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# Dr. G.I. D'Souza Memorial Lecture on Nematode Diseases of Plantation Crops

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**ABSTRACT :** Plantation crops perennial in nature, cultivated extensively in tropics/subtropics, which demand employment of labour throughout the year and require some processing before use. The important crops in India are coffee, tea, rubber, cashew, cocoa, coconut, arecanut, oil palm, black pepper, cardamom, ginger and turmeric. They play an important role from the point of export earning and import substitution. In India, these crops are being cultivated in an area of 5.8 million ha and generate an annual income of Rs. 4,48,590 million. They occupy a premier position in the export earnings amounting to Rs. 72,350 million. India is known as the “home of spices” and is a leading country in production, consumption and export of spices. The world trade of spices is estimated around 4.5 lakh million tones of which Indian share is 47% in terms of quantity and 25% in terms of value (Pal & Khan, 2001). Spices occupy a dominant role in Kerala's agricultural economy. Kerala shares about 90% of the total spices output in the country. Nearly one lakh tonnes of spices are being exported from the country, annually earning foreign exchange of Rs. 275–300 crores.

**Key words :** Plantation crops, nematodes, diseases.

## Interaction Effects Between Arbuscular Mycorrhizal Fungi and Root-Knot Nematode *Meloidogyne incognita* on Tomato

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**ABSTRACT :** Five different arbuscular mycorrhizal (AM) fungi (*Glomus fasciculatum*, *G. macrocarpum*, *Gigaspora margarita*, *Acaulospora laevis* and *Sclerocystis dussii*) were evaluated for their ability to mitigate damage caused by *Meloidogyne incognita* on tomato. *G. fasciculatum* was most efficient in promoting plant growth in presence of nematodes. However, *G. macrocarpum* and *G. margarita* were also efficient. Plant biomass and phosphorus uptake were highest in these treatments. The development of nematode stages in the roots and the nematode numbers in soil were differently suppressed by AM fungi, with most pronounced effect with *G. fasciculatum*, comparatively less with *G. macrocarpum* and *G. margarita*. *A. laevis* and *S. dussii* did not show any effect.

**Key words:** Arbuscular mycorrhizae, *Meloidogyne incognita*, interaction, tomato.

# Antinemic Activity of Plant Extracts Against *Pratylenchus coffeae* Infecting Banana

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**ABSTRACT :** Fresh leaves of *Abutilon indicum*, *Azadirachta indica*, *Calotropis procera*, *Cassia auriculata*, *Crotalaria juncea*, *Datura stramonium*, *Prosopis juliflora*, *Tridax procumbens*, *Vitex negundo* and *Xanthium indicum* were dried and the prepared extracts were tested against the root-lesion nematode, *Pratylenchus coffeae* infesting banana. In the preliminary study almost all the plant species exhibited nematicidal activity ranging from 20.7 to 96.5 per cent mortality at 24 hr exposure period. The best 3 plant extracts viz. *A. indica*, *C. juncea* and *V. negundo* were further diluted at 20, 40, 60 and 80 per cent concentration and tested. *A. indica* exerted 73.4 per cent mortality of *P. coffeae* when exposed to 20 hr in the 80 per cent concentration of leaf extract followed by 76.4 and 64.8 per cent mortality with respect to *V. negundo* and *C. juncea*. No mortality was recorded in distilled water.

**Key words:** Nematicidal activity, plant species, plant extracts, *Pratylenchus coffeae*.

## Response of Resistant Barley Cultivars to the Indian Populations of *Heterodera avenae* Complex\*

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**ABSTRACT :** Reported resistant barley cultivars BH 331, BH 338, C 164, Rajkiran, RD 2035, RD 2052 and RD 2508 were tested against three (Jaipur, Udaipur and Sirsa) populations of *Heterodera avenae* pathotype Ha 21 and a single population (Ambala) of *H. filipjevi* pathotype Hf31. All these resistant cultivars turned out to be susceptible to *H. filipjevi* population. BH 331 and BH 338 were susceptible to all the three populations of *H. avenae*. However varied reactions were obtained for rest of the cultivars against *H. avenae* populations. RD 2052 was susceptible against Udaipur population but resisted Jaipur and Sirsa populations. Jaipur and Udaipur populations were virulent on RD 2508.

**Key words:** *Heterodera avenae* complex, Resistant cultivars, barley, Indian population.

# Management of Root-Knot Nematode *Meloidogyne incognita* in *Abelmoschus esculentus* through Botanical Extracts and Organic Amendments

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**ABSTRACT :** *In vitro* studies on larval emergence from eggs of *Meloidogyne incognita* revealed inhibitory effect of neem cake and Rakshak gold (neem-based product). Plant growth was increased along with significant reduction in root-knot infestation in pot experiments when seed was treated with botanical extracts. In field experiment, application of neem cake @ 5 t/ha decreased root-knot infestation significantly and increased okra yield.

**Key words:** *Azadirachta indica*, Rakshak gold, okra, *Meloidogyne incognita*, organic amendments.

## **Antagonistic Efficacy of *Azotobacter chroococcum* against *Meloidogyne javanica* Infecting Brinjal**

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**ABSTRACT :** In-planta studies were carried out to investigate effect of *Azotobacter chroococcum* inoculation on root invasion and reproductive potential of *Meloidogyne javanica*. The results indicated that *A. chroococcum* affected their development and multiplication in the host plant. *Azotobacter* inoculation was partially responsible for increased plant growth in brinjal by alleviating, to some extent, the damaging effect of root-knot nematode.

**Key words:** Biological control, *Azotobacter chroococcum*, *Meloidogyne javanica*, brinjal.

## Interactive Effect of *Fusarium solani*, *Rotylenchulus reniformis* and *Meloidogyne javanica* on Tomato

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**ABSTRACT :** The interactive effect of *Fusarium solani*, *Rotylenchulus reniformis* and *Meloidogyne javanica* was studied in tomato var. Pusa Ruby in a glasshouse pot experiment. Plant growth was significantly affected when *M. javanica*, *R. reniformis* and *F. solani* were inoculated either alone or in combinations with maximum reduction in concomitant inoculation of the 3 pathogens. In inoculations with two pathogen only, maximum damage was with *M. javanica* and *F. solani* and least with sequential inoculation of *F. solani* preceded with *R. reniformis*. The rate of multiplication of *M. javanica* was higher than *R. reniformis* when present individually but in combined inoculation both the nematodes were adversely affected by each other, with *M. javanica* more than *R. reniformis*. *Fusarium solani* also inhibited multiplication of both the nematodes in sequential as well as in concomitant inoculations. The percentage of root-rot increased in plants inoculated either concomitantly or sequentially with either of the nematode species.

**Key words:** Tomato, *Fusarium solani*, *Rotylenchulus reniformis*, *Meloidogyne javanica*, interaction.

# Biodiversity of Nematode Fauna in Tamil Nadu Range of Nilgiris Biosphere

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**ABSTRACT :** An investigation was carried out in the Tamil Nadu range of Nilgiris biosphere, at an altitude of 600-2500m MSL, on cultivated crop plants for plant parasitic and predatory nematodes. Forty-eight species were recorded comprising 28 genera, 10 sub-families, 10 families, 4 super families, 4 sub-orders, 3 orders, 2 sub-classes and 2 classes. The population data was subjected to community analysis and based on the prominence and importance values, *Meloidogyne incognita*, *Globodera pallida*, *G. rostochiensis*, *M. hapla*, and *Helicotylenchus nilgiriensis* were dominant.

**Key words:** *Meloidogyne incognita*, *Globodera pallida*, *G. rostochiensis*, *M. hapla*, *Helicotylenchus nilgiriensis*, Relative frequency, Relative density, biomass, Relative prominence value and Importance value.

## **Organic Amendments for Management of *Heterodera cajani* in Pulses**

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**ABSTRACT :** Non-conventional management approach using, sawdust, rice husk, Wheat bran, cow dung, rabbit dung, goat dung, pigdung and poultry manure when applied @ 400 kg/ha against *Heterodera cajani* infesting arhar and moong bean increased plant growth, rhizobium nodulation and reduction in nematode population. Oil cake (neem, mustard and linseed) @ 100 and 400 kg/ha were also effective.

**Key words:** *Heterodera cajani*, management, organic amendments, pulses.

# Response of Some Cultivars of Pepper, Eggplant and Tomato to Races of Root-Knot Nematodes, *Meloidogyne incognita* and *M. javanica*

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**ABSTRACT :** Response of some cultivars of pepper, eggplant and tomato to races of *Meloidogyne incognita* and *M. javanica*, under artificial inoculation conditions, was evaluated. All cultivars (10) of eggplant were susceptible to *M. incognita* and *M. javanica* races. Some cultivars of pepper and tomato exhibited race specific resistance with variable response depending upon the race and species of the nematode involved. Selection of cultivars for planting according to their known responses have been discussed.

**Key words:** Race, race-specific resistance, root-knot nematodes, species, vegetables.

## Management of Citrus Nematode, *Tylenchulus semipenetrans* on Khasi Mandarin, by *Paecilomyces lilacinus*

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**ABSTRACT :** *Paecilomyces lilacinus*, grown on mustard oil cake or rice bran, and applied on khasi mandarin, at different levels, against *Tylenchulus semipenetrans* resulted in improved plant growth and reduction in nematode population. Maximum reduction in nematode population was obtained at 8 g fungus culture per kg soil.

**Key words :** Khasi mandarin, *Paecilomyces lilacinus*, *Tylenchulus semipenetrans*, Biocontrol.

## **Effect of *Meloidogyne incognita* and *Fusarium oxysporum* f.sp. *lycopersici*, alone and together, on NPK of Roots and Shoots and Chlorophyll Contents of Tomato**

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**ABSTRACT :** Mineral contents of root and shoot, affected by inoculation of both the pathogens, upset the nutrient balance. In case of dual inoculations, the treatments showing synergistic effect (N+F and N+f<sub>10</sub>) exhibited more accumulation of nutrients in roots than in shoots, suggesting poor uptake and translocation. Among the treatments, although treatments N alone and F alone exhibited reduced chlorophyll content. Significantly least content was recorded in plants of N+F (simultaneously inoculation) and N+f<sub>10</sub> (nematode applied 10 days prior to fungus) treatments, both showing synergistic effect on the host.

**Key words:** *Meloidogyne incognita*, *Fusarium oxysporum*, NPK, chlorophyll a and b.

# Biochemical Alterations in Resistant and Susceptible Banana Clones due to the Burrowing Nematode

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**ABSTRACT :** A pot culture experiment with 8 banana clones, comprising 5 hybrids and 3 diploid parents, was conducted to study the biochemical alterations induced by the burrowing nematode, *Radopholus similis* in banana (*Musa* sp.). The results revealed presence of higher quantities of phenols in the uninoculated roots of resistant clones than susceptible clone Matti. The amount of total protein, carbohydrates and sugars were more in the susceptible clone than other clones. Accumulation of phenols increased with the infestation of *R. similis*. Amount of total protein increased with the infection of nematodes. Decrease in the level of carbohydrates and increase in sugars was observed in the nematode infested roots.

**Key words:** *Banana, Radopholus similis*, resistance, biochemical alterations

# Survey of Farmer's Fields for the Association of Plant Parasitic Nematodes and Wilt Fungi with Pigeonpea and Quantification of Losses

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**ABSTRACT :** Farmer's fields, growing pigeonpea (*Cajanus cajan*), at different localities in Agra, Aligarh, Bulandshahr, Hathras and Mathura districts were surveyed. Wilt disease complex (*Fusarium udum*), *Heterodera cajani*/*Meloidogyne* spp) was most severe problem in its cultivation. Severity of stunting, yellowing and wilting of plants appeared directly proportional to the population of pigeonpea cyst nematode, *H. cajani*. Population of some other nematodes, such as *Tylenchorhynchus brassicae*, *Hoplolaimus indicus* and *M. incognita* was high at some localities. Maximum population of *H. cajani* was in Bulandshahr followed by Agra, Aligarh, Mathura and Hathras. Population of cysts in soil was comparatively high in irrigated areas than in rainfed areas. Infection of roots by *Fusarium udum* was observed at all the localities surveyed.

**Key words :** Survey, pigeonpea, plant parasitic nematodes, wilt, *Heterodera cajani*, *Fusarium udum*.

## Utility of a Molecular Diagnostic Method for Potato Cyst Nematode (*Globodera pallida* and *G. rostochiensis*) of Nilgiri Hills

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**ABSTRACT :** Random amplified polymorphic DNA (RAPD) markers are very efficient tools for detecting intra-specific genetic variability. A random operon primer OPG 5 that can differentiate between the two species of *Globodera* has been used to characterize the gene pool similarity of the field populations of potato cyst nematode from Nilgiri Hills. Of 44 individual cysts analyzed by RAPD-PCR, 41 had same RAPD profile and they were assigned to *G. rostochiensis*. However, 3 individuals were different which could be variants of *G. rostochiensis*.

**Key words:** Potato cyst nematode, DNA/molecular markers, RAPDs, genetic variability, resistance breeding, quarantine.

# ***Xiphinema mali* sp. n. (Nematoda : Dorylaimida) from Nepal with a Compendium and Key to the Species of Group 3 *sensu* Loof & Luc (1990) of the Genus**

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**ABSTRACT :** One new species *Xiphinema mali* sp.n. collected from the rhizosphere of apple (*Pyrus malus*) growing in Nepal has been described and illustrated. The new species is didelphic amphidelphic with anterior gonad much shorter than the posterior one and hence placed under Group 3 *sensu* Loof & Luc, 1990 of the genus along with other 4 species. *X. mali* sp.n. is characterized by having lip region set off by a constriction; L = 2.46 - 2.79 mm; a = 49-62; b = 6.0-7.4; c = 19-28; c' = 4.0-5.6; odontostyle = 105-120  $\mu$ m; V = 27-31; tail length = 100-145  $\mu$ k; elongate-conoid tail with rounded terminus bearing 4 pairs of caudal pores; and absence of males. A diagnostic key and compendium to the species of Group 3 is also provided.

**Key words:** Description, New Species, *Xiphinema mali* sp.n., taxonomy, key, compendium, apple, Nepal.

# The Response of Root-Knot Nematode, *Meloidogyne incognita*, to a Brassinosteroid

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**ABSTRACT :** The second stage juveniles (J<sub>2</sub>) of *Meloidogyne incognita* were exposed, *in vitro*, to ten concentrations (ranging from 0.0001 ppm to 3.5 ppm) of Brassinolide (BI), a brassinosteroid, for 48 hours. There was no significant mortality or apparent adverse effect on the juvenile vigour as compared to the control. The treated juveniles were allowed to develop on tomato seedlings in pots. The juveniles treated with low concentrations of Brassinolide (BI) resulted in more galls and egg masses when examined after 32 days. However in higher concentrations the galls and egg masses were fewer. Randomly picked plants after 45 days showed the similar trend.

**Key words :** Brassinolide (BI), *Meloidogyne incognita*, second stage juveniles (J<sub>2</sub>), juvenile mortality, *M. incognita* development.

## **Management of Root-Knot Nematode, *Meloidogyne incognita* on Tomato using Bio-agent *Verticillium chlamydosporium*, Neem Cake, Marigold and Carbofuran**

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**ABSTRACT :** Efficacy of bio-control agent *Verticillium chlamydosporium* Goddard, neem cake, marigold and carbofuran against root-knot nematode *Meloidogyne incognita* on tomato were tested by applying individually and in combinations. Amongst treatments all components individually recorded maximum plant growth and minimum galls and egg masses, which were statistically on par. In combinations, *V. chlamydosporium* + carbofuran, marigold + carbofuran, *V. chlamydosporium* + marigold recorded maximum plant growth and minimum galls and egg masses, which were statistically on par. These treatments also recorded maximum number of fruits per plant and yield per plot. Maximum parasitisation of *V. chlamydosporium* was recorded when carbofuran was integrated compared to its individual application or in combination with neem cake.

**Key words :** Carbofuran, management, marigold, neem cake, root knot nematode and *V. chlamydosporium*.

# **Management of Root-Knot Nematode, *Meloidogyne incognita* on Tomato using Bio-agent *Verticillium chlamydosporium*, Neem Cake, Marigold and Carbofuran**

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