

PLANT PARASITIC NEMATODES OF SMALL CARDAMOM AND THEIR MANAGEMENT

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Small cardamom (*Elettaria cardamomum*, Maton), the 'queen of spices', is grown in the evergreen forests of Western Ghats in Kerala, Karnataka and Tamil Nadu. According to the recent estimates, it occupies around 81,110 ha in India. The average production of cardamom in India for the past few years was about 4000 tonnes which is around 30 per cent of the global production. However, our productivity is about one third of that of Guatemala, the leading producer in the world today.

Cardamom is generally grown in an area where the annual rainfall ranges from 1500-4000 mm and at an altitude of 600-1200 m above MSL. It is a perennial plant cultivated as a monocrop or as an intercrop in arecanut or coffee plantations. One of the major production constraints of cardamom is pests and diseases. Among the variety of pests attacking cardamom from the seedling stage in the nursery to the capsule stage in plantation, plant parasite nematodes are an economically important group.

IMPORTANT NEMATODES AND THEIR DISTRIBUTION

The perennial nature and other agronomic characteristics of cardamom cultivation are very congenial for nematodes. However, the first report on the incidence of plant

parasitic nematodes in cardamom plantations was by D'Souza and others in 1970. About 20 genera of plant parasitic nematodes are reported on cardamom till today. Among them, root knot nematodes (*Meloidogyne* spp.), borrowing nematodes (*Radopholus similis*), lesion nematodes (*Pratylenchus* spp.), reniform nematodes (*Rotylenchulus reniformis*) and spiral nematodes (*Helicotylenchus* spp.) are of much importance.

A survey conducted in the cardamom growing areas of the country has revealed root knot nematodes as the most widely distributed nematode pest of this crop. They were present both in nurseries and plantations with their population varying from place to place. The predominant species was *M. incognita*. Other nematodes had only restricted distribution. *Radopholus similis* and *Pratylenchus* spp. were generally found when cardamom is intercultivated with arecanut or coffee.

The maximum population of root knot nematodes occur in cardamom roots during the post monsoon season with the peak in November-December. However, second stage juveniles in soil around cardamom show multiple peaks with the highest population during the summer months.

NATURE OF DAMAGE

- * Poor germination of seeds in primary nurseries

- * Poor establishment after transplanting to secondary nurseries or fields
- * Yellowing, narrowing and drying of leaf tips and margins
- * Stunting and poor growth of the plants
- * Reduced tillering, shedding of immature capsules and poor yield
- * Heavy galling and abnormal branching of roots (Borrowing and lesion nematodes induce characteristic brown patches on cardamom roots while reniform nematodes form thick, brown cortical thickenings on roots).

The nematodes damage is more serious and pronounced in the nurseries. More than 50 per cent reduction in germination is reported in nurseries infested with root knot nematodes. Such nurseries show patches of stunted and weak seedlings. Galling and root reduction are greater in young seedlings than in mature plants. High incidence of diseases like damping off, rhizome rot, etc. is noticed in infested nurseries. Heavy infestation at seedling stage and subsequent neglect lead to poor crop. A recent study has shown 38-54 per cent reduction in the yield of *M. incognita* infested plants compared to that of healthy ones.

However, damage due to nematodes may vary depending on the nematode population level, type

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and age of the host plant, soil type, presence of other soil borne pathogens and other extrinsic factors.

INTEGRATED NEMATODE MANAGEMENT

The integrated approach for management of nematodes aims at checking the nematode population well below damaging level. This can be achieved by a variety of measures which are either preventive or curative in nature.

1. In Nurseries

Indiscriminate distribution and use of nematodes infected cardamom seedlings are reported to be the major reason for extensive distribution of root knot nematodes in cardamom growing areas. Considering the fact that seedlings are highly susceptible to nematodes, top priority should be given for production and distribution of clean and healthy seedlings. Nematode free seedlings transplanted to fields have a better chance of establishment, surviving and yielding higher than the infested seedlings. Mass production of such seedlings can be achieved through raising them in disinfested nursery beds. Disinfection of nursery sites is done by various pre- and post-sowing methods as described below:

a) **Use of soil fumigants :** Pre sowing fumigation of nursery beds with Methyl Bromide (500 g/10 sq.m.) or Ethylene di Bromide (20 l/ha) or Durofume (30 l/ha) was found to give excellent control of nematodes and thereby good germination. Drenching with 2 per cent formalin was also reported to be effective against nematodes.

Among these, Methyl Bromide was found to be the best as it has got many additional advantages like control of weeds and other soil borne pathogens. Considering the benefits and unit expenditure over a period of time, fumigation is the best available way for disinfection. But, the highly toxic nature of these volatile nematicides and the problem of residues in ground water make them non attractive.

b) **Use of solar heat :** Solar heat can be effectively used in cardamom nurseries for minimising nematode problems. Deep ploughing and exposing nursery soil to sunlight during summer help in destroying the nematodes present in soil. Soil solarisation is a technique of increasing soil temperature to lethal levels by spreading transparent polythene sheets (25-100 μ m thickness) over moist soil beds for 4-6 weeks during the hot season. Preliminary trials conducted at NRCS had shown that solarisation can increase germination by 25.5 per cent and reduce weed growth by 82 per cent. Besides, the incidence of other nursery diseases are quite less in solarised beds. Apart from all these, solarised beds respond well to other plant protection measures.

c) **Use of biocontrol agents :** Nurseries provide an excellent vehicle for incorporation of suitable biocontrol agents. Some recent studies at NRCS with *Paecilomyces lilacinus* has given encouraging results. Incorporation of the above fungus at the time of sowing and 30 days thereafter in the soil has reduced the nematode population and galling in cardamom roots. Seedlings raised in such beds had excellent root system, tillering and vegetative

growth. Attempts are also being made to isolate new biocontrol organisms from the rhizosphere of cardamom. In a pot study, two VAM fungi viz. *Glomus fasciculatum* and *Gigaspora margarita*, were found to be effective in reducing the nematode colonisation and in improving the plant growth.

d) **Use of non volatile nematicides :** Post sowing application of nematicides becomes necessary when heavy infestation is noticed in nurseries. Several nematicides have been evaluated to study their comparative efficacy in controlling these pests. Carbofuran @ 5 kg a.i./ha (i.e. one g a.i./row of 6 m length) may be applied in such nurseries 10 days after germination and this has to be repeated after three months. In secondary nurseries the dosage should be 10 kg a.i./ha.

e) Traditionally nursery beds are prepared at the same site continuously, resulting in nematode population build up. Therefore, it is beneficial to shift the nursery sites periodically. If possible nursery sites may be subjected to fallowing coupled with frequent tillage for killing nematodes. Good sanitation should be strictly followed in nurseries. Pruning of roots at the time of transplanting will also help to some extent in reducing the problem.

2. In Plantations

Nematode distribution in a plantation is not uniform. The general agro-climatic conditions of plantations viz. clayey or loamy soils, high organic content, low soil temperature, etc. are not conducive for the growth of root knot nematodes. In such a situation,

properly established and well cared plants can yield well even in the presence of nematodes. But suboptimal conditions may lead to significant yield losses.

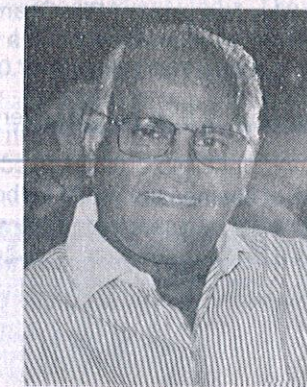
a) **Use of nematicides :** Applying nematicides as an insurancish treatment is no more feasible in cardamom plantations, because of the (prohibitory) costs of these chemicals and fluctuating prices of cardamom. Therefore, it is recommended that only severely infested 'sick' patches in the field may be treated with nematicides. Recent trials at NRCS has proved that there is about 67-11 per cent and 34.8-2 per cent increase in yield when plants were treated with phorate and carbofuran respectively. Phorate treated plants produced capsules of bold size. These chemicals have additional advantages of controlling root grubs, thrips, etc. Treatment with

nematicides can be limited to one round in an year (October-November), when there is maximum nematode population in the field and also young and active roots for better absorption of the chemical.

b) **Organic amendments :** Cardamom soils are rich in humus and organic content due to regular biocycling of mulch materials and other plant residues. This promotes the activity of biocontrol agents inhabiting the rhizosphere. Efforts should be made to preserve these conditions in the field so as to favour the activity of endemic biocontrol agents. Incorporation of oil cakes helps in reducing nematode damage, improves soil fertility and structure. Neem oil cake @ 500 g per clump, twice a year is reported to reduce the nematode population and thereby improve the yield of cardamom.

CONCLUSION

Eventhough, plant parasitic nematodes are not a key pest of cardamom they are certainly a 'limiting factor' which adversely affect the productivity of the plant. The strategy for better management of these pests is protection at the nursery level itself, by integrating various control tactics, in an economically viable manner. Being a perennial crop, the long term goals should be to develop a resistant/tolerant line, to isolate a natural and efficient biocontrol organism and thereby to minimise the use of chemicals. Nematode problems in cardamom plantations will become more complex and serious during the coming days, as more and more areas are brought under irrigation and multiple cropping with other susceptible crops like pepper, and coffee.



Birth
28 - 5 - 1934

Death
21 - 2 - 1993

Mr. H. JAYARAM, Founder of The Consolidated Group of Companies passed away following a massive heart attack in Coimbatore, at his residence, on 21st February 1993. He had very close association with all Plantations in South India, meeting the entire requirements of the Estates for more than three decades. He had abounding faith in Human endeavours and Divine grace behind all his achievements.

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