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PLANT PARASITIC NEMATODES ASSOCIATED WITH BLACK PEPPER (*PIPER NIGRUM* L.) IN KERALA

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Abstract : Fourteen genera of plant parasitic nematodes are associated with black pepper (*Piper nigrum.*), in nine major pepper growing districts of Kerala. *Meloidogyne incognita, Radopholus similis, Trophotylenchulus piperis, Rotylenchulus reniformis* and *Helicotylenchus* sp. are the major nematode species associated with the crop. *M. incognita* is widely distributed in Calicut, Cannanore and Wynad districts. *R. similis* is a major problem in Calicut, Cannanore and Idukki districts. In Quilon, Trivandrum and Wynad districts, the incidence of *R. similis* is low. *T. piperis* is also widely distributed in all the pepper growing areas in Kerala and its occurrence is high in Idukki district. The concomitant infestation of *M. incognita, R. similis* and *T. piperis* in the roots of black pepper is high compared to their solitary infestation.

Key words : Occurrence and distribution, Black pepper, *Piper nigrum*

Plant parasitic nematodes belonging to 29 genera and 48 species are reported from black pepper (Sundararaju *et al.*, 1979a). So far, only seventeen genera are reported in association with the crop in Kerala and Karnataka (Sundararaju *et al.*, 1979b). Jacob & Kuriyan (1979) stated that *M. incognita, R. similis* and *Holicotylenchus* sp. were commonly associated with black pepper in Kerala of which *M. incognita* was the predominant species. Recently, a new semi-endoparasitic nematode, *T. piperis* was also found infesting black pepper in Kerala (Mohandas *et al.*, 1985). *M. incognita* and *R. similis* are considered to be important as they are suspected to be responsible for the slow wilt/yellows disease of black pepper (van der Vecht, 1950; Venkitesan & Setty, 1977). So far, no detailed survey of pepper plantations in Kerala, have been undertaken to identify plant parasitic nematodes associated with the crop. Hence, these studies were made and the results are presented here.

MATERIALS AND METHODS

The survey was conducted in a phased manner for five years (1980-84), during September to November months, when the nematode populations on black pedder were found to be maximum. A total of 332 each, of soil and root samples, from 177 gardens in Calicut, Cannanore, Idukki, Kasaragod, Kottayam, Pattanamthitta, Quilon, Trivandrum, and Wynad districts, were collected. Each sample was a composite sample drawn from five vines. Thus a total of 1660 pepper vines were sampled. The gardens were selected at random to represent the major pepper growing pockets in each district. For estimation of soil nematode population, the samples (100 ml each were) processed by modified Cobb's sieving and decenting technique. Nematode populations in the root samples (one gram each) were estimated after staining the roots with acid fuchsin lacto-phenol and blending.

RESULTS AND DISCUSSION

Fourteen genera of plant parasitic nematodes were found in the rhizosphere soils of black pepper. Two endoparasitic nematodes *viz.*, *M. incognita* and *R. similis*

TABLE 1. *Occurrence and distribution of plant parasitic nematodes of black pepper in nine districts of Kerala*

Sl. No.	Nematode genera/ species	No. of samples which yielded plant parasitic nematodes									
		Calicut 42*	Cannanore 26*	Idukki 102*	Kasaragod 47*	Kottayam 10*	Pattanamthitta 37*	Quilon 12*	Trivandrum 26*	Wynad 30*	Total 332*
1.	*Acontylus* sp.	1	—	—	—	—	—	—	—	—	1 (0.3)
2.	*Aphelenchus* sp.	1	—	—	—	—	—	—	—	—	1 (0.3)
3.	*Criconemoides* sp.	29	11	14	14	4	13	3	8	30	126(37.9)
4.	*Helicotylenchus* sp.	40	13	75	16	8	23	8	15	26	224(67.4)
5.	*Hoplolaimus* sp.	5	4	12	6	2	11	3	—	1	44(10.2)
6.	*Longidorus* sp.	—	—	2	—	2	6	4	5	—	19 (5.7)
7.	*Meloidogyne incognita*	41	22	63	24	3	19	8	6	26	212(63.8)
	,, (root)	40	22	67	25	5	27	8	9	29	232(69.8)
8.	*Pratylenchus* sp.	2	—	9	5	—	6	1	2	3	28 (8.4)
9.	*Radopholus similis*	29	17	54	22	6	13	2	5	—	148(44.5)
	,, (root)	34	19	73	25	8	21	3	7	1	191(57.5)
10.	*Rotylenchulus reniformis*	16	9	57	21	8	25	10	19	29	194(58.4)
11.	*Scutellonema* sp.	1	—	—	—	—	—	—	—	—	1 (0.3)
12.	*Trophotylenchulus piperis*	7	3	54	20	4	19	2	14	3	126(37.9)
	,, (root)	19	9	66	21	5	21	3	16	9	169(50.9)
13.	*Tylenchorhynchus* sp.	4	2	14	3	3	10	1	4	—	41(12.3)
14.	*Xiphinema* sp.	5	6	22	14	2	15	2	7	4	77(23.1)

*No. of samples examined. Figures in parentheses are percentages.

and a semi-endoparasitic nematode, *T. piperis* were isolated from the roots. *M. incognita*, *R. similis*, *T. piperis*, *R. reniformis* and *Helicotylenchus* sp. were the major nematode species associated with black pepper in Kerala with more than 50 per cent of the pepper vines infested by these nematode species. The other genera of importance were species of *Criconemoides*, *Xiphinema*, *Hopolamus*, *Tylenchorhynchus*, *Pratylenchus* and *Longidorus* (Table 1).

Calicut district recorded maximum number of nematode genera (13) followed by Idukki, Pattanamthitta, Quilon and Trivandrum districts (11). In Wynad district only nine nematode genera were recorded. Out of 14 nematode genera recorded, 7 genera were present in all the nine districts surveyed.

T. piperis was found in all the 9 districts of Kerala and 50.9 per cent of the root samples yielded the nematode, indicating its widespread occurrence in Kerala.

An analysis of infestations of *M. incognita*, *R. similis* and *T. piperis*, individually or in association with each in the roots, indicated that in comparison to *M. incognita*, single occurrence of *R. similis* or *T. piperis* was less (17.8 per cent). The associated infestation of *M. incognita* with *R. similis* was high (18.1 per cent) compared to the combined infestation of either *M. incognita* with *T. piperis* (12 per cent) or *R. similis* with *T. piperis* (11.4 per cent). The concomitant infestation by all the three nematode species was high (21.9 per cent) compared to their solitary infestation. The results indicated that infestation by all the three nematode species to the roots of black pepper was more common than infestation by single nematode species (Table 2).

In general, the population density of *M. incognita* in the roots was higher (about four times) than that of *R. similis* and *T. piperis* populations. The maximum population per gram of roots was around 10,000 for *M. incognita* and around 3000

TABLE 2. *Association of three nematode species with the roots of black pepper in Kerala*

District/No. of samples examined	No. of root samples infested with the nematodes						
	MI alone	RS alone	TP alone	MI + RS	MI + TP	RS + TP	MI + RS + TP
Calicut/42	6(14.3)	1 (2.4)	— (0.0)	16(38.1)	2 (4.8)	1 (2.4)	16(38.1)
Cannanore/26	5(19.2)	1 (3.8)	— (0.0)	9(34.6)	— (0.0)	1 (3.8)	8(30.8)
Idukki/102	8 (7.8)	8 (7.8)	7 (6.9)	17(16.7)	11(10.8)	17(16.7)	31(30.4)
Kasaragod/47	10(21.3)	6(12.8)	2 (4.3)	5(10.6)	5(10.6)	9(19.1)	5(10.6)
Kottayam/10	— (0.0)	1(10.0)	1(10.0)	3(30.0)	— (0.0)	2(20.0)	2(20.0)
Pattanamthitta/37	5(13.5)	1 (2.7)	1 (2.7)	7(18.9)	7(18.9)	5(13.5)	8(21.6)
Quilon/12	4(33.3)	1 (8.3)	— (0.0)	1 (8.3)	2(16.7)	— (0.0)	1 (8.3)
Trivandrum/26	2 (7.7)	1 (3.8)	7(26.9)	1 (3.8)	4(15.4)	3(11.5)	2 (7.7)
Wynad/30	19(63.3)	— (0.0)	— (0.0)	1 (3.3)	9(30.0)	— (0.0)	— (0.0)
Total/332	59(17.8)	20 (6.0)	18 (5.4)	60(18.1)	40(12.0)	38(11.4)	73(21.9)

Figures in parentheses are percentages.
MI = *M. incognita*
RS = *R. similis*
TP = *T. piperis*

TABLE 3. *Occurrence of different population levels of three nematode species in the roots of black pepper in Kerala*

District/No. of gardens surveyed	No. of gardens which yielded different nematode population levels								
	M. incognita			*R. similis*			*T. piperis*		
	0	Low	High	0	Low	High	0	Low	High
Calicut/21	— (0.0)	7(33.3)	14(66.7)	2 (9.5)	7(33.3)	12(57.2)	9(42.9)	7(33.7)	5(23.8)
Cannanore/15	— (0.0)	7(46.7)	8(53.3)	1 (6.7)	3(20.0)	11(73.3)	8(53.3)	1 (6.7)	6(40.0)
Idukki/51	10(19.6)	32(62.7)	9(17.7)	5 (9.8)	19(37.3)	27(52.9)	10(19.6)	25(49.0)	16(31.4)
Kasaragod/25	8(32.0)	16(64.0)	1 (4.0)	10(40.0)	3(12.0)	12(48.0)	8(32.0)	3(12.0)	14(56.0)
Kottayam/9	5(55.6)	4(44.4)	— (0.0)	2(22.2)	4(44.5)	3(33.3)	4(44.4)	5(55.6)	— (0.0)
Pattanamthitta/22	6(27.3)	13(59.1)	3(13.6)	8(36.4)	11(50.0)	3(13.6)	7(31.8)	11(50.0)	4(18.2)
Quilon/6	1(16.7)	3(50.0)	2(33.3)	3(50.0)	2(33.3)	1(16.7)	4(66.7)	1(16.7)	1(16.7)
Trivandrum/13	5(38.5)	8(61.5)	— (0.0)	7(53.8)	6(46.2)	— (0.0)	4(30.7)	6(46.2)	3(23.1)
Wynad/15	— (0.0)	5(33.3)	10(66.7)	14(93.3)	1 (6.7)	— (0.0)	8(53.3)	3(20.0)	4(26.7)
Total/177	35(19.8)	95(53.7)	47(26.5)	52(29.4)	56(31.7)	69(38.9)	62(35.0)	62(35.0)	53(30.0)

Figures in parentheses are percentages.

for *R. similis* and *T. piperis*. Based on the population densities of the three nematodes species generally present in the root systems their population levels (per gram of roots) were grouped into three categories *viz.*, (1) '0' level (no nematodes), (2) 'low level' (A population of 1 to 1000 for *M. incognita* and 1 to 250 for *R. similis* and *T. piperis*) and (3) 'high level' (A population of > 1000 for *M. incognita* and > 250 for *R. similis* and *T. piperis*).

The occurrence of different population levels of *M. incognita*, *R. similis* and *T. piperis* in the roots of black pepper is presented in Table 3. All the root samples collected from Calicut, Cannanore and Wynad districts yielded *M. incognita*, and more than 50 per cent gardens recorded high populations. In Idukki, Kasaragod, Pattanamthitta, Quilon and Trivandrum districts more than 50 per cent of the gardens had low populations of *M. incognita*. In Kottayam and Trivandrum districts none of the gardens had high populations of this nematode. This survey showed that *M. incognita* is widely distributed in Calicut, Cannanore, Wynad districts followed by Idukki, Kasaragod, Pattanamthitta, Quilon, Trivandrum and Kottayam districts.

The burrowing nematode, *R. similis* was present in all the districts surveyed. High population of the nematode was found in more than 50 per cent of the gardens in Calicut, Cannanore and Idukki districts. In Kasaragod district though 40 per cent of the gardens did not yield this nematode, 48 per cent gardens had high population. In Pattanamthitta and Kottayam districts more number of gardens had low population of *R. similis*. In Quilon, Trivandrum and Wynad districts more than 50 per cent of the gardens did not yield the nematode. The studies indicated that *R. similis* is a major problem in Calicut, Cannanore and Idukki districts and to a lesser extent in Kasaragod, Kottayam, Pattanamthitta, Quilon, Trivandrum and Wynad districts.

The semi-endoparasitic nematode, *T. piperis* was found in all the districts surveyed. However, its occurrence was high (80.4 per cent) in Idukki district, though 49 per cent of the gardens had low population. The number of gardens with high population of this nematode was less in all the districts except Kasaragod district where 56 per cent of the gardens had high population. The incidence of this nematode was low in Quilon, Cannanore and Wynad districts.

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