THE WEST INDIAN SUGARCANE ROOTSTALK BORER WEEVIL IN FLORIDA

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Abstract. **The history of the West Indian sugarcane rootstalk borer weevil, Diaprepes abbreviatus, dates back to the early 1900s when it was reported being an economic pest on sugarcane in the West Indies.**

In 1964, a single adult weevil was discovered in Florida, the first reported for the United States. At present, the weevil is known to be established in 3 Florida counties—Orange, Seminole and Broward. As of September 30, 1975, there are 10,738 acres of citrus within the quarantine area; 4,299 acres have actually been found infested. In Florida, the weevil has never been found on sugarcane, but it has proved to be a serious economic pest of citrus.

State and federal eradication efforts have been seriously hampered by the Federal Environmental Protection Agency's stringent restrictions on the use of pesticides. Presently, there is no approved pesticide available to accomplish the eradication of this pest. The present policy involves stronger regulatory action to prevent further introduction of the weevil from foreign countries and to control the spread from the 3 infested Florida counties. Foliage sprays are used to reduce high adult weevil populations; hopefully, this will provide some measure of time for research to develop an effective chemical or biological control method.

In September 1964, citrus, Florida's number one agricultural crop, has again been attacked by an immigrant insect that has the potential of being one of the most destructive citrus pests yet encountered by the industry.

The West Indian sugarcane rootstalk borer weevil, *Diaprepes abbreviatus* (L.), unfortunately, is tagged with a common name that is misleading to many of the citrus industry people—assuming it to be a pest of sugarcane and not citrus. This weevil is reported to be a native of the West Indies and is a serious pest of sugarcane and citrus in that region (1). The adult (Fig. 1) is a large snout beetle ranging in size from 1/2 to 3/4 inch long and the color varies from a scale pattern in striking orange-brown to

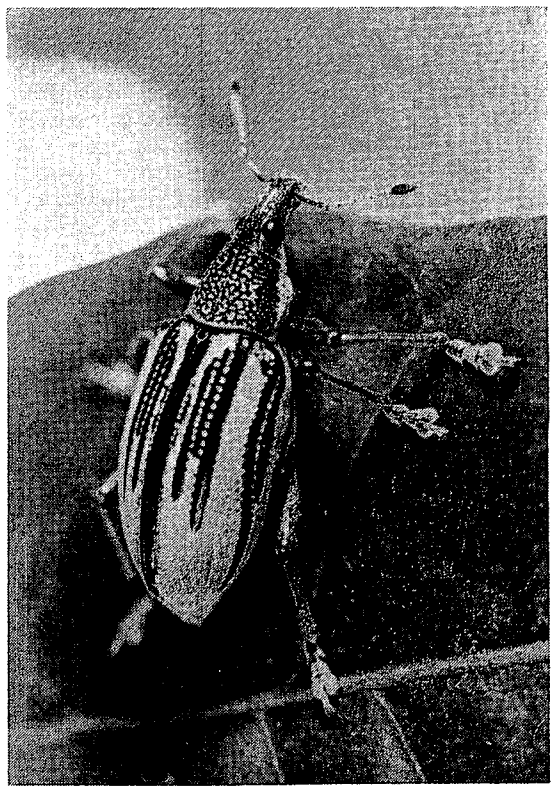

Fig. 1. Photograph of an adult West Indian sugareane rootstalk borer weevil, Diaprepes abbreviatus (L.)

a dull light gray with black denuded stripes extending down the wing covers. The adult feeds on the foliage leaving a notched pattern resembling that caused by the common citrus root weevils, *Pachnaeus spp.* or sometimes called the powder-blue or blue-green weevil, which are found throughout the state.

The female *Diaprepes* lays an average of 40 eggs per mass between 2 leaves that are then glued together with an adhesive substance that she produces. A single female can lay up to 5,000 eggs during her life span of some 2-3 months. The eggs will normally hatch in 7 days at which time the tiny larvae fall to the ground and work their way into the soil where they feed on roots of the host plant (2). In the larval stage of this weevil, the destructive ability is much greater than that of the foliage-feeding adult. The larva inherits the ability to remain in the

soil for a prolonged period, ranging from 2 months to as long as 2 years before emerging as an adult. Under Florida conditions, the most significant damage caused by the larvae occurred on the taproot of citrus trees.

It was formerly thought that only young citrus nursery trees were seriously damaged by the larval feeding and that mature trees were capable of overcoming the damage. We now realize this to be far from the truth because many mature trees showing decline within the infested area of Orange County have been removed and the majority had dead taproots and lateral roots damaged beyond recovery. The condition of the roots was attributed to the damage caused by the larvae of this weevil.

When and how this insect made entry into the United States is not known, but it is reasonable to assume it reached Florida in shipments of foliage plants from Puerto Rico, which are received at Apopka and other points in the state on a regular basis. Despite the restrictions placed on importation of plants into Florida and the United States from overseas, it is not uncommon for the U. S. Department of Agriculture port inspectors to intercept shipments containing serious agricultural pests. Florida has recently strengthened the importation requirements on foliage plants being shipped from Puerto Rico.

I am sure by now you are wondering how extensive is the spread of this destructive insect and what has been done thus far to eradicate or control it?

The initial infestation of the West Indian sugarcane rootstalk borer weevil in Florida was discovered September 25, 1964 (3) with only a single adult weevil being found in a small citrus nursery at Apopka in northwest Orange County. Repeated surveys produced no additional specimens until September 16, 1968 (4) at which time adult weevils were found established in 796 acres of commercial citrus groves in scattered locations from Apopka to Plymouth. Aimed at preventing further spread of this pest, restrictions were immediately placed on the movement of citrus fruit and citrus nursery stock from the quarantine zone which consisted of over 5,000 acres surrounding infested properties. Restricted articles (citrus fruit, nursery stock, soil, etc.) had to be properly certified by soil treatment and/or foliage sprays before leaving the quarantine area.

Coupled with the regulatory program, control efforts were implemented to reduce the larval and adult weevil population by the use of approved pesticides. An immediate larvicide soil treatment, using granular heptachlor at the rate of 3 lbs. actual ingredient per acre, was applied by aircraft during November 1968 to the entire quarantine area. Subsequent soil applications were made in 1970 and 1972, using granular chlordane at the rate of 10 lbs. actual ingredient per acre. The most recent soil treatment was applied in 1973 and 1974 using granular dieldrin at the rate of 5 lbs. actual per acre in split applications. Present evaluation of these materials indicates some measure of control was realized, but showed no hope for eradication at the rate applied.

In addition to the larvicide treatments, aerial foliage sprays, using Sevin (carbaryl), were started in 1969 and were routinely applied each year starting at the time adults appeared (usually in April and continuing through October). Frequency of foliage sprays varied each year depending on the adult population.

In spite of the vigilant efforts exerted by state and federal regulatory and control agencies, the adult weevil still managed to escape and become established in areas outside the boundaries of the original quarantine zone. From what seemed to be an isolated infestation in 1964, it now covers areas in 3 Florida counties (Fig. 2): *Orange*—32,640 acres under quarantine of which 4,299 acres are known to be infested; *Seminole*—5,760 acres in vicinity of Forest City has been placed under quarantine, 156 acres actually infested; and *Broward*—2 landscape ornamental nurseries near Davie, totaling 14 acres have now been found infested. All infested properties in the 3 counties have received soil treatments and are under a foliage spray program. Infested

Fig. 2. Initial acres found infested by county per year.

County	1964	1968	1969	1970	1971	1972	1973	1974	*1975	Total Acres
Orange	1	796	281	51	578	436	1,641	249	96	4,129
Broward								4	10	14
Seminole									156	156
									Grand Total	4,299

*Through September 1975

nurseries are required to follow a rigid control program to certify plants for movement.

To further complicate matters, in May 1974, a survey team found adult weevils feeding on landscape ornamental plants in a 110-acre, field-planted nursery located on the edge of the Zellwood muck farming area near Plymouth. Several hundred adult weevils were collected from a wide selection of plants ranging from day-lilies to oak trees. Then on September 16, 1974, a local Division of Plant Industry nursery inspector at Davie, Broward County, discovered weevils attacking Australian umbrella tree (*Brassaia actinophylla* Endl.) in a 4-acre landscape nursery (Fig. 3).

Fig. 3. Adult weevils have been found on the following plants in Florida since 1964:

1) Citrus (all varieties)
2) Maypop (*Passiflora incarnata*)
3) Peach (*Prunus persica*)
4) Wild cherry (*Prunus sp.*)
5) Kudzu vine (*Pueraria thunbergiana*)
6) Blackberry (*Rubus betulifolius*)
7) Gallberry (*Ilex glabra*)
8) Wax Myrtle (*Myrica cerifera*)
9) Sugarberry or hackberry (*Celtis laevigata*)
10) Laurel Oak (*Quercus laurifolia*)
11) Live oak (*Quercus virginiana*)
12) Pignut hickory (*Carya glabra*)
13) Hercules club or toothachetree (*Zanthoxylum clava-herculis*)
14) Winged or shining sumac (*Rhus copallina*)
15) Wild persimmon (*Diospyros* sp.)
16) Pear (*Pyrus serotina*)
17) Sweet bay (*Magnolia virginiana*)
18) Hairy indigo (*Indigofera* sp.)
19) Okra (*Hibiscus esculentus*)
20) Bean (*Phaseolus* sp.)
21) Groundsel bush (*Baccharis* sp.)
22) Crape Myrtle (*Lagerstroemia indica*)
23) Silver thorn (*Elaeagnus pungens*)
24) Chinese holly (*Ilex cornuta*)
25) American holly (*Ilex opaca* var. East Palatka)
26) Pfitzer juniper (*Juniperus chinensis* var. pfitzeriana)
27) Hetzi juniper (*Juniperus chinensis* var. hetzi)
28) Chinese elm (*Ulmus parvifolia*)
29) Chinese pittosporum (*Pittosporum tobira*)
30) Day-Lily (*Hemerocallis* sp.)
31) Pineapple guava (*Feijoa sellowiana*)
32) Chinaberry tree (*Melia azedarach*)
33) Maple tree (*Acer rubrum*)
34) Sicklepod (*Cassia obtusifolia*)
35) Fla. Beggarweed (*Desmodium tortuosum*)
36) Lily-turf (*Liriope* sp.) -8-29-74 (larva only)
37) Australian Umbrella Tree (*Brassaia actinophylla*)
38) *Dracaena marginata*
39) Anise (*Illicium anisatum*)
40) Christmas Berry or Tropical Holly (*Ardisia crispa*)
41) Italian Cypress (*Cupressus sempervirens*)
42) Ragweed (*Ambrosia artemisiifolia*)
43) Yaupon holly (*Ilex vomitoria*)
44) Tube-flower (*Clerodendrum indicum kuntze*)
45) Rose (*Rosa spp.*)

The discovery of these infestations prompted program leaders to reevaluate the entire regulatory and control project.

Since 1968, the Florida Department of Agriculture and Consumer Services, Division of Plant Industry, in cooperation with the USDA (APHIS, Plant Protection and Quarantine), have devoted many costly hours to regulatory, survey and control in an effort to eradicate this pest. However, it soon became evident that, with the use of the present approved pesticides, eradication was futile. Therefore, the only hope was to suppress the weevil population with the most effective chemical available which would give research scientists of the USDA, ARS, Citrus Root Weevil Laboratory, and University of Florida, IFAS Agricultural Research, time to search for effective methods to control this weevil.

Restrictions by the Federal Environmental Protection Agency have hampered control work to the point that those pesticides showing some promise in controlling this weevil have either been suspended and can no longer be used or they have been placed on "EPA's suspect chemical list" and are subject to possible cancellation at some future date.

Unless research can develop an effective chemical or biological method of control that EPA will approve, this insect will be so well established that it will be virtually impossible to eradicate. Widespread colonization infestations of this insect could have catastrophic effects on the entire agricultural industry, not only from the resulting damage inflicted to plants, but a far greater economic impact could be felt by the severe regulatory restrictions that would be imposed on Florida's agricultural commodities by other states and countries as well as intrastate movements.

As can be clearly seen, there still remain many unanswered questions on the life habits of

this insect and how to cope with those we now know. Although prospects for total eradication are not encouraging at this time, hopefully, a chemical attractant, specific pesticide, or biological control may be devised to effectively suppress the population to a tolerable level or even accomplish eradication of this exotic and destructive immigrant pest.

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FLORIDA CITRUS HARVESTING LABOR AND THE ECONOMY

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Abstract. **The supply of citrus harvesting labor is closely linked to the performance of the economy. In the short run, the real piece rate is principally a function of the unemployment rate and the non-farm wage. During periods of full employment, the elastic response to the non-farm wage indicates a smaller movement from the non-farm sector thereby stimulating wages and income to hired agricultural workers. A recessionary, slack economy increases the intersectoral mobility and provides the setting for declining wages and income to workers in agriculture. Assuming that restriction of labor supply is a key factor in unionization, empirical estimates suggest that during recession the prospects for unionizing are bleak. Yet, in full employment times, prospects for unionization are dampened by farm worker participation in non-farm activities.**

The Problem

Florida growers are concerned with rising wage rates, and scarcities of hired agricultural labor at the going wage rate [2, 7]. Grower concern further manifests itself in Florida's declining market share for labor intensive commodities relative to foreign producers who face considerably lower wage rates.

Wages for hired labor have recently risen rapidly while the comparative advantage of Florida producers in labor intensive, agricultural commodities has declined. The trend in the piece rate for citrus harvesting provides an example of these wage movements. The cost per box for picking labor for the orange harvest increased by 28 percent from the 1971-72 to the 1972-73 season [11]. In 1974, for states intensive in hired labor use, Florida experienced the second highest hourly payment to all hired farm workers and the highest hourly wage rate to supervisory labor [14].

The importance of hired labor to Florida agriculture can be demonstrated by reviewing the unique characteristics of the State's labor situation relative to that of the United States. From the period 1953-57 to 1967-69, the total number of U. S. farm workers decreased by 43 percent; however, Florida was the only state to register an increase in the agricultural labor force. For the same time span, a 53 percent increase in hired labor more than offset a 38 percent decrease in Florida family labor [10]. Furthermore, Florida is characterized by a higher percentage of hired workers in the agricultural labor force for each month of 1973 than the comparable percentage calculated for the U.S.

The relative share of labor in U.S. agriculture has been declining steadily [8]. In contrast to this U. S. trend, the relative share held by Florida's hired labor has held nearly constant relative to value of production and has increased slightly with respect to net farm income. With reference to Figure 1, Florida hired labor's share relative to both value of production and net farm income is higher than comparable hired labor shares for the U. S. Moreover, the gap between the Florida and U. S. hired labor share estimates appears to be widening. Based upon labor force

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