterized by the presence of a down-turned ovipositor, 8-segmented antennae, and conical formation of the female's last abdominal segment (Bailey 1933). *Caliothrips fasciatus* was considered a serious agricultural pest in California in 1933 but soon lost its pest status. The implementation of integrated pest management, effective use of new insecticides, and resistant cultivars could be the possible reason for this decline (Hoddle et al. 2006). In Florida, *Caliothrips fasciatus* is commonly found in bean with low population (personal observation Khan and Seal). However, populations of *Caliothrips fasciatus* on bean can occasionally be damaging in Florida.

Figure 1. Adult female (A) and male (B) bean thrips, *Caliothrips fasciatus* Pergande (dorsal view).
Credits: Rafia A. Khan, UF/IFAS Entomology and Nematology Department

Synonymy

Heliothrips fasciatus (Pergande, 1895)

Heliothrips fasciatus (Hinds, 1902)

Caliothrips woodworthi (Daniel, 1904)

Hercothrips fasciatus (Hood, 1927)

Distribution

Caliothrips fasciatus is native to North America and western Mexico (Hoddle et al. 2006). In the United States, *Caliothips fasciatus* has been reported from Alabama, Arizona, California, Florida, Idaho, Louisiana, Nevada, South Carolina,

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Texas, Washington, and Wyoming. *Caliothrips fasciatus* was widely distributed in urban, agricultural, and natural areas in California (Bailey 1933). The range of bean thrips also includes the west coast of Canada, Mexico, the state of Bahia in Brazil, and China (Bailey 1933, 1940, Hoddle et al. 2006, 2012, Mound et al. 2011, 2016). *Caliothrips fasciatus* is a quarantine pest in Australia and New Zealand (Hoddle et al. 2006). The distribution of *Caliothrips fasciatus* elsewhere can be considered uncertain (Mound et al. 2011).

Description

Adults of *Caliothrips fasciatus* are uniformly dark brown. Females are fusiform, averaging 1.1 mm in length. The antenna is 8-segmented; the first two segments are uniformly brown; the third and fourth segments are yellow with the apical half light brown and with a forked sensorium; the anterior half of the fifth segment is brown, and the remainder of segments are a uniform brown. The terminal antennal segments are very long and needle-like. The 8th segment is less than twice as long as the 7th segment. The head is not constricted at the base (Figure 2). The pronotum possesses equiangular reticles and many markings within each reticle without any long setae. The metanotum is irregularly reticulate with one pair of major setae close to the anterior margin (Figure 3) (Bailey 1933).

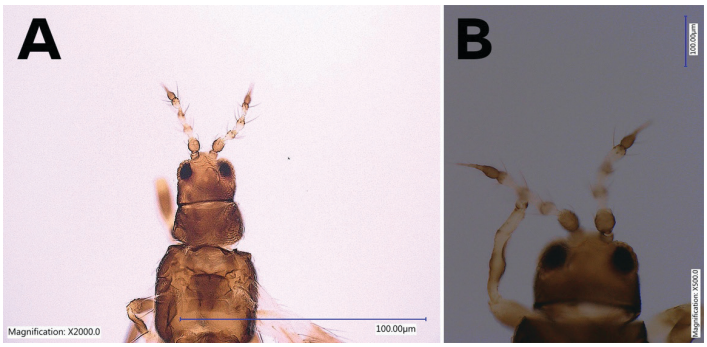

Figure 2. Head and thorax of an adult bean thrips, *Caliothrips fasciatus* Pergande showing antenna with eight antennal segments (A) and enlarged view of one antenna (B).
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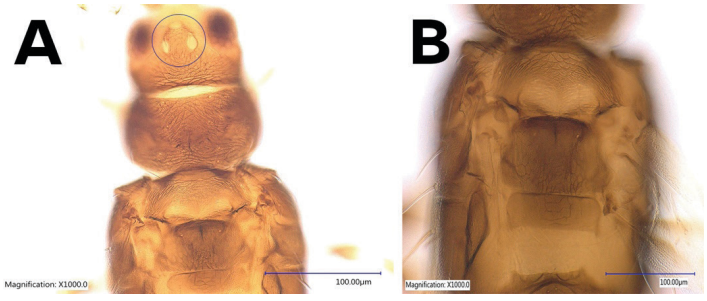

Figure 3. Head of an adult bean thrips, *Caliothrips fasciatus* Pergande, showing ocelli (A, blue circle) and Meso-metathorax (B).
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Both sexes of *Caliothrips facsiatus* are macropterous (having long wings). The fore wing is grayish brown with two white cross bands at the base and sub-apically. The second vein in the forewing possesses five to seven setae, and the costal cilia are shorter than the costal setae. The setal row of the first vein in the forewing is incomplete and uniformly spaced. The setal row of the second vein in the forewing is complete, close together but uniformly spaced. The forewing postero-margin cilia is undulated near the apex. Hind wings are uniformly grayish brown, with one longitudinal vein in the center of the wing that becomes indistinct near the base (Figure 4) (Bailey 1933).

Figure 4. Wings of an adult bean thrips, *Caliothrips fasciatus* Pergande.
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Femora is dark brown and light-colored at the tip. Central portion of tibia is dark brown with yellow extremities. Tarsi are elongated and 1-segmented. Tergites reticulate on lateral thirds; reticles are longer than wide with numerous internal markings. The 8th abdominal tergite is with posteromarginal craspedum medially but the comb of microtrichia laterally. The median split on the 10th segment is about half as long as tergite (Figures 5 and 6). The third to seven male sternites are with small oval glandular area or pore plate and tergite nine with three pairs of stout setae medially, the median pair thorn-like. The male sternites 3-7 are with a small transverse pore plate (Figure 7) (Bailey 1933).

Figure 5. The whole abdomen (A) and abdominal tergites of female adult bean thrips (B), *Caliothrips fasciatus* Pergande.
Credits: Rafia A. Khan, UF/IFAS Entomology and Nematology Department

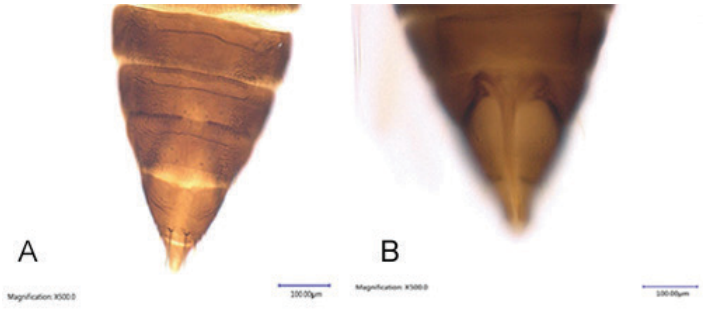

Figure 6. Abdominal tergites of female adult bean thrips, *Caliothrips fasciatus* Pergande, showing abdominal tergite 8 and 9 (A), and ovipositor (B).
Credits: Rafia A. Khan, UF/IFAS Entomology and Nematology Department

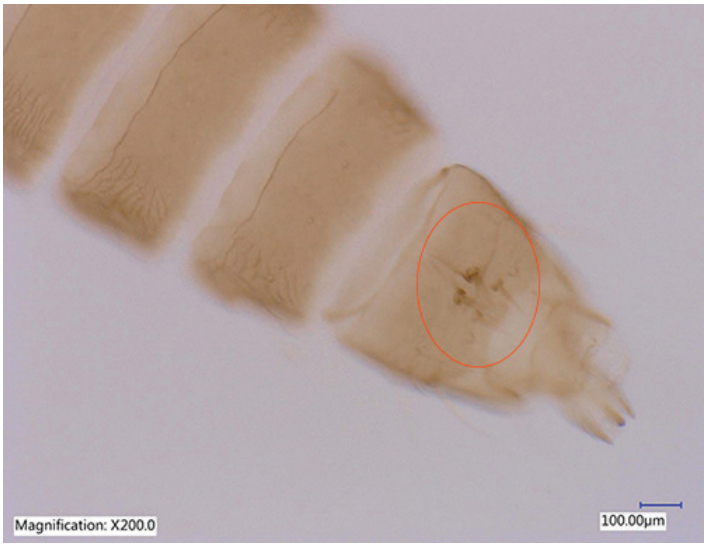

Figure 7. Abdominal tergites of male adult bean thrips, *Caliothrips fasciatus* Pergande, showing abdominal tergite IX with 3 pairs of short and very stout setae (red circle).
Credits: Roshan Adhikari, UF/IFAS Entomology and Nematology Department

Life Cycle

The detailed life cycle parameters of *Caliothrips fasciatus* were studied by Bailey (1933) in California on pears and beans. *Caliothrips fasciatus* reproduces bisexually and parthenogenetically (arrhenotoky, a form of parthenogenesis in which the unfertilized eggs develop into males). Females are produced from fertilized eggs, and males from unfertilized eggs. The sex ratio of *Caliothrips fasciatus* is 2:1 (female:male). In California, Bailey (1933) found that the overwintering adults migrated to prickly lettuce (*Lactuca serriola* L.) and sow thistle (*Sonchus* spp. L.) of the plant family Asteraceae and completed two generations from April to early June. The generation time of *Caliothrips fasciatus* is three weeks during summer, and it can complete six or seven generations from April to October. When natural vegetation senesces, adults migrate to crops in late June or early July. Females insert eggs within plant tissue in the early morning and late afternoon. There are two larval instars of *Caliothrips fasciatus,* found primarily on the undersides of leaves. Mature second instars drop from the host to the ground for pupation, passing through prepupal and pupal stages. Eggs hatch in about seven days; the first and second instars feed for ten days, and the pupal stage is five days long during the summer in central California. *Caliothips fasciatus* adults are active between 50°F (10°C) and 117°F (47°C) while the optimum activity ranges from 75°F (24°C) and 90°F (32°C). In California, a 60% natural mortality of *Caliothrips fasciatus* was reported. The adult longevity of *Caliothrips fasciatus* varies by season, averaging 22 days on pears (*Pyrus* spp. plant family Rosaceae) and beans (*Phaseolus vulgaris* L. plant family Fabaceae). *Caliothrips fasciatus* adults disperse into crop fields in irregular patterns with dispersion depending on wind and location of host plants. Females require mating with males to produce female offspring. Females, once mated, lived 20 days (Bailey 1933).

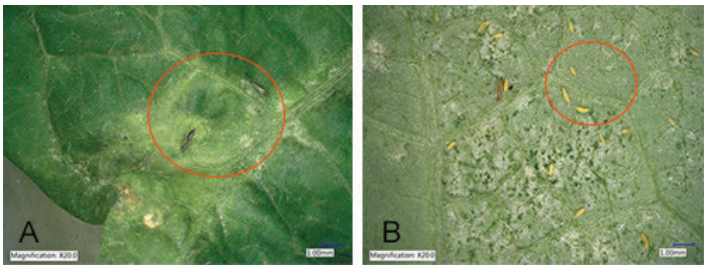

Figure 8. Adult bean thrips, *Caliothrips fasciatus* Pergande on bean leaf (A) (red circle), and immature stages of *Caliothrips fasciatus* Pergande, showing first and second install larva (B) (red circle). In both figures also showing the feeding injury by thrips (white colors and stipples).
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Hosts

Table 1. *Caliothrips fasciatus* exhibits a wide range of hosts listed below.

Type of host	Common Name	Scientific name	Plant Family
Crop	Alfalfa	*Medicago sativa* L.	Fabaceae
Crop	Beans	*Phaseolus vulgaris* L.	Fabaceae
Crop	Clover	*Trifolium* L.	Fabaceae
Crop	Pea	*Pisum sativum* L.	Fabaceae
Crop	Almond	*Prunus amygdalus* Batsch	Rosaceae
Crop	Apple	*Malus domestica* Borkh.	Rosaceae
Crop	Peach	*Prunus persica* L.	Rosaceae
Crop	Pear	*Pyrus communis* L.	Rosaceae
Crop	Strawberry	*Fragaria x ananassa* Duchesne	Rosaceae
Crop	Prune	*Prunus domestica* L.	Rosaceae
Crop	Cabbage	*Brassica oleracea* L.	Brassicaceae
Crop	Cauliflower	*Brassica oleracea* L.	Brassicaceae
Crop	Kale	*Brassica oleracea* L.	Brassicaceae
Crop	Turnips	*Brassica rapa* L.	Brassicaceae
Crop	Radishes	*Raphanus* sp. L.	Brassicaceae
Crop	Potato	*Solanum tuberosum* L.	Solanaceae
Crop	Tomatoes	*Solanum lycopersicum* L.	Solanaceae
Crop	Avocado	*Persea americana* Mill.	Lauraceae
Crop	Swiss Chard	*Beta vulgaris* L.	Amaranthaceae
Crop	Corn	*Zea mays* L	Poaceae
Crop	Cotton	*Gossypium hirsutum* L.	Malvaceae
Crop	Grape Vine	*Vitis vinifera* L.	Vitaceae
Crop	Lettuce	*Lactuca sativa* L.	Asteraceae
Crop	Olive	*Olea europaea* L.	Oleaceae
Crop	Onions	*Allium cepa* L.	Amaryllidaceae
Crop	Oranges	*Citrus* spp. L.	Rutaceae
Crop	Persimmon	*Diospyros virginiana* L.	Ebenaceae (Bailey 1933)
Crop	Onion	Allium cepa L.	Amaryllidaceae (Greenberg et al. 2009)
Weed	Rough Pigweed	*Amaranthus retroflexus* L.	Amaranthaceae
Weed	Mayweed	*Anthemis cotula* L.	Asteraceae
Weed	Bamboo	*Arundinaria japonica* Michx.	Poaceae
Weed	Milkweed	*Asclepias Mexicana* L.	Apocynaceae
Weed	Aster	*Aster* sp. L.	Asteraceae
Weed	Saltbush	*Atriplex* sp. L.	Amaranthaceae
Weed	Bur Marigold	*Bidens polisa* L.	Asteraceae
Weed	Common Yellow Mustard	*Brassica campestris* L.	Brassicaceae
Weed	Indian Shot	*Canna* sp. L.	Cannaceae
Weed	Golden Shower	*Cassia* sp. L.	Fabaceae
Weed	Nettle Leaf Goosefoot	*Chenopodium murale* L.	Amaranthaceae
Weed	Indian Thistle	*Cirsium edule* Nutt.	Asteraceae),
Weed	Morning Glory	*Convolvulus arvensis* L.	Convolvulaceae
Weed	Hawksbeard	*Crepis* sp. L.	Asteraceae
Weed	Prickly Cucumber	*Echinocystis* sp. Torr. and A. Gray	Cucurbitaceae
Weed	Horseweed	*Erigeron canadensis* L.	Asteraceae

Economic Importance

Both larval and adult *Caliothrips fasciatus* cause direct feeding injury to plants by using their asymmetrical piercing-sucking mouthparts. They consume the plant sap from the epidermal and mesophyll cells of the host leaves (Lewis 1973, Hunter and Ullman 1992). However, large aggregations of larvae cause more injury to host plants than adults. Larvae and adults feed on foliage, flowers, fruits, and stems of the host plant (Childers and Achor 1995). Feeding injury of *Caliothrips fasciatus* appears as silvering or bronzing on leaves leading to defoliation and plant death. In pears, feeding injury of *Caliothrips fasciatus* results in "sun-scald" on immature fruits and reduces the productivity of the tree in the following growing season. *Caliothrips fasciatus* can feed on immature fruits producing scarring and downgrading at the packinghouse. *Caliothrips fasciatus* may also cause cosmetic injury on fruit surfaces from black fecal droplets (Russell 1912, Bailey 1933). *Caliothrips fasciatus* was identified as a quarantine pest of several shipments of navel oranges sent from California to Australia in the 1996–1997 season. California growers were concerned about the potential loss of the Australian citrus market, however, *Caliothrips fasciatus*did not develop into a serious pest of California citrus (Hoddle et al. 2006).

Management

Monitoring

Green sticky cards are more effective at capturing *Caliothrips fasciatus* than yellow, white, or blue sticky cards, but all colors can be used to monitor population trends of *Caliothrips fasciatus* (Harman et al. 2007). *Caliothrips fasciatus* is commonly observed on bean plants in Florida. The larvae are more abundant on the underside of the leaves than the upper side and adults are more common in flowers than leaves (personal observation Khan and Seal 2019).

Chemical Control

Insecticides of different modes of action can be effective against *Caliothrips fasciatus* when applied to foliage (Greenberg et al. 2009, Renkema et al. 2020). However, information on registered insecticides to manage *Caliothrips fasciatus* is scarce in the literature. Leesch et al. (2007) reported that the combination treatment of ozone, vacuum, and carbon dioxidecould control the overwintering *Caliothrips fasciatus* on navel oranges shipped to Australia without damaging the fruits. Fumigation of California navel oranges with ethyl formate mixed with carbon dioxide effectively managed adult *Caliothrips fasciatus* without affecting fruit quality (Bikoba et al. 2019).

Biological Control

Biological control agents of thrips can be useful to manage *Caliothrips fasciatus* populations. Important predators of thrips include minute pirate bug *Orius* spp. Wolff, *Anthocoris* sp. Fallen (Hemiptera: Anthocoridae); ladybird beetles *Hippodamia* spp. Dejean (Coleoptera: Coccinellidae); syrphid larvae such as *Syrphyus* sp. Fabricius and *Sphaecrophoria* sp. Thomson (Diptera: Syrphidae); lacewing *Chrysopa* spp. Leach (Neuroptera:Chrysopidae), predaceous thrips *Aeolothrips* spp. Priesner (Thysanoptera: Aeolothripidae), and *Scolothrips* sp. Hinds (Thysanoptera: Thripidae). Both adults and nymphs of *Orius insidious* var. *tristicolor* White, larva of *Chrysopa californica* Coq., larva of *Hippodamia convergens* Guerin, larva of *Aeolothrips kuwanai* Moulton, larva of *A. fasciatus* L., mites *Phytoseiulus macropilis* Banks (Acari: Phytoseiidae) and *Anystis agilis* von Heyden (Trombidiformes:Anystidae) were found to predate on larval *Caliothrips fasciatus* in central California (Bailey 1933). The predatory thrips such as *Aeolothrips* spp., *Franklinothips vespiformis* Craw. (Thysanoptera: Aeolothripidae), *Franklinothrips orizabensis* Back (Thysanoptera: Aeolothripidae), and *Scolothrips sexmaculatus* Pergande (Thysanoptera: Thripidae) are potential predators of *Caliothrips fasciatus* (Dreistadt et al. 2004). The hymenopteran parasitoid *Thripoctenus russelli* Craw. (Hymenoptera: Eulophidae) was recognized as the most important natural enemy of *Caliothrips fasciatus* in California (Bailey 1933).

Cultural Control

Heavyrainfall can suppress *Caliothrips fasciatus* populations (Greenberg et al. 2009) and overhead irrigation would be useful for management. *Caliothrips fasciatus* can complete its life cycles on many cultivated crops and wild plants. Therefore, removal of weeds from and around the field may help reduce *Caliothrips fasciatus* in the crop and the migration to the crop (Parker et al. 2013).

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