

DEBILITATION OF CACAO IN COSTA RICA BY PLANT NEMATODES [DECAIMIENTO DEL CACAO EN COSTA RICA POR NEMATODOS FITOPARASITOS]. A. C. Tarjan and M. F. Jiménez. University of Florida Agricultural Research and Education Center, Lake Alfred, Florida 33850, U. S. A.; Cía Bananera Atlántica Ltda., San José, Costa Rica.

(Florida Agricultural Experiment Stations Journal Series No. 4709)

#### ABSTRACT

Cacao (cocoa), *Theobroma cacao* L., seedlings were grown for 7 months in gallon (3.8 liter) cans of soil from 4 locations within a large cacao plantation on the Atlantic coast of Costa Rica. Comparison of these plants with plants grown in an autoclaved mixture of the 4 soils after 7 months showed a significant increase in plant height and weight, stem diameter, and root weight in the plants growing in autoclaved soil. Plant nematodes are implicated as being directly responsible for the decline. *Hoplolaimus galeatus* and *Helicotylenchus erythrinae* were found to be the dominating nematode species present.

#### INTRODUCTION

The role of plant nematodes in causing debilitation of cacao (cocoa), *Theobroma cacao* L., has been amply speculated upon (1, 2, 3, 7). Various nematode genera have been reported associated with cacao roots in Costa Rica (3) while good growth and yield responses have been obtained by application of chemicals to nematized plantations in the country (4, 5).

The senior author, while working at the Interamerican Institute of Scientific Agriculture of the Organization of American States in Turrialba, Costa Rica, had found *Hoplolaimus galeatus* (Cobb) and *Helicotylenchus erythrinae* (Zimmermann) to predominate in nematode populations from cacao growing on the Atlantic coast of Costa Rica. In one test, cacao seedlings (cultivar UF 676 x IMC 67) in gallon (3.8 liter) cans had been inoculated with

Table 1. Differences in growth and fresh weight of cacao seedlings after 7 months cultivation in nematode-infested soils from 4 locations within a cacao plantation.

Soil used	Plant height in cm	Aerial part weight in g	Greatest stem diameter in cm	Root system weight in g
Section 10	39.6 B,C <sup>a,b</sup>	51.1 B	1.15 B	40.6 B
Section 17	43.8 B	57.4 B	1.14 B	34.5 B,C
Section 23	34.6 C	46.0 B	1.05 B	32.7 C
Section 25	34.4 C	50.2 B	1.07 B	34.8 C
Autoclaved mixture of above	70.2 A	143.6 A	1.38 A	49.6 A

<sup>a</sup>Mean of 5 replicate plants per treatment.

<sup>b</sup>Means followed by the same capital letter are not statistically different from one another at the 5% level.

picked females of *H. galeatus*. Plants were harvested 2 1/2 months later and yielded specimens of both sexes and juveniles, suggesting that feeding on the roots and oviposition could have occurred.

The work described in this paper sought to determine the effect of various nematode-infested soils from a producing cacao plantation on the growth of cacao seedlings and to evaluate the results obtained.

#### MATERIALS AND METHODS

Ten-weeks-old seedlings of cacao (cultivar UF 676 x IMC 67) were transplanted into gallon (3.8 liter) cans of soil from 4 locations within the Cacao Experiment Station, Inter-American Institute of Scientific Agriculture, situated between Batán and Siquirres, on the Atlantic coast of Costa Rica. In addition, equal quantities of the 4 lots of soil were mixed and autoclaved for 20 minutes at 15 pounds pressure. Seedlings were also transplanted into cans of the autoclaved mixture after it had cooled. There were 5 replicates for each of the treatments. Seedlings were maintained in a plant shelter with solid roof and screened sides.

Seven months later, various plant measurements were obtained and counts were made of the nematodes in the soil and associated with the roots.

#### RESULTS

Growth of plants in the autoclaved mixture of soil was superior to plant growth in the other soils (Table 1). Plant height, aerial part weight, greatest stem diameter, and root weight of plants in autoclaved soil were significantly greater than for plants growing in the untreated field soils.

Analysis of the soils after 7 months growth of plants showed *Helicotylenchus*, *Hoplolaimus*, and *Tylenchus* to be the predominant genera present (Table 2). The first 2 genera were also found parasitizing the roots, as determined by maceration of roots (6).

#### DISCUSSION AND CONCLUSIONS

The presence in the soils tested of a principle noxious to plant growth has been demonstrated. Dr. J. Soria, in charge of cacao investigations of the I.I.C.A., told of a pattern of general decline in yield over the past few decades for the approximate 15,000 hectares of cacao in Costa Rica. No insect pest or fungus pathogen had been found directly responsible, but parasitic nematodes have been implicated as a distinct possibility (3). Further evidence incriminating nematodes is offered by the favorable growth response and yield increase when nematicides were used on a group of 64 trees growing in section 25 (5), from which one of the soils tested in the present experiment was obtained. These results do not exclude the possibility that other undetected entities may play a role in causing declines of cacao in Costa Rica. They do, however, present strong evidence that nematodes, if not directly responsible, are a contributing factor.

#### REFERENCES

1. JIMENEZ SAENZ, E. 1969. Relación entre el ataque de nematodos y la muerte súbita del cacao (*Theobroma cacao* L.) en Bahía, Brasil. Turrialba 19(2):255-260.
2. SHARMA, R. D. 1971. Nematodes associated with cacao and rubber in Bahia. Rev. Theobroma (CEPEC, Itabuna, Brazil) 1(3):43-45.
3. TARJAN, A. C. 1972. Some interesting associations of parasitic nematodes with cacao and coffee in Costa Rica. (abst.) Nematropica 1(1):16.
4. TARJAN, A. C., M. F. JIMENEZ, and J. SORIA V. 1971. Reaction of nematized cacao to chemical treatment. Nematropica 1(1):16.
5. TARJAN, A. C., M. F. JIMENEZ, and J. SORIA V. 1972. Improving yields from nematode-infected cacao trees (*Theobroma cacao* L.) in Costa Rica by use of nematicides. Nematropica 2(1):10-11.

Table 2. Mean nematode counts from cacao soil and roots after 7 months.<sup>a</sup>

Nematode genus	Section 10 <sup>c</sup>		Section 17		Section 23		Section 25	
	Soil <sup>b</sup>	Roots <sup>c</sup>	Soil	Roots	Soil	Roots	Soil	Roots
Atylenchus	--	--	--	--	6	--	10	--
Criconemoides	--	--	2	--	--	--	74	--
Helicotylenchus	107	3	1235	28	257	11	70	--
Hemicyclophora	344	--	--	--	--	--	--	--
Hoplolaimus	67 <sup>d</sup>	17	180	16	24	27	144	23
Longidorus	82	--	49	--	30	--	66	--
Pratylenchus	--	--	200	14	--	--	62	6
Trichodorus	86	--	--	--	--	--	30	--
Tylenchidae (various)	34	--	34	--	41	--	28	--
Tylenchorhynchus	--	--	--	--	36	6	--	--
Tylenchus	24	--	61	2	41	--	415	--

<sup>a</sup>No plant nematodes were found with plants growing in an autoclaved mixture of the above soils.

<sup>b</sup>Extracted from 50 ml of soil.

<sup>c</sup>Nemas per g of root.

<sup>d</sup>Each figure is the mean of 5 replications.

6. TAYLOR, A. L. and W. Q. LOEGERING. 1953. Nematodes associated with root lesions in Abaca. Turrialba 3:8-13.
7. WHITEHEAD, A. G. 1969. Nematodes attacking coffee, tea, and cocoa, and their control. In Nematodes of Tropical Crops. J. E. Peachey (ed.). Tech. Communi. Commonw. Bur. Helminth. 40:238-250.

#### RESUMEN

Plantas de cacao (*Theobroma cacao* L.) fueron sembradas por 7 meses en recipientes de 3.8 l de capacidad con suelo proveniente de 4 localidades en una plantación de cacao en la costa Atlántica de Costa Rica. Comparación de estas plantas con otras sembradas en el mismo suelo esterilizado en autoclave mostró un incremento significativo en la altura y el peso, el diámetro del tallo y el peso de las raíces de las plantas sembradas en el suelo esterilizado. Se citan los nematodos fitoparásitos como responsables directos de la decadencia del cultivo. *Hoplolaimus galeatus* y *Helicotylenchus erythrinae* fueron las especies predominantes en este estudio.

#### RESEARCH NOTES - NOTAS DE INVESTIGACION

PRESENCE OF *APHELENCHOIDES RITZEMABOSI* (SCHWARTZ, 1911) STEINER, 1932 ON A COMMERCIAL PLANTING OF TUBEROSE (*POLIANTHES TUBEROSA* L.) IN VENEZUELA [PRESENCIA DE *APHELENCHOIDES RITZEMABOSI* (SCHWARTZ, 1911) STEINER, 1932 EN UNA SIEMBRA COMERCIAL DE NARDOS (*POLIANTHES TUBEROSA* L.) EN VENEZUELA]. Julia A. Meredith and G. Yépez T. Universidad Central de Venezuela, Facultad de Agronomía, Instituto de Zoología Agrícola, Sección de Nematología, Apartado 4579, Maracay, Aragua, Venezuela.

This note reports the presence of *Aphelenchoides ritzemabosi* (Schwartz, 1911) Steiner, 1932 on a commercial planting of tuberose (*Polianthes tuberosa* L.) near La Encrucijada de Carabobo (490 m), State of Carabobo, Venezuela. Brown, oblong, irregular lesions are produced on the leaves of the plant. The upper half of the leaf blade usually becomes completely brown, dies, and falls over. The plants are much smaller and show less vigor than healthy ones. The nematode was found in both leaves and bulbs, although in smaller numbers in the latter. Apparently the planting material was originally transported from Los Teques (1,170 m), State of Miranda, an important area for the cultivation of ornamental plants, but the exact location has not been established. This nematode has not been associated before with damage in aerial plant parts in Venezuela, and it is the first report of this species in the country.

(The authors gratefully acknowledge the help of Dr. s'Jacob, Landbouwhogeschool, Wageningen, for the identification of the nematode species.)