Field Biology and Control of *Haplaxius crudus*[1] on St. Augustinegrass and Christmas Palm[2]

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ABSTRACT

Haplaxius crudus (Van Duzee) develops readily on St. Augustinegrass, *Stenotaphrum secundatum* (Walt.) Kunze, Bahiagrass, *Paspalum notatum* Flugge, and Bermudagrass, *Cynodon dactylon* (L.) Pers. Adults feed on these turfgrasses and on at least 9 species of palms including the Christmas palm, *Veitchia merrillii* (Becc.) Moore, and coconut palm, *Cocos nucifera* L. Mean populations of 3.1/leaf on Christmas palms and 23.7/0.09m^2 on St. Augustinegrass were reported.

Populations of *H. crudus* were controlled with aldicarb and with carbofuran and dimethoate soil drenches at rates of 28 g AI/tree on mature Christmas palms. Chlorpyrifos, diazinon, and propyl thiopyrophosphate provided 100% control, while carbaryl and carbofuran gave excellent control of *H. crudus* on St. Augustinegrass. Malathion also provided good control, but acephate, dimethoate, and methomyl did not give control on this grass.

Lethal yellowing disease has killed more than a third of Florida's coconut palms, *Cocos nucifera* L. (an estimated 300,000), almost an equal number of Christmas palms, *Veitchia merrillii* (Becc.) Moore, and an undetermined number of palms of other species during 4 years since its discovery in 1971 on the mainland of Florida. *Haplaxius crudus* (Van Duzee) is closely associated with *C. nucifera* and is considered to be a likely or potential vector of lethal yellowing disease. Therefore, its behavior and biology were investigated and several insecticides were screened for its control on Christmas palms as well as St. Augustinegrass, *Stenotaphrum secundatum* (Walt.) Kunze, on which it normally breeds.

METHODS AND MATERIALS.—*Christmas Palm Test*.—A street planting of *V. merrillii* palms 2.5–3.5 m tall with 1.4–1.8 m of clear trunk and each ca. 2 m apart were selected to evaluate 3 systemic insecticides for control of *H. crudus*. Palms adjacent to diseased palms were all assigned to one block; remaining trees were randomly assigned to an additional 9 blocks. Treatments consisting of the 3 insecticides and 2 untreated checks were then randomly assigned within each block for a total of 10 trees/treatment.

Each tree was treated with 28 g AI/tree (ca. 1.57 g AI/cm of trunk diam) based on measurements about 0.6 m above the soil. The soil in a circle ca. 0.9 m in diam was loosened under each tree receiving carbofuran and dimethoate. These materials were then mixed with 7.6 liters of water/treatment and drenched into the loosened soil. An equal amount of water was used to wash the chemical into the tree's root zone.

A golf cup cutter was used to remove 6 plugs (10.2 cm diam and ca. 15 cm deep) within a 0.9 m diam circle around each palm treated with aldicarb. Granular material was then equally dispensed into the 6 holes, and after plugs were replaced, it was flushed into the root zone with 7.6 liters of water applied equally around each tree. This plugging procedure insured that the material was out of normal contact of human beings.

H. crudus populations were sampled before the test was established and 12 days posttreatment by counting the number of adults per leaf on the 5 lowest leaves/tree which essentially formed a leaf whorl about the base of the tree canopy.

St. Augustinegrass Test.—Insecticides at the rates given in Table 2 were applied to 2.32 m^2 plots of St. Augustinegrass with 0.6 m buffer zones between plots.

Plots were divided into 5 blocks, based on differing population levels, and treatments were randomized within each block. Chemicals for each treatment were mixed with 1.9 liters of water and applied to the turf with a sprinkler can. An equal amount of water per plot was used to wash the chemical into the thatch zone where *H. crudus* populations were feeding.

H. crudus populations were sampled before and one and 6 weeks after treatments were applied. Samples were made by a procedure used for counting chinch bugs (Reinert 1972) by forcing a metal cyclinder (equivalent to 0.09 m^2) into the turf, flooding it with water, and counting the number of nymphs and adults that floated to the surface in 10 minutes. Since nymphs did not readily float to the surface, the matted grass within each cylinder was vigorously shaken several times underwater to dislodge those concealed in the waxy exuvia secreted on the stolons and roots.

RESULTS AND DISCUSSION.—*H. crudus Behavior under Field Conditions*.—This insect actively breeds on the roots of St. Augustinegrass, Bahiagrass, *Paspalum notatum* Flugge, and Bermudagrass, *Cynodon dactylon* (L) Pers., which are the most widely used turfgrasses in southern Florida landscapes including home lawns, industrial plantings, parks and golf courses where palms also are extensively planted. St. Augustinegrass appears to be its preferred host, and it can almost always be observed in all stages of development on this grass. This insect was observed to kill St. Augustinegrass under greenhouse conditions.

Oviposition occurs on moist soil adjacent to grass stolons or palm roots. As the nymphs develop, a white, waxy exuvia is secreted on the stolon or root and often completely envelopes the nymphs. Nymphs have been observed feeding on Christmas palm roots,

[1] Hemiptera (Homoptera): Cixiidae.

[2] Florida Agric. Exp. Stn. Journal Series No. 9092. Received for publication May 4, 1976.

and Eden-Green (1976) and Waters (1976) reported nymphs also feeding on coconut palm roots.

Adults feed on phloem of palm leaves as illustrated by Waters (1976) and as many as 50 adults/coconut leaf have been observed in the field. In Jamaica, A'Brook (1974) and Johnson (1973) found *H. crudus* to be the second most common planthopper associated with *C. nucifera*. Adults migrate to palms at night and many return to the underlying turf as temperature begins to increase after sunrise. Sampling was made easier at 12 days posttreatment on *V. merrillii*, since the ambient temperature was 7.2°C the previous night and a chill remained throughout the morning. Because of the cold, the insects remained in the trees and were easily counted. During the heat of the day, *H. crudus* which are still present on a palm leaf will have migrated to the protection at the base of the leaflet sinus.

H. crudus adults are easily collected on St. Augustinegrass or on the lower leaves of a coconut or Christmas palm since they readily feed on these hosts. Adults of this insect also have been observed on the following palms: *Arecastrum romanzoffianum* Becc., *Chrysalidocarpus lutescens* Wendl., *Livistona chinensis* R. Br., *Phoenix canariensis* Hort. ex Chab., *Pritchardia pacifica* Seem & H. Wendl., *Roystonea regia* H.B.K. Cook, and *Sabal palmetto* Lodd.

Christmas Palm Test.—At 12 days posttreatment, all 3 systemic treatments provided excellent control of *H. crudus* on *V. merrillii* (Table 1). Aldicarb provided 100% control, while populations of less than 0.3 and 1.9 insects/5-leaf sample/tree were left by the dimethoate and carbofuran treatments, respectively. The higher mean population left by carbofuran was the result of only one tree which still had a population of 13 *H. crudus* adults. Only 1 adult was observed on each of 2 trees treated with dimethoate when populations were examined at 12 days.

An average population of 2.6 insects/leaf or 13.2/tree were counted before treatments were applied, and as shown in Table 1, the mean populations per tree for both checks were even higher (14.2 and 17.2) at 12 days and were not significantly different. Based on the 20 untreated trees, the overall mean population per leaf was 3.1 and 15.7/5-leaf sample, which was very close to the mean at the beginning of the experiment. It is assumed therefore that these values represent the population density level for *H. crudus* supported by *V. merrillii* at this time of year.

Table 1.—Populations of *Haplaxius crudus* per sample of 5-leaf/tree on *Veitchia merrillii* treated with soil drench insecticides on Feb. 14, 1974, (10 replicates; readings taken 12 days posttreatment).

Treatments (28 g AI/Tree)[a]	Mean population[b]	Numbers/ tree
Aldicarb 10G	0 a	0
Dimethoate 2.67EC	0.3 a	0–1
Carbofuran 4F	1.9 a	0–13
Untreated Check No. 1	14.2 b	4–42
Untreated Check No. 2	17-2 b	0–51

[a] Equivalent to an average rate of 1.57 g AI/cm trunk diam.
[b] Means in a column followed by the same letter are not significantly different ($P = 0.01$) by Duncan's multiple range test.

Table 2.—Numbers of *Haplaxius crudus* per 0.09 m² on St. Augustinegrass treated with insecticides on Oct. 11, 1974 (5 replicates).

Chemical	Rate kg AI/ha	Means[a] at weeks posttreatment 0	1	6
Propyl thiopyrophosphate 13%EC	4.20	23.6	0.0 a	0.0 a
Diazinon 4EC	4.48	23.6	0.0 a	0.0 a
Chlorpyrifos 2EC	1.12	23.8	0.0 a	0.0 a
Carbofuran 4F	5.60	24.0	0.0 a	0.4 a
Carbaryl 80WP	5.60	23.8	2.0 a	0.8 a
Malathion 5EC	5.60	23.4	5.2 ab	6.6 ab
Dimethoate 2.67EC	2.24	24.6	4.6 ab	17.4 c
Methomyl 1.8L	1.12	23.8	6.6 abc	15.0 bc
Acephate 75WP	2.80	23.4	10.6 bc	13.4 bc
Untreated Check	0	23.2	12.4 c	11.2 bc

[a] Means in a column followed by the same letter are not significantly different ($P = 0.05$) by Duncan's multiple range test.

St. Augustinegrass Test.—*H. crudus* was controlled by several chemicals recommended for turf insect control (Table 2). Chlorpyrifos, diazinon, and propyl thiopyrophosphate reduced populations to 0, while carbofuran and carbaryl killed all but 0.4 and 0.8 *H. crudus*/0.09 m², respectively. Malathion also provided some control. Even though significant control was provided by dimethoate and methomyl at one week, by the 6th week, populations in these plots were higher than in the untreated plots.

Carbofuran gave excellent control in both tests while dimethoate provided control only on palms. Reinert and Woodiel (1974) reported excellent control of a palm aphid *Cerataphis variabilis* Hille Ris Lambers on *C. nucifera* with both chemicals as foliar sprays but only with dimethoate as a soil drench. It is assumed therefore that dimethoate is tied-up in the turf system by some undetermined mechanism.

No apparent phytotoxicity was observed on either St. Augustinegrass or Christmas palms as a result of these chemical treatments.

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