

The effects of *Meloidogyne incognita* and *Heterodera sacchari* on the Growth of Sugarcane

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ABSTRACT

The effects of a root-knot nematode, *Meloidogyne incognita*, and the sugarcane cyst nematode, *Heterodera sacchari*, on the growth of sugarcane (*Saccharum officinarum* L.) variety Co 396, were investigated in the screenhouse. *H. sacchari* alone significantly reduced the shoot weights and caused severe root necrosis. *M. incognita* caused heavy galling of the roots and significantly reduced the plant growth. In a concomitant infection with *H. sacchari* and *M. incognita* the shoot and root weights of plants were significantly reduced; other symptoms include severe root necrosis and galling of the roots.

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.), like other agricultural crops, is attacked by various species of plant-parasitic nematodes (Goodey *et al.*, 1965). Caveness (1967) working in Nigeria, reported 22 species belonging to 16 genera of parasitic nematodes associated with the crop.

The sugarcane cyst nematode (*H. sacchari* Luc and Merny) and the root-knot nematodes (*Meloidogyne incognita*) are the two most serious nematode pest affecting sugarcane production in Nigeria (Jerath, 1968; Odihirin, 1976; Salawu and Adeniji, 1985). Jerath (1968) reported that sugarcane plants attacked by *H. sacchari* grew thin and stunted. Odihirin (1976) indicated that the nematode was responsible for total crop failure at the Bacita Sugar Estate during 1966 to 1975 cropping seasons. Salawu and Adeniji (1985) in pot experiments showed that *H. sacchari* significantly reduced the growth of sugarcane variety Co. 1001.

Although root-knot nematodes, are known to be pests of sugarcane (Goodey, *et al.*, 1965) information about the reaction of various varieties of sugarcane cultivated in the Nigerian Sugar Estates is still scanty. Salawu (1985; 1986), however, reported sugarcane varieties B41227, B60267, B59162, B62163, B61110, B60163, B4360, D47/15, BR6223, Co 396, Co 453, Co 443, Co 957, Co 1001, B5992 and B57175 to be susceptible to *Meloidogyne incognita*.

This work reports on the effects of *Heterodera sacchari* and *Meloidogyne incognita* singly and in combination on the growth of sugarcane.

MATERIALS AND METHODS

A pure culture of *H. sacchari* used in the investigation was raised on rice cv "OS6". Second stage juveniles of *M. incognita* used as inoculum were extracted from eggmasses on the infected roots of tomato cv Ite 1, using the modified extraction tray method of Whitehead and Hemming (1965).

Sugarcane variety Co 396 was used as planting material. Single-budded setts were surface-sterilized in 1.5% sodium hypochlorite (NaOCl) solution for ten minutes and then planted in steam-sterilized sandy loam top soil mixed with pure sand in a 2 : 1 ratio, in perforated 5-litre plastic pots. Two weeks after emergence, soil near the base of the stem of certain seedlings was inoculated with approximately 5000 second stage juveniles of *H. sacchari* per plant, 5000 second stage juveniles of *M. incognita* per plant, 5000 second stage juveniles of *H. sacchari* plus 5000 second stage juveniles of *M. incognita* per plant. Untreated plants served as controls. Each treatment was replicated five times, randomly arranged on the screenhouse bench, and watered from tap daily. Four grams of NPK fertilizer was added four times to each plant at 30d intervals to provide the plant with nutrient for growth. Plants were harvested from the pots 120d after inoculation. Plant height, tiller and internode number per plant and the fresh weights of roots and shoots were recorded.

Five grams random samples of infected roots were macerated in a blender and nematodes recovered as mentioned above. Root galls were counted per whole root system per plant and recorded. Cysts of *H. sacchari* were collected from the soil using the modified Fenwick Can (Oostenbrink, 1950).

RESULTS AND DISCUSSION

The results of the investigation are presented in Tables 1 and 2. There was a significant reduction in root proliferation in plants inoculated with both *M. incognita* and *H. sacchari* and this was accompanied by significant reduction in plant top growth compared to the untreated plants (Table 1). Plants treated with the nematodes singly had reduced top growth. Salawu and Adeniji (1985) and Salawu (1986) had reported similar reduction in the growth of sugarcane variety Co 1001 infected with *H. sacchari* and *M. incognita* respectively.

There is no known work on the joint effects of *H. sacchari* and *M. incognita* on sugarcane. In this investigation, it was evident that increase in the population of the

two nematodes in the rhizosphere, and severe damage caused to the root of sugarcane was responsible for the reduction of the top growth of the plants so affected (Table 2).

Examination of the roots 120d after inoculation with *M. incognita* revealed formation of galls on the roots typical of root-knot nematode infection. Females of *H. sacchari* emerged from the cracks on the roots and clustered in large number little apart from the apical meristem of the root. The roots carried few root hairs and showed severe necrosis. Microscopic examination of the roots, however, showed that swollen roots contained the juveniles and the mature females of *M. incognita*. Poor development of root hairs in certain roots was caused by *H. sacchari*. Jerath (1968) indicated that sugarcane roots infected by the nematode developed few root hairs.

Table 1. Influence of *H. sacchari* and *M. incognita* singly and in combination on fresh shoot and root weights, height of sugarcane, tillering and internode number.

Soil treatment	Fresh weight		Height* of Shoot (cm)	Tiller* * number	Internode** number
	shoot (g)	Root (g)			
<i>Heterodera sacchari</i>	215.57b	150.89a	58.40ab	(5) 2.27a	(11) 3.28a
<i>Meloidogyne incognita</i>	219.57b	133.58a	67.00b	(6) 2.40b	(11) 3.37a
<i>H. sacchari</i> + <i>M. incognita</i>	170.82a	88.87b	51.80a	(4) 3.09a	(10) 3.12a
Control (untreated)	269.80c	159.73a	59.60ab	(4) 2.08a	(11) 3.40a

* From ground level to the topmost visible dewlap (TVD)

** Square root transformation, untransformed data in parentheses. Means followed by same letter, in each column, do not differ significantly ($P = 0.05$) according to Duncan Multiple Range Test.

The most significant result from this study was the antagonistic interaction between *H. sacchari* and *M. incognita* on sugarcane. The number of *H. sacchari* increased whereas those of *M. incognita* decreased (Table 2). This suppression of *M. incognita* by *H. sacchari* may be due to overcrowding, and/or interspecific competition for infection court as suggested by Salawu (1978) in a similar study on rice.

Table 2. Population of cysts and root-knot second stage juveniles collected 120 days after inoculation on sugarcane plants.

Soil treatment	<i>H. sacchari</i>		<i>M. incognita</i>	
	Cysts*	L ₂ Juveniles**	Gall	L ₂ Juveniles**
<i>Heterodera sacchari</i>	300	1942	—	—
<i>Meloidogyne incognita</i>	—	—	129	1922
<i>M. incognita</i> + <i>H. sacchari</i>	415	2587	47	1202
Control	—	—	—	—

* Mean number of cysts obtained per 250 ml soil.

** Mean number of second stage juveniles obtained per 5 g root.

From this study, it is evident that simultaneous infection of sugarcane by *M. incognita* and *H. sacchari* is detrimental to the growth of the crop.

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