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A Survey of Puerto Rican Soils for Entomogenous Nematodes Which Attack *Diaprepes abbreviatus* (L.) (Coleoptera:Curculionidae)[1,2]

J. Román and J. B. Beavers[3]

ABSTRACT

A survey was conducted to determine the presence of entomogenous nematodes which might parasitize *Diaprepes abbreviatus* (L.) larvae in Puerto Rican soils. One larva (2.3%) was parasitized with *Heterorhabditis* sp. Poinar when 4-month-old larvae were placed in the soil at eight different sites throughout the Island. Soil samples, taken from sugarcane fields and pasture lands in five geographical regions during July and September 1980, and January and April 1981, and inoculated with *D. abbreviatus* larvae did not reveal entomogenous nematodes. In the laboratory, when *Neoaplectana carpocapsae* Weiser was introduced into sterile soil from these regions, 40% of the exposed *D. abbreviatus* larvae became infected. We believe this is the first report of the entomogenous nematode, *Heterorhabditis* sp., occurring in Puerto Rico.

INTRODUCTION

Diaprepes abbreviatus (L.), the so-called surgarcane rootstalk borer weevil or "vaquita," is now considered to be the most important pest of sugarcane in Puerto Rico (7); other cultivated host plants such as *Citrus* sp. and pigeon pea, *Cajanus indicus*, are also seriously attacked. The weevil eggs are deposited in masses between sugarcane blades. Hatchling larvae drop to the ground where they feed on the root systems during their younger larval stages, and as they mature, they bore into the subterranean portions of the cane stems. In heavily infested areas, portions of newly planted sugarcane fields are destroyed; late replanting is necessary. In addition, maturing cane stools dry and brown early; the result is premature harvest or death of the plant. The adult weevils emerge after 1–2 years (8). In 1979–80, the gross income from sugarcane production in Puerto Rico was $56 million (3), an amount which represents an important role in the Island's economy. Although the total land devoted to sugarcane production is currently being reduced, attempts are being made to increase yields by intensifying production technology (6).

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[2] Joint Contribution from the Horticultural Research Laboratory, USDA, ARS, Orlando, FL, and the Agricultural Experiment Station, University of Puerto Rico, Mayaguez Campus, Rio Piedras, PR.

[3] Nematologist, Agricultural Experiment Station, University of Puerto Rico, Mayagüez Campus, and Research Entomologist, Horticultural Research Laboratory, USDA, ARS, Orlando, FL, respectively. The authors wish to thank Dr. G. O. Poinar, Jr., University of California, Berkeley, and Dr. D. T. Kaplan, USDA, ARS, Orlando, Florida, for assistance in nematode identification.

An important aspect in this effort is to develop new control techniques for *D. abbreviatus*, since losses attributed to this insect during 1978–79 were estimated to be $27.7 million (4). So far, no new insecticides evaluated since aldrin was removed from the market have proved to be effective in controlling this insect.

In a recent 2-year study to determine the natural enemies attacking the subterranean stages of *D. abbreviatus* in Florida (2), the entomogenous nematodes, *Heterorhabditis* sp. Poinar (probably *H. heliothidis*) and *Neoaplectana carpocapsae* Weiser were found to be the primary parasites recovered when *D. abbreviatus* larvae were introduced into the soil. The results of their study indicated that the parasitization rate was high from May through November, peaking at 70% in July 1980. *D. abbreviatus* larvae were inoculated into soil samples taken from 55 groves located throughout Florida's citrus growing region; in 47% of the groves either *Heterorhabditis* sp. and/or *Neoaplectana* sp were present.

Since these entomogenous nematodes are not known to occur in Puerto Rico but are widespread in Florida and show potential for biological control of *D. abbreviatus*, we conducted a soil survey in Puerto Rico to determine whether nematode parasites of *D. abbreviatus* larvae were present.

MATERIALS AND METHODS

Two survey techniques were used. In the first, 10 laboratory-reared 4-month-old *D. abbreviatus* larvae (1) obtained from the USDA Citrus Root Weevil Laboratory, Orlando, Florida, were caged in individual 7.5 × 12.5 cm wirescreen cages (324 mesh/cm^2) and placed 30 cm deep in sugarcane fields at eight locations October 29, 1979 (fig. 1a). The cages were recovered after 2 weeks and the larvae examined for nematode infection. In the second test, soil samples were collected from sugarcane fields and pasturelands in five geographical zones of Puerto Rico: north, south, east, west and central (fig. 1b). Samples were taken from five areas within each geographic zone and brought to the laboratory. Soil samples were taken at each site at four different times: July and September 1980, and January and April 1981. Samples were analyzed for pH and for percent sand, clay, and silt content. In the laboratory, each sample was thoroughly mixed and placed in 1-kg aliquots in cylindrical cardboard containers with three replications. These were inoculated with five *D. abbreviatus* larvae (375 larvae/test) and stored at 23–26° C for 2 to 3 weeks. The soil was adequately moistened throughout the duration of each test. At the end of the incubation period, each sample was carefully screened and larvae examined. All larvae recovered were cut into 2 or 3 pieces, and placed on a 10-mesh screen on top of Baermann funnels filled

with water. After 12 hours, 10 ml of water were drained from the funnels and examined for nematodes.

In a third test to determine whether *N. carpocapsae* was capable of parasitizing *D. abbreviatus* larvae in Puerto Rican soil types, three 1-kg soil samples taken from each of the five geographical zones were steam sterilized, we infested the soil samples with *N. carpocapsae* by placing five nematode-infected bait crickets containing about 375,000 nematodes and four or five *D. abbreviatus* larvae into each container. After an incubation period of 2 weeks, larvae were removed from the soil, placed

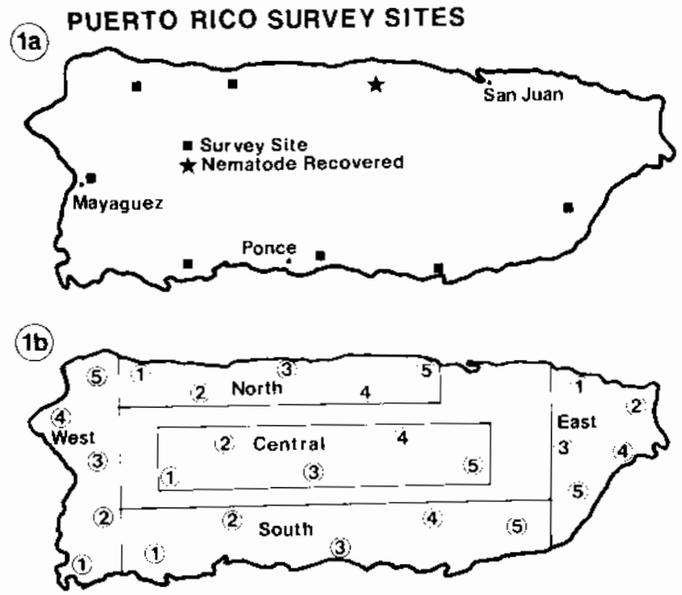

FIG. 1a.—Survey sites for *Diaprepes abbreviatus* larvae placed in individual screen cages. Ten larvae/site. 1b.—Soil sampling sites for laboratory bioassay to determine presence of entomogenous nematodes.

in individual petri dishes on filter paper moistened with a 0.25 NaCl solution, and held to determine nematode emergence.

RESULTS AND DISCUSSION

In the first test, when *D. abbreviatus* larvae were placed in individual screen cages, of the 46 larvae recovered (35 alive, 11 dead), one larva (2.3%) recovered from a sugarcane field approximately 15 km west of

larvae in central Florida, Environ. Entomol. (In press.)
3. Departamento de Agricultura de Puerto Rico, Oficina de Estadísticas Agrícolas, 1981. Ingreso Agricola de Puerto Rico 1978-79—1979-80, pág. 3.
4. Estacion Experimental Agrícola, Univ. de P. Rico, 1979. Informe Anual 1978-79, pág. 4.
5. Poinar, Jr., G. O., 1975. Entomogenous nematodes, Leiden, The Netherlands, E. J. Brill.
6. Vincente-Chandler, J. (Ed), 1978. Conceptos, plan y programa para una agricultura moderna en Puerto Rico, Esta. Exp. Agric. Univ. P. R.
7. Wolcott, G. N., 1948. The insects of Puerto Rico, J. Agric. Univ. P.R. 32 (1-4): 975.
8. ——, 1936. The life history of *Diaprepes abbreviatus* at Río Piedras. J. Agric. Univ. P.R. 20: 883-914.

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[1] Manuscript submitted to Edito

[2] Assistant Economist, Agricult search Assistant, Nutritionist, and ment, Agricultural Experiment Sta Piedras, P.R.