

## 2017-2018 FLORIDA CITRUS PRODUCTION GUIDE:

# Plant Bugs, Chewing Insect Pests, Caribbean Fruit Fly, and Thrips<sup>1</sup>

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The insects listed in this section are generalist feeders for which citrus is not a preferred host. They are, therefore, only sporadic problems in Florida citrus. While these pests do not require routine treatment in all groves, periodic outbreaks can potentially have dramatic impact on tree health and/or productivity. When these insects are detected at damaging levels, it is often a result of unusual climatic conditions or cultural practices. Some pests may also migrate into citrus from adjacent field or forage crops when these are harvested. Given that the distribution of these insects is rarely uniform, some monitoring effort should be directed towards delineating the boundaries of an infestation prior to any chemical application so that treatment can be limited to affected blocks only. Benefits of 'spot' applications, or restricting treatments to affected areas only, are twofold: (1) direct monetary savings realized through reduced labor and material costs, and (2) the preservation of unsprayed refuges for beneficials that ensures rapid recovery of natural enemy populations and accelerates the post-treatment restoration of biological control. Frequent monitoring (especially during growth flushes), proper identification, and timely application of the appropriate control measures are all essential to reducing the impact of these pests.

## PLANT BUGS

Plant bugs are sucking insects that feed on a wide variety of plants and occasionally migrate into citrus in large numbers when adjacent field crops are harvested. The most important species affecting citrus are the citron bug (*Leptoglossus gonagra*), the leaf-footed plant bug (*L. phyllopus*), and the southern green stink bug (*Nezara viridula*). They may also

develop on rank undergrowth within the grove. Under normal conditions, plant bugs are rarely numerous enough to be any cause for concern. However, if large numbers move into trees during the fruit ripening period, they may cause substantial direct damage by puncturing the peel to suck the juices. Pathogens enter through the puncture wound, producing a surrounding sunken area of necrotic tissue. If damage is done early enough, fruit will fall before harvest. Thin-skinned varieties such as Hamlin are especially vulnerable. Timely weed control may often avert plant bug problems whereas mowing or herbiciding infested weeds may exacerbate a problem. In such a case insecticidal control may be necessary. If possible, spot treatments of infested areas are always preferable in the interest of conserving natural enemies.

## ORANGEDOG

The adult of the orangedog is the giant swallowtail butterfly (*Papilio crephontes*). Orangedog eggs are large, round, semi-translucent, orange in color, and easily recognized on the expanding terminals where they are typically laid. The developing larvae are shiny brown and white, resembling bird-droppings and feed preferentially on the new leaves. Under normal conditions, populations are sufficiently low, and the damage sufficiently dispersed, that there is little cause for concern. However, situations can arise especially in the fall, when large numbers of butterflies deposit numerous eggs on very young trees that then suffer severe damage from developing larvae. However, damage can only be averted by chemical treatment if the problem is detected early, i.e., when the majority of larvae are still in early stages of development. When larvae reach later

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instars, they are more resistant to insecticides and most feeding damage will have already occurred. Careful monitoring of young groves early in flush cycles is necessary for timely detection and treatment. *Bacillus thuringensis* (Bt)-based materials provide effective control with the added advantage of not affecting beneficial species.

## GRASSHOPPERS, CRICKETS AND KATYDIDS

These insects rarely require chemical control, as they are only a problem sporadically and in specific circumstances. Grasshoppers, primarily the eastern lubber grasshopper (*Romalea microptera*), and the American locust (*Schistocera americana*), can cause serious damage to growth flushes and may also damage fruit, especially in its early stages. The broadwinged katydid (*Microcentum rhombifolium*), the restless bush cricket (*Hapithus agitator*) and the jumping bush cricket (*Orocharis luteolira*) may also attack citrus. However, these insects typically do not spend their entire life cycle on citrus and usually are only a problem if they enter groves in large numbers. Adjacent pastures, hay fields, and fallow lands can be significant sources of these insects, as can weedy swales and row middles. For this reason, timely weed control may often avert a problem. The American locust is migratory and may become gregarious, in which case it can cause rapid and severe damage to new growth and young fruit.

## ASIAN COCKROACH

The Asian cockroach (*Blattella asahinai*) is very similar in appearance to the German cockroach (*Blattella germanica*) although their habits are quite different. The Asian cockroach flies readily and rarely invades dwellings in contrast to its German cousin. First detected in Lakeland in 1986, the Asian cockroach quickly spread throughout the state and is now present in most citrus growing areas. They feed primarily on decaying vegetation and largely inhabit moist litter under trees. However, they can also climb into the canopy, especially at night, where they feed on tender flush giving it a ragged appearance. Nevertheless, insecticide applications, if deemed necessary, should be directed at the soil under the canopy where population resides and takes refuge.

## FIRE ANTS

Fire ants (*Solenopsis invicta*) are largely predaceous, feeding on other insects, and as such may provide a useful function, attacking such pests as citrus leafminer larvae or newly hatched root weevil larvae as they seek to enter the soil in search of rootlets. However, there are several contexts in which fire ants can be considered pests in citrus. Trunk wraps applied to very young trees provide a protected environment for fire ants to

attack tender young bark. These attacks elicit sap flows that are collected by the ants, but girdling and death of the tree may result from direct effects of ant feeding and/or footrot caused by infection of *Phytophthora*. Leaf buds may also be damaged by feeding. High densities of fire ant mounds can create problems for grove workers during maintenance of irrigation systems and for fruit pickers at harvest. Long-term control is best obtained with baits, although soil applications of contact insecticides or even foliar applications of oil may provide temporary relief sometimes needed during harvest.

## EASTERN SUBTERRANEAN TERMITE

The Eastern Subterranean Termite (*Reticulitermes flavipes*) is a native inhabitant of forests throughout the Eastern U.S., where it plays a major role in the decomposition cycle of wood into soil. Subterranean termites feed on seasoned wood, especially pines, and are major pests of wooden structures throughout their range. Only rarely do they attack living trees. This habit is poorly documented in the literature. Nevertheless, they can become serious pests of citrus in groves where pine woods had supported large termite populations. They persist on buried remnants of the original wood but will also girdle and kill young citrus. Populations in groves have been estimated at 5 million individuals and may range over thousands of square yards. Termites are most prone to attack citrus in the summer when rising water tables force them to abandon other food sources, but attack may occur in any season. Attack commences below the soil line and thus may escape detection until tree death. The termites chew away bark and cambium, generally above the scaffold roots and down to bare wood, encircling the trunk. Lesions are characteristically clean and free of gumming. Feeding may advance above the soil line below the bark, in covered galleries, or under tree wraps. Rapid tree decline once girdling is 90% or more complete is characterized by shock bloom, interveinal chlorosis, loss of foliage, and death. Attack is usually limited to trees 5 or fewer inches in diameter.

Control consists of avoiding the problem, first by meticulous removal of wood residues from new grove sites, and then by creating physical or chemical barriers around trees. Eventually, the problem usually subsides due to tree growth beyond the susceptible stage and/or natural attrition of the colony through lack of sufficient food supply. Baiting methods are now being tested and may soon be available to the grower. Meanwhile, the following recommended practices can be employed to avoid most losses:

- Remove as much wood as possible when preparing a new grove site, particularly on pine land.
- Scout suspected infested areas by looking for signs of girdling and inspecting tree crowns below the soil line for lesions and termite activity.
- Do not use tree wraps in infested areas.

- Wash soil from crowns exposing scaffold roots to discourage termites from preferred attack site.
- Create a chemical barrier directly around tree crown, preferably with a granular insecticide. This practice will give a maximum of 3 months protection.

## CARIBBEAN FRUIT FLY

The Caribbean fruit fly, *Anastrepha suspensa*, is a pest of many tropical and subtropical fruits of south and central Florida. The Caribfly is about 1/4<sup>th</sup> inch long, yellow brown with black markings on the wings. Eggs are laid singly under the surface of the peel on ripe or overripe fruit and hatch in 2-3 days. Larvae feed for 10-14 days and develop in decaying fruit. Pupae are then formed and the adults emerge later to complete the cycle.

Caribfly does not pose a direct threat for Florida citrus production, but the management of this pest may be necessary in order to export fruit to certain domestic and foreign markets. For export fruit, fly-free zones may be created to produce fruit for export. The primary requirements are: 1) the designated area and a buffer zone must be maintained free of preferred hosts such as loquat, rose apple, guava, and Surinam cherry, and 2) routine trap surveys must be conducted to monitor any Caribfly movement into the area and document absence. When populations are sufficiently high on the survey traps, bait sprays are used to reduce fly numbers. In addition, postharvest protocols may be implemented to assure that fruit arrives at its destination free of live flies.

Growers and others interested in participating in the Caribfly program must contact the Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Caribbean Fruit Fly Protocol, 3501-0-03 South US # 1, Ft. Pierce, FL 34982-6666. Phone (772) 468-4092.

## FLOWER AND ORCHID THIRPS

Thrips are small, elongate insects in the Order Thysanoptera and vary in size from less than 0.2 mm to over 2.0 mm in length. They are easily overlooked because of their minute size.

The life cycle of a thrips species consists of an egg, two larval feeding stages, a non-feeding pre-pupal stage, a non-feeding pupal stage and feeding adults. About 14-18 days are required to complete development from egg to adult in some *Frankliniella* species.

### Flower Thrips

Flower thrips, *Frankliniella bispinosa* and *F. kellyae*, have been identified as causing injury to developing flowers of navel and Valencia oranges. Crop loss on other citrus varieties has not

been evaluated to date. *F. bispinosa* is the prevalent species throughout the citrus growing areas of the state while *F. kellyae* occurs on citrus from Vero Beach and Hardee County in the north to Dade County in the south. Thrips feeding results in cellular evacuation 1-5 cells deep and subsequent necrosis that can result in abortion of the flower or small fruitlet. Adult populations of these two species are migrating as “aerial plankton” prior to and during the regular flowering cycle between January-April each year. Both species have very wide host ranges and utilize flowers or pollens of many plants as food sources. High populations of these thrips can cause economic loss in navel or Valencia orange by reducing fruit set. Both thrips species insert their eggs singly into all floral parts.

Examine orange blocks during flowering at least twice each week to identify periods when high populations of thrips (i.e. *Frankliniella* spp.) are migrating into the trees. However, numbers of thrips per citrus flower that cause economic loss have not been determined. The adult thrips are about 1 mm long and yellow to straw colored. Dark banding along the upper surface of the abdominal segments may be evident on some adult specimens. Larvae are white or yellow. Thrips are capable of entering buds as soon as individual petals begin to separate. Examine individual flowers, at random, with a 5-10X magnification (head set) and observe their numbers. Residual activity of insecticides is very short (i.e. 3-7 days). Timing of one application to protect the major flowering period between maximum bud swell and full bloom should be considered when thrips are abundant. This is best achieved by treating the block at maximum bud swell or onset of full bloom. Delay will allow thrips to enter the opening flowers and reduce exposure to the insecticide. Treatment recommendations (Table 3) are based on the need for chemical control to optimize fruit set for fresh market. Remember, the recommended insecticides are toxic to honeybees, which also are active around citrus blooms.

### Orchid Thrips

The orchid thrips (*Chaetanaphothrips orchidii* and *Danothrips trifasciatus*) and the greenhouse thrips (*Heliothrips haemorrhoidalis*) cause rind blemish problems on developing fruit (i.e. ring spotting or irregular russeting) on immature and mature clustered fruit or where a leaf or twig is in direct contact with a fruit. The orchid thrips females are yellow to straw colored with distinctive dark banding on the wings. Larvae are white or yellow with distinctive minute spines present on the upper surface of the eighth abdominal segment. Adult female greenhouse thrips are black, while the larval and pupal stages are white. All stages of the greenhouse thrips are occasionally found on the fruit. Economic loss to growers has been restricted to red grapefruit varieties in Florida. However, they are capable of causing damage to white grapefruit varieties also. The orchid thrips is the most commonly-found species associated with damaged grapefruit and occur throughout the year. *Danothrips* is usually present in lower numbers with the orchid thrips.

Examine interior clusters of red grapefruit at random with a 5-10X magnification (head set) beginning the first week of May or just as clustered fruit begin to touch for presence of orchid thrips, *Danothrips trifasciatus*, and greenhouse thrips larvae and adult females. Either wash suspected individual infested fruit in a bucket containing 80% alcohol and record the grove location to verify pest thrips or collect three or more samples of 20 clustered fruit at random from each 10-acre red grapefruit block. Each of the 20 interior canopy red grapefruit should be immediately washed in a bucket containing about one pint of 80% alcohol. Fruit should be collected at random with not more than 4 fruit taken per tree and a minimum of 5 trees per sample. The presence of 20 or more adult or larval thrips warrants an insecticide treatment. If more than 5 thrips are found, the area should be resampled in a week. One or two insecticide applications (Table 3) between May and July may be required to prevent rind blemish damage on red or white grapefruit varieties.

## RECOMMENDED CHEMICAL CONTROLS

READ THE LABEL.

See Table 1.

Rates for pesticides are given as the maximum amount required to treat mature citrus trees unless otherwise noted. To treat smaller trees with commercial application equipment including handguns, mix the per acre rate for mature trees in 250 gallons of water. Calibrate and arrange nozzles to deliver thorough distribution and treat as many acres as this volume of spray allows.

**TABLE 1.** Recommended Chemical Controls for Chewing Insect Pests

Pesticide	IRAC MOA <sup>1</sup>	Mature Trees Rate/Acre <sup>2</sup>	Comments	Other Pests Controlled
<b>Plant Bugs</b>				
Malathion 5 EC Malathion 8EC	1B	6 pt 3.75 pt		See Scale Insects
<b>Orangedog</b>				
<i>Bacillus thuringiensis</i>	11	See label		
Chlorpyrifos 4E	1B	5 pt	May increase spider mite populations. (4 EC is a restricted use pesticide.)	Aphids, crickets, flower and orchid thrips, grasshoppers, katydids, mealybugs, scale insects
Chlorpyrifos 50W		5 lb		
Carbaryl 80S	1A	2.5 lb		
Carbaryl 4L		2 qt	May increase spider mite populations.	Crickets, katydids, grasshoppers, adult root weevils, scale insects
Sevin XLR		2 qt		
<b>Grasshoppers, Crickets and Katydid</b>				
Chlorpyrifos 4E	1B	5 pt	May increase spider mite populations. (4 EC is a restricted use pesticide.)	Aphids, flower and orchid thrips, grasshoppers, katydids, mealybugs, orangedog, scale insects
Chlorpyrifos 50 W		5 lb		
Carbaryl 80S	1A	3.75 lb		
Carbaryl 4L		3 qt	May increase spider mite populations.	Adult root weevils, scale insects
Sevin XLR		3 qt		
<b>Asian Cockroaches</b>				
Chlorpyrifos 4E	1B	1 qt	Soil or chemigation applications. (4 EC is a restricted use pesticide.)	Fire ants, aphids, grasshoppers, katydids, crickets, thrips, mealybugs, scale insects, orangedogs
Chlorpyrifos 15G		6.7 lb		
<b>Fire Ants</b>				
Clinch Bait	6	1 lb	Bearing and nonbearing.	
Extinguish Bait	7A	1 lb	Bearing and nonbearing. Labeled for aerial application.	
Award Fire Ant Bait	7B	1 lb	Nonbearing only. Two applications/season - Spring and late summer.	
Chlorpyrifos 4E	1B	1 qt	Soil, chemigation or fertilizer mix applications. Multiple applications may be required. (4 EC is a restricted use pesticide.)	Termites, Asian cockroaches, aphids, crickets, katydids, mealybugs, scale insects, orangedogs
Chlorpyrifos 15G		6.7 lb		
<b>Eastern Subterranean Termite</b>				
Chlorpyrifos 4E	1B	1 qt	Usually only a problem on young trees. Direct application to base of tree. (4 EC is a restricted use pesticide.)	Fire ants, aphids, crickets, katydids, mealybugs, scale insects, orangedogs, thrips
Chlorpyrifos 15G		6.7 lb		

<sup>1</sup>Mode of action class for citrus pesticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification V.7.3 (2014). Refer to ENY-624, Pesticide Resistance and Resistance Management, in the 2017-18 Florida Citrus Production Guide for more details.

<sup>2</sup>Lower rates may be used on smaller trees. Do not use less than minimum label rate.

**TABLE 2. Recommended Chemical Controls for Flower Thrips on Navel or Valencia Orange**

Pesticide <sup>1</sup>	IRAC MOA <sup>2</sup>	Mature Trees Rate/Acre <sup>3</sup>	Comments	Other Pests Controlled
Danitol	3	1 pt	Restricted use pesticide. See label.	Asian citrus psylla, root weevils
Dimethoate	1B	See label		Aphids, scale insects except citrus snow and black scales
Chlorpyrifos 4 EC	1B	4 pt	Restricted use pesticide. See label.	Mealybugs, orangedog, katydids, aphids, grasshoppers, scale insects, thrips

<sup>1</sup> All products toxic to honeybees.

<sup>2</sup> Mode of action class for citrus pesticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification V.7.3 (2014). Refer to ENY-624, Pesticide Resistance and Resistance Management, in the 2017-18 Florida Citrus Production Guide for more details.

<sup>3</sup> Lower rates may be used on smaller trees. Do not use less than minimum label rate.

**TABLE 3. Recommended Chemical Controls for Orchid Thrips, *Danothrips trifasciatus*, and Greenhouse Thrips on Developing Red or White Grapefruit**

Pesticide <sup>1</sup>	IRAC MOA <sup>2</sup>	Mature Trees Rate/Acre <sup>3</sup>	Comments	Other Pests Controlled
Danitol	3	1 pt	Restricted use pesticide. See label.	Asian citrus psylla, root weevils
Chlorpyrifos 4 EC	1B	5 pt	Restricted use pesticide. See label.	Mealybugs, orangedog, katydids, aphids, grasshoppers, scale insects, thrips

<sup>1</sup> All products toxic to honeybees.

<sup>2</sup> Mode of action class for citrus pesticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification V.7.3 (2014). Refer to ENY-624, Pesticide Resistance and Resistance Management, in the 2017-18 Florida Citrus Production Guide for more details.

<sup>3</sup> Lower rates may be used on smaller trees. Do not use less than minimum label rate.