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DENSITY AND FREQUENCY OF ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* IN RUBBER PLANTATIONS

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ABSTRACT

A survey of plant parasitic nematodes covering twenty-one different rubber-growing areas showed that *Meloidogyne* sp is the predominant nematode in all the locations. Absolute and relative nematode density and frequency were calculated and from these data obtained a distinct distribution pattern of nematodes in the rubber growing soils. The infectivity of soil was also studied by suitable bioassays.

INTRODUCTION

Root-knot nematodes, *Meloidogyne* spp. is distributed worldwide and are economically important plant pathogens of global significance (Sasser, 1980). The occurrence of root-knot nematodes on rubber, *Hevea brasiliensis* has been reported from India (Raveendran & Nadackal, 1975), Malaysia (Rao, 1965), Vietnam (Erashenko *et al.*, 1985) and Brazil (Lordello, *et al*; 1989). Studies on the frequency and distribution of plant parasitic nematodes in nurseries have indicated the presence of five important nematode genera (Thankamony *et al.*, 1996) of which *Meloidogyne* was the predominant one, known to be a pest of rubber seedlings (Nehru *et al.*, 1991). As most of these nurseries are located in rubber growing areas of Kerala State, India, it is likely that mature rubber plantations are also infested by root-knot nematodes although the symptoms on mature trees remain unnoticed. Hence, a detailed survey was taken up to study the population density and frequency of *Medoidogyne* spp. in rubber plantations.

MATERIALS AND METHODS

A total of 349 soil samples were collected at random from twenty-one different locations (Table 2) of which 18 were from Kerala and one each from Tamil Nadu, Karnataka and Maharashtra States in India from a depth of 10-30 cm. Composite samples were drawn by mixing ten sub samples from each site, labelled and brought to the laboratory. Each sample was thoroughly mixed and 250 g soil was drawn from the homogenous mixture for processing. Extraction of nematodes was done by Cobb's sieving and petridish extraction method (Chawla and Prasad, 1974) and the nematode population was assayed. From these data, the absolute density, relative density, absolute frequency and relative frequency of nematodes were calculated using the methodology of Norton (1978).

Absolute and relative frequencies

From assay of nematode population, absolute frequency and relative frequency of *Meloidogyne* spp - in samples were calculated. Frequency denotes how often a species occur among the samples examined.

Thus, absolute frequency =

$$\frac{\text{No. of samples that contained } \textit{Meloidogyne}}{\text{Total no. of samples collected}} \times 100$$

Relative frequency calculated from absolute frequency is per cent of total absolute frequency of a species to sum of frequencies of all the species.

Relative frequency =

$$\frac{\text{Frequency of } \textit{Meloidogyne} \text{ spp}}{\text{Sum of frequencies of all species}} \times 100$$

Absolute and relative densities

Absolute density represents the total population of plant parasitic nematodes identified and estimated in each sample analysed. From this data, the relative density of *Meloidogyne* spp. was calculated as a percentage of *Meloidogyne* spp. to total population of plant parasitic nematodes (Sundararaju and Mehta, 1991).

Based on the absolute density of root-knot nematodes per 250 g soil, the infestation in locations were categorised as shown below:

Low - 1 – 100 nematodes/250 g soil (+)
Moderate - 101 – 1000 nematodes/250 g soil (++)
High - 1001 – 5000 nematodes/250 g soil (+++)
Very high - >5000 nematodes/250 g soil (++++)

Infectivity test

The indicator plant technique (Mcsorley *et al.*, 1983) has been used to test the infectivity of soil samples. Tomato seedling were raised in the soil to be tested and grown for six weeks by providing nutrients and water as per the normal recommendations. The plants were thereafter uprooted and nematode infestation recorded using a gall index on a 0-5 scale as depending on the percentage of root system infested viz. 0=no galls; 1= <10%; 2=11-25%; 3=26-50%; 4=51-75% and 5= 76-100%. The incidence of *Meloidogyne* spp. is indicated by the relative extent to which the roots get infested (Dropkin, 1954).

RESULTS AND DISCUSSION

The population of plant parasitic nematodes observed in rubber plantations are furnished in Table 1. Twelve important genera of plant parasitic nematodes were recorded from the rhizosphere of *H. brasiliensis*. *Meloidogyne*, *Helicotylenchus* and *Aphelenchoides* were the most predominant, encountered in more than forty per cent of the soil samples studied. *Hemicriconemoides* and *Longidorus* were recorded at forty per cent of frequency of occurrence followed by *Radopholus*, *Tylenchus*, *Hoplolaimus*., *Criconemoides*, *Trichodorus* and *Xiphinema*.. Lowest frequency of 13.46 was recorded for *Hemicycliophora*. The relative frequency was found to vary from region to region. Maximum relative density of 37.13 was noticed for *Meloidogyne* and a minimum of 1.87 for *Criconemoides* and *Hoplolaimus*.

Survey on the prevalence and distribution of plant parasitic nematodes in different crops in different locations in Kerala was conducted by many workers. Spices such as pepper, cardamom, ginger, turmeric, clove, cinnamon and nutmeg are reported to be attacked by root-knot nematodes, *M. incognita* (Sundararaju *et al.*, 1979). Ramana & Mohandas (1987) reported the wide spread occurrence of *M. incognita* in cardamom in Calicut, Cannanore and Wayanad districts. The soil samples collected from the root zone of cocor from different regions of Kerala State also show 15 per cent frequency of occurrence of root-knot nematodes (Koshy *et al.*, 1979). The infection of root-knot nematodes in citrus caused small elongated galls at terminal and sub-terminal e and caused severe rotting of roots (Siddique *e* 1987). It is reported as a predominant nematode species attacking different horticultural crops in Karnataka (Singh *et al.*, 1979). All these observations clearly indicate the wide spread occurrence and extensive host range of root-knot nematode, *M.incognita* compared to other plant parasitic nematodes.

Distribution and occurrence of *M. incognita*

The absolute density of *Meloidogyne* spp.

Table 1: Frequency and density of occurrence of plant parasitic nematodes in rubber growing soi

Nematode genera observed	No. of infested samples	Absolute frequency (%)	Relative frequency (%)	Absolute density	Relative density (%)
Meloidogyne	298	85.38	17.68	1818.49	37.13
Helicotylenchus	240	68.76	14.76	978.83	19.90
Aphelenchoides	147	42.12	8.65	228.5	4.68
Hemicriconemoides	141	40.40	8.29	443.73	9.06
Longidorus	140	40.11	8.24	161.93	3.31
Xiphinema	80	22.92	4.71	143.66	2.93
Trichodorus	100	28.65	5.88	106.73	2.18
Tylenchus	126	36.10	7.42	433.8	8.86
Criconemoide	106	30.37	6.24	91.8	1.87
Radopholus	139	39.82	8.18	171.8	3.51
Hoplolaimus	121	34.67	7.12	91.8	1.87
Hemicycliophora	47	13.46	2.76	115.2	2.35

varied from region to region and ranged from 36 in Dapchari (Maharashtra) to 2225 per 250 g soil in Punalur (Kerala) region (Table 2). Out of the twenty-one locations studied, Kottayam, Punalur, Vaniampara, Muvattupuzha, Padiyoor, Kanhikulam and Calicut in Kerala State were rated as high infestation area (+++). Moderate level of infestation was observed in ten locations such as Chethackal, Malankara, Palai, Palakkad, Kulasekharam, Manjeri, Nedumangad, Ulickal, Perumpulickal and Peruvannamoozhy.

Soil samples collected from Dapchari, Nettana, Alakode and Paraliar showed low level of root-knot infestation. Further it was noticed that 33.33, 47.6 and 19.04 per cent of total locations recorded high, moderate and low level of nematode population respectively.

The soil samples having a population of two nematodes and above per g soil showed high gall indices (>2) on rootlets of indicator plants. The formation of root galls on more than 10% of the root system adversely affects the growth of plants. Two larvae per g soil can be regarded as an optimum damaging threshold level of *M.incognita* infestation as reported by Nath *et al.*, (1979) and Mani (1983). These observations also are in conformity with the findings of Krishna Rao and Krishnappa (1994) who reported an inoculum of 2 larvae per g soil as an optimum damaging threshold level on cultivars Annegiri –1 of chick pea under green house conditions. The present survey on the distribution of plant parasitic nematodes in rubber plantation gives a distinct picture on their occurrence. It also identifies the areas, which are highly infested by root-knot nematodes. This estimation of densities of plant parasitic nematodes will help in the study of their population behaviour in relation to crop performance or environment as well as in planning and evaluation of management programmes.

Table 2. Density and frequency of occurrence of *M. incognita* in rubber plantations

Location	No. of samples collected	No. of samples infested	Absolute frequency %	Relative frequency %	Absolute density	Relative density %	Gall index (GI)	Level of Infest-ation
Kulasekharam	16	16	100	15.44	688	14.05	2.4	++
Paraliar	10	3	30	4.63	95	1.94	0.0	+
Nedumangad	15	12	80	12.35	450	9.19	2.0	++
Punalur	30	30	100	15.44	2225	45.43	4.8	+++
Perumpulickal	10	10	100	15.44	300	6.13	1.0	++
CES, Chethackal	22	18	82	12.66	325	6.63	1.0	++
Kottayam	27	24	88	13.59	1083	22.11	3.4	+++
Palai	15	12	80	12.35	950	19.40	3.2	++
Malankara	18	14	70	10.81	700	14.29	2.4	++
Muvattupuzha	27	23	85	13.13	1357	27.70	3.6	+++
Vaniampara	24	24	100	15.44	1625	33.18	3.6	+++
Palakkad	15	13	87	13.43	950	19.40	2.6	++
Manjeri	10	6	60	9.27	700	14.29	3.0	+++
Calicut	20	20	100	15.44	1625	33.18	3.6	+++
Kanhikulam	15	15	100	15.44	2050	41.86	4.0	+++
Peruvannamoozhy	15	12	80	12.35	868	17.72	3.2	++
Ulickal	10	7	70	10.81	434	8.86	1.8	++
Padiyoor	20	20	100	15.44	1500	30.63	3.8	+++
Alakode	15	15	100	15.44	96	1.96	0.0	+
Nettana	10	2	20	3.08	50	1.02	0.0	+
Dapchari	5	2	40	6.18	36	0.74	0.2	+

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REFERENCES

Chawla,M.L. and Prasad, S.K. 1974 Techniques in Nematology. 11 Comparative efficiency of sampling tools and nematode extraction methods. *Indian Journal of Nematology.* 4:113-115.

Dropkin,V.H. 1954. Infectivity and gall size in tomato and cucumber seed lings infected with *Meloidogyne incognita* Var. *acrita* (root-knot nematode) *Phytopathology.* 44: 43-49

Erashenko,A.S., Nguen and Ngok – 'Yau Naguen Vu Tkhan and Doan Kan' 1985. Parasitic plant nematodes on North Vietnam (Ed.E.L.Krall"). Nanka, Leningradskoe, Otdelenie, Leningrad

Koshy, P.K., Sosamma, V.K. and Sundararaju, P. 1979. Survey of plant parasitic nematodes of coconut in India. *Proceedings of the Second Annual Symposium in Plantation Crops* P. 45-49.

Krishna Rao, V. and Krishnappa, K. 1994. Variation in pathogenicity of *Meloidogyne incognita* on chick pea at different inoculation densities. *Indian Journal of Nematology.* 24(1): 88-92

Lordello,A.I.L., Lordello,R.R.A. and Cardoso, M. 1989. Pest resistance of young rubber (*Hevea*) trees to *Meloidogyne incognita* races and *Meloidogyne javainca Nematologia, Brasileria,* 13: 189-193.

Mani,A. 1983. Studies on the interaction of root-knot nematode *Meloidogyne incognita* with *Fusarium oxysporum* f. sp. Ciceri and *Fusarium solani* on Chickpea. Ph.D Thesis. *Indian Agricultural Research Institute,* New Delhi 106 pp.

Mcsorley, R. and Parradd,J.L. 1983. A bioassay sampling plan for *Meloidogyne incognita. Plant Disease;* 67(2): 182-184.

Nath, R.P. Banerjee,A.K., Haider, M.G. and Sinha,B.K. 1979. Studies on the nematodes of pulse crops in India.1. Pathogenicity of *Meloidogyne incognita* on gram. *Indian Phytopathology.* 32: 28-31.

Nehru,C.R., Thankamony,S and Jayarathnam, K. 1991. Ooccurrence of root-knot nematode *Meloidogyne incognita* as a pest of rubber (*Hevea brasiliensis*) seedlings. *Indian Journal of Natural Rubber Research.* 4(1): 77-78.

Norton,D.C. 1978. Ecology of plant parasitic nematodes. John Wiley & Sons. W-Y 268 pp.

Ramana, K.V. and Mohandas, C 1987. Plant parasitic nematodes associated with black pepper (piper nigrum L) in Kerala. *Indian Journal of Nematology.* 17(1): 62 – 66.

Rao,B.S. 1965. Pests of *Hevea* plantations in Malaya. Rubber Research Institute of Malaysia Kuala Lumpur, Malaysia. Pp 98.

Raveendran,V and Nadackal,A.M. (1975). An additional list of plants infected by root-knot nematode *Meloidogyne incognita* (Kofoid & While, 1919), Chitwood, 1949 in Kerala. *India Journal of Nematology.* 5 (1): 126-127.

Sasser, J.N. 1980. Root-knot nematodes. A global menace to crop production. *Plant Disease.* 64: 36-41.

Siddique, Z.A., Rashid,A. , Farooqi, N and Bisheya, F. 1987. A survey of plant parasitic nematodes associated with citrus in Libya and trials on chemical control. *Indian Journal of Nematology.* 17(1): 76-80

Singh, D.B., Rao, V.R. and Parvathareddy, P. (1979). Plant parasitic nematodes associated with Horticultural Crops in South India. *Indian Journal of Nematology* 9(2): 183

Sundararaju, P and Mehta, G.K. 1994. Distribution pattern of important species of plant parasitic nematodes in the sugarcane ecosystem of India. *Indian Journal of Nematology.* 24:176-180

Sundararaju, P., Koshy, P.K. and Sosamma, V.K. 1979. Survey of plant parasitic nematodes associated with spices in Kerala and Karnataka. *Proceedings of the Second Annual Symposium Plantation Crops* P 39-44

Thankamony, S, Nehur, C.R. and Jayarathnam, K (1996). Frequency of occurrence and distribution of plant parasitic nematodes in rubber nursery soils. *Indian Journal of Natural Rubber Research.* 9(1): 60-62

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