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Source: Florida Entomologist, 93(2) : 294-297

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/024.093.0222

ROYAL PALM BUG *XYLASTODORIS LUTEOLUS* (HEMIPTERA: THAUMASTOCORIDAE) CONTROL WITH SOIL APPLIED SYSTEMICS

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Abstract

The Royal Palm, *Roystonia regia* (Kunth) O. F. Cook, is a quintessential tree in South Florida landscapes and has relatively few pests. However, it can be severely damaged by non-predictable population flare-ups of the Royal Palm Bug (RPB), *Xylastodoris luteolus* Barber. Damage appears as frizzled new growth that reduces aesthetics and may affect photosynthetic ability. This study was conducted to evaluate the efficacy of soil-applied neonicotinoid systemic insecticides. All 3 active ingredients tested, Merit 2F (imidacloprid), Safari 2 G and Safari 20 SG (dinotefuran) and Arena 50 WDG (clothianidin) provided excellent RPB control 30 and 75 d after treatment. ELISA analysis of palm foliage showed dinotefuran translocated fastest, followed by imidacloprid and then clothianidin. Soil application of insecticides is preferred in urban landscapes over foliar treatments due to elimination of drift and reduction in environmental concerns. To protect the appearance of the popular Royal Palm, it is advantageous to apply a systemic neonicotinoid at the first symptom of an infestation.

Key Words: Royal Palm Bug, Royal Palm, *Xylastodoris luteolus*, neonicotinoid insecticides, systemics

Resumen

Royal Palm, "La Palma Real" *Roystonia regia* (Kunth) O. F. Cook, es un espécimen de excelencia en los paisajes del sur de Florida. Esta palma de mucho valor padece relativamente de pocas plagas. Sin embargo, puede ser gravemente dañada por brotes no previsibles de Royal Palm Bug "La plaga de la Palma Real" (RPB), *Xylastodoris luteolus* Barber. Las características de daños se manifiestan en los nuevos retoños rizados que reducen la estética y pueden afectar la capacidad fotosintética. El siguiente estudio se realizó para evaluar la eficacia de los terrenos tratados con insecticidas neonicotinoides sistémicos. Los tres productos probados, Merit 2F (imidacloprid), Safari 2 G/Safari 20 SG (dinotefuran) y Arena 50 WDG (clothianidin) proporcionaron excelente control de RPB 30 y 75 días después del tratamiento. El análisis de ELISA de follaje de la palma, mostró que dinotefuran fue translocado más rápido, seguido por el imidacloprid finalizando con clothianidin. La aplicación de insecticidas en los jardines urbanos es preferible en los suelos que la aplicación al follaje, debido a la eliminación del sumo o la deriva, y con esto, eliminar preocupaciones en cuanto al medioambiente. Para proteger la apariencia de este popular espécimen, La Palma Real debe ser tratada aplicando neonicotinoides a la primera síntoma de infestación.

The Royal Palm Bug (RPB), *Xylastodoris luteolus* Barber, is an occasionally serious pest of Royal Palms, *Roystonia regia* (Kunth) O. F. Cook, in the landscape. This bug seems to have an irregularly cyclical pattern of abundance. In normal years they are found in low levels infesting few trees. However, in certain years they build up to extremely high populations that cause severe damage to Royal Palms. Damaging populations have been reported in 1921, 1957, and 1975 on the east coast of Florida (Baranowski 1966; Reinert 1975). Feeding by adults and nymphs occurs in the spear leaf and newly expanding fronds (Fig. 1). As the fronds unfurl, the damage appears as brown-gray areas on the leaflets which become frayed and ragged in appearance (Fig. 2). This reduces the aesthetic value and, with repeated attacks, may reduce photosynthetic ability of the tree. Damage is most severe in spring and early summer. Populations then seem to subside until the following spring (Howard & Stopek 1999).

RPB has been described from Florida and Cuba (Reinert 1975), and has been collected as far north as Largo on the west coast and Vero Beach on the east coast of Florida. Their biology and morphology have been detailed by Baranowski (1966). Adults are small insects (2-2.5 mm) with tan-yellowish bodies, red eyes, and somewhat transparent wings (Fig. 3). Nymphs range in size from 0.7 mm-2 mm. Females deposit 1-2 eggs per

Fig. 1. Close-up of Royal Palm Bugs (RPB) feeding on unfurled Royal Palm leaflets.

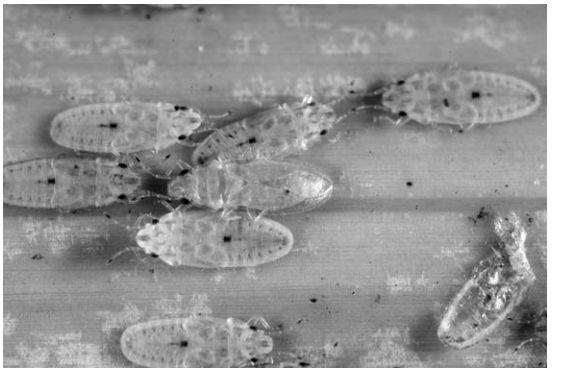

Fig. 3. Close-up of RPB adult (center) and nymphs (photo by Lyle J. Buss, University of Florida).

day on the leaflet midrib. When nymphs hatch they feed inside folded leaflets and undergo 5 stadia. The duration of the life cycle averages 28 d from egg to adult.

RPB adults and nymphs are flattened dorsoventrally, and feed and rest in tight spaces. Feeding damage occurs initially as stippling of tissue as the bugs suck out cell contents. This is followed by browning (necrosis) and eventual frizzing of the leaflets. The bugs feed in newly unfolding leaflets. They attack the tip of the spear leaf as it begins to unfurl then progress to the leaflets down the rachis. If damage is severe, both the aesthetic value and photosynthetic ability of the palm may be reduced. This study was conducted to evaluate the efficacy of several soil applied systemic neonicotinoid insecticides against RPB.

Materials and Methods

Heavily infested trees based on damage appearance were selected for the study. They were approximately 10 m tall, with an average trunk diameter at breast height (DBH) of 50 cm, and growing in a landscaped setting in Ft. Myers, FL. Soil type was sandy and the palms were growing in mulched beds with no turf competition. The products tested were: Safari® 20 SG and Safari® 2 G (both dinotefuran), Arena® 50 WDG (clothianidin), CoreTect™ (2.4 gm tablets containing imidacloprid + fertilizer; 12-9-4 with 20% ai imidacloprid) and Merit® 2F (imidacloprid). Safari 2 G was applied broadcast to the soil surface and watered in. Safari 20 SG, Arena and Merit were applied as soil drenches with a watering can at the base of the trunk with the required amount of insecticide in 0.5 L water per 2.54 cm DBH. The CoreTect tablets were inserted into the root zone soil to a depth of 4-6 cm, at a spacing of 8 cm apart. Tablet placement was within 30-45 cm from the trunk. All treatments were applied on 11 Apr 2009.

Fig. 2. Frizzling of Royal Palm leaflets due to feeding damage by RPB.

RPB populations were evaluated in the field by counting the number of live adults and nymphs on 5 randomly selected, unfolded leaflets per tree utilizing a Liftall® aerial lift (bucket) mounted on a Ford F800 truck (courtesy of The Davey Tree Expert Co.) (Fig. 4). Only leaflets from the newest unfolding frond or from the unfurling tip of the spear leaf were selected. Evaluations of RPB numbers were made pretreatment (11 Apr), and at 30 and 75 d after treatment (DAT). The experimental design was RCB with 5 replications (trees) per treatment, for a total of 30 trees. Data were analyzed with analysis of variance and means separated by the SNK test.

In addition, ELISA (Enzyme-Linked Immuno-Sorbent Assay) analyses were conducted to determine the concentration of all insecticides (except CoreTect) in the foliage. Five randomly selected leaflets per palm were cut and placed in plastic storage bags. The samples were kept frozen until the ELISA analysis was done. All 5 leaflets from the same palm were lumped into 1 sample for the ELISA. Sampling was done 30 and 75 DAT. Two separate test kits were used in the analysis, one

Fig. 4. Sampling of RPB populations in the field utilizing an aerial lift (bucket).

for imidacloprid, the other for dinotefuran/clothianidin. Matrix effects from naturally occurring plant compounds were eliminated from the untreated Check through multiple dilutions until a non-detectable level was reached. The study was conducted from 11 Apr to 20 Jun 2009. During the first half of the study, due to the lack of precipitation, palms were sprinkler irrigated weekly with 2.5 cm water. A total of 24.6 cm of precipitation occurred during the second half of the study.

Results

All treatments resulted in significant reductions of RPB adults and nymphs on 9 May at 30 DAT (Table 1). On 20 Jun at 75 DAT, Arena resulted in complete control, followed closely by the Safari formulations and the Merit formulations. The 20 Jun data contained several '0' values and thus were transformed to Log (X + 1) for statistical analysis. Untransformed data are presented in the table. No phytotoxicity was observed with any of the treatments.

ELISA analyses showed that Safari (dinotefuran) and Merit (imidacloprid) were present in palm foliage by 30 DAT, but Arena (clothianidin) residues were not detected until 75 DAT (Fig. 5). Neonicotinoids concentration increased between 30 and 75 DAT in palms that received a soil drench of Merit 2 F or Safari 20 SG, but declined in palms treated with Safari 2 G. On both sample dates, Safari (dinotefuran) concentrations were much higher in foliage than Merit (imidacloprid) or Arena (clothianidin) concentrations. Differences among neonicotinoids in speed of uptake and peak concentration are likely due to differences in physical and chemical properties. Dinotefuran is much more water soluble than either imidacloprid or clothianidin (39,800 mg/L, 514 mg/L, and 259 mg/L, respectively). In addition, dinotefuran is less tightly bound to soil (Koc 30.0) than either imidacloprid (Koc 262.0) or clothiani-

Table 1. Efficacy of selected soil applied systemic insecticides against royal palm bugs infesting royal palms in southwest Florida, Spring 2009.

			Avg. # live adults and nymphs/5 leaflets[1]	
			9-May-2009	20-Jun-2009[2]
Treatment[3]	Rate per 2.54 cm DBH[4]	11-Apr-2009	30 DAT[5]	75 DAT
Safari 20 SG (dinotefuran)	7.2 g	479 a	7 b	0.4 b
Arena 50 WDG (clothianidin)	2.9 g	459 a	107 b	0 b
Safari 2G (dinotefuran)	72 g	365 a	8 b	0.2 b
CoreTect[6] (imidacloprid)	3 tablets	390 a	50 b	0.6 b
Merit 2F (imidacloprid)	6 mL	595 a	18 b	3 b
Check		430 a	310 a	266 a

[1]Means within columns not followed by the same letter are significantly different (SNK $P < 0.05$).
[2]Original data were transformed to Log (X + 1) for statistical analysis. Untransformed data are presented.
[3]All treatments were applied on 11 Apr 2009.
[4]Diameter at Breast Height.
[5]Days After Treatment.
[6]Imidacloprid plus fertilizer; each tablet weighed 2.4 g with an analysis of 12-9-4 and 20% ai imidacloprid.

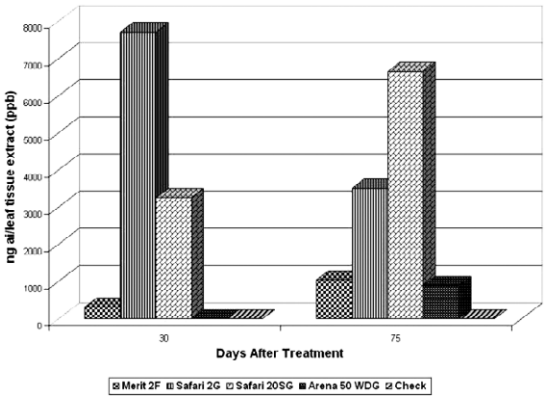

Fig. 5. Concentration of selected insecticides in Royal Palm foliage as determined by ELISA (Enzyme-Linked Immuno-Sorbent Assay) Analysis, Southwest Florida, Spring 2009.

din (Koc 160.0); hence higher amounts of dinotefuran are more quickly absorbed by roots and transported via the xylem into the foliage.

Discussion

Previous control efforts have utilized foliar applications of systemic and contact insecticides (Reinert 1975). Most of those earlier products were organophosphates and their uses have been cancelled. Howard & Stopek (1999) investigated the use of imidacloprid as a soil drench and recommended that the application be made prior to the incidence of damage. In our study, all the neonicotinoid systemics were applied when damage was noticed in the spring. Both Safari formulations were translocated fairly rapidly, with Merit 2F at a somewhat lower rate. Arena 50 WDG provided reduction in RPB populations at 30 DAT but was not detected in foliage until 75 DAT. The lack of detection during the early sampling date was likely a consequence of the ELISA test kit sensitivity.

Soil application is a more convenient and environmentally friendly approach than either foliar application or trunk injection. Foliar applications to tall palms may be objectionable in urban areas due to drift concerns. Trunk injections of current systemics are not an option for two reasons. First, the distribution in the canopy will probably not be sufficient. Palms are arborescent monocots and they lack the cambium layer found in hardwoods. Second, any injury, and resultant oozing, to the trunk will be undesirable since a large part of Royal Palm's attractiveness is in the smooth, grey trunk.

RPB damage does not occur at severe levels every year. In most years, the damage levels remain low. The latter was attributed in part by Reinert (1975) to washing action of heavy rainfall and to predators such as the spiders *Hentzia grenada* and *Theridion* sp. With the exception of the occasional jumping spider (Salticidae), and an unidentified pirate bug, not many predators were observed during this study. Howard & Stopek (1999) speculated that the lack of severely cold temperatures (freezing) may contribute to RPB population buildup. Accordingly the high population encountered in this study may have been an artifact of temperatures above freezing over the past 3 winters in Ft. Myers (National Weather Service 2009).

Even though RPB does not reach severely damaging levels every year, it is advisable to closely monitor palms with a known history of infestation as well as high value palms in the landscape. Since the damage starts cryptically in the unfolded leaflets, it could go unnoticed until more serious infestations become evident. To protect the appearance of the popular Royal Palm, it is advantageous to apply a systemic neonicotinoid at the first symptom of an infestation.

Acknowledgments

The authors express gratitude to Edison State College and Bob DuFresne of GCA Services Group for providing a site for this study. Logistical support and aerial lift assistance was masterfully provided by Josh McIntosh of the Davey Tree Expert Co. This study was funded, in part, by generous grants from Valent, USA, and from Bayer Environmental Science. ELISA analyses and data were provided by Valent, USA.

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