

Banana Moth

A Resurgent and Serious Pest of Palms in Southern California

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The banana moth (*Opogona sacchari*) is a primary pest of many agricultural and landscape plants, including palms (Howard et al. 2001). Although native to tropical and subtropical areas of Africa, it is now a widespread and rather common pest and occurs in California, Florida, Hawaii, South and Central America, Europe, Madagascar, and many Pacific Islands. In Hawaii it is a significant pest of sugarcane, banana, pineapple, and palms, especially the much beloved native *Pritchardia* spp. (*loulou*) (Hodel 2012c, Nelson and Wright 2005).

In southern California, the banana moth has mostly been documented or observed on only a few species of palms, primarily *Ravenea rivularis* (majesty palm) (**Fig. 1**), *Trachycarpus fortunei* (windmill palm), and sometimes *Syagrus romanzoffiana* (queen palm), the latter typically as young, containerized nursery plants (Hodel 2012 a, b). However, in the last several years, two additional species have come under increasing attack, including *Archontophoenix cunninghamiana* (king palm) and *Howea forsteriana* (kentia palm), two of our more elegant, stately, and common landscape palms (**Fig. 2**). Or, perhaps these species were always under attack but the symptoms were attributed to other causes.

While the banana moth attacks mostly stressed, weakened, and/ or wounded palms, in some instances it attacks seemingly healthy, unstressed palms although the underlying stress might not always be obvious or the attacked palm has yet to show stress symptoms. One of the subtle factors that could be stressing palms and leaving them susceptible to banana moth is climate change and its attendant ramifications, including temperature extremes, reduced rainfall, salt accumulation in the root zone, and excessively high soil pH, among others.

The impetus for this paper came from co-author Hodel's observations over the last several years of decline in *Howea forsteriana* in Los Angeles and Orange Counties. Also, in early 2020, arborist Kenneth Greby encouraged Hodel to look at declining *Archontophoenix cunninghamiana* in northern Orange County and adjacent southeastern Los Angeles Counties (**Figs. 3–4**). In both instances, emerging new growth was damaged and/or deformed and in some cases the palms had died. West Coast Arborist's, Inc. took down and cut up an affected *A. cunninghamiana* on



1. These *Ravenea rivularis* in San Diego, California are severely infested with banana moths.



2. Banana moths have nearly killed this *Howea forsteriana* in Beverly Hills, California.



3. Arborist Ken Greby stands with an *Archontophoenix cunninghamiana* showing severe symptoms of a banana moth infestation. Note the restricted root space.



4. The damaged new growth on several *Archontophoenix cunninghamiana* in this mass planting in Fullerton, California is evidence of banana moths.

Tustin Ave. in the City of Orange, an area with many declining *A. cunninghamiana*. Co-author Santos found banana moth larvae in the samples.

Here we provide an overview of the banana moth including identification, biology, damage, hosts, and management strategies.

Identification and Biology

Adult banana moths are small, about 1–1.5 cm long (**Fig. 5**), with a wingspan of 1.8–2.5 cm, dark grayish or yellowish brown, and have two distinctive dark spots on each wing (CABI 2020, Davis and Pena 1990, Nelson and Wright 2005).

At 15 C (59 F) degrees the banana moth life cycle is about three months: eggs hatch in 12 days; larval development requires 50 days; the pupal stage is 20 days; and the adult lives for about six days (Veenenbos 1981). However, under warmer conditions, like in Hawaii, the life cycle can be much shorter, allowing up to eight generations annually (Giannotti et al. 1077, Heppner et al. 1987). For example, eggs hatch in about seven days and the entire life cycle is completed in 40 to 45 days in Hawaii (Nelson and Wright 2005). Thus, we expect the life cycle to take from 40–50



5. Adult banana moths are 1–1.5 cm long with a wingspan of 1.8–2.5 cm, dark grayish or yellowish brown, and have two distinctive dark spots on each wing. © Lyle J. Buss, University of Florida. Used with permission.



6. Banana moth larvae are 2–3 cm long, 2.5–3 mm diameter, dirty white and somewhat transparent with a dark brown head. © Lyle J. Buss, University of Florida. Used with permission.



7. This larva of the banana moth (at the tip of sickle) has a clear body and a dark head. This infestation killed this container-grown *Syagrus romanzoffiana* (see Fig. 21).

days in coastal southern California. The mobile, light-evading, voracious larvae are 2–3 cm long, 2.5–3 mm diameter, dirty white and somewhat transparent with small legs and a dark brown head (**Figs. 6–7**) (CABI 2012, Davis and Pena 1990, Nelson and Wright 2005).

Banana moth pupae are up to 1 cm long, brown, and formed in a cocoon. Pupae partially work themselves out of the tissue to allow the adult to emerge unhindered (CABI 2012).

Although not particularly strong fliers, wound-seeking adult banana moths are attracted to freshly cut petioles or leaf bases of recently pruned palms, especially those that are stressed (Nelson and Wright 2005). Palms offer a number of hidden, protected places and adult females lay eggs into naturally existing crevices or wounds, such as behind leaf bases or bracts of inflorescences and among the fibers of leaf base margins. The larvae hatch and bore into the palm, typically heading toward the apical meristem (CABI 2020, Nelson and Wright 2005).

Damage, Symptom, and Signs

Banana moth larvae are voracious eaters but are typically detritus feeders and scavengers and attracted to stress-induced, decaying, or dead tissues. However, because of their voracious appetite, they quickly begin feeding on living tissue (Howard et al. 2001, Nelson and Wright 2005). On already stressed palms and/or those with high populations of banana moths, the larvae can eventually bore into the apical meristem, damaging or destroying it (Hodel 2012a, b). Thus, the initial symptoms frequently are dead, damaged, and/or deformed new leaves (Hodel 2012a, b) (**Figs. 8–11**). However, on young *Chamaedorea* spp. (bamboo palms) and *Syagrus romanzoffiana* they can attack the base of the stem where new roots emerge, sometimes eventually toppling the plant (Howard et al. 2001) (**Fig. 21**).

Banana moth damage on affected leaves might not be visible until the leaf pushes up and begins to unfold, at which time stunted or deformed leaves, including compressed zigzag or accordion-like tissue unopened or unevenly opened spear leaves; dark, necrotic areas (**Figs. 12–16**); missing or deformed pinnae; and copious, somewhat coarse, sawdust-like or mealy frass are typically visible (**Fig. 17**). Once the apical meristem is dead, the newer leaves die and the palm is dead but older leaves in the lower part of the canopy can remain green for an extended period before they, too, will turn brown and die (**Fig. 18**). The damage can also leave the apical meristem and newest leaves susceptible to opportunistic, secondary diseases like pink rot, which can kill the leaves or eventually even the palm before the banana moth has run its course (Hodel 2012a, b). If the palm recovers from an attack of banana moth the first several leaves produced are typically stunted (Hodel 2012 a, b) (**Figs. 19–20**). Because the symptoms of a banana moth infestation appear on the newest leaves first, it could easily be mistaken for a disease, such as pink rot; one of several disorders, like micronutrient deficiencies (for example boron deficiency), water stress,



8–9. Banana moths on *Trachycarpus fortunei* can cause deformation and death of the new leaves, as here in Brea, California.



10–11. Banana moths damaged the new leaves on these *Ravenea rivularis* in San Diego, California.



12–15. Dead, damaged, and/or deformed new leaves are evidence of a banana moth infestation, as here on *Archontophoenix cunninghamiana* in Orange, California.



16. Compressed zigzag or accordion-like and dark brown necrotic tissue on new spear leaves near the apical meristem often accompanies a banana moth infestation, as here on *Archontophoenix cunninghamiana* in Orange, California.



17. Copious mealy or sawdust-like frass is typically present with a banana moth infestation, as here on *Trachycarpus fortunei* in Irvine, California.



18. Once the apical meristem is dead from banana moths, the palm is dead but older leaves in the lower part of the canopy can remain green before dying, as on this *Howea forsteriana* in Laguna Hills, California.



19. The new leaves are stunted and deformed on this *Trachycarpus fortunei* in Irvine, California that is recovering from a banana moth infestation.



20. If the palm recovers from a banana moth infestation, the first several leaves produced are typically stunted, as on this *Archontophoenix cunninghamiana* in Orange, California.

or excessive heat; or pests, such as the South America palm weevil or eriophyid mites, which also appear on the newest leaves first (Hodel 2009, 2010a, b, 2012a, b, Hodel et al. 2016). Indeed, pink rot and one or more of the disorders might have stressed the palm and/or be present during a banana moth infestation. Symptoms of these disorders are similar to those of banana moth but lack the frass deposits. Symptoms and signs of the South American palm weevil appear on the newer leaves and include conspicuous petiole and leaf base grooving, often with embedded, fibrous frass; conspicuous entry/exit hole; sharply truncated leaves or pinnae; collapse of the apical meristem area; canopy tilting; and the presence of large, shredded wheat-like cocoons (Hodel et al. 2016). Eriophyid mites cause severe stunting, deformation, and discoloration of new leaves but lack the sawdust-like frass.

Hosts

In many other parts of the world, the banana moth attacks a wide variety of palms. In Florida nurseries it has attacked *Dypsis lutescens* (Areca palm), *Chamaedorea* spp., *Syagrus* spp., *Bactris gasipaes* (peach palm), and *Wodyetia bifurcata* (foxtail palm) (Davis and Pena 1990, Pena et al. 1990). In Hawaii, they are particularly devastating on the native *Pritchardia* spp. in the landscape but also attack *Adonidia merrillii* (Manila palm), *Cocos nucifera* (coconut palm), and *Wodyetia bifurcata* (Nelson and Wright 2005). In California the banana moth has traditionally attacked *Syagrus romanzoffiana* in nurseries (**Fig. 21**), and *Trachycarpus fortunei* and *Ravenea rivularis* (**Figs. 1, 22**) in the landscape. Now, in the last several years, it has been observed attacking *Phoenix dactylifera* (date palm) and especially *Archontophoenix cunninghamiana* (**Figs. 3, 23**) and *Howea forsteriana* (**Figs. 2, 18, 24**).

Management

Although the banana moth might attack healthy, unstressed palms, unhealthy, stressed palms are likely more susceptible to attack; thus, the best management strategy is to minimize palm stress and maximize palm health and vigor. Also, healthy, unstressed palms will recover from a banana moth attack more quickly than unhealthy, stressed palms. The most dangerous and common stress factors are inadequate water and poor nutrition (Nelson and Wright 2005). Indeed, for many blocks along Tustin Ave. and adjacent side streets in the City of Orange where *Archontophoenix cunninghamiana* were planted as street trees, banana moth was attacking many of these palms and was killing some. All palms were in small cutouts in the sidewalk and did not appear to have an irrigation system or were fertilized; therefore, they likely did not have adequate irrigation or fertilizer.

Thus, keep palms appropriately irrigated and fertilized. Scout palms frequently and be aware of alternate hosts in the vicinity that may harbor the banana moth. Avoid excessive pruning and, in consultation with a licensed pest control advisor/operator, apply prophylactic treatments to the



21. Banana moths attack this nursery-grown *Syagrus romanzoffiana* in Oxnard, California in the apical meristem at the base, causing it to topple over.



22. Banana moths have severely damaged this *Ravenea rivularis* in San Diego, California.



23. Banana moths have attacked this *Archontophoenix cunninghamiana* in Orange, CA. Note the restricted root space.



24. Banana moths have severely damaged this *Howea forsteriana* in Los Angeles, California.

palm canopy and treat cut surfaces with approved pesticides, like *Bacillus thuringiensis* (Bt) or some of the newer systemic materials (Nelson and Wright 2005). Pena et al. (1990) reported that a single application of approved pesticides is typically effective in suppressing populations of the banana moth.

However, banana moth infestations must be detected and treated early in their development; once damage is severe and extensive, and the larvae are deep inside leaf bases, developing leaves, and even the apical meristem, treatment is difficult and recovery is unlikely or is much delayed, leaving the palm susceptible to a host of secondary ailments. Thus, frequent, vigilant scouting and prompt treatment are critical.

In some cases, removal of the infested spear leaf before larvae have made their way down into the apical meristem can be effective. In more advanced cases, a rather drastic surgical technique must be employed to clean out and open up the apical meristem area. This technique is the same as the one Hodel (2010, 2012a) discussed and illustrated for treating early onset leaning crown syndrome in palms. Although for a different malady, the principle is the same: cutting out and removing as many affected (in this case infested) leaves or parts of leaves as necessary and as low as possible that arise from the apical meristem area but without damaging the actual apical meristem. This procedure will reduce the banana moth larvae population and enable better application of pesticides.

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