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INTRODUCTION TO SYMPOSIUM ON BANANA NEMATODES [INTRODUCCION AL SIMPOSIO SOBRE NEMATODOS DEL BANANO]. J. E. Edmunds, Director of Research and Development, Windward Islands Banana Growers' Association, St. Lucia.

According to an FAO report, on a global basis the annual banana exports amount to 6 million tons with 8 million forecast for 1975. This establishes bananas as the most important fresh fruit in international trade. The annual foreign exchange earnings are around US $550 - $600 million, which ranks bananas as one of the 5 or 6 most valuable agricultural exports of tropical countries. In 1973 it accounted for 85% of world exports. This in itself gives some idea of this crop's importance to the economics of the banana-growing areas.

Unlike bananas, plantains are grown mainly for local consumption. Latin America produces most of these with Colombia having the largest production (2,000,000 tons) followed by Ecuador with about 800,000 tons. It is considered to be a major food source in several tropical countries.

It is therefore important that our organization considers the importance of nematodes in the production of this crop and the methods available to us for control.

VARIETAL RESPONSES AND PROSPECTS FOR BREEDING NEMATODE RESISTANT BANANA VARIETIES [RESPUESTAS DE VARIEDADES Y LAS PROBABILIDADES PARA LA PRODUCCION DE VARIEDADES DE BANANOS RESISTENTES A NEMATODOS]. S. R. Gowen, WINBAN Research and Development, P. O. Box 115, Castries, St. Lucia. Nematologist on secondment from Ministry of Overseas Development, London.

ABSTRACT

Diploid, triploid and tetraploid banana clones were evaluated for response to attack by *Radopholus similis* and *Helicotylenchus multicinctus*. The cultivated diploid clone 'Sikuzani' was marginally less susceptible to these nematodes than 2 other diploids. Tetraploid A was significantly less susceptible than 2 commercial triploids and tetrapolid C in a greenhouse test carried out with mixed nematode populations in Jamaica, but not in a field trial in St. Lucia. The first requirement in developing a banana breeding programme for nematode resistance will be to locate a suitable source of resistance in wild varieties.

INTRODUCTION

The literature contains several references to varying reactions of Cavendish varieties and 'Gros Michel' (*Musa* AAA) to banana nematodes (3, 6, 7). Some of these records may be confused by the existence of races of *Radopholus similis*

(1, 8). Unfortunately no conclusions referring to nematode resistance in commercial banana clones are based on controlled experiments. The principal difficulty is to begin such experiments with nematode-free plants. In essence the literature records are of differentials in nematode susceptibility rather than in nematode resistance.

Since 1960, the Banana Breeding Scheme in Jamaica has produced a series of tetraploid banana clones originating from seedling bananas developed from the pollination of flowers of the triploid clone 'Highgate' (a dwarf mutant of 'Gros Michel') with pollen from wild diploid varieties or synthetic diploid hybrids bred specifically for desirable factors such as disease resistance or fruit character.

The problems of breeding bananas are well described by Shepherd (4), who explains the difficulty of producing seedless progeny from a seedless plant. Banana breeding is somewhat empirical. Pollinated inflorescences may produce two seeds (from maybe 20,000 ovules) of which only 10% are likely to be tetraploid. Because tetraploid seedlings possess the entire unreduced chromosome complement of the female parent, all the important factors for which a breeding programme is designed must come from pollen of the diploid male parent.

MATERIALS AND METHODS

Host Evaluation: Two tests were used to evaluate the host suitability of eleven banana clones for *R. similis* and *H. multicinctus.* Large numbers of small 'suckers' (peepers) (5) collected from different diploid, triploid and tetraploid clones growing in the Banana Breeding Scheme collection at Bodles, Jamaica were pared of all nematode damage and planted in 4 litre potting bags containing unsterilised compost. Following germination, experimental plants were selected for uniformity of size and vigour and repotted into 24 litre potting bags containing a similar compost mixture.

Equal volumes of root debris containing *R. similis* and *Helicotylenchus multicinctus* prepared by comminuting large quantities of infected roots collected from a Jamaican banana plantation were poured around the plants.

Diploid clones; 'Sikuzani', 'Pisang Lilin' and 'Anai Komban': *Musa acuminata* seedless cultivars; 'Pahang' and 'Selanger': *Musa acuminata malaccensis,* wild varieties; 'M 48' a *Musa acuminata* synthetic hybrid, and 5 triploid and tetraploid clones; 'Robusta' and 'Valery' *Musa* AAA Cavendish group; tetraploids 'A', 'B' and 'C' *Musa* AAAA hybrids of 'Highgate' and synthetic diploids were used in the first and second tests, respectively.

Ten or 16 wks later for the first and second tests, respectively, the plants were washed from the pots. The roots were washed, chopped into 2 - 3 cm lengths and nematodes extracted from a 20 or 25 g subsample using a comminution and "pie-pan" extraction technique.

Population Dynamics: Assessments of nematode populations in triploid and tetraploid clones were made from a variety field experiment at WINBAN Experimental Farm, St. Lucia. The experiment contained 6 replicates of 6 clones (Poyo (*Musa* AAA), 'Valery' and tetraploids 'A', 'B', 'D' and 'E'). Bulk root samples from 4 plants from each plot were taken 36 (4/7/74) and 41 (16/12/74) mos after planting. *R. similis* and *H. multicinctus* were extracted from 25 g subsamples of chopped root using a modified incubation technique (2).

Invasion and Population Development: Single roots growing from small suckers were placed in polyethylene bags containing moist autoclaved sand. *R. similis* females in a few drops of water were placed close to the root tip. In one test 20 active *R. similis* females were placed near the tips of 6 roots each of 'Valery', 'Highgate' and tetraploid 'A'. Four days later the roots were fixed in boiling lactophenol with acid fuschin. Nematodes were teased from the roots and counted. In a second test, nematode assessments were made 4 wks after inoculating root tips with 20 active *R. similis* females. The roots were chopped and comminuted for 10 secs and incubated for 4 days on small extraction filters made from 6 cm diameter polyvinyl chloride conduit. The results presented are from a series of inoculations made over a 2-wk period. Although replication was irregular, the methods of treatment and numbers of nematodes used were constant.

RESULTS

Host Evaluations: Of the diploids, 'Sikuzani' was a significantly (P = 0.05) less favourable host for *R. similis* and *H. multicinctus* than 'Anai Komban' or 'Pisang Lilin' (Table 1). 'Anai Komban' had significantly (P = 0.05) higher populations than all of the clones except 'Pisang Lilin' and 'Selanger'. In the second test, significantly (P = 0.05) fewer nematodes were recovered from tetraploid 'A' than from tetraploid 'C' and the triploids 'Valery' and 'Robusta' (Table 1).

Population Dynamics: Samples taken 36 and 41 months after planting showed no statistical difference in the combined *R. similis* and *H. multicinctus* populations among the 6 varieties. In all cases, however, the populations were greater at the later sampling date.

Table 1. *Radopholus similis* and *Helicotylenchus multicinctus* recovered from banana roots 10 wks and16 wks after inoculation.

10 week test		16 week test	
Clone	Nematodes [1,2] per 20 g	Clone	Nematodes [1,2] per 25 g
Sikuzani	2.89[a]	Valery	3.63[b]
Pisang Lilin	3.15[b c]	Robusta	3.70[b]
Anai Komban	3.34[c]	Tetraploid A	3.32[a]
Pahang	3.07[a b]	B	3.49[a b]
Selangor	3.12[a b c]	C	3.66[b]
M48	3.06[a b]		

[1] Combined *R. similis* and *H. multicintus* totals transformed to log (n+1)

[2] Column means followed by same letter not significantly different (P=0.05).

Invasion and Population Development: *R. similis* females were able to invade roots of 'Valery', 'Highgate' and tetraploids 'A' and 'B' within 4 days after inoculation. The populations that developed after 28 days were 36 to 67 times greater than the original inoculum. (Table 2).

DISCUSSION

R. similis and *H. multicinctus* invade and reproduce on banana clones of differing ploidy. Of the tetraploids, clone 'A' was a less favourable host, in terms of nematode population density, than were the other tetraploid and triploid clones. This trend was also apparent with a different nematode population in a field experiment in St. Lucia.

The results give little support for the existence of an obvious nematode resistance factor in 'Highgate' or its tetraploid progeny. Unlike nematode resistance in some crops, banana breeders have not yet found the resistance factors on which a breeding program might be based.

Although differential responses to nematodes may exist between different tetraploid and triploid clones, these slight differences are of susceptibility to nematodes rather than resistance.

The stature, growth habit and vigour of diploids, triploids and tetraploids may also influence the way symptoms of nematode damage are expressed, not least the incidence of toppling.

RESUMEN

Clones diploides, triploides y tetraploides de banano, fueron seleccionados por diferentes respuestas al ataque de *R. similis* y *H. multicinctus.* El clon diploide 'Sikuzani' fue ligeramente menos susceptible a nemátodos que otros 2 diploides. El tetraploide A fue significativamente menos susceptible que 2 triploides comerciales y el tetraploide C en un ensayo llevado con poblaciones mezcladas de nemátodos en Jamaica (en invernadero) pero no con prueba de campo en Santa Lucia. El primer requerimiento para desarrollar un programa de mejoramiento genético, para obtener resistencia a nemátodos, será ubicado en una fuente apropiada de variedades silvestres con resistencia a nemátodos.

Table 2. Nematode invasion and population development in single roots of triploid and tetraploid clones after inoculation with 20 *Radopholus similis* females.

	R. similis per root			
	Triploid		Tetraploid	
Days after Inoculation	Valery	Highgate	A	B
4	8.9(8-12)[1]	6.1(0-12)[1]	9.8(6-13)[1]	–
28	1335(626-1980)[2]	941(554-2015)[3]	734(286-1249)[4]	998(436-1895)[3]

1. Six replicates
2. Five replicates
3. Nine replicates
4. Eight replicates

LITERATURE CITED

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CHEMICAL CONTROL OF *RADOPHOLUS SIMILIS* ON PLANTAINS [CONTROL QUIMICO DE *RADOPHOLUS SIMILIS* EN PLATANOS].

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Large quantities of plantains (*Musa* AAB) are eaten in some African countries; however, they are not usually grown commercially but are found planted near to dwellings or in fields, frequently interplanted with other crops. A few yrs ago some African governments asked IRFA to extend the planting of this crop to promote local supplies for the population. As a part of this program it was necessary to obtain information regarding the nematode problems of plantain.

The first stage was to determine the seriousness of the damage caused by *Radopholus similis*. This was carried out at the IRFA station in Cameroon on fertile soils of volcanic origin formerly planted with bananas and infested with *R. similis*. The variety "vert sombre," belonging to the French plantain group which is a triploid (genome AAB), was planted. The chemical treatments were: a) 3 applications/yr of 3 g phenamiphos/plant, b and c) 3 and 6 applications/yr of 3 cc DBCP a.i./plant.

The effectiveness of these treatments was assessed by comparing the yields of treated and untreated plots. The populations of *R. similis* in the root systems were counted each mo.

When compared to the untreated, all 3 treatments showed good nematode control (Table 1). However, these results cannot be considered of great significance since the low *R. similis* infections in the untreated plot could have been due to the variety of plantain used in the experiment, or that the Cameroon race of *R. similis* is better adapted to bananas than plantains. The results were surprising because previous observations on varietal collections seemed to indicate that plantains were highly susceptible to attack by the burrowing nematode.

In the absence of heavy infections, the differences in yield between treated and untreated plots are of little significance. Due to an increase in the number of plants/ha after the first cycle, the plants which would have produced the second cycle were weak and therefore were cut down. Discrepancies in the third cycle result from a wind-storm which broke the pseudostems of many plants causing a loss of bunches.

Although the infections of *R. similis* were lower than expected, DBCP gave the best nematode control of the 2 chemicals. Overall yield seemed to indicate that the 6 applications/yr of 3 cc DBCP a.i./plant was the best treatment used in this experiment.