

Pitaya (Dragon Fruit) (*Hylocereus undatus*) Pests and Beneficial Insects¹

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Pitaya (Pitahaya) or Dragon Fruit, *Hylocereus undatus* (Haworth) Britton & Rose (Cactaceae) is an emerging crop in South Florida. Acreage of this fruit crop in Florida has grown rapidly and shows a good potential for commercialization. This fact sheet contains some of the pests and beneficial insects associated with it.

Key Pests

Thrips

Several species of thrips (Thysanoptera: Thripidae) can be found on pitaya plants in South Florida. The species most commonly found are *Frankliniella occidentalis* Pergande (Fig. 1), *Scirtothrips dorsalis* Hood (Fig. 2), *Thrips palmi* Karny, *F. bispinosa* (Morgan), *F. kelliae* (Sakimura), and *F. insularis* (Franklin) (Fig. 3), the first three of these have been found to be common pests. These are slender insects, about 1.5 mm long with piercing and sucking mouthparts and the adults have delicate, slender wings. Females insert their eggs into the flowers or young fruit. The larvae (Fig. 4) feed on these tender tissues and generally pupate in the soil. They have a short life cycle, can have up to 10 generations per year, and prefer dry periods from Oct to April (Capinera 2015; Childers & Nakahara 2006). Thrips scar the fruit as they feed, cause deformation when ovipositing their eggs, and leave fecal deposits that turn reddish brown to black (Fig. 5). The unsightly damage has rendered 20-80% of the fruit unmarketable during years with high populations. Thrips can live and reproduce on many of the plants grown in South Florida, including avocado, mango, lychee, peppers, and on common weeds (i.e. pigweed, spiny amaranth, balsam apple [Childers & Nakahara 2006]). Since weeds are a habitat, weed management can be an important control measure, and visual inspections of pitaya flowers or sticky cards (blue, white or yellow) can be used to monitor populations [Capinera, 2015]. Thrips are known for their ability to develop resistance to insecticides. They do have some natural enemies, such as ladybugs, lacewing larvae (see Generalist Beneficial Fauna section), predatory mites, and the minute pirate bug; some of these are also used as biocontrol agents.



Figure 1. An adult western flower thrips, *Frankliniella occidentalis* Pergande. Determined by J. Xian, 2016. Photograph by Daniel Carrillo, UF/IFAS.



Figure 2. An adult thrips, *Scirtothrips dorsalis* Hood. Determined by K. Williams, 6 Aug. 2015. Photograph by Rita Duncan, UF/IFAS.



Figure 3. *Frankliniella insularis* (Franklin) a thrips found in pitaya flowers with pollen grains attached to it. Determined by F. Soto-Adams, 11 Jun 2019. Photograph by Rita Duncan, UF/IFAS.



Figure 4. An immature thrips feeding on pitaya sepals and the reddish fecal deposits left behind. Photograph by Daniel Carrillo, UF/IFAS.



Figure 5 a & b. Fruit made unmarketable by scarring from thrips. Photographs by Daniel Carrillo, UF/IFAS.

Leaf-footed bugs

Two species of leaf-footed bugs, *Leptoglossus concolor* (Walker) and *Leptoglossus phyllopus* (Linnaeus), (Hemiptera: Coreidae) have been found damaging pitaya fruits in South Florida (Figs. 6 & 7). These are conspicuous insects (20 -25 mm long) that make a buzzing sound during flight. Feeding produces unsightly punctures that result in poor quality fruit (Figs. 8 a & b) and may allow bacteria and fungi to enter the fruit. They can also damage the stems and arms of pitaya plants; this damage is represented as deep puncture wounds (Figs. 9 a & b). Eggs are laid in a row along the stems, on fruits, or on weeds around the crop (Fig. 10). These are true bugs, the immatures (nymphs) resemble the adults in shape but are flightless and their large hind tibiae (leaf shaped) develop only in the latter instars. Leaf-footed bugs are generally considered minor pests, but occasionally large numbers accumulate and cause economic damage. In South Florida, leaf-footed bugs are present throughout the year; they feed on pitaya, guava, carambola, papaya, passion fruit, citrus, and vegetable crops in the fall and winter (Peña et al. 2002; and personal observation). Weeds are also a source of food and oviposition sites therefore cultural control can be an important factor in controlling them (Chi 2012). There are some tachinid flies (Diptera: Tachinidae) that attack adults and some wasps (Hymenoptera) in the Eupelmidae and Scelionidae families that attack the eggs of leaf-footed bugs (Xiao 2009).



Figure 6. *Leptoglossus concolor* (Walker), a leaf-footed bug. Determined by S. Halbert, 3 Nov. 2015. Photograph by Rita Duncan, UF/IFAS.



Figure 7. *Leptoglossus phyllopus* (Linnaeus), a leaf-footed bug. Determined by S. Halbert, 3 Nov. 2015. Photograph by Rita Duncan, UF/IFAS.



Figure 8 a & b. Leaf-footed bug damage to pitaya fruit. Photographs by (a) Rita Duncan and (b) Daniel Carrillo, UF/IFAS.



Figure 9. Pitaya cactus plants (a) trellis (b) close up of wounds caused by leaf-footed bugs. Photographs by Rita Duncan, UF/IFAS.



Figure 10. Leaf-footed bug eggs laid in a row or chain along the stem of a pitaya plant. Photograph by Daniel Carrillo, UF/IFAS.

Aphids

Two species of aphids (Hemiptera: Aphididae), *Aphis craccivora* Koch (Fig. 11) and *Aphis gossypii* Glover (Fig. 12), have been found feeding on the flowers and fruits of pitaya plants in South Florida. Adults of both species are blackish brown and about 2 mm long, immatures feeding on this crop can range from light gray to green. Aphids give live birth (viviparous) and have protrusions on their backs called cornicles (Fig. 12); some have wings, but most do not (apterous). They are soft-bodied, slow moving, sucking insects and exude a sugary, sticky substance (honeydew) that becomes a breeding ground for sooty mold (Fig. 13). The sooty mold is very difficult to clean and diminishes the market value of the fruit. Ants also feed on this honeydew and, in exchange, they protect the aphids from natural enemies and transport them to new sites where these aphids start new colonies (Fig. 14). This interaction may contribute to increases in aphid populations. Aphids are active throughout the year in South Florida. There are several species of hymenopteran parasitoids (wasps) that are beneficial and serve as natural enemies of aphids. They oviposit their eggs in the aphid, and as the parasitoid grows inside, the aphid mummifies and turns into a hard shell that can be easily recognized (Fig. 15 a & b). Two of these beneficial parasitoids are *Lysiphlebus testaceipes* (Cresson) (Hymenoptera: Aphidiidae) and *Aphelinus* sp. (Hymenoptera: Aphelinidae) (Fig. 16 a & b). Lady beetles (Fig. 35) and lacewings (Fig. 36) are also important predators. Aphids are normally not an important pest of pitaya unless their natural enemies are disrupted.



Figure 11. An adult alate aphid with three immatures, *Aphis craccivora* Koch, on a sepal of a pitaya fruit. Determined by S. Halbert, 3 Nov. 2015. Photograph by Rita Duncan, UF/IFAS.

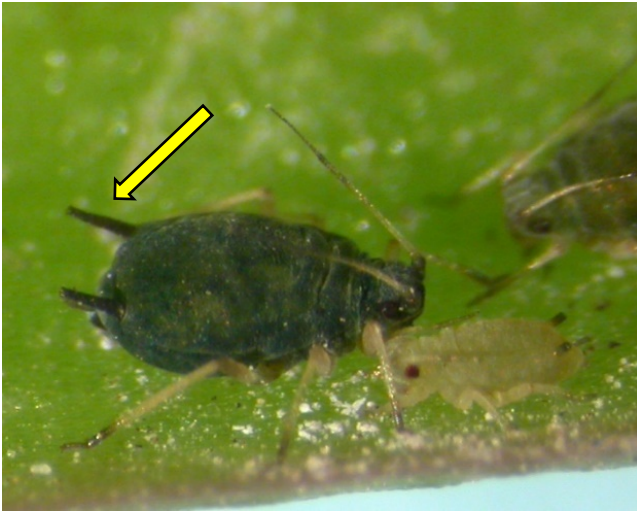


Figure 12. Adult and immature aphids, *Aphis gossypii* Glover, on a sepal of a pitaya fruit. Yellow arrow pointing to one of the two cornicles. Determined by S. Halbert, 7 Jun 2011. Photograph by Rita Duncan, UF/IFAS.



Figure 13. Young pitaya fruits (a) un-infested (b) heavily infested with aphids and covered in black sooty mold. Photographs by Rita Duncan, UF/IFAS.



Figure 14. An ant tending an aphid colony. Photograph by Rita Duncan, UF/IFAS.

Beneficial

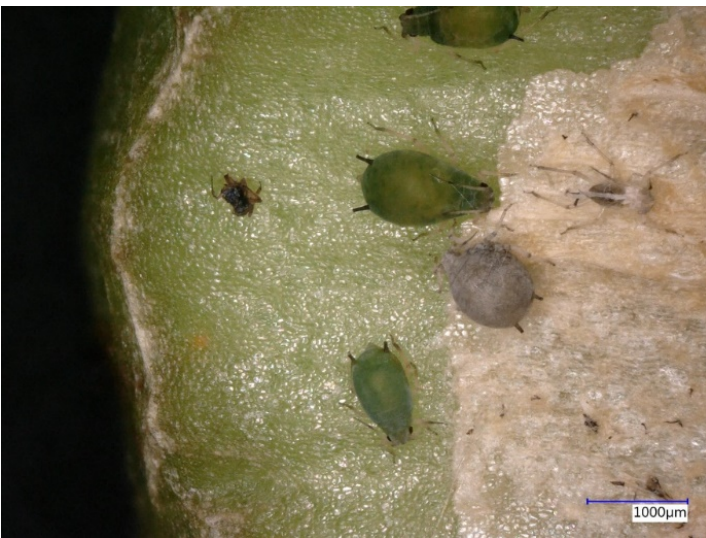


Figure 15. Mummified aphid, attacked by a hymenopteran parasitoid, (a) next to live aphids; (b) close up of mummified aphid. Photograph by Rita Duncan, UF/IFAS.



Figure 16. Two species of aphid parasitoids (beneficial parasitic wasps) emerged from the mummified aphids above (a) *Lysiphlebus testaceipes* (Cresson), (b) *Aphelinus* sp. Determined by E. Talamas, 17 May 2019 & 6 Jun 2019. Photographs by Rita Duncan, UF/IFAS.

Mealybugs

Ferrisia dasyliirii (Cockerell) (Hemiptera: Pseudococcidae) is a mealybug that has been identified infesting the flowers and fruits of pitaya. These are small (4-6 mm) soft-bodied insects with waxy filaments (Fig. 17). They insert a stylet into the plant to draw the sap; as they feed and colonize plants, they extrude honeydew, a sugary substance conducive to the growth of sooty mold. The sooty mold inhibits photosynthesis; it is also difficult to remove, making the fruit less marketable. Females reproduce rapidly; they produce pads with eggs. Crawlers (immature stages) hatch and as they begin to crawl, can be easily carried by wind currents to infest new plants. Only the males have wings. They are polyphagous and feed on a large number of crops, i.e., papaya, guava, mango, and vegetable crops (Marques et al. 2015). This is a tropical insect that does well in the sub-tropical climate of South Florida and can be found throughout the year. Populations of this mealybug do occasionally increase and become a problem; however, they are normally kept under control with good cultural practices by predators such as ladybugs (Fig. 35), lacewing larvae (Fig. 36), spiders, and parasitoids. Ants protect mealybug colonies from parasitoids; therefore, controlling ant populations may be necessary. Scouting for mealybugs should include the well protected areas under the bracts of developing flowers and fruits; infested parts should be removed and destroyed. The mealybug destroyer (*Cryptolaemus montrouzieri* [Coleoptera: Coccinellidae]) is a commercial biocontrol agent available for release in greenhouses (McCorquodale & Hodges 2016).



Figure 17. *Ferrisia dasyliirii* (Cockerell), a mealybug infesting flowers and fruits (a) young fruit with colonies (b) close up of colonies (c) close up of adult and immatures (yellow arrow) (d) adult. Determined by I. Stocks, 11 Aug 2015. Photographs by Rita Duncan, UF/IFAS.

Minor Pests

Lepidoptera

The beet armyworm, *Spodoptera exigua* (Hübner) (Lepidoptera: Noctuidae), has been found damaging pitaya flowers. Adult moths are nocturnal, about 20 mm long (Fig. 18e) and lay their eggs on the petals and sepals. The larvae feeding on pitaya range from a light greenish-white color at first, to darker greens with longitudinal white stripes as they mature (Fig. 18b & c). Beet armyworm use their chewing mouth parts to eat through the flower (Fig. 18a & b). They drop and use sand and soil particles to make a pupal chamber and pupate (Fig. 18d). The life cycle can be completed in as few as 24 days and they are present throughout the year in Florida (Capinera. 1999). This species is an important pest of various crops (i.e., cabbage, broccoli, tomatoes) including vegetable crops, ornamentals, grasses and weeds (Capinera 1999; Capinera, 2008). Although this moth has not been found in large numbers on pitaya in South Florida, it has the potential of becoming a significant pest. There are parasitoids in the Braconidae (Hymenoptera) and Tachinidae (Diptera) families, predators such as the minute pirate bug, *Orius* spp. (Hemiptera: Geocoridae) and others that serve as natural enemies for this pest (Capinera 1999).



Figure 18. *Spodoptera exigua* (Hübner) (a) Damage from moth larvae to the flowers. (b) Close up of the damage and larva. (c) Small and large larvae. (d) Pupa (e) Adult. Determined by J. Hayden, 4 June 2019. Photographs by Rita Duncan, UF/IFAS.

Scales on Fruits

Philephedra tuberculosa Nakahara & Gill (Hemiptera: Coccidae) was found for the first time on pitaya in South Florida in June 2010 (Fig. 19). These are soft scales; the mature females are 3-5 mm long, green to yellow and produce a white egg sac with waxy filaments (Figs. 19 & 20). The male pupae are easily visible through the transparent waxy cover (Fig. 21) and the developing wings are forming at this stage (Fig. 22); only adult males have wings. Female fertility rate is very high; they produce up to 709 crawlers (immatures, nymphs) (Fig. 20, yellow arrow) in a study on sugar apple (*Annona squamosa*) (Peña et al. 1984). Female life span is approximately 24 days for males and 59 for females (Peña et al. 1984). Since scales in general prefer hot and humid weather, in South Florida they are present all year. They feed on the plant sap and produce honeydew. This secretion is conducive to the growth of sooty mold, which in turn blocks photosynthesis and makes the fruit less marketable. So far, this scale has not developed into a major problem on pitaya, but it is a key pest of papaya (*Carica papaya* L.) in this area and can also be a problem on sugar apple (*Annona squamosa* L.). There are many predators such as ladybugs (Fig. 35), lacewings (Fig. 36) and parasitoids (Fig. 23 & 24), for example, *Coccophagus lycimnia* Walker (Hymenoptera: Aphelinidae), *Trichomastus portoricensis* Crawford and *Metaphycus* sp. (Hymenoptera: Encyrtidae) that help to control mealybugs in those crops (Peña et al. 1987 and unpublished data).



Figure 19. *Philephedra tuberculosa* Nakahara & Gill scale on a pitaya fruit, female with ovisac. Determined by I. Stocks, 23 June 2010. Photograph by Rita Duncan, UF/IFAS.



Figure 20. *Philephedra tuberculosa* Nakahara & Gill scale on a papaya (*Carica papaya*) stem, females and crawlers or nymphs (yellow arrow). Determined by J. Peña, UF/IFAS. Photograph by Rita Duncan, UF/IFAS.



Figure 21. *Philephedra tuberculosa* male pupa on a papaya leaf (*Carica papaya*). Determined by J. Peña, UF/IFAS. Photograph by Rita Duncan, UF/IFAS.



Figure 22. *Philephedra tuberculosa* male pupa on a papaya leaf (*Carica papaya*), opened to show the wing buds. Determined by J. Peña, UF/IFAS. Photograph by Rita Duncan, UF/IFAS.

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Figure 23. Parasitized *Philephedra tuberculosa* female opened to show the parasitoid larvae; from an infestation on papaya (*Carica papaya*). Determined and photograph by Rita Duncan, UF/IFAS.



Figure 24. Holes in a female *Philephedra tuberculosa* carved by adult wasp parasitoids (*Metaphycus* sp.) as they emerged; from an infestation on papaya (*Carica papaya*). Determined by G. Evans. Photograph by Rita Duncan, UF/IFAS

Scales on the stems

The scale, *Diaspis echinocacti* (Bouche) (Hemiptera: Diaspididae) (Fig. 25), has been found infesting the stems of pitaya plants. This is a hard scale (a waxy or resin covering over the scale), but like the soft scale *Philephedra* mentioned above, it also feeds on the sap of the plant and produces honeydew resulting in similar damage. Scales are regularly controlled by natural enemies, however when their natural enemies are disrupted, they become abundant enough to be considered a pest and require control (Fig. 26). Sanitation, pruning and removal of the infested parts, and good cultural practices are recommended to keep scale populations at manageable levels (Crane et al. 2005). *Zaomma lambinus* (Walker) (Hymenoptera: Encyrtidae) (Fig. 27), was reared from *Diaspis echinocacti*, cactus scale. This beneficial wasp may be a contributing factor in regulating the scale populations on pitaya.



Figure 25. *Diaspis echinocacti* (Bouche) scale on pitaya (a) a small colony with males & females (b) close up of the males with waxy filaments. Determined by I. Stocks, 16 Jul 2015. Photograph by Rita Duncan, UF/IFAS.



Figure 26. A large infestation of *Diaspis echinocacti* scales on the stems of pitaya cactus. Determined by I. Stocks, 17 Dec 2014. Photograph by Rita Duncan, UF/IFAS.

Beneficial



Figure 27. *Zaomma lambinus* (Walker) is a small beneficial wasp parasitizing cactus scale. Determined by K. Williams, 10 Dec 2014. Photograph by Rita Duncan, UF/IFAS.

Beetles

Banded cucumber beetles, *Diabrotica balteata* LeConte (Coleoptera: Chrysomelidae), (Fig. 28) have been found feeding on pitaya flowers (Fig. 29), occasionally populations increase and cause significant damage. Adults are 5 to 6 mm long, live 26 days on average and females may produce 850 eggs in their lifetime (Capinera 1999). These beetles have a wide host range; Cucurbitaceae, Rosaceae, Leguminosae, Cruciferae are some the preferred hosts (Saba 1970). The larvae feed only on the roots of plants while adults feed on flowers, fruits, and stems. These are tropical and subtropical insects found throughout the year in South Florida; the highest populations in a 13-year study in Mexico occurred from May to July, the hottest and most humid months in the area of study (Rodriguez & Magallanes 1994). Weed control is one of the control tactics recommended to contain their populations because some of its many hosts are weed species (Capinera 1999).



Figure 28. Banded cucumber beetle, *Diabrotica balteata* LeConte. Determined by M. Thomas, 9 June 2011. Photograph by Rita Duncan, UF/IFAS.



Figure 29. Pitaya flowers (a) undamaged (b) sepals with damage caused by banded cucumber beetles, *Diabrotica balteata* LeConte. Photographs by Rita Duncan, UF/IFAS.

The beetle *Myctides imberbis* Lea (Coleoptera: Curculionidae) (Fig. 30) is normally found feeding in large numbers on wax jambu (*Syzygium samarangense*) fruits and have been found on pitaya plants grown adjacent to these groves. These are small weevils, between 4-6 mm in length. In South Florida they have also been found feeding on guava (*Psidium guajava*), Suriname cherry (*Eugenia uniflora*), Brazil cherry (*Eugenia brasiliensis*) and ovipositing in carambola (*Averrhoa carambola*) (unpublished data) (Fig. 31). Originally from Australia where it is a pest of rose apple and other members of the Myrtaceae family, it is now in Miami-Dade, Broward, Collier and Martin counties in Florida (FDACS 2019). Rose apple is the common name for several species of the genus *Syzygium* (including *S. samarangense*). This curculionid beetle has not achieved pest status.



Figure 30. An adult *Myctides imberbis* Lea, a beetle occasionally found on pitaya. Determined by P. Skelley, 27 Aug 2013. Photograph by Rita Duncan, UF/IFAS.



Figure 31. *Myctides imberbis* Lea eggs oviposited in carambola fruit. Photograph by Rita Duncan, UF/IFAS.

The dark flower scarab, *Euphoria sepulcralis* (Fabricius) (Coleoptera: Scarabaeidae) has been observed in pitaya flowers occasionally, but it has not reached pest status. Adults are 10 to 12 mm long (Fig. 32) and found on the flowers of a wide range of plants. This scarab beetle has been reported as a pest of corn and roses; they pupate in the soil but not much is known about the immature stages (Thomas 2007). In Alachua county, their populations peak in August, but they have been collected throughout the year in Florida except for October and December (Thomas 2007).



Figure 32. The dark flower scarab beetle, *Euphoria sepulcralis* (Fabricius). Identified by K. Schnepf, 30 May 2019. Photograph by Rita Duncan, UF/IFAS.

There is a complex of sap beetles from the family Nitidulidae (Coleoptera) that may be pollinating pitaya flowers. *Nitops craigheadi* (Dobson) is one of the most prominent of these beetles found in freshly opened flowers (Fig. 33). *Nitops craigheadi* was previously named *Carpophilus craigheadi* and was transferred to this genus in 2007 (Kirejtshuk et al. 2007). Five species in this genus were detected entering *Annona* flowers in the early mornings (7 to 9 AM) and evenings (5-9 PM) in a pollination study in South Florida (Nadel and Peña 1994). Sap beetle adults and larvae are regularly found in rotting fruit; however, adults are the main pollinators of *Annona* in South Florida, Israel and Australia (Nagel and Peña 1989, Nadel 1990). They are considered a pest in Mexico and the larvae have been observed feeding on damaged fruits in South Florida. Large numbers of adults and larvae are conspicuously visible in the flowers in this region, however there is little, or no damage observed (Fig. 34). Their primary role as pollinators or secondary pest that may transmit pathogens is unclear and requires further research. Bats and hawk moths have been reported as pollinators (Gunasena et al., 2006); however, they have not been observed pollinating in South Florida (Crane et al. 2005). In Sri Lanka, bees are known to pollinate flowers in the early morning, that were not already pollinated at night (Gunasena et al. 2006).



Figure 33. *Nitops craigheadi* (Dobson) (a) male and (b) female beetles carrying pollen grains. Determined by Kyle Schnepf, 17 May 2019. Photographs by Rita Duncan, UF/IFAS.



Figure 34. Nitidulid beetles (a) larva on the petals and stamen of a pitaya flower (b) flower with a large number of adults. Photographs by Rita Duncan (a) and Daniel Carrillo (b), UF/IFAS.

Generalist beneficial fauna

There are some common predators that feed on a variety of pests such as ladybugs (ladybird beetles) (Coleoptera: Coccinellidae) (Fig. 35) and lacewing larvae (Neuroptera: Chrysopidae) (Fig. 36). These predators keep insects from becoming a pest by reducing their population size. Good cultural control methods and minimalizing insecticides will help to preserve these natural enemies.



Figure 35. Ladybugs (ladybird beetles) are common generalist predators. Photograph by Rita Duncan, UF/IFAS.



Figure 36. Lacewing larvae are a common generalist predator referred to as trash bugs (they have a habit of covering themselves with debris) (a) with “trash” cover (b) debris removed and feeding on avocado lace bug. Photographs by David Long, UF/IFAS.

Visitors

Picture wing flies, *Euxesta abdominalis* Loew (Diptera: Udididae) have been found visiting pitaya flowers (Fig. 37). This fly is common, widespread and not a plant pest (pers. comm. G. Steck).



Figure 37. *Euxesta abdominalis* Loew, a picture wing fly found visiting pitaya flowers. Identified by G. Steck, 31 May 2019. Photograph by Rita Duncan, UF/IFAS.

Potential Pest

We should be on the lookout for some key insect species that have the potential to become a problem for pitaya in this area.

Leptoglossus zonatus (Dallas) is a leaf-footed bug causing damage to pitaya in Nicaragua (OIRSA, 2000), Colombia (Medina & Kondo 2012) and Mexico (Cruz et al. 2015). It is a minor pest of fruits and vegetables in the United States along the Gulf coast, but it has caused considerable damage to satsuma mandarin in Louisiana and Alabama (Chi and Mizell 2012; Halbert, pers. comm.). To date, it has not been collected in the pitaya growing region in Miami-Dade County (Halbert 2019. FDACS DPI database, pers. comm.). The adult is similar to *L. concolor* (Fig. 6) and *L. phyllopus* (Fig. 7) but it has two distinct yellow spots on the pronotum (yellow arrow) (Fig. 38).

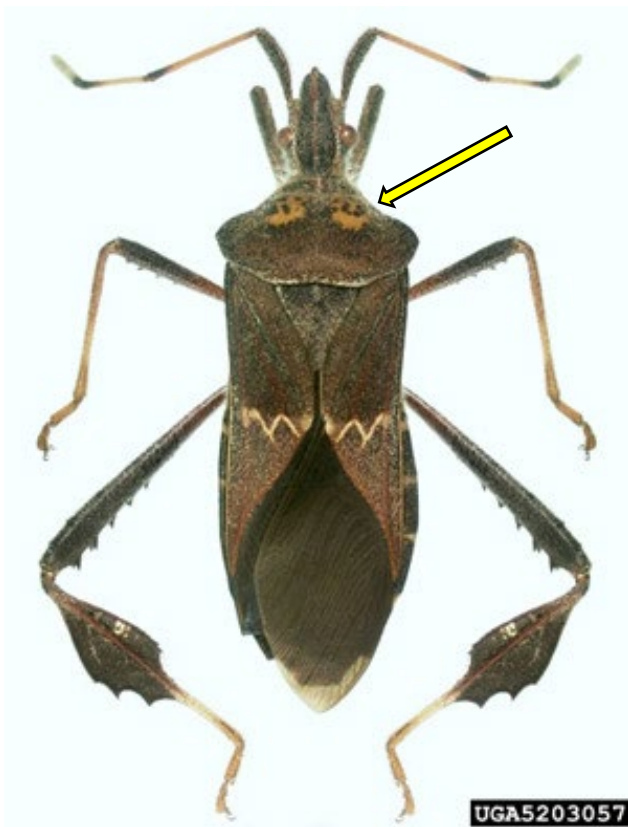


Figure 38. Adult western leaf-footed bug, *Leptoglossus zonatus* (Dallas). Photograph by Natasha Wright, Florida Department of Agriculture and Consumer Services.

The cactus moth, *Cactoblastis cactorum* (Berg) is an invasive pest first found in the Florida Keys in 1989 and it is now throughout the state. This moth is a major pest of *Opuntia* cacti and could become a problem for pitaya growers (Fig. 39). For more information on this species please see the Featured Creatures article (Habeck et al. 1998) on this pest http://entnemdept.ufl.edu/creatures/bfly/cactus_moth.htm.



Figure 39. *Cactoblastis cactorum* (Berg), the cactus moth (a) Adult (b) Larvae (c) Egg stick (d) damage. Photographs a & c by D. Habeck and F. Bennett, b & d by C. Miller, University of Florida.

The fly, *Dasiops saltans* Townsend (Diptera: Lonchaeidae), is a potential invasive pitaya flower pest to Florida and a major pest of yellow pitaya in Colombia. The adult females oviposit their eggs in the flowers and the larval feeding destroys the blooms (Fig. 40) (Delgado et al. 2010). Three baits were successfully tested in Colombia to capture this fly, however many similar species difficult to differentiate from *D. saltans*, were also captured with the same baits; therefore, the authors do not recommend using baits for monitoring this pest (Imbachi 2013).



Figure 40. *Dasiops saltans*, a fly causing damage to pitaya in Colombia (a) adult on a flower, (b) flower with larval feeding damage, (c) larva (d) exit hole caused by the emerging adult. Photograph a, b & d by T. Kondo; c by A. Delgado, CORPOICA.

Pitaya is included in the USDA list of host species for the oriental fruit fly, *Bactrocera dorsalis* (Hendel) (Diptera: Tephritidae). This is serious pest that, from time to time, has turned portions of South Florida into a quarantine area in order to eradicate them. Currently, it is not established in South Florida. For more information on this species please see the Featured Creatures article (Weems & Heppner 2019) on this pest http://entnemdept.ufl.edu/creatures/fruit/tropical/oriental_fruit_fly.htm.



Figure 41. Oriental fly adult. Determined and photographs by Daniel Carrillo, UF/IFAS.

Control, Precautions and Restrictions

Pitaya plants are subject to attack by several insects, however only a few have populations increase to levels high enough to be considered pests. Key pests may require immediate attention and control, minor pests should be monitored, but will normally remain under biological control by beneficial insects and good cultural practices. Biological and cultural management tactics should be the primary method for controlling insects that have a tendency to become pests. For a list of pesticides, fungicides, lures, and oils registered for pitaya, please go to the CDMS website at <http://www.cdms.net/Label-Database/Advanced-Search>. Please be advised that efficacy data is not available on some of these products; also, the user must read the labels carefully and adhere to regulations. The local County Agricultural Extension office may be able to provide more information on pest control materials.

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