# INSECT PESTS OF PALMS AND THEIR CONTROL

Forrest Howard at University of Florida's Fort Lauderdale Research & Education Centre, USA, discusses the wide range of insects which attack palm trees and chemical and biological methods used for their control



## Palms and insects

Palms constitute one of the largest families of plants, and many species provide important products. Since the 19th century, an increasing number of insect pests of palms have been recognised, as the area in commercial palm plantations has been extended and as more kinds of palms have come under cultivation (Caballero Ruano, 1999; Howard *et al.*, 2001).

Coconut palm (*Cocos nucifera*), African oil palm (*Elaeis guineensis*) and date palms (*Phoenix dactylifera*) are major world crop plants. Many other palm species provide products for international commerce, and some are of local or regional importance and have great potential for expanded development and distribution. Palms of many species have long been grown as ornamental plants.

## Insect defoliators of palms

Palm growers often contend with leaf-feeding insects, *i.e.* defoliators. On a world basis, a total of ten families of moths and butterflies (Lepidoptera) are significantly represented among palm defoliators. Larvae of some moth and butterfly species consume entire portions of the leaf blade tissue, while other species remove only the superficial tissues of the abaxial ('lower') leaf surfaces, leaving the tough leaf veins intact. The latter are sometimes referred to as 'skeletonizers'. Among the more notorious lepidopterous defoliators of palms are the coconut blackheaded caterpillar (*Opisina arenosella,* Oecophoridae) (Figure 1) of Southern Asia, the coconut leaf caterpillar (*Artona catoxantha,* Zygaenidae) of South-East Asia, the South American coconut caterpillar (*Brassolis sophorae,* Nymphalidae) which attacks many kinds of palms in South America, and various bagworms (Psychidae) and nettle caterpillars (Limacodidae) in both the eastern and western hemispheres.

Leaf beetles (Coleoptera: Chrysomelidae) overwhelmingly are the most important family of beetles that consume plant foliage. One subfamily, the Hispinae, contains many species that are leaf-miners on palms.

In the Pacific Region, species of long-horn grasshoppers (Orthoptera: Tettigoniidae) and stick insects (Phasmida) are important palm defoliators.

## Sap feeders

Diverse species of the order Hemiptera pierce into the tissues of foliage or fruits of palms to feed on the juices. These include 'true bugs', planthoppers, aphids, whiteflies, mealybugs and scale insects. Sap-feeding on foliage causes chlorosis; dense populations kill entire fronds, which may translate to production loss, or affect the vigour of palms and increase their susceptibility to some diseases. Damage to fruits by such insects may affect their market value or result in actual fruit loss.

The coconut lace bug (*Stephanitis typica,* Tingidae) generally does little damage in its own right, but is implicated as a vector of an important wilt disease of coconut in southern India. Some lace bugs are considered pests of African oil palm in South America, but much of the damage associated with them is due to fungi which invade their feeding sites, rather than to the insects themselves. Several species of the stink bug family, Pentatomidae, are vectors of trypanosomes (Protozoa) that cause sudden wilt in African oil palm, and hartrot in coconut palm, in South America.

Planthoppers (superfamily Fulgoroidea) are typically present but in low populations on palm foliage. They usually do negligible direct damage, but some species are known to transmit important palm diseases. *Myndus crudus* (Cixiidae) is a vector of lethal yellowing (LY), a phytoplasma-associated disease of coconut and other palms in Florida and some parts of the Caribbean Region (Howard 1995). *Myndus taffini* transmits foliar decay of coconut in Vanuatu (Julia 1982). Several additional diseases of palms in different regions are suspected of being transmitted by planthoppers.

A planthopper of the Middle East known as the dubas bug (*Ommatissus lybicus,* Tropiduchidae) is not a disease vector, but often occurs in dense populations that damage palms directly.

Palms are highly favourable hosts of small, sessile insects, including whiteflies, scale insects and mealybugs (superfamily Coccoidea). Armoured scale insects (Diaspididae) are the largest family of scale insects. More than 100 species are known on palms, about 10 of which are widespread, important pests. Most of these also attack other plants, and are distributed widely in warm regions and well-adapted to life in glasshouses in colder regions. Among the more notorious are coconut scale (*Aspidiotus destructor*), Florida red scale (*Chrysomphalus aonidum*), oriental scale (*Aonidiella orientalis*) and black thread scale (*Ischnaspis longirostris*). The white date scale (*Parlatoria blanchardi*) is a pest of date palms in the Middle East and North Africa. It was introduced into the south-western USA late in the 19th century, but was eradicated after 44 years in a campaign which relied heavily on dousing the palms with petrol and setting them ablaze! (Date palms and some other palms can survive fires.)

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Figure 1. **Larva of coconut blackheaded caterpillar (*Opisina arenosella*), Sri Lanka. Photo by Dave Moore, CABI Biosciences.**

## Stem borers

Insects borers of palms are widely distributed. In the eastern hemisphere, adults of rhinoceros beetles (*Oryctes* spp., Coleoptera: Scarabaeidae) feed in 'buds' (*i.e.*, the apical meristematic tissue and unopened fronds) of palms. In palm weevils (*Rhynchophorus* spp., Coleoptera: Curculionidae), which are distributed in most palm-growing regions of the world, it is the larva which bores in the bud, and sometimes penetrates the trunk. Several other borers, including beetles and moth larvae, bore in palm stems or petioles.

## Contending with insect pests

In palm-growing regions, most of the caterpillar and beetle pests of palms are native and their populations are usually regulated naturally. Parasitoids, predators, and microbial diseases are important biotic factors. For reasons still not completely understood, but thought to be at least partly related to cyclic disruptions of natural enemies, insects on palms may at times undergo population explosions. Results may be destruction of foliage of large numbers of palms, translating to widespread production losses. Without human intervention, native pest populations ultimately subside as their natural enemies become re-established. By then, however, damage and losses in production may be excessive. Thus, plantation managers often opt to apply chemical control methods early in an outbreak. This may exacerbate the problem by delaying the eventual recovery of natural enemies.

A somewhat different situation involves the accidental introduction of an insect into a new area. Introduced species may become pests, especially if they have no important natural enemies in their new environment. The best long-term strategy against an introduced pest may be classical biological control *i.e.*, introduction of natural enemies from the native region of the pest. This generally involves a great deal of exploration and research, but there have been some notable success stories in control of insect pests of palms.

Recently, several important pests of palms have been spread into new regions. The red palm weevil (*Rhyn-*

Figure 2. **Royal palm (left) with fronds damaged by royal palm bug and (right) after treatment with imidacloprid to prevent damage by royal palm bug. Photos by the author.**

*chophorus ferrugineus,* Curculionidae), a native of South-East Asia that bores into the buds, has shown up on date palms in the Middle East and most recently in Spain. This past year a palm leaf skeletonizer (*Homaledra sabalella,* Coleophoridae) that is native to the south-eastern United States, was found on palms in California, where it is a threat to ornamental palms as well as the date palm industry in that state. Coincidentally, an additional and apparently undescribed species of the same genus was recently found in Florida and has become a new pest of palms. Its origin remains unknown. Coconut mite (*Aceria guererronis,* Acari: Eriophyidae), which causes deformities and fruit drop of coconuts, has been known in West Africa and Tropical America since the 1960s (Moore and Howard 1996). In the past few years this species was accidentally introduced into southern India and Sri Lanka, where it has spread rapidly on coconut palms.

Cultural control may be effective in reducing certain insect pests of palms. For example, vast areas where LY eliminated coconut palms in Jamaica were planted to palms that were resistant to the disease (Eden-Green, 1997). Combining use of resistant palms with cultural control of the insect vectors could further reduce the threat of this disease. Since the immature stages of *Myndus crudus* develop on grasses, maintaining leguminous ground covers, already a recommended practice in palm plantations for soil improvement and as a nectar source for beneficial insects, could provide the additional benefit of reducing populations of these vectors (Howard, 1999).

## Indoor greenery

Palms which have been grown as urn plants since Victorian times (*e.g.,* kentia palm, *Howea forsteriana*), are more popular today than ever. Palms are displayed in interior courtyards of hotels and shopping malls, and in glasshouses in major botanical gardens. Palms in 'interiorscapes' are often already grown when obtained from warm climates, providing a means for hitch-hiking pests to be introduced into the in-door greenery. Pest management methods developed for plantations and other outdoor situations may not be suitable for indoor palms or must be greatly modified. This presents new challenges to researchers and pest management personnel.

## Chemical control of palm pests

A variety of equipment and methods are used for applying insecticides to palms. On small farms, hand-held or back-pack sprayers with long booms are used for foliar applications. Aerial applications are used on extensive African oil palm plantations.

In the interest of conserving natural enemies, trunk injections of systemic insecticides have been developed for several important pests of palms (Dharmaraju, 1977; Nadarajan and Channa Basavanna 1981; Ooi *et al.*, 1975; Singh 1986). A disadvantage of this method is that as monocots, palms undergo no diametrical stem growth, thus do not heal holes drilled in the trunk.

Like stem injections, root injections are designed to target the pest, but have the added advantage of not damaging the trunk. The insecticide is contained in a small container from which a tube extends and is fitted over the cut end of a root, and the material fed by gravity. It is a slow method when numerous palms are involved (Philippe *et al.*, 1999).

Systemic insecticides drenched into the root zone of palms offer a practical solution for controlling some palm pests. For example, the royal palm bug (*Xylastodoris luteolus,* Thaumastocoridae), causes extensive damage to fronds of royal palms (*Roystonea regia*), one of the major palms grown as ornamentals in cities of southern Florida (Figures 2a and 2b). Foliar applications result in drift, which is especially objectionable in the urban environment. Trunk injections are not an option, because part of the beauty of this majestic species is its smooth, columnar trunk. Recently, a method was developed in which a single root drench with imidacloprid, a relatively safe insecticide, was found to protect royal palms from damage by the bugs for up to two seasons (Howard and Stopek, 1999). In recent years, many thousands of royal palms in Florida have been protected from royal palm bug damage using this method.

## Biopesticides, natural products, and pheromones

There is increasing interest in biopesticides and safe natural products for control of palm pests. Such products may be highly effective, but generally require extensive knowledge of the target pest and well-timed and thorough application techniques.

Interest in semiochemicals for monitoring and controlling insect pests of palms has increased dramatically in recent years (Giblin-Davis *et al.*, 1996)

## Outlook

Traditional economic palms continue to be important crop plants, and demand for their products will increase. Additionally, cultivation of many palms that are presently not well known outside of their native regions may expand as their products or use as ornamentals are developed and promoted

Insect pests of palms are likely to continue to be mostly old enemies, augmented by new pests spread inadvertently to new areas. Research and development of management techniques for these pests will focus on cultural and biological control, the role of semiochemicals in insect pest management, and on safe pesticides and application techniques, and their incorporation in integrated pest management of palm pests.

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# FEEDBACK

In one of your recently published R&D News (*Pesticide Outlook*, 2001, **12**(3), 87) a few misleading statements on imidacloprid resistance in Greek greenhouses pests, and differentially targetted receptor sites by neonicotinoids (chloronicotinyls) in aphids were made. I strongly suggest to reconsider these statements as there is no scientifically sound evidence for their correctness. No resistance to imidacloprid has been observed in greenhouse pests in Greece. This is supported by an extensive EU-funded monitoring programme carried out in 2001 and the years before. However, strong cross-resistance between thiamethoxam and imidacloprid and other neonicotinoids) was reported in whiteflies (Elbert & Nauen, *Pest Management Science*, 2000, **56**, 60–64). Furthermore, it was very recently demonstrated by John Casida's group in collaboration with Syngenta (A. Zhang *et al.*, *Journal of Neurochemistry*, 2000, **75**, 1294–1303) that obviously all chloronicotinyls (irrespective of so-called "1st and 2nd generation neonicotinoids" as used for marketing reasons) bind to the same receptor site in the same way with each insect species examined, including aphids. This is reflected by grouping imidacloprid and similar chemistry such as thiamethoxam within the very same mode of action group, as done (with participation and agreement of Syngenta) by IRAC, an independent and internationally recognised scientific committee dealing with insecticide resistance matters (http://www.plantprotection.org/irac).

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