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EFFECT OF DIFFERENT TYPES OF SOILS ON MULTIPLICATION OF *RADOPHOLUS SIMILIS* AND GROWTH OF COCONUT SEEDLINGS

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Abstract : The influence of different soil types viz. laterite, riverine alluvium, coastal alluvium (Coastal sand), loamy sand and reclaimed marshy or *'Kari'* soil on multiplication of *Radopholus similis* and growth of coconut seedlings was studied. Best growth of uninoculated seedlings was recoded in riverine alluvium followed by the laterite soil. Plant growth was poor in reclaimed marshy soil with maximum per cent clay, silt and a minimum of coarse sand with a pH of 4.1. In inoculated plants the maximum plant damage was recorded in riverine alluvium followed by loamy sand and coastal sand and the least in laterite soil. Maximum nematode multiplication was obtaind from loamy sand followed by riverine alluvium and the least in *'Kari'* soil.

Key words : *Radopholus similis*, coconut, soil types ,multiplication.

The burrowing nematode, *Radopholus similis* (Cobb, 1893) Thorne, 1949, has been reported to cause lesions and severe root rotting of coconut (Koshy *et al.*, 1975). Since it is wide spread in South India on coconut, arecanut, banana and pepper (Koshy *et al.*, 1978), grown under different soil types, an attempt was made to investigate the influence of different soils on the nematode-host interaction.

MATERIALS AND METHODS

Five different soils namely laterite, riverine alluvium, loamy sand, coastal sandy and acid saline (reclaimed marshy or *'Kari'*) were collected respectivety from Kollakadavu, Mavelikara, Kayangulam, Purakkadu and Thottappally areas, of Alleppey district (Kerala). Fifty pits, to accomodate cement tubs of 70 × 80 cm, were opened at a distance of 1.5 m apart. Cement tubs were inserted into pits leaving the top 10 cm above the ground level. Ten cement tubs each were filled with different soils after assigning random numbers. The soil in each pot was fumigated with DD @ 561 l/ha in May, 1977. One year-old, West Coast Tall coconut seedlings, of uniform size, raised in sterile soil in greenhouse, were transplanted into individual tub, 30 days after soil fumigation. On establishment, 5 seedlings each, in every soil, were inoculated with 10,000 nematodes (females and larvae) collected from coconut roots in October and the remaining 5 plants, in each soil, served as untreated controls.

The experiment was terminated in October, 1980. Three 250 cm^3 soil samples were drawn from each pot. Plants were displaced from the pots by washing out the soil with a strong jet of water. The seedlings, were then washed again to remove the adhering soil particles. Plant growth characters such as girth at collar region, number of leaves, height of the plant, length of the lamina, number of leaflets per leaf, shoot weight and root weight, were recorded. Visual observations of lesions and rotting of roots were also recorded. Lamina length was taken by measuring the distance from the leaf tip to the point from where the leaflets emerged. Maximum leaflet length was recorded by measuring the longest leaflet in the middle of the leaf. Roots were cut into small pieces after indexing, mixed thoroughly and three 50 g aliquots of roots were collected from each of the

seedlings for population assessment. The total population was computed with the average per gram population.

RESULTS AND DISCUSSION

Within three years, the inoculated seedlings were stunted with reduced vigour compared to uninoculated seedlings (Fig. 1, Table 1). In general, the best plant growth was recorded in riverine alluvium soil followed by laterite soil. The plant growth was at par in loamy sand and coastal sandy soils and very poor in reclaimed marshy (*'Kari'* soil).

In the uninoculated treaments, maximum height was recorded in riverine alluvium (303 cm) followed by laterite (290 cm) and least in reclaimed marshy soil (142 cm) as against inoculated seedlings where maximum height was recorded in laterite (279 cm) followed by coastal alluvium and the least in the reclaimed marshy soil (112 cm). The maximum percentage reduction in height of the seedlings was noticed in loamy sand (30) followed by riverine alluvium. It was the least in the case of seedlings grown in laterite soil.

Girth of the seedlings in the uninoculated was maximum in riverine alluvium (49 cm) followed by laterite (47 cm) with the least in reclaimed marshy soil (22 cm). In the inoculated seedlings maximum girth (46 cm) was recorded in laterite soil and minimum (20 cm) in the reclaimed marshy soil. The percentage reduction observed was in the order of loamy sand (24), riverine alluvium (23), reclaimed marshy and coastal sandy (9). There was no reduction of girth in the case of seedlings grown in laterite soil.

Soil types affeted leaf production also. In the inoculated as well as uninoculated seedlings, maximum number of leaves was recorded in laterite closely followed by loamy sand and riverine alluvium and minimum in reclaimed marshy soil. Significant differrence in the number of leaves in inoculated versus uninoculated seedlings was also obtained.

Maximum lamina length in control plants was recorded in seedlings grown in riverine alluvium and laterite soil (169 cm) followed by those in coastal sandy and loamy sand and the minimum in reclaimed marshy soil (81 cm). In case of inoculated seedlings, it was 155, 143, 137, 115 and 61 cm in laterite, riverine alluvium, coastal sandy, loamy sand and reclaimed marshy soils respectively. The percentage reduction was maximum in reclaimed marshy soil followed by loamy sand and riverine allluvium and the minimum in laterite and coastal sandy soil.

The longest leaflets were observed in seedlings grown in laterite and riverine alluvium soils and shortest in reclaimed marshy among the uninoculated seedlings but in the case of inoculated seedlings, maximum was in laterite soil. A total of 103 leaflets could be observed in the case of seedlings grown in riverine alluvium, followed by 88 in loamy sand and 86 in laterite soil and minimum number in reclaimed marshy soil (46) for the uninoculated seedlings. Among the inoculated seedlings it was in the order of laterite (80), loamy sand, riverine alluvium, coastal sandy and reclaimed marshy soil. The percentage reduction over control was maximum in riverine alluvium (18).

A perusal of the data in Table 1 shows that maximum shoot weight was observed in seedlings grown in riverine alluvium followed by coastal sandy of control seedlings, whereas on inoculation it was maximum in laterite followed by loamy sand and least in reclaimed marshy soil. The percentage reduction over control in shoot weight was maximum in riverine alluvium followed by coastal sandy and the minimum in reclaimed marshy soil.

Maximum root weight could be obtain-

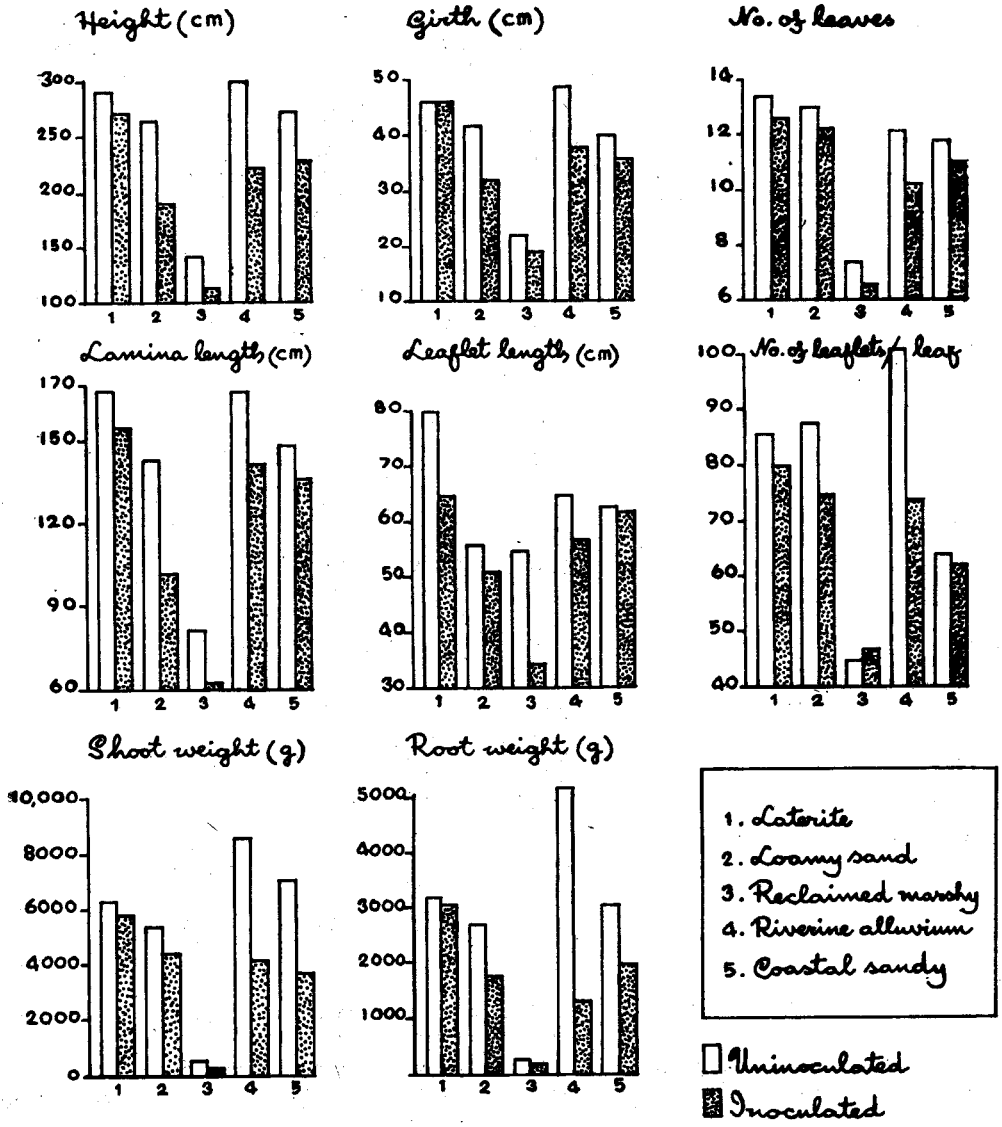

Fig. 1. Effect of different soils on multiplication of *R. similis* and its influence on growth of coconut seedlings.

ed in control seedlings grown in riverine alluvium followed by laterite, coastal sandy, loamy sand and reclaimed marshy but it was in the order of laterite, coastal sandy, loamy sand and riverine alluvium and reclaimed marshy among the inoculated seedlings. Treatment differences were significant. Maximum reduction in root

TABLE I. *Effect af different soils on the growth characters of coconut seedlings*

Treatment *a. Height*	Laterite	Loamy sand	Reclaimed marshy	Riverine alluvium	Costal sandy	Mean	C.D. at 5% Treatments	Soil
Inoculated	278.8	190.8	111.6	225.8	236.6	208.56[b]		
	(3.7)	(29.8)	(21.4)	(25.8)	(14.8)			
Uninoculated	289.6	270.0	142.0	303.0	277.6	256.48[a]		
Mean	284.2[a]	230.5[b]	126.8[c]	264.0[ab]	257.1[ab]		32.9	52.1
b. Girth at collar								
Inoculated	46.4	32.0	19.6	37.8	36.2	34.4[b]		
	(0.0)	(24.2)	(11.0)	(22.9)	(9.5)			
Uninoculated	46.6	42.2	22.0	49.0	40.0	40.0[a]		
Mean	46.5[a]	37.1[c]	20.8[d]	43.4[ab]	38.1[bc]		3.84	6.07
c. Number of leaves								
Inoculated	12.6	12.2	6.6	10.2	11.0	10.5[b]		
	(6.0)	(6.2)	(10.8)	(16.4)	(6.8)			
Uninoculated	13.4	13.0	7.4	12.2	11.8	11.6[a]		
Mean	13.0[a]	12.6[a]	7.0[c]	11.2[b]	11.4[b]		0.527	0.833
d. Lamina length								
Inoculated	155.2	114.6	61.0	143.4	136.6	122.2[b]		
	(8.2)	(20.8)	(24.7)	(15.2)	(8.6)			
Uninoculated	169.0	114.6	81.0	169.0	149.4	142.6[a]		
Mean	162.1[a]	129.6[b]	71.0[c]	156.2[ab]	143.0[ab]		19.87	32.41
e. Length of leaflet								
Inoculated	65.2	51.2	34.2	56.6	62.6	53.9[b]		
	(19.1)	(7.9)	(37.4)	(13.5)	(1.6)			
Uninoculated	80.6	55.6	54.6	65.4	63.4	63.9[a]		
Mean	72.9[a]	53.4[bc]	44.4[c]	61.0[b]	62.9[ab]		6.98	11.02
f. Number of leaflets per leaf								
Inoculated	80.6	74.6	47.4	74.4	62.6	67.9[b]		
	(6.3)	(15.2)	(+3.5)	(27.6)	(3.1)			
Uninoculated	86.0	88.0	45.8	102.8	64.6	77.4[a]		
Mean	83.3[ab]	81.3[ab]	46.6[c]	88.6[a]	63.6[b]		—	20.2
g. Shoot weight								
Inoculated	5980	4442	480	4200	3660	3752.4[b]		
	(2.6)	(22.5)	(4.0)	(52.0)	(48.6)			
Uninoculated	6140	5730	500	8750	7120	5648.0[a]		
Mean	6060[a]	5086[a]	490[b]	6475[a]	5390[a]		1164	1840
h. Root weight								
Inoculated	3140	1780	184	1340	2000	1688.8[b]		
	(4.0)	(35.3)	(26.4)	(74.3)	(34.6)			
Uninoculated	3270	2750	250	5220	3060	2910.0[a]		
Mean	3205[a]	2265[a]	217[b]	3280[a]	2530[a]		721	1139

Means with notations by the same letter do not differ at 5% level
Figures in parentheses are percentage redutcion over control.

weight on inoculation was observed in riverine alluvium (74 per cent), whereas in loamy sand, coastal sandy and reclaimed marshy, they were 35, 35 and 26 per cent respectively. Seedlings grown in laterite soil were the least affected ones with nematode inoculation (4 per cent). Irrespective of the soils used, production of lateral roots and rootlets was considerably reduced in *R. similis* inoculated seedlings compared to the uninoculated control seedlings.

Maximum population of nematodes from soil and roots was obtained from loamy sand followed in the order of riverine alluvium, coastal sandy, laterite and reclaimed marshy soil (Fig. 2, Table II). The nematode multiplication was least in reclaimed marshy (*'Kari'* soil), probably due to lack of adequate aeration and the development of root system of coconut seedlings for the nematodes to multiply. Situation in laterite soil was totally different. The laterite soil is well aerated and always supported good growth of coconut seedlings, but the nematode multiplication was the least compared to other soil groups except in reclaimed marshy soil. The inoculated seedlings in laterite soil recorded the minimum reduction in plant growth (Table 1).

These results indicate that multiplication of the burrowing nematode and growth of coconut seedlings were influenced by soil types. Best growth of uninoculated seedlings was recorded on riverine alluvium, followed by the laterite soil, as also reported by John (1949, 1952).

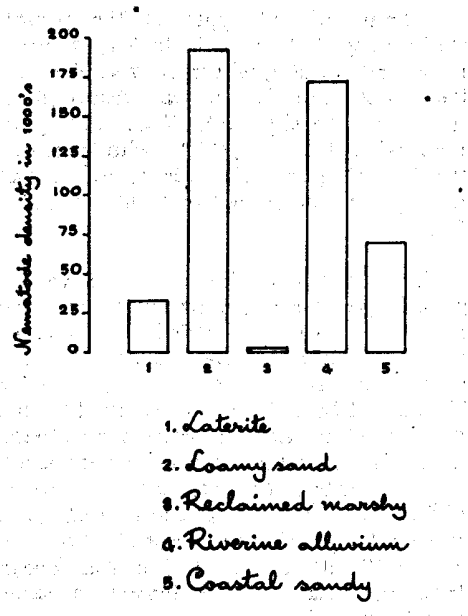

Fig. 2. Effect of different soils on multiplication of *R. similis*

Plant growth was rather very poor in reclaimed marshy soil with maximum per cent clay, silt and a minimum of coarse sand with pH of 4. Coconut is known to thrive in *'Kari'* soils near the back waters in Kerala, on the bunds of canals, where there is an assured supply of underground water within easy reach of roots (John. 1949, 1952). Under the present experimental conditions, continuous availability of water was a major constraint on plant growth as well as nematode multiplication in *'Kari'* soil.

TABLE II. *Effect of different soils on multiplication of* R. similis (Mean of five seedlings)

Nematode population	Laterite	Loamy sand	Reclaimed marshy	Riverine alluvium	Coastal sandy	C.D. at 5%
Soil	6010^{bc}	9360^{ab}	866^{c}	14980^{a}	5080^{bc}	7296**
Root	27104^{bc}	183892^{a}	1010^{c}	156479^{ab}	65142^{abc}	141063*
Total	33114^{b}	193052^{a}	1876^{b}	171459^{a}	70222^{ab}	140548*

The pH of soil types in the present study ranged from 5.8 to 5.1, except in reclaimed marshy, where it was 4.1 and the lowest population was recorded in reclaimed marshy soil. This is in agreement with Davide (1980) who recorded the largest population densities of burrowing nematode between pH of 5.0 to 5.6.

Taking into consideration the various growth parameters, maximum per cent reduction was recorded in riverine alluvium, followed by loamy sand and coastal sandy and the least in laterite. This could be well explained by the total multiplication of the nematode in loamy sand, riverine alluvium and coastal sandy in that order. though not significantly different with each. O' Bannon *et al.* (1976) recorded maximum reproduction of *R. similis* on cirtus in fine and coarse textured soils and the lowest in sandy clay loam soil.

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