COMPARISON OF FOUR ISOLATES OF *RADOPHOLUS SIMILIS* FROM CENTRAL AMERICA ON VALERY BANANAS [COMPARACION DE CUATRO POBLACIONES DE *RADOPHOLUS SIMILIS* DE CENTRO AMERICA EN BANANO VALERY]

Jorge Pinochet, Division of Tropical Research, United Fruit Company, La Lima, Honduras.

Accepted:
10.X.1978
Aceptado:

ABSTRACT

The effects of four *Radopholus similis* isolates from Central America were compared on Valery bananas. The isolates from Armuelles, Panama, and Coto, Costa Rica caused higher damage to the root system than the Honduran isolate. Population increase in the Honduran isolate was also considerably lower than in the rest of the isolates suggesting that another banana biotype might be present in banana production areas of Central America.
Key Words: burrowing nematode, races, virulence, population dynamics.

INTRODUCTION

The nematode of major concern in banana culture in Central America is *Radopholus similis* which causes destruction of the root system and rhizome (2,3,10). This results in poor anchorage of the plant and thus, a tendency to uproot, especially those plants bearing bunches. High losses can be expected in areas infested with this nematode even in the presence of mild winds. In Costa Rica and Panama uproot losses are much higher than in Honduras (11, 13). *R. similis* is also wide-spread in Honduras and Belize, but for some unknown reason root damage appears to be considerably less (8). Environmental factors in Costa Rica and Panama, especially rainfall are quite different than in Honduras and may be a reason for these differences. Other factors such as soil type and drainage have also been considered as being predisposing factors to major nematode damage. The existence of a more pathogenic form of *R. similis,* perhaps a biotype, in Costa Rica and Panama has never been considered as another factor accounting for higher uproot losses. The existence of *R. similis* biotypes is well documented in the literature (1, 4, 12).

This study compares the effects of 4 isolates of *R. similis* on lesion index of roots, lesion index of rhizome, root weights and population increase at 4 months after inoculation. All original isolations were made from Valery bananas.

MATERIALS AND METHODS

Four populations of *R. similis* from different areas of Central America were raised on carrot disks (7). All these were originally isolated from bananas from La Lima, Honduras; Coto, Costa Rica; Changuinola, Panama; and Armuelles, Panama. The Honduran population was first isolated in August, 1976 and the others in February-April, 1977. Since then, isolates have been kept in culture jars for many generations. Rhizomes of Valery were peeled and heat-treated at 56° C for 10 minutes and planted in 30-liter plastic containers with autoclaved sandy loam soil. Pots were arranged in a completely randomized design of 5 treatments with 10 replications each. The treatments were the following: 1) Control; 2) Honduras isolate; 3) Costa Rica isolate;

4) Panama-Armuelles isolate; and 5) Panama-Changuinola isolate. Two months after rhizomes were planted, 50 plants were selected for uniform growth and inoculated with an aqueous suspension of 5,000 *R. similis* per pot. During the length of the experiment, plants were maintained outdoors under shaded conditions and irrigated with distilled water as needed. Also, half strength of Hoagland's nutrient solution was added once every 15 days.

At the end of the experiment nematode counts were made from soil and roots. Nematodes in the soil were recovered by removing soil from pots and placing them in a large pan. Then, roots and rhizomes were washed free of particles in a second pan that had a measured volume of water. Contents of both pans were mixed and stirred for 3 minutes. A sample of 250 ml of the slurry was used for nematode extraction by differential sieving and sugar flotation (6). The total number of nematodes in the soil per pot was calculated based on 250 ml aliquotes. Nematodes in the root tissue were extracted by the standard method used by the United Fruit Company. In this method, roots are washed free of soil particles and cut into 1 cm pieces. Chopped roots are placed in a pan of water and stirred to obtain an homogeneous sample of 25 g. Sample is macerated in a blender containing 400 ml of water for 45 sec (15 second blending intervals separated by 2 periods of 10 second pauses). Suspension is passed through the 40, 100, 200, and 325 mesh screens (twice through this last one). Holdings from the 200 and two 325 screens are collected and raised to a volume of 500 ml. Also, 1 ml of methylene blue is added. Readings are made on 4 ml samples. Nematode numbers are multiplied by 500, the resulting figure represents the number of nematodes per 100 g of roots (9). In this study the amount of root sample was modified to 12.5 g since 25 g of roots were not available in many replicates.

Evaluation of root-weights, lesion index of the roots, and lesion index of the rhizome were made in order to determine the nematode's damage to the underground part of the plant. The lesion index of the root measures the length of roots with lesions, and is expressed in percentage. Lesion index of the rhizome measures the amount of rhizome surface with lesions, and is expressed on an arbitrary grading from 0 to 4: grade 0, clean; grade 1, one to three small lesions; grade 2, from three to six small to medium size lesions; grade 3, 10 to 25% of the rhizome surface with lesion; grade 4, more than 25% of the rhizome surface with lesions that coalesce.

RESULTS

The lesion index of the roots showed no differences between the control and the Honduras isolate. The Honduras isolate differed significantly from the Costa Rica and Panama-Armuelles isolate, but not from the Panama-Changuinola isolate (Table 1). There were no differences between the Costa Rican and Panamanian isolates. In the lesion index of the rhizome, the control differed from inoculated treatments. There were no differences in fresh root weights between any of the 5 treatments. *R. similis* population increase was lowest in the Honduras isolate (33.56 times), and highest in the Panama-Changuinola isolate (64.56 times).

DISCUSSION

The higher lesion index of the Costa Rican and Panama-Armuelles isolates as compared to the Honduras isolate would imply a difference in the nematode's ability to colonize banana root tissue. The Costa Rican and both Panamanian isolates also achieved a higher population increase in comparison to the Honduran isolate for the same period of time indicating a faster reproduction rate. This rapid population increase together with the destruction of the root system in less time provides strong

Table 1. Comparative effects of 4 Central American populations of *Radopholus similis* on Valery bananas over lesion index of the roots, lesion index of the rhizome and root weights at 4 months after inoculation.

Treatment (isolates)	Les. index[2] of roots % infection	Les. index[3] of rhizome 0-4	Fresh root weight in grams	Final nem.[4] population in soil & roots
Control	0 a[5]	0 a	25 a	0
Honduras	8 ab	2.5 b	21 a	167,800
Costa Rica	31 c	2.2 b	25 a	279,950
Panama-Armuelles	36 c	2.6 b	21 a	239,350
Panama-Changuinola	28 bc	2.4 b	24 a	322,700

[1]Means of 10 replicates.
[2]Lesion index of the root is the amount of root length with lesions in percentage.
[3]Lesion index of the rhizome is the amount of rhizome surface with lesion expressed on an arbitrary grading: 0, clean; 1, 1-3 lesions; 2, 3-6 lesions; 3, 10-25% of surface lesioned; and 4, 25% or more of the surface lesioned.
[4]Initial inoculation level was 5,000 nematodes per pot.
[5]Values in each column not followed by the same letter differ significantly at the 5% probability level (Duncan's Multiple Range Test).

evidence that a more pathogenic form of *R. similis,* perhaps a second banana biotype might be present in Costa Rica and Panama, and explain why uproot losses are higher there. Edwards and Wehunt in 1971 (5) made a host range study of 2 isolates of *R. similis,* one from Panama, and the other from Honduras. Their findings revealed that these 2 isolates had a different host range suggesting that more than one banana race (biotype) might be involved in banana producing areas of Central America. The results obtained in this study would confirm these previous observations through a comparative study of damage evaluation and population increase of different *R. similis* isolates over the same host. Unfortunately, proof of 2 distinct banana biotypes being involved can only be confirmed by an extensive host-range study of these nematode isolates.

It is not known whether any of the 4 isolates used in these tests increased or reduced their ability to reinfect their original host (Valery banana) when cultivated for several generations on carrot disks. Speed of growth in culture jars is faster in the Costa Rican and Panamanian isolates than in the Honduran isolate. No measurements have been made on this variable. It is noteworthy that three attempts at culturing an isolate from Turbo, Colombia, were unsuccessful.

RESUMEN

Los efectos de cuatro poblaciones de *Radopholus similis* de Centro América fueron comparados en banano Valery. Las poblaciones provenientes de Armuelles, Panamá y Coto, Costa Rica causaron mayor daño al sistema radicular que la población de Honduras. El incremento en número de nematodos de la población de Honduras fue considerablemente más bajo que las demás poblaciones sugiriendo que otro biotipo del banano podría estar presente en las áreas productoras de banano de Centro América.
Claves: nematodo barrenador, razas, virulencia, dinámica de poblacion.

LITERATURE CITED

1. Blake, C. D. 1961a. Nematologica 6: 295-310; *2.* Blake, C. D. 1966. Nematologica 12: 129-137; *3.* Blake, C. D. 1972. Economic Nematology, Academic Press, London-New York 245-267; *4.* Du Charme, E. P., and W. Birchfield. 1956. Phytopathology 46: 615-616; *5.* Edwards, D. I., and F. J. Wehunt. 1971. Plant Dis. Reptr. 55: 415-418; *6.* Jenkins, W. R. 1964. Plant Dis. Reptr. 48: 692; *7.* Moody, E. H., B. F. Lownsbery, and J. M. Ahmed. 1973. J. Nematol. 5: 225-226; *8.* Pinochet, J., and O. Ventura. 1977. Tropic. Agric. 54: 349-352; *9.* Salas, J. A., R. Oyuela, and P. L. Taylor. 1972. Annual Report, Division of Tropical Research, United Brands Co., Part 1, 5-8; *10.* Stover, R. H. and M. J. Fielding. 1958. Plant Dis. Reptr. 42: 933-940; *11.* Stover, R. H. 1972. Banana, Plantain, and Abaca Diseases, Commonwealth Mycological Inst., Kew. Surrey, England. 316 pp.; *12.* Van Weerdt, L. G. 1957. Plant Dis. Reptr. 41: 832-835; *13.* Wehunt, E. J., and D. I. Edwards. 1968. Tropic. Agric. Univ. of Florida Press, 1-19.

EVALUATION OF NEMATICIDES AND METHODS OF THEIR APPLICATION FOR CONTROL OF NEMATODES ON FIELD CORN [EVALUACION DE NEMATICIDAS Y METODOS DE APLICACION PARA CONTROLAR LOS NEMATODOS EN EL MAIZ]

H. L. Rhoades, Agricultural Research and Education Center, P. O. Box 909, Sanford, Florida 32771.

Accepted:
29.I.1979
Aceptado:

ABSTRACT

Soil fumigants and nonvolatile nematicides increased growth and yield of field corn *(Zea mays* L.) over that of control plots in a 2-yr study. Nematicide treatments increased average yields by 28% in 1977 and 58% in 1978. Increases in yield were related to control of *Belonolaimus longicaudatus.* Application of phenamiphos, carbofuran, aldicarb, and oxamyl in a 38-cm band incorporated with rotary wheels just prior to planting controlled *B. longicaudatus* better than applying the chemicals in a 25-cm band in front of the press wheel or in the seed furrow with the planter. However, grain yields were not significantly different between treatments.
Key Words: chemical control, nematicides, methods of application, sting nematode, stubby-root nematode, lance nematode.

INTRODUCTION

In 1968, Rhoades (5) reported that sting nematodes could be economically controlled on field corn with low rates of several organophosphate and carbamate nematicides incorporated in 38-cm band row treatments just prior to planting. Johnson and Dickson (3) confirmed these results in 1973. The list of these materials effective for controlling this nematode on field corn was expanded in 1978 (6). In 1974, Dickson and Johnson (1) demonstrated that several of these materials banded behind the planter opening disks and incorporated only by the soil movement and press wheel action was as effective as preplant-incorporated treatments.

This report describes results of experiments designed to compare the efficacy of additional nonfumigant nematicides developed in recent years and three different