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Control of Royal Palm Bug with Imidacloprid

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ABSTRACT

Imidacloprid at 42.5 g per palm used as a root drench was effective in preventing damage to royal palms (*Roystonea regia* (Kunth) O. F. Cook) by the royal palm bug, *Xylastodoris luteolus* Barber (Hemiptera: Thaumastocoridae) in a test in Florida, USA. Infestation levels on untreated palms were at levels up to 300 bugs per leaflet. The treatment was effective for at least three months. The potential of this treatment for managing this and related pests of palms is discussed.

The royal palm bug, *Xylastodoris luteolus* Barber (Hemiptera: Thaumastocoridae), feeds exclusively on royal palms (*Roystonea regia* (Kunth) O. F. Cook. It has been reported from Cuba and Florida. Extremely small piercing-sucking insects, the adults of *X. luteolus* are elongate, 2–2.5 mm long and of a pale yellow-green (luteous) color (Fig. 1). Baranowski (1958) conducted a very thorough study of this insect's bionomics.

The bugs attack freshly opened leaves. This results in small, yellow spots scattered on the lower frond surfaces. As the bug populations increase and more bugs feed, fronds become necrotic, turning brown and desiccated (Fig. 2). Damaged fronds eventually become tattered due to wind action, and sunlight bleaches them to a lighter grey color. As each new leaf is produced about monthly the bugs attack them so by the end of the summer a large portion of the crown may be damaged (Baranowski 1958).

Royal palm bug damage was reported as unusually intensive in Florida in 1921, 1957 and 1975 (Reinert 1975). In 1997 and several preceding years, severe damage was observed on royal palms throughout southern Florida. These reports, indicating peak activity being 36, 18, and 22 years apart, may be biased and inaccurate, being based on opportunistic observations by different people rather than systematic observations. Nevertheless, most observers would agree that the bugs do more damage to royal palms during some years than others.

Reinert (1975) identified three species of spiders that preyed on royal palm bugs, and suggested that they, along with heavy rains, were major factors in the natural control of the species. However, we have observed dense populations of the bugs on palm fronds during very rainy periods, and whether populations of these prolific bugs are regulated by spiders and rain alone is still open to question. Other natural enemies or abiotic factors that may regulate royal palm bug populations in Florida have not been identified.

When populations of royal palm bugs reach damaging proportions, chemical control is the only known method of controlling them. But chemical control of *X. luteolus* is difficult because of the tallness of the palms: Baranowski (1958) reported that *X. luteolus* seldom attacks palms less than 4 m in height. Reinert (1975) found that foliar applications of oxamyl, monocrotophos, and carbofuran reduced royal palm bug populations from more than 68 to less than three bugs per three leaflets. Unfortunately, because of chemical drift, none of these highly toxic chemicals would be suitable for foliar applications to tall palms, especially in cities.

Root drenches of oxamyl and monocrotophos reduced numbers of bugs per three leaflets after two weeks, but after four weeks the bug popula-

tions were well into recovery (Reinert 1975). Again, these chemicals were applied in a research study; they may not be suitable for widespread use as root drenches, especially under the edaphic and hydrological conditions of southern Florida (chemicals travel fast in the sandy soil and the water table is relatively high, especially in summer). Dimethoate shares some of the undesirable characteristics of other synthetic pesticides, but used as a drench was probably the safest of the methods tested. This treatment reduced the bug populations from 113.2 to 32.8 bugs per three leaflets after four weeks (Reinert 1975). Because about one-third of the population remained, it would have rebounded quickly. In summary, a practical method for controlling royal palm bug has not been available for years.

A relatively new insecticide, imidacloprid, seemed promising for this use. This chemical was discovered and developed as an insecticide by Bayer AG, Agriculture Division. It is the active ingredient in several of Bayer's products, including Admire, Gaucho, and Provado in different countries for use on various food crops—Premise for termite control, Marathon for use on ornamentals in greenhouses, and Merit for use on ornamentals and turf grass out of doors. Imidacloprid is also the active ingredient in Advantage, which is administered to dogs and cats for flea control. According to the product label, Merit has been proven to be effective against insect pests of 14 taxa. It was particularly encouraging that Tingidae (lacebugs) was one of these taxa, because they are closely related to the Thaumastocoridae.

The present report communicates results of a test of imidacloprid for effectiveness in controlling royal palm bug.

Methods

The experiment was conducted in the town of Palm Beach, Florida, which is on a coastal barrier island with sandy soil. Field evaluations were conducted at two sites where royal palm bug damage had been severe in previous years. Site 1 was adjacent to Lake Worth. Site 2 was about 1.5 km inland on the island from Lake Worth.

Four palms were treated on each site with 56.7 g (2 oz.) of Merit 75 WP mixed in 9.5 L (2.5 gal) of water, the equivalent of 42.5 g of imidacloprid per palm. Half of this rate was applied to one palm at one of the sites. This mixture was poured from a bucket very slowly into the soil immediately surrounding each palm. Mulch layers, if present, were scraped back, then returned after the drench treatment. At both sites, every other palm was treated, leaving alternate palms as controls. The treatments were applied on 21 January 1997.

Damage assessment was conducted 51, 108, and 170 days later (13 March, 8 May, and 10 July), on which dates the first, second, and youngest leaves of treated and control palms were observed from the ground for evidence of royal palm bug damage.

Initially we attempted to count numbers of royal palm bugs per leaflet as a measure of their populations on each palm. However, the mean height of the palms at both sites was about 20 m. With a lift truck we could reach the fronds of only about half of the palms at about 15 m. Because we could not reach the fronds of all the palms, we did not obtain statistically analyzable data to compare insect populations on treated palms and controls. However, we examined many fronds closely to confirm the association between bugs and their damage, and counted the numbers of bugs per leaflet on several fronds as an indication of the severity of the infestations at the study sites. We examined some leaflet samples in the laboratory under a stereoscopic microscope to determine the presence of eggs.

Results

Damage Assessment. Prior to application of treatments on 21 January, at site 1 there was only minor damage due to royal palm bugs, but some fronds had necrotic areas that we attributed to wind damage from a storm in November. At site 2, there were brown necrotic streaks typical of royal palm bug damage on some younger fronds of some palms. Royal palm bug damage had been especially severe at this site in past years (Richard Horne, Parks Foreman, Palm Beach Public Works Department, personal communication).

When the palms at both sites were examined 51 days after application of treatments, bug damage had progressed since January on some of the untreated palms, but there was no conclusive difference between treatment and controls.

When the palms were examined 108 days after application of treatments, the fronds of the seven palms treated with 42.5 g of imidacloprid were virtually free of royal palm bug damage, ex-

cept for damage on older fronds, which may have been caused by either bugs, wind, or cold spells prior to the treatment (Fig. 3). The single palm treated with 21.3 g of imidacloprid was similarly free of damage. In contrast, the first and second fronds of the eight untreated palms previously selected as controls had extensive damage typical of royal palm bugs. The tissue of these leaves was mostly brown with some small green areas remaining. The damage was very conspicuous from the ground.

As a further observation, a total of 15 royal palms in a row at site 1, including the four treated palms and 11 untreated palms, were examined 108 days after treatment. The four undamaged (treated) palms contrasted dramatically with the 11 untreated palms, which were all severely damaged by royal palm bug.

When the palms were examined 170 days after the treatments were applied, the newly opened leaf of both treated and control palms was free of damage. The next three youngest leaves of most of the untreated palms had extensive damage typical of royal palm bug. All fronds of the treated palms remained free of bug damage.

Observations on Royal Palm Bugs. On 21 January, we counted a mean of 3.0 (range: 2–5) royal palm bugs per leaflet on ten leaflets randomly selected from palms at site 1. At site 2, where there was typical royal palm bug damage on younger fronds of some palms, a mean of 59.1 (range: 8–17) royal palm bugs per leaflet were counted on seven leaflets from one of these palms.

When examined 108 days after treatments, there were abundant royal palm bugs on young damaged fronds of three of the untreated palms that we could reach. On a leaflet that we selected as harboring a typical infestation, we determined that there were about 300 of the bugs, including adults and nymphs. There were only about 15 bugs per leaflet on the fourth untreated palm that we examined. Bug damage was as severe on this palm as on the other untreated palms, suggesting that the population had been higher and was now declining. On the treated palms, 0–5 royal palm bugs per leaflet were observed.

Several fronds of treated and untreated palms were closely examined 170 days after the application of treatments (10 July). The bug populations appeared to have declined since the previous observation. Many fronds were free of the bugs, although aggregations of up to about 20 bugs per leaflet were seen on untreated palms. When these leaflets were examined under a stereoscopic microscope, groups of up to four eggs were observed inserted in fibrous scales all along the midvein, as described by Baranowski (1958). This indicated that a new generation of the bugs would soon be emerging to attack the leaves.

We observed no evidence of important natural enemies of royal palm bugs on any of the palms.

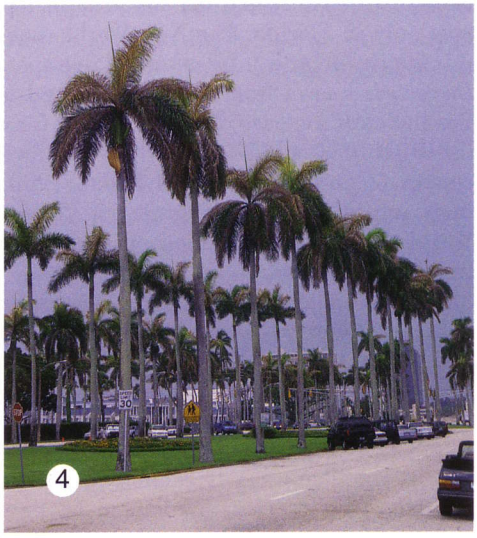
Discussion

These preliminary data on bug populations show that royal palm bugs occurred at levels of up to 300 bugs per leaflet in association with severe damage. More frequent observations on a larger number of palms would be required for conclusive data on population dynamics of this bug. However, the results of damage assessment clearly showed that the treatments prevented damage by royal palm bugs.

Imidacloprid is considered to be a pesticide of unusually low mammalian toxicity. Animal toxicity data from the Material Safety Data Sheet for this product list oral LD50 rates as 1858–2591 mg/kg and the dermal LD50 rate as >2000 mg/kg. When applied as a root drench, it remains for long periods in the soil and is taken up slowly by the plant. For this reason, there is typically a delay of a few weeks to a few months, depending partly on the size of the plant, before the chemical becomes active against the target pest. Once active, it may remain so for an extended period as long as the plant continues to take up the chemical. These characteristics make it potentially very useful for controlling the royal palm bug.

The delayed period before imidacloprid treatments become effective and the period during which they remain effective in controlling royal palm bug remain unclear. Since it protected the youngest three leaves, and in royal palm a new leaf is produced about monthly (Baranowski 1958), it was apparently effective in the palms that we treated for at least three months, possibly longer.

A disadvantage of this product for this use is its cost. At current prices the cost of treatment at the lowest rate used in this evaluation (21.3 g) is $14–$19 per palm. It is doubtful that even wealthy communities such as Palm Beach will use this treatment to protect large numbers of



1. Royal palm bugs, *Xylastodoris luteolus*. Photo by J. V. DeFilippis. 2. Typical damage to *Roystonea regia* leaf caused by *Xylastodoris luteolus*. Photo by F. W. Howard. 3. Left to right, untreated and imidacloprid-treated royal palms 108 days after application. Note damage to new leaves of untreated palm. Photo by Alan Stopek. 4. Royal palms along avenue in Palm Beachshowing major royal palm bug damage.

royal palms. However, it may be applicable to limited areas, e.g., on private properties or around tourist hotels. Imidacloprid has been applied to royal palms on Fisher Island, an affluent development in Miami, for control of royal palm bugs (Lee Anderson, Property Management, Montgomery Foundation, Miami, Florida, personal communications).

A cost advantage of the imidacloprid soil drench over other potential treatments, e.g., insecticides applied to leaves, is that there is no need for a hydraulic lift truck or other special equipment. Also, the relatively long period during which the treatment is effective may make it more economical than other potential treatments. Further testing may possibly reveal that imidacloprid is effective against royal palm bug at a dosage lower than those that we tested, thus reducing the cost. Finally, because the royal palm bug reaches damaging populations only during certain years, treatments would not be necessary every year.

Because the damage to royal palms by the royal palm bug was widespread in Florida this year, local newspapers reported partial results of our experiments. Unfortunately, many residents

formed the impression that any product containing imidacloprid could be used to control this insect. Many inquired how to apply Advantage, the flea control product, to palms. We wish to emphasize that insecticides should be used only for uses registered on the label, and products formulated for one use probably would not be effective for another use.

Xylastodoris luteolus is the only palmivorous species of Thaumastocoridae reported as a pest. Its host, *R. regia,* is native to Florida, Cuba, Caiman Islands, and the Yucatan Peninsula, and has long been planted widely in the New and Old World tropics as an ornamental. The insect has been reported only in Cuba and Florida, and as a pest only in Florida. The New World species of this family include *X. luteolus* and five species of *Discocoris* known from widely separated localities in South America. *Discocoris* spp., for which information is published, feed on the infructescences of palms (Slater and Schuh 1990), but their impact on the plants is not known. Old World thaumastocorids feed on dicotyledonous trees.

Natural enemies of *X. luteolus* of potential use in biocontrol may possibly be present in Cuba, or in other parts of tropical America in association with species of *Discocoris.*

Imidacloprid is potentially useful for controlling *Stephanitis typica* (Distant), which is in the family Tingidae, closely related to Thaumastocoridae. This species is common on palms in Asia and has been implicated as a vector of Kerala root wilt of coconut in India (Mathen et al. 1990). The bug also sometimes causes direct damage in coconut nurseries (Dr. Rey Abad, Philippine Coconut Authority, personal communication).

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