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EFFECT OF *HELICOTYLENCHUS DIHYSTERA* (COBB) SHER ON GROWTH OF COCOA SEEDLINGS

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RINGKASAN

Suntikan dengan 2,800, 3,500 dan 4,200 *Helicotylenchus dihystera* tidak mengurangkan anak benih koko jenis Upper Amazon selepas empat bulan setengah dalam perkara-perkara yang berikut: timbangan-kering daun, batang dan akar, jumlah timbangan-kering, jumlah daun dan tinggi pokok. Populasi nematod dalam tanah diakhir percubaan lebih tinggi daripada populasi yang biasa dijumpai dalam tanaman-tanaman koko di ladang.

INTRODUCTION

The spiral nematode, *Helicotylenchus dihystera* is widely distributed geographically, being present in temperate as well as tropical countries. This species is an ecto- and semi-endoparasite of plant roots and has a wide host range including vegetables, fruit trees, ornamentals and forest trees (SIDDIQI, 1972). In Peninsular Malaysia, this nematode is commonly found on cocoa (*Theobroma cacao* L.) (YUEN, 1979) Likewise, *Helicotylenchus* is among other genera of nematodes reported to be common on cocoa in Mexico (BELMONT, 1977) and India (SOSAMMA, *et. al.*, 1980), though little is known of its effect on the host (WHITEHEAD, 1969). Eight species of the spiral nematode have been identified in Malaysia, *H. dihystera* being the most common, having been recorded on 30 host plants (WINOTO, 1975). However, the economic importance of this species on locally-grown cocoa is unknown. This study was conducted to observe the short-term effects of this nematode on the growth of cocoa seedlings.

MATERIALS AND METHODS

H. dihystera was obtained from an abandoned cocoa field at MARDI Station, Serdang and subsequently cultured and maintained on brinjal (*Solanum melongena* L.) variety Hitam Bulat. The cocoa variety used in this study was Upper Amazon. To minimise variation, all plants used in the experiment were raised from seeds selected from the same pod and grown in a 7:3:2 soil mixture of loam, peat and sand, sterilized with methyl bromide. The seeds were germinated in a propagation bed and transplanted a fortnight later, one plant to a 5-hole clay pot holding 10 litres of sterilized soil. Two weeks after transplanting, the seedlings were inoculated with suspensions of adult and larval stages as follows: A = No nematodes (control), B = 2800 nematodes, C = 3500 nematodes, D = 4200 nematodes per plant. This was equivalent to 0, 28, 35 and 42 nematodes per 100 ml soil per plant respectively. In cocoa plantations, *H. dihystera* is commonly found in populations of about 30 nematodes per 100 ml soil (YUEN, 1979). Each treatment was replicated 5 times. Inoculation was effected by pouring a suspension of nematodes into a trough dug in the soil around the stem-base. The plants were arranged in a completely randomised block design in a plant-house and watered twice daily in the morning and afternoon.

The investigation was concluded 4½ months later. At the end of the experiment, the height and leaf number of each plant were recorded after which the plant was carefully uprooted. Estimates of the nematode population in the soil were made by thoroughly mixing the soil in each pot and obtaining two 100 ml composite soil samples.

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Population counts were made after extracting the nematodes from the soil by the Decanting-Sieving method originated by COBB (1918). Each plant was cut up into its component roots, stem and leaves. The stem and leaves were then oven-dried at 100°C for 36 hours. The roots of each plant (except the main tap root) were washed clean of soil and cut into 1 cm lengths, then thoroughly mixed and a 5 gm composite sample obtained. Recovery of nematodes from the roots was by the Maceration-Filtration technique (STEMERDING, 1964). Each 5 gm batch of roots after nematode extraction was mixed together with its respective remaining bulk of roots and placed in the oven for drying at 100°C for 36 hours. The oven-dry weights of the individual lots of leaves, stems and roots were subsequently recorded.

RESULTS AND DISCUSSION

Results in *Table 1* show no significant differences between treatment means in the dry weight of leaves, stem and roots, total dry weight, leaf number and plant height. Treatments C and D show significantly higher population counts in soil and roots than treatment B which had the lowest initial inoculum level of 2800 nematodes *(Table 2)*.

However, no significant differences in the same variables are seen between treatments C and D which had the higher inoculum levels of 3500 and 4200 nematodes. The final soil-population counts for all inoculated plants in treatments B, C and D are respectively, 3.4, 6.9 and 5.1 times higher than the initial numbers introduced, and are also respectively 3.2, 8 and 7.2 times higher than the populations of 30 per 100 ml spiral nematodes often recorded in local cocoa plantations.

The overall results indicate that the Upper Amazon variety of cocoa may be tolerant to *H. dihystera* at the young seedling stage. This study contrasts with the findings of CAMPELO and GALLI (1980) who found that an initial inoculum level of 1000 nematodes per plant caused a significant decrease in dry root weight of cocoa seedlings (variety Catongo). It is possible that different levels of tolerance are exhibited by different cocoa varieties to infection by *H. dihystera*. The effects of parasitization by *H. dihystera* have been found to vary with the host plant. BARKER, *et. al.*, (1979) reported that this nematode species enhanced the growth of dwarf yaupon hollies, while BERNARD and HUSSEY, (1979) found that yields of Coker 201 cotton were not affected

TABLE 1: EFFECT OF NEMATODE INOCULUM LEVELS ON GROWTH PARAMETERS OF COCOA SEEDLINGS (VARIETY UPPER AMAZON)

	Treatment means				F value (df 3, 12)
	A	B	C	D	
Dry wt. of leaves (gm)	12.3	11.3	12.7	12.7	0.12 NS
Dry wt. of stem (gm)	6.7	5.3	6.1	5.5	0.55 NS
Dry wt. of roots (gm)	6.5	5.7	6.3	6.7	0.29 NS
Total dry wt. (gm)	25.5	22.3	25.1	24.9	0.19 NS
Leaf number	32	27	27	29	0.94 NS
Plant height (cm)	58.7	52.6	55.2	54.3	0.25 NS

A : no nematodes
B : 2800 nematodes
C : 3500 nematodes
D : 4200 nematodes
NS: not significant

TABLE 2: DIFFERENCES IN NEMATODE COUNTS IN SOIL AND ROOTS BETWEEN TREATMENT MEANS OF INOCULATED COCOA SEEDLINGS

	Nematode no./100 ml soil	Nematode no./5gm roots
Treatment means		
C (3500 nematodes)	240.5	117.5
D (4200 nematodes)	216.5	94.5
B (2800 nematodes)	95.0	47.0
A (0 nematodes)	0	0
F value (df 2,23)	4.63*	9.87**
S.E. $\bar{x}$	51.28	16.18
LSD (0.05)	106.10	33.48
LSD (0.01)	143.94	45.42

*significant at $P<0.05$
**significant at $P<0.01$
Figures joined by bar are not significantly different

by this nematode. The results of the present study show that *H. dihystera* does not depress growth of Upper Amazon cocoa seedlings at the population densities tested within a period of 4½ months. This is the duration for which seedlings in polybags are usually kept in the nursery (ANON, 1978; PHANG, 1972). The reason for the apparent non-effect of *H. dihystera* on cocoa in this experiment may be that either the nematode population levels tested were below the threshold level of damage for the Upper Amazon variety or that the cultivar is tolerant to this particular nematode species i.e. able to support relatively high populations of the parasite without suffering appreciable injury.

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SUMMARY

An initial inoculum level of 2,800, 3,500 and 4,200 *Helicotylenchus dihystera* did not significantly depress growth of Upper Amazon seedlings after 4½ months in the following variables: dry weight of leaves, stem and roots, total dry weight, leaf number and plant height. Final soil population of nematodes exceeded numbers usually encountered in cocoa plantings.

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