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NEMATODES ASSOCIATED WITH COCOA HYBRIDS AND CLONES IN BAHIA, BRASIL

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INTRODUCTION

Cocoa is next to coffee and soybean among Brazilian export commodities. Cocoa produced in the State of Bahia the years 1978/79 earned in foreign exchange worth one billion dollars (CACAU INFORME ECONOMICO,1979).

Like many other tropical crops, cocoa (*Theobroma cacao* L.) has been found attacked by plant parasitic nematodes from different cocoa growing regions of the world (JIMENEZ SAENZ, 1969; SHARMA, 1971, 1973a; SHARMA & SHER, 1973, 1974; TARJAN, 1972; TARJAN & JIMENEZ, 1973; and WHITEHEAD, 1969). A large number of nematode genera and species have been reported associated with cocoa roots from different parts of the world (MEREDITH, 1974; BELMONT, 1977; LOPES *et alii*, 1980). Improvement in growth and increased yields of cocoa have been obtained by application of chemicals to nematode infested plantations in Brazil and Costa Rica (SHARMA, 1973; SHARMA & SMITH, 1973; SHARMA & FERRAZ, 1977; and TARJAN *et alii* 1971, 1972).

Susceptibility of cocoa clones and hybrids have been studied under greenhouse conditions (SHARMA, 1973b; SHARMA & MAIA, 1976; SHARMA, 1977) but nothing is known about nematode association with cocoa hybrids and clones under field conditions, that is why the present study was undertaken.

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MATERIALS AND METHODS

As a part of general nematode survey started in May, 1971, thirty seven soil and root samples were collected from 10 hybrids and 16 clones of cocoa grown at Centro de Pesquisa do Cacau (CEPEC) Km 22 da Rodovia Ilheus/Itabuna, Bahia, Brazil. The 26 genotypes (clones and hybrids) sampled for nematode presence, soil type and growing conditions and number of samples per genotype are presented in table I.

The method of sampling for nematodes and their extraction was according to the method described by SHARMA & LOOF, 1972. The nematodes isolated from the wamples were identified up to generic level at CEPEC using a stereoscopic microscope. For identifying nematodes up to species level, the isolated nematodes were concentrated in small quantities of water and killed in hot 5% formalin. The permanent mounts were prepared in pure glycerine using Southey's slow glycerine method (SOUTHEY, 1970). Identifications up to species level was done by late Prof. Dr.S.A.SHER, Department of Nematology, University of California, Riverside, California, U.S.A. and some at CEPEC.

RESULTS AND DISCUSSION

Eleven genera and 13 species of plant parasitic nematodes from 37 samples collected from 26 genotypes (10 hybrids and 16 clones) of cocoa along with their frequency of occurrence in samples and genotypes are presented in table II.

Helicotylenchus was the most common nematode and was associated with largest number of genotypes. Among the different species of *Helicotylenchus*, *H. dihystera* had the highest frequency of occurrence in samples i.e. 70.3% and was associated with 19 genotypes (9 hybrids and 10 clones). Where as *H. multicinctus* was present in 8.1% of the samples and was associated with three genotypes. This nematode (*H. multicinctus*) is a serious pathogen of

banana, which is commonly used as a shade crop for young cocoa transplants and seems to be introduced in this area through infected banana rhizomes.

The other species of nematodes found to be causing most damage to cocoa roots were: the root-knot nematode, *Meloidogyne incognita*, the awl nematode *Dolichodorus minor*, the reniform nematode, *Rotylenchulus reniformis* and an unidentified species of dagger nematode, *Xiphinema*, which were present in 48.6, 45.9, 35.1 and 35.1 percent of the samples respectively and the numbers of genotypes associated with each nematode species were 18, 13, 12 and 8 respectively. Serious growth reductions due to *M. incognita* were reported in cocoa clones "comum" and "catongo" under greenhouse conditions by SHARMA (1975) and SHARMA & MAIA (1976). While studying interaction between *M. incognita* and *R. reniformis* on cocoa clone "catongo", the concomitant inoculations with both species had more adverse effect on plant growth than either of them inoculated separately (SHARMA, 1975). Also significant growth reductions in two clones (comum and catongo) under nursery conditions was observed when soil infested with plant parasitic nematodes was partially sterilized in comparison to naturally nematode infested soil. The infested soil harboured a mixed population of *X. setariae*, *M. incognita* and *H. dihystera* (SHARMA, 1975). None of the 12 cocoa hybrids tested for their susceptibility to *M. incognita* under greenhouse conditions showed resistance to this nematode (SHARMA, 1977).

The nematode genera *Hemicriconemoides*, *Longidorus* and *Trichodorus* had the lowest frequencies of occurrence in samples as well as genotypes besides having a very low number in the samples and that too mostly juveniles. Due to the above mentioned reasons, the identification up to species level could not be made. *Hemicycliophora loofi*, *Macroposthonia onoensis* and *Peltamigratus holdemani* occupied the intermediate positions regarding their frequencies of occurrence in samples and genotype association. Plant parasitic nematode genera have been reported in association with cocoa by several workers (LORDELLO, 1968; SHARMA, 1971; SHARMA & SHER, 1973, 1974; TARJAN, 1971, 1973; MEREDITH, 1975; BELMONT, 1977; and

LOPEZ *et alii*, 1980).

H. multicinctus, *Peltamigratus holdemani* and *Hemicycliophora loofi* are reported herein for the first time in association with cocoa from the State of Bahia.

The results of this limited survey indicate that many species of plant parasitic nematodes are associated with cocoa genotypes of which some have been studied for their pathogenic role in cocoa culture.

SUMMARY

A preliminary survey of cocoa (*Theobroma cacao* L.) hybrid and clone collection of Centro de Pesquisa do Cacau (CEPEC), Itabuna, Bahia during the year 1974 for plant parasitic nematodes was conducted. A total of 37 soil and root samples were collected from the rhizospheres of 26 genotypes (10 hybrids and 16 clones). The soil samples were prepared for nematode extraction according to the method described by SHARMA & LOOF (1972). The percentage frequency of occurrence of plant parasitic nematode species, in the samples was: *Helicotylenchus dihystera* (70.3), *Meloidogyne incognita* (48.6), *Dolichodorus minor* (45.9), *Helicotylenchus* spp. (35.1), *Rotylenchulus reniformis* (35.1), *Xhiphinema* sp. larvae (35.1), *Hemicycliophora loofi* (16.2), *Macroposthonia onoensis* (10.8), *Helicotylenchus multicinctus* (8.1), *Peltamigratus holdemani* (8.1), *Hemicriconemoides* sp. (2.7), *Longidorus* sp. (2.1), and *Trichodorus* sp. (2.1).

H. multicinctus, *P. holdemani* and *H. loofi* are reported for the first time in association with cocoa from the State of Bahia, Brazil.

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Table 1. Genotype, symptoms, soil type and number of samples collected from the rhizosphere of cocoa hybrids/clones at CEPEC

Genotype	Symptom* (H/D)	Soil type	No. of samples
- UF 613	2H + 1D	Heavy	3
- SIC 823	1D	Heavy	1
- UF 667	1H + 1D	Heavy	2
- PERU 11 - POUND	1H + 1D	Heavy	2
- DR_2 - INDONESIA	2D	Heavy	2
- SIAL 283 - BRASIL	1H + 1D	Light/heavy	2
- SIC 864 - BRASIL	1H + 1D	Light	2
- EEG 9 - BRASIL	1H	Heavy	1
- SCA 12 - BRASIL	1H + 1D	Heavy	2
- EEG 8 - BRASIL	1D	Heavy	1
- EEG 50 - BRASIL	1D	Heavy	1
- TSA 644 - TRINIDAD	1H	Heavy	1
- PA 46 - PERU	1H + 1D	Heavy	2
- SIC 847	1H + 1D	Heavy	2
- PA 46 - PERU	1H	Heavy	1
- IMC - 86	1H	Heavy	1
- COMUM x SCA	1H	Heavy	1
- COMUM x CATONGO	2H	Heavy	2
- SIC 3 x UF 168	1H	Heavy	1
- SIC 891 x 2 - R1	1D	Heavy	1
- SIC 891 x R1	1H	Heavy	1
- SIAL 88 x SIAL 70	1H	Heavy	1
- SCA x SIAL 70	1H	Heavy	1
- SCA 12 x UF 613	1D	Heavy	1
- UF 168 x SIC 3	1H	Heavy	1
- SCA x COMUM	1H	Light	1

* Symptom - H - Healthy or D - Diseased

Table II. Frequency of occurrence of plant parasitic nematodes associated with different genotypes of cocoa (*Theobroma cacao* L.) in 37 soil samples from CEPEC, Itabuna, Bahia

Nematodes	Frequency of occurrence	
	Genotypes	% 9n 37 samples
Dolichodorus minor	A,B,C,F,I,J,N,P,Q,R,W,X,Y	45,9
Helicotylenchus spp.	C,E,F,I,J,L,N,O,R,S,T,W,Z,	35,1
H.dihystera	A,C,D,G,H,J,K,M,N,P,Q,S,T,Y,V,W,X,Y,Z	70,3
H.multicinctus	A,B,K	8,1
Hemicriconemoides sp.	V	2,7
Hemicycliophora loofi	A,B,E,F,G,R	16,2
Longidorus sp.	U	2,7
Macroposthonia onoensis	D,G,J	10,8
Meloidogyne incognita	A,B,C,D,F,G,H,J,K,L,M,N,Q,S,T,U,W,Y	48,6
Peltamigratus holdemani	T,U,V	8,1
Rotylenchulus reniformis	B,D,E,F,G,H,L,M,Q,S,Y,Z	35,1
Trichodorus sp.	A	2,7
Siphinema sp.	A,C,D,E,H,J,Q,Y	35,1

* Genotipos (Clones and hybrids)

A - UF 613; B - SIC 823; C - UF 667; D - PERU 11 - POUND; E - DR 2 - INDONESIA; F - SIAL 283-BRASIL; G - SIC 864 - BRASIL; H - COMUM x SCA; I - EEG 9 - BRASIL; J - COMUM x CATONGO; K - SCA x COMUM; L - SCA 12 - BRASIL; M - EEG 8 - BRASIL; N - SIC 3 x UF 168; O - EEG 50 - BRASIL; P - TSA 644 - TRINIDAD; Q - PA 46 - PERU; R - SIC 891 x 2-R1; S - SIC 891 x R1; T - SIAL 88 x SIAL 70; U - SCA x SIAL 70; V - SCA 12 x UF 613; W - UF 168 x SIC 3; X - SIC 847; Y - PA 46 - PERU; Z - IMC-86.