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CARDAMOM PLANTATIONS OF TAMIL NADU**

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## OCCURRENCE OF ROOT-KNOT NEMATODES IN CARDAMOM PLANTATIONS OF TAMIL NADU\*

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### ABSTRACT

A survey was carried out on the incidence of root-knot nematodes in cardamom in Tamil Nadu covering Tirunelveli, Ramanathapuram and Madurai districts. Root-knot nematodes were present in all fields of cardamom as well as in primary and secondary nurseries sampled, indicating that infestation is widespread in Tamil Nadu.

Maximum population of root-knot nematodes was recorded in Rajapalayam Taluk of Ramanathapuram District. *Meloidogyne incognita* was recorded from Tirunelveli, Ramanathapuram and Madurai Districts while *M. arenaria* was recorded in Ramanathapuram District only.

### INTRODUCTION

Cardamom (*Elettaria cardamomum* (L.) Maton) grown in moist deciduous rain forest of Tamil Nadu at altitudes ranging between 600–1500 metres and occupies over 8110 ha with an annual production of 300 M.T. (Anon., 1978). The conditions under which cardamom is grown in Tamil Nadu are different as it receives lesser rainfall compared to the other cardamom growing states of Kerala and Karnataka. Recently, wide-spread infestation of root-knot nematodes in nursery and fields of cardamom was reported in 4 taluks of Kerala (Ali and Koshy, 1982). A survey was carried out in Tamil Nadu during 1981 to determine the distribution of root-knot nematodes in this crop. This paper presents the results of a survey on the incidence of root-knot nematodes in cardamom nurseries as well as fields of Tamil Nadu.

### MATERIAL AND METHODS

Seventy two samples each of soil and roots were collected from fields and nurseries in three districts of Tamil Nadu (Table 1).

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Each sample consisted of 250g of soil and 10–15g of root. Nematodes were extracted from soil samples by Cobb's sieving technique, and from root samples (5g) by cutting them into small pieces after fixation in 4% formalin and staining in acid fuchsin-lactophenol for 5 minutes and then dispersing in 150 ml water. Another lot of roots was stained with acid fuchsin-lactophenol, and 15–20 adult females were teased out. Anterior and posterior ends of adults were cut and mounted in lactophenol for species identification.

#### RESULTS AND DISCUSSION

All soil and root samples from nurseries and fields yielded root-knot nematodes (Table 1). Maximum population of root-knot nematodes was recorded in Rajapalayam taluk of Ramana-thapuram district. The higher incidence of root-knot nematodes in nurseries was due to the repeated use of same nursery beds year after year. In general, nurseries had poor percentage of germination (15–25%). Very young seedlings (1–2 months old) had typical knotted appearance on root system, whereas 6 month-old seedlings rarely showed galling, but exhibited excessive branching especially on root-tips. In such seedlings, rosette appearance of leaves was commonly observed. Stunted seedlings with sickly appearance showed poor tillering, yellowing of leaf margin, and drying of leaf tips. The problem was found to be serious when such seedlings were transplanted to infested secondary nurseries resulting in their poor establishment (40% approximately).

Root-knot infested seedlings used for transplantation in the main field served as an important source of inoculum. Besides, the intensity of the infestation was high in places where *Erythrina* sp. were grown as shade trees in cardamom plantations. Shallow root-knot cardamom plants exhibited excessive branching near the root tip or all along the entire root at different intervals. A bunch of rootlets emerged a little above the root tip which were readily discernible from other healthy roots by the absence of root hairs and milky white colour. The root tips which were attacked initially by nematodes were more prone to invasion by fungus; hence, decaying and rotting generally started from this point. Maximum population of 2nd stage larvae and adult females of root-knot

Table 1. Occurrence of root-knot nematode (*Meloidogyne*) on Cardamom in Tamil Nadu (Root and Soil)

| Area                           | Sites sampled and average population/g of root and 150g of soil |                 |                |                 |                 |                |                 |                 |                     |                    |
|--------------------------------|-----------------------------------------------------------------|-----------------|----------------|-----------------|-----------------|----------------|-----------------|-----------------|---------------------|--------------------|
|                                | Nursery                                                         |                 |                |                 |                 | Plantations    |                 |                 |                     |                    |
|                                | Primary                                                         |                 | Secondary      |                 |                 | Total          |                 | Positive for    |                     |                    |
|                                | No. of samples                                                  | Root population | No. of samples | Root population | Soil population | No. of samples | Root population | Soil population | <i>M. incognita</i> | <i>M. arenaria</i> |
| <i>Tirunelveli District</i>    |                                                                 |                 |                |                 |                 |                |                 |                 |                     |                    |
| Tenkasi Taluk                  | 4                                                               | 105             | 47             | 2               | 183             | 49             | 17              | 144             | 35                  | 23                 |
| <i>Ramanathapuram District</i> |                                                                 |                 |                |                 |                 |                |                 |                 |                     |                    |
| Rajapalayam Taluk              | 5                                                               | 530             | 28             | 5               | 576             | 60             | 23              | 343             | 105                 | 30                 |
| <i>Madurai District</i>        |                                                                 |                 |                |                 |                 |                |                 |                 |                     |                    |
| Periyakulam Taluk              | —                                                               | —               | —              | 2               | 205             | 79             | 14              | 174             | 86                  | 16                 |
| Total                          | 9                                                               | 635             | 75             | 9               | 964             | 188            | 45              | 743             | 238                 | 69                 |

nematodes were recovered from root tips. In severe cases, tips of branch roots exhibited pronounced galling.

Shedding of immature fruits and excessive tillering were also commonly observed in nematode infested plants. In case of excessive tillering, a mass of dwarf tillers emerged among the infested dying tillers, bearing narrow, curled small leaves. These dwarf tillers either dried up or became sterile. Root-knot infested plants further exhibited narrowing of top leaves, yellowing of leaf margins, burning of leaf tips, and stunted tillers.

Root-knot nematodes were present in all fields of cardamom as well as in the nurseries sampled in three taluks (Table 1), indicating that infestation is widespread in Tamil Nadu. Cardamom being a perennial crop, the infestation of root-knot nematodes is not spectacular or of a sudden epidemic type but rather exhibits a slow decline in yields, spreading gradually but steadily. The symptoms caused by nematodes on roots and aerial parts of the clumps were not recognized, and hence attributed to other factors.

*Meloidogyne incognita* (Kofoid et White) Chitw. was recorded from Tirunelveli, Ramanathapuram and Madurai districts while *M. arenaria* (Neal) Chitw. was tentatively identified from Ramanathapuram district only. *M. incognita* is a predominant species causing widespread infestation in cardamom crop of Tamil Nadu.

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## DISCUSSIONS

P. S. SREENIVASAN (Palghat): From the tables, it is seen that there is not much relation between number of nematodes in soil and the roots. Thus, the nematode status in the soil at the three selected localities are more or less the same while the cardamom roots affected in Rajapalayam is of the order of ten times while in other two centres it is about twice only. Is this due to variation in soil environment or agronomic practices?

ALI: Maximum population of root-knot nematodes will always be found in root zone. The nematodes enter into roots and become sedentary and lay eggs in roots not in soil. In soil, only 2nd stage larvae can move through soil pores, not adult females and other stages of nematodes. Main inoculum of nematodes are in roots, while in soil they pass only a part of their life-cycle.

R. NAIDU (CPCRI): Narrowing of leaf is common even under field conditions in the plantations. In advanced stage, 6-8 clumps will be reduced to the height of 6 to 19". Such severely infected plants responded to Timek and Darinet application under laboratory conditions. Though the symptoms are similar to the Bunchytop disease of banana, there is no relation to that.

ALI: Narrowing of leaf seems to be a symptom of root-knot infestation. During the survey, heavy populations were recorded from clumps having narrowing of leaf. From visual symptoms, it is almost certain that it is only due to nematodes.

P. T. JOHN: For the control of nematodes in cardamom, whether a control of nematodes in nurseries will alone be sufficient since all the cardamom areas surveyed are already infested by the particular nematode ?

ALI: Control of nematodes in nurseries will alone not be sufficient, as in field the nematodes may occur naturally particularly in virgin soil. Nematode-free seedlings definitely reduce the chance of high build-up of nematode population. In field it is very difficult to eradicate nematodes but in nurseries eradication of nematodes is possible by MBr-fumigation.

B. CHANDRAMOULI (UPASI): What are the species of *Meloidogyne* that you observed in the cardamom tracts of T. Nadu?

ALI: *Meloidogyne incognita* and *M. arenaria* only.

G. P. SHETTY (Multiplex, Bangalore): Nematode attacked plants develop secondary roots, devoid of root hairs. Why root hairs are not developed in newly developed roots?

ALI: In nematode-free roots which are newly developed plenty of root hairs along with small rootlets can be observed, whereas nematode-infested roots showing excessive branching never have root hairs because these roots are developed in response to the attack by root-knot nematodes.

GPS: Can we grow some plants like sunflower whose root exudates will control the spread of nematodes—It has been observed in Simla that sunflower grown in between the main crop of *Capsicum* reduced nematode attack.

ALI: We do not have any report about sunflower's tolerance to root-knot nematodes in cardamom.

C. KURUVILLA JACOB (RRII): For the control of root-knot nematode Dr. Ali has suggested 2.5 kg of nematodes like Aldicarb, Carbofuran and Phorate. But much higher doses of 10–15 kg ai/ha were tried by us, and the latter two chemicals could not give effective control even at such high rates of application. In this connection attention is invited to the results of our trials presented in the poster session.

ALI: Dr. Koshy has also used 10–15 kg/ha of Aldicarb and carbofuran in nursery. From your studies, now we know that dosage must be high, but we don't know about residual toxicity of such high doses of nematodes.

R. CHANDRASEKHARAN (UPASI): The narrowness of leaves is often found in nurseries where the soils are poor with extensive nematode damage. The narrowness of leaves is not noticed when the nutritional status of the soil is high even with high intensity of nematodes.

ALI: This is a wrong belief that due to poor soil, narrowing of leaves is occurring. As far as I know there is no data available to prove that narrowing of leaf is due to nutrient deficiency. Clumps having narrowing of leaf contain high population of nematodes, and show excessive branching. Perhaps due to nematode infestation, roots are not able to take up these nutrients.

R. C.: The narrowing of leaves disappears in the following year, and if the narrowing is attributed to the nematode, what is the explanation for the normal leaves?

ALI: Every year new roots are coming up which are able to take water and nutrients. This is the only reason we are getting broader leaves but as soon as these roots are attacked again by nematodes, narrowing of leaf can be observed.

P. K. RAMESH (Chikmagalur): Are there any alternate hosts for nematodes in cardamom fields?

ALI: *Erythrina* sp. are better hosts for root-knot nematodes than cardamom.