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YELLOW LEAF DISEASE : NEMATOLOGICAL STUDIES

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Abstract

In an extensive survey conducted in Kerala and Karnataka States plant parasitic nematodes belonging to 22 genera have been isolated and identified from the root zone of arecanut. *R. similis* on inoculation produced lesions, rotting and black tip of roots. Possibility of *R. similis* as an aggravator in the disease complex is brought out. Recorded wide spread occurrence of *R. similis* in all soil types in Kerala and Karnataka States. Intercultivation of banana in arecanut gardens favours the multiplication of *R. similis*. Chances for recovery of *R. similis* from soil samples around roots harbouring them have been found to be less than 50 per cent.

Introduction

Nair (1964) was the first to report the presence of nematodes in association with arecanut. He observed *Meloidogyne javanica, Helicotylenchus* sp. and *Tylenchorhynchus* sp. from the root zone of yellow leaf disease affected palms of Palode. Weischer (1967) recorded seven genera of plant parasitic nematodes from a few soil samples collected from the root zone of healthy and disease affected palms. He did not correlate the population of any one of these with the incidence of the disease. However, he suggested intensive studies to determine this. Kumar *et al* (1971) recorded the presence of *Hemicriconemoides gaddi, Hemicriconemoides* spp., *Pratylenchus coffeae, Radopholus similis* and *Tylenchorhynchus* spp., from soil samples collected from around roots of arecanut in the coffee tracts of South India.

Materials and Methods

During September—November, 1974 an extensive survey of arecanut areas of Kerala and Karnataka States were carried out in mostly disease affected regions. The purpose of the survey was to find out the influence of elevation, soil types, and water logging on the incidence of the disease. Sampling was confined to the feeder root zone of the palms, viz., 50—100 cm from the bole of the palm to a depth of 10—50 cm. From every location soil and root samples were collected. Fifty grams each of root samples were washed, cut into 2.5 cm bits, sliced longitudinally and left in petriplates containing 150 ml of tap water for 72 hr in the laboratory (25—27°C). The nematodes were extracted after passing through 60 and 350 mesh sieves. For analysis of 250 g each of soil samples, Cobb's sieving and sifting method followed by modified Baermann's funnel method (Christie and Perry, 1951) were used. The population of different plant parasitic forms and also the saprophyles were recorded from both soil and root samples.

The samples were collected from the entire region and sent by post and parcel services to CPCRI, Kayangulam by CPCRI Centres at Vittal and Palode. This resulted in much variation in days between collection and extraction of nematodes from 5-45 days for samples received from Karnataka. Therefore the population recorded may not be the true picture existed in a few samples. Fourteen soil samples were not processed as they got dried up in transit.

Results and Discussion

Samples were collected from 148 locations in Kerala and 70 locations from Karnataka States. Plant parasitic nematodes belonging to 22 genera were isolated from the root zone of healthy and disease affected palms (Table I). Of these, *Radopholus similis* was obtained from 111 out of 218 root samples. *Meloidogyne* sp. was obtained from 33 soil samples but root galls were not observed in these samples and larvae were also not extracted from roots. The list of other nematode species isolated and the number of samples from which they were recovered are given in Table I. Except for *R. similis* the occurrence of nematodes belonging to other genera in small numbers in samples collected from the root zone of both healthy and diseased

palms may not be of any significance. They may probably be feeding on other herbaceous weeds growing in the root zone.

The occurrence of *R. similis* in relation to the health of the palm (Table II) do not show any correlation between the presence of *R. similis* and the disease. The possibility, however, exists that in areas where *R. similis* is present, they may be acting as aggravators by contributing to root decay. Another observation was the increase in population of *R. similis* in gardens intercultivated with banana.

When the data on the presence of *R. similis* vis-a-vis the soil type (Table III) was analysed, *R. similis* was seen to occur more in sandy loam than in laterite. Also the low lying sandy loam areas yielded more *R. similis* as compared to elevated areas. This may be due to the availability of better soil moisture conditions in low lying areas. However, the position was just the reverse in laterite soil.

Another observation was that irrespective of the soil type, water table, health of the palm, area involved, moisture condition of the soil etc., only less than 50% of soil samples collected from around root samples which yielded *R. similis* yielded them. This would indicate the advantage of collecting root samples to soil samples in a survey for *R. similis*.

A study of the distribution of *R. similis* in the survey areas (Table IV) shows that it is present in all places except Belthangadi tehsil of South Kanara District.

Since many of the root samples which yielded *R. similis* showed typical lesions root rotting and blackening of root tips, *R. Similis* population from yellow leaf affected palms at Palode was extracted and inoculated on to healthy arecanut seedlings grown in sterile soil in pots @ 50 nematodes per 100 g of soil to study their role in the production of lesions. After two months the roots of these plants exhibited typical orange coloured, elongate, cortical lesions separate from one another on young, while fleshy roots. These lesions later coaleased and caused extensive rotting. Root tips infested by these nematodes exhibited rotting and blackening. The inoculated plants also showed reduced vigour, height (44%) girth (37%) and number of leaves (43%) as compared to the uninoculated plants two years after inoculation. These studies are continuing.

There are also two field experiments using nematicides viz. fensulfothion. Aldicarb, DBCP, DD and neem oil cake on the control of *R. similis* in disease affected palms to find out the role of *R. similis*, if any, in the incidence of yellow leaf.

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TABLE I

Showing genera of plant parasitic nematodes isolated from the root zone of arecanut palm

Sl. No.	Genera observed	Total Samples		Diseased			Healthy		Population exceeding 500 Nos.	Water Table	
		Soil	roots	Initial	Middle	Advanced	Advanced healthy	Healthy		Above 50 cm	Below 50 cm
	Total	*204	*218	*87	*5	*2	*86	*38			
1.	*Tylenchus*	3	..	..	..	..	1	2	..	2	..
2.	*Ditylenchus*	1	..	1	..	..	..	..	..	..	..
3.	*Psilenchus*	1	..	1	..	..	..	..	..	..	1
4.	*Tylenchorhynchus*	22	..	8	..	..	9	5	..	12	4
5.	*Meloidogyne*	33	..	12	1	..	18	2	..	8	6
6.	*Hoplolainus*	18	..	7	..	..	11	..	..	6	3
7.	*Scutellonema*	1	..	..	..	..	1	..	..	..	..
8.	*Helicotylenchus*	122	..	49	3	2	53	15	2	40	28
9.	*Dolichodorus*	7	..	4	..	..	3	..	..	2	3
10.	*Pratylenchus*	4	..	2	..	..	2	..	..	1	..
11.	*Radopholus similis* (Roots)	..	111	40	..	1	42	28	17	46	22
	Do. (Soil)	52	..	27	..	..	23	2	7	19	10
12.	*Rotylenchulus reniformis*	97	..	36	2	2	42	15	6	31	20
13.	*Criconemoides*	22	..	8	1	..	11	2	..	6	5
14.	*Hemicriconemoides*	67	..	30	2	2	29	4	..	23	13
15.	*Caloosia*	45	..	17	3	1	18	6	..	18	11
16.	*Paratylenchus*	17	..	8	2	..	5	2	1	10	2
17.	*Xiphinema*	25	..	13	1	..	10	1	..	3	8
18.	*Longidorus*	6	..	2	..	..	4	..	..	1	2
19.	*Paralongidorus*	1	..	1	..	..	..	..	..	..	..
20.	*Trichodorus*	1	..	1	..	..	..	..	..	..	..
21.	*Aphelenchus*	1	..	..	..	..	1	..	..	..	1
22.	*Aphelenchoides*	6	..	3	..	..	3	..	..	1	3
23.	*Mononchus*	92	..	35	3	2	40	12	..	28	15
24.	*Saprophytes*	187	..	78	5	2	81	21	54	59	33

*Number of samples under each category.

TABLE II

Population of R. similis *in relation to health of the arecanut palm*

Sl. No.	Health of the plant	Total No. of root samples	*R. similis* Population in roots		Total No. of soil samples	*R. similis* Population in soil		Banana as intercrop	
			Number	percent		Number	percent	Number	percent
1.	Healthy (in healthy tract)	38	28	76	24	2	8	24	63
2.	Apparently healthy (in diseased tract)	86	42	49	90	23	26	26	30
3.	Diseased : Initial Stage	87	40	46	83	27	33	28	32
4.	Diseased : Middle Stage	5	..	..	5	..	..	..	..
5.	Diseased : Advanced Stage	2	1	50	2	..	..	..	..

TABLE III

Occurrence of R. similis *in different soil types*

Sl. No.	Soil Type	Total root sample	*R. similis* population in ROOTS		*R. similis* population in SOIL		Irrigated	Non-irrigated	Water Table above 50 cm	Water Table Below 50 cm	Banana as Intercrop
			Number	percent	Number	percent					
1.	Laterite elevated	83	31	37	19	20	10	73	83	..	11
2.	Laterite low-lying	106	58	54	24	23	31	75	62	44	42
3.	Red loam elevated	2	2	100	..	..	1	1	2	..	2
4.	Sandy loam low-lying	11	6	55	2	18	8	3	3	8	9
5.	Sandy loam elevated	10	10	100	5	50	5	5	9	1	7
6.	Red sandy loam low-lying	2	1	50	..	..	..	2	2	..	2
7.	Red sandy loam elevated	2	1	50	..	..	1	1	2	..	2
8.	Black soil	2	2	100	2	100	2	..	..	2	2
	TOTAL	218	111	51	52	26	58	160	163	55	77

TABLE IV

Distribution of R. similis *in Kerala and Karnataka States*

Sl. No.	Locality	Total samples	*R. similis* population in ROOTS		SOIL	
			Number	percent	Number	percent
1	2	3	4	5	6	7
KERALA STATE						
I.	*Trivandrum District*					
1.	Trivandrum	6	4	67	3	50
2.	Nedumangad	34	21	62	12	36
3.	Neyyattinkara	18	9	50	6	34
4.	Chirayinkeezh	17	8	47	9	53
	TOTAL	75	42	56	30	40
II.	*Quilon District*					
1.	Quilon	7	1	14	..	..
2.	Kottarakara	23	6	27	4	18
3.	Pathanapuram	28	7	25	4	13
4.	Karunagappally	4	4	100	3	75
5.	Kunnathur	9	1	10	1	10
	TOTAL	71	19	28	12	15
III.	*Alleppey District*	2	..	..	2	100
	GRAND TOTAL	148	61	42	44	28
KARNATAKA STATE						
I.	*South Kanara District*					
1.	Bantwal	20	17	85	2	10
2.	Sullia	12	8	67	..	..
3.	Puthur	7	4	57	..	..
4.	Belthangady	4	..	..	..	..
5.	Karkala	4	4	100	..	..
	TOTAL	47	33	67	2	4
II.	*Chickmagalore District*					
1.	Chickmagalur	1	1	100	..	..
2.	Moodigere	5	4	80	..	..
3.	Koppa	9	7	78	2	20
4.	Sringeri	6	3	50	2	33
5.	Kadur	2	2	100	2	100
	TOTAL	23	17	71	6	25
	GRAND TOTAL	70	50	71	8	11