Chapter- 2

REVIEW OF LITERATURE
Chapter 2  Review of Literature

Ali and Mian (1989) reported the efficacy of oil cakes of cotton seed (Gossypium hirsutum) and mustard (Brassica campestris) for the control of Meloidogyne incognita on potato. In general the oil cake amendments reduced root galling development of nematodes and improved plant growth and yield of tubers. Nematode control was directly proportional to the amount of the materials added to soil within the range of 0.125-0.500% (w/w).

Nazar and Nath (1989) studied the effect of leaf extracts of Argemone mexicana, Calotropis procera, Cannabis sativa, Croton sparsiflorus, Datura alba, Datura metel, Eclipta alba, Leucas aspera, Oxalis corniculata and Parthenium hysterophorus on the mortality of Meloidogyne incognita and Meloidogyne javanica. Parthenium hysterophorus and Eclipta alba were found to be highly toxic to the two nematodes.

Ramraj et al. (1991) examined that the effect of leaf extracts of Origanum vulgare at 0.25, 0.5, 1 and 1.5 concentrations on hatching of Meloidogyne incognita was studied at 24, 48, 72, 96, and 120 h. The leaf extract had nematicidal activity in all concentrations and time.

Gokte et al. (1991) evaluated the essential oils of Mentha piperita, Cymbopogon martini, Cymbopogon nardus, Cymbopogon winteruanus, Cymbopogon flecuosus, Ocimum sanctum and Ocimum basilicum against Meloidogyne incognita, Heterodera avenae, Heterodera cajani and Heterodera zea. All oils caused significant mortality at 500 ppm. However, at the lowest concentration (100 ppm) only Ocimum sanctum and Ocimum basilicum were effective. The two components extracted from Ocimum basilicum are methyl
chavicol and linalool, had nematicidal activity when present together, while the components of *Ocimum sanctum*, eugenol and non-eugenol showed nematicidal activity alone or in combination.

Ahmad *et al.* (1999) reported that the leaf extracts of *Azadirachta indica*, *Melia azedarach*, *Datura alba* and *Ricinus communis* were highly toxic to *Meloidogyne incognita*. *Azadirachta indica* gave maximum (100%) inhibition of egg hatching and larval mortality followed by *Melia azedarach*, *Datura alba* and *Ricinus communis*. Inhibition of egg hatch and larval mortality followed by *Melia azedarach*, *Datura alba* and *Ricinus communis*. Inhibition of egg hatch and larval mortality were significantly affected by the concentration of the leaf extract and the exposure time.

Sharma and Trivedi (1991) *in vitro*, tested the nematicidal properties of some angiosperms and gymnosperms against *Meloidogyne incognita*. It was observed that leaf extract of *Malva sylevestris*, *Chrysanthemum indicum*, *Calendula officinalis*, *Commiphora wightii*, *Cycas circinalis* and *Casuarina equisetifolia* were nematicidal. Juvenile hatching of *Meloidogyne incognita* was greatly inhibited by the extracts. Leaf extract of *Eschscholtzia califomica*, *Petunia violacea*, *Phlox paniculata*, *Mesembryanthemum crystallinum* and *Linum usitatissimum* were less nematicidal. Inhibition in hatching increased with greater concentration of leaf extract.

Goswami and Meshram (1991) used amendment of soil with mustard and karanj oil seed cakes, caused a marked change in the frequency and type of mycoflora genera as compared to untreated soil. It is proposed that the microbial activity in the amended soil may lead to the release of a wide variety of
chemically different substances that may be directly toxic to *Meloidogyne incognita*.

Gupta and Sharma (1991) found that aqueous extracts of garlic bulbs applied to *Meloidogyne incognita* suppressed egg hatch from 88.64-98.88% concentrations, respectively. The bulb extract also had high larval toxicity but leaves were less toxic as compared to bulbs. Larval kill after 24h was 88.00 and 20.67% at 5 and 1% concentrations respectively. The distilled oil fraction was highly toxic against larvae at 8-ppm concentration. Dry garlic powder at 5% concentration also killed 100% larvae after 72 h.

Abid and Maqbool (1991) studied the bare root dip treatment in the extracts of oil cake of castor on root-knot infection caused by *Meloidogyne javanica* on tomato cv Rutgers and egg plant (brinjal) cv. Round purple. The damaging effects of the nematode were masked by bare root dip treatments as shown by improved plant growth in both the test plants.

Mojumder and Mishra (1992) reported that seeds of *Vigna radiata* cv PS-16 were soaked in aqueous extract of *Azadirachta indica* kernels and seed coat for 24h in a pot trial. Germination was not much affected upto the 6 h exposure with any extract. At 12 and 24 h exposure there was a considerable reduction in germination particularly at the higher concentrations. The numbers of *Meloidogyne incognita* penetrating in roots declined with increasing concentration and soaking time. The best nematicidal treatment is recommended at 6 h in standard (S) concentration followed by S/2 and S/4 and 3h in S and S/2 concentrations.
Ghosh and Sukul (1992) found that the steam distillate of *Xanthium strumarium* leaves showed nematicidal activity against *Meloidogyne incognita* in *vitro* and *in vivo* tests. Oleic acid and 3,4-dihydroxycinnamic acid, present in the leaves also showed a nematicidal effect. In *in vitro* tests the steam distillate at 20mg/ml killed 93% of nematodes in 2h. In *in vivo* tests where the distillate was applied to tomato plants infested with *Meloidogyne incognita* using soil drench or foliar spray, both methods of application were equally effective. Oleic acid and 3,4-dihydroxycinnamic acids showed more effect with soil drench and foliar spray respectively. No phytotoxicity was observed below 4mg/ml.

Goswami (1992) reported that Algan a commercial product of the water extract of *Ascophyllum nodosum* was tested for the control of *Meloidogyne incognita* infesting aubergines *in vitro* and in pot trials. Both tests showed a significant reduction in *Meloidogyne incognita* populations in treated plants with an increase in plant growth characters.

Mojumder and Mishra (1992) applied the powdered *Azadirachta indica* seed coat to soil infested with *Meloidogyne incognita* or given as seed treatments to chickpeas in pot trails. Soil and seed treatments were given separately or in combination. All treatments significantly reduced the number of root galls, with combined soil and seed treatments, having the greatest reduction.

Sasanelli (1992) studied that aqueous extracts from leaves of *Ruta graveolens* had a high nematicidal effect against *Xiphinema index*, *in vitro*. The LD-50 value, obtained by probit analysis, ranged between 83.14% and 1.79% of a standard solution. Nematode mortality increased with the increase of the leaf extract concentration and the exposure time. There was a high negative correlation between the log10 of these two parameters.
Awan et al. (1992) reported that the effect of leaf extracts of *Azadirachta indica, Calotropis procera, Nerium indicum* (Nerium oleander) and *Datura alba* (Datura metel) in larval mortality of *Tylenchulus semipenetrans* was investigated. *Azadirachta indica* gave maximum larval mortality followed by *Datura metel*, *Nerium oleander* and *Calotropis procera*. Larval mortality increased with increase in exposure time and concentration of extract. *Citrus* plant growth variables were also enhanced significantly by leaf extracts when applied *in vitro*.

Wani (1992) examined that seeds of okra were soaked in leaf extracts of *Azadiracta indica* for 0, 2, 4, 6, 8, 12, or 24 hr and seedlings were inoculated with 5000 *Meloidogyne incognita* juveniles. All seed soakings controlled nematodes, the control increasing with increasing duration of soaking.

Haider (1993) reported that the effect of plant extracts and incorporation of leaf, stem, fruit and root of *Anagallis arvensis, Clerodendrum infortunatum* and *Cuscuta reflexa* on nematodes increased with increase in exposure period and concentration of extracts with leaf extracts of *Anagallis arvensis* being most toxic followed by stem extracts of *Cuscuta reflexa* and leaf extracts of *Clerodendrum infortunatum*. Incorporation of plant parts in soil significantly suppressed gall number and root-knot index caused by *Meloidogyne incognita* and increased growth characters of tomatoes, greatest reduction in nematode damage occurring with *Anagallis arvensis*.

Gupta and Sharma (1993) studied that allicin has been isolated from *Allium sativum* and tested against *Meloidogyne incognita* infesting tomato. Allicin resulted in 11-75 eggs hatched at 5.0-0.5 ppm. as compared with 146 hatched at 0 ppm. after 120h. A juvenile kill of 87-100% at 2.5-5.0 ppm. in allicin was
recorded within 72 h. Concentrations of 200 and 100 ppm. allicin as bare root dips for 30 min killed 83% and 87% of tomato seedling respectively. Penetration of tomato roots by juveniles was 13%, 14% and 18% in seedling, which had been dipped in allicin at 200, 100 and 25 ppm for 5 min, respectively, compared with 36% in untreated seedlings. Allicin at 25ppm for 5min as root dip treatment for tomato seedlings is effective against *Meloidogyne incognita*.

Gupta and Sharma (1993) found that three *Allium* species (garlic, onion and zimmu) were tested against 4 nematodes for their nematicidal and ovicidal action. Complete kill of *Meloidogyne incognita* and *Tylenchulus semipenetrans* larvae was recorded with all the plant extracts at 5% concentration. Garlic extracts proved more toxic to *Aphelenchoides compositicola* and *Helicotylenchus dihystera* than other treatments used. Egg hatch of *Meloidogyne incognita* was adversely affected by all the treatments when egg masses were dipped in the plant extracts and nematicide (fenamiphos) for 3 days. Hatching was stimulated when the egg masses were transferred to distilled water. After 12 days, garlic and onion though less toxic to nematicides resulted into low hatching as compared to Zimmu and control.

Mojumder and Mishra (1993) reported that aqueous extracts of *Azadirachta indica* cake, seed kernel and seed coat were applied as a single full dose or split doses to soil naturally infested with *Meloidogyne incognita* in a pot experiment. Chickpea seeds were then sown in the pots. All treatments significantly reduced the number of root galls. *Azadirachta indica* seed kernels applied at the full dose being most effective.
Mojumder and Mishra (1993) reported that *Vigna radiata* seeds were soaked in aqueous extracts of *Azadirachta indica* seed kernels and seed coats at 100, 50, and 25%. All extracts reduced the number of root-knot galls in plants and the *J₂* of *Meloidogyne incognita* in the soil. Significant effects were obtained with the 100 and 50% concentrations for 3 h soaking or the 50 and 25% concentrations for 6 h soaking.

Rangaswamy and Reddy (1993) reported that the effect of leaf extracts of *Tagetes patula* and Indian mustard at 1:5, 1:10 and 1:20 dilutions on the development of *Meloidogyne incognita* and growth of tomato was investigated in green house trials. Maximum shoot height, shoot weight and root weight occurred with *Tagetes patula*, mustard had no effect on plant growth characters. The leaf extracts of both plants significantly reduced root galling and egg mass production.

Nidiry *et al.* (1993) tested the methanol extract of defatted seeds of *Gloriosa superba* showed *in vitro* nematicidal activity against *Meloidogyne incognita* and one of the active principles has been identified as colchicines.

Philip *et al.* (1993) reported that *Meloidogyne incognita* occurs widely in the irrigated mulberry *Morus* gardens of South India. Leaf extracts of *Carica papaya*, *Euphorbia synadenium*, *Calotropis gigantea* and *Sesamum indicum* at S/10 concentration completely suppressed the larval hatching of the nematode in petri dishes. *Carica papaya* and *Euphorbia synadenium* at S/10 concentration at 48 h exposure gave 100 and 96% larval mortality respectively. Leaves of all these plants can be used as green mulch in mulberry gardens to reduce the incidence of root-knot disease.
Sasanelli and D’Addabbo (1993) used the extracts from *Tagetes erecta* and *Cineraria maritima* and *Senecio bicolar* showed good nematicidal activity against *Meloidogyne arenaria*, *Meloidogyne hapla* and *Meloidogyne javanica* but not on *Meloidogyne incognita*. *Ruta graveolens* had a greater nematicidal effect on all species tested, and in particular the leaf extract was more efficient than fenamiphos. Root leachates showed no nematicidal activity.

Goswami (1993) reported that cowpeas were grown in soil in pot trials amended or unamended with *Azadirachta indica* cake. Pots were then inoculated with *Meloidogyne incognita*. Nematode populations were lower in soil amended with *Azadirachta indica* cake than in oven dried and autoclaved soils. This was attributed to the greater nematicidal activity on soil mycoflora.

Kurundkar et al. (1993) used the okra seedlings inoculated with safflower oilseed cakes or leaf extracts of *Ocimum americanum*, *Anona squamosa*, *Butea monosperma* or *Pongamia pinnata*, stem powder of *Acarus calamus* or fruit powder of *Embelia ribes*. All treatments significantly reduced nematode numbers with the greatest reduction occurring with sunflower oilseed cake, and leaf extracts of *Ocimum americanum* and *Anona squamosa*.

Nogueira et al. (1994) used the cold crude extracts prepared from the leaves and stems of *Mucuna aterrima* and carried as powder in aqueous suspensions on to eggs of *Meloidogyne incognita* race 3, were detrimental to egg hatching.

Sellami and Mouffarrah (1994) reported that aqueous extracts of leaves of *Ricinus communis*, *Datura stramonium*, *Crotolaria saharae*, *Melia azedarach* and *Calendula officinalis* and leaf and root extracts of *Tagetes minuta*, *Tagetes erecta* and *Tagetes patula* were tested against *Meloidogyne incognita*. The percent
inhibition of juvenile hatching varied between 21.11% for *Calendula officinalis* to 56.67% for *Ricinus communis*, with *Ricinus communis* extracts there was 95% larval mortality with 48h exposure.

Mukhtar *et al.* (1994) used leaf extracts of *Azadirachta indica*, *Melia azedarach*, *Datura alba*, *Datura metal* and *Ricinus communis* to tomato plants inoculated with *Meloidogyne incognita* in a pot trial. All extracts except *Ricinus communis* enhanced plant growth and reduced disease severity with *Azadirachta indica* extracts being most effective.

Mukhtar *et al.* (1994) found that the addition of organic soil amendments proved effective in controlling *Meloidogyne incognita* in tomato plants, in pot experiments. Castor (*Ricinus communis*) oil cake at 25g/kg of soil amended before sowing gave better results than neem leaf (*Azadirachta indica*) cake and sawdust at the same dosage where as a combination of these amendments gave maximum control of nematodes.

Nidiry *et al.* (1994) found that among the various solvent extracts of the bulbs and seeds of onion assayed for *in vitro* nematicidal activity against *Meloidogyne incognita*, hot methanol extract of defatted seeds exhibited significant activity. The active extract contained a compound, which fluorescent in ultra violet light; it coloured pink when sprayed with diazotized sulphanilic acid followed by sodium hydroxide on a TLC plate. Free amino acids viz. leucine (isoleucine), aspartic acid, methionine and threonine each exhibited nematicidal activity but to a much lesser extent than the extract itself.
Chandravadana et al. (1994) found that serpentine (obtained from *Catharanthus roseus*) caused 10, 25, 40 and 100% mortality of *Meloidogyne incognita* with increasing concentration of extract (0.2, 0.35, 0.5 and 1.0% respectively) in laboratory experiments.

Patel et al. (1994) reported that the effect of leaf powders of *Clerodendrum inerme*, *Catharanthus roseus* and *Azolla pinnata* at 25g/m² row on control of *Meloidogyne incognita* and *Meloidogyne javanica* in Okra was investigated in micro plots. All plant products significantly reduced root-knot index 32.2, 30.8, 28.7 and 24.6% reduction occurring with *Clerodendrum inerme*, white and pink flowered *Catharanthus roseus* and *Azolla pinnata* respectively.

Onifade and Egunjobi (1994) studied the efficiency of water hyacinth (*Eichhormia crassipes*) and water lettuce (*Pistia stratiotes*) in the control of *Meloidogyne incognita* on tomatoes was compared with thionazin in laboratory and green house trails in Nigeria. Water extracts of these aquatic weeds, each in 3 concentrations of 1, 2 and 3 kg fresh leaves/ 2 liters of water were directly nematotoxic after 24 h exposure and toxicity increased with decreased extract dilution. Blended water hyacinth was superior to the boiled extract, where as the reverse was true for water lettuce. Thionazin treatment where neither egg hatching nor larval survival occurred did not differ from blended water hyacinth at 3kg/L extract. Pathological symptoms were pronounced in the untreated control plants and those receiving 1 and 2 kg/2 liters blended water lettuce, proved virtually as effective as thionazin application reducing soil and root populations of *Meloidogyne incognita*, galling index in pot cultures and crop damage. Improvements in tomato growth and yield in water hyacinth and water lettuce
amended soil were associated with nematode population suppression as well as the probable fertilizing of water hyacinth.

Thakur and Darekar (1995) reported that the studies conducted on the decomposition of 4 non edible oilseeds cakes during the year 1991, indicated that the leachates obtained from decomposed neem oil cake had a promising effect on mortality of *Meloidogyne incognita* juveniles at 3% w/w dose until the end of the third week in which it was maximum.

Thakur and Darekar (1995) found that the effectiveness of four non-edible oilseed cakes viz. neem, karanj, castor and mustard was tested against *Meloidogyne incognita* infesting brinjal (aubergine). The results indicated that neem cake at 35g/plant and karanj cake at 44g/plant were most effective in controlling *Meloidogyne incognita* both under pot culture and field conditions. These oil seed cakes had recorded reduced root galling, egg/egg masses, root-knot index and increased shoot and root length as well as dry shoot and root weight and yield of aubergine.

Swamy *et al.* (1995) reported that six trap/antagonistic crops viz. castor, cowpea, marigold, mustard, sesamum and sunhemp were evaluated for the management of *Meloidogyne incognita* in tomato nursery. All the crops (except cowpea) were effective in suppressing the nematode population in soil and favoured the germination of tomato seeds and production of healthy transplants. However nursery beds previously planted with marigold gave maximum reduction in root-knot nematode population in soil, which also increased the germination of seeds and production of more healthy tomato seedling. Possible explanation for the effectiveness of marigold in the management of root-knot nematodes has been discussed.
Suresh Prasad et al. (1995) reported that experiments were conducted to assess the effects of 25-100% aqueous extracts of fresh leaves of *Parthenium hysterophorus*, *Calotropis gigantea* and *Jatropa curcas* on *Meloidogyne incognita* exposed for 24-72 h. Results indicated that all concentrations of *Calotropis gigantea* inhibited hatching and gave 100% larval mortality at all exposure times, except for the 25% concentration at 24 h. *Parthenium hysterophorus* and *Jatropa curcas* gave 100% mortality and inhibited hatching at 75-100% concentrations at all exposure times, but only achieved this at the longer exposure times for lower concentrations. Nematode failed to penetrate and develop (assessed by gall formation and egg mass production) in Chilli, treated with 50-100% *Calotropis gigantea* extract and development was poor at 25% and also inhibited by 75-100% *Parthenium hysterophorus* and *Jatropa curcas* extracts.

Ali et al. (1995) reported that garlic and *Tagetes erecta* were planted each either alone or combined with infested tomato plants. Root galling of *Meloidogyne incognita* on tomato roots, numbers of egg/plant and J$_2$ in soil were significantly decreased in the single than in the combined plantings. *Tagetes erecta* was generally more effective than garlic and Vydate oxamyl. Residues of these 2 plants significantly decreased root galling of *Meloidogyne incognita* and J$_2$ population in soil in the single than in combined plantings. Garlic and in particular *Tagetes erecta* residues were effective in improving shoot growth of the infected tomato by 11.6-16.0% respectively. However, this improvement was not achieved due to the intercropping treatment. Oxamyle was the best treatment to improve plant growth. Garlic was recommended as the overall best treatment.
Ramakrishanan et al. (1995) found that the effects of leaf extracts of *Parthenium hysterophorus, Calotropis procera, Catharanthus roseus, Azadirachta indica, Solanum elaeagnifolium* and *Melia azederach* were treated on *Meloidogyne incognita* in petri dish experiments. *Azadirachta indica* followed by *Melia azederach*, were the most effective in reducing nematode numbers.

Abid et al. (1995) reported that soil amended with neem cake, cotton cake, *Datura fastuosa* and *Calotropis procera* at 0.1, 0.5 and 1% w/w reduced infection of *Meloidogyne incognita* on mungbean (*Vigna radiata*) with no significant differences at different dosages. *Bradyrhizobium* sp., the root nodule bacterium also effectively reduced gall formation. *Calotropis* at 1% showed greater reduction in root-knot index. Mustard cake at low dosages (at 0.1 and 0.5% w/w) effectively reduced the gall formation but was phytotoxic at 1%. Organic amendments significantly increased plant height but reduced root nodulation.

Abd-Elgawad and Omer (1995) reported that the essential oils of four medicinal plants belonging to Lamiaceae were explored for phytonematode control. The four oils inhibited nematode mortality but *Mentha spicata* was generally more effective in reducing the numbers of active nematodes followed by *Thymus bulgaris, Majorana hortensis, Origanum majorana* and *Mentha longifolia*. The main corresponding compound of each oil determined by GLC analysis, was carvone (58.14%), P-cymene (40.5), terpinen-4-ol (41.6%) and carvone (70.36%). Soil stages of *Rotylenchulus reniformis* were more affected by the oil than those of *Criconemella spp.* and *Hoplolaimus spp*. When transferred to water the total nematodes that regained their activeness ranged from 12% for *Thymus vulgaris* to 60% for *Mentha longifolia*. The 40.1% oil solutions inhibited
more than 80% of *Meloidogyne incognita* juvenile hatching compared to about 3.5% at the control. The content of oxygenated compounds in these oils ranged from 45.79% to 96.5% and may be partially responsible for the nematicidal effects.

Jatala *et al.* (1995) used thirteen plants of the Amazon basin known to the local Indian population as being potently antihelminthic, as well as having other medicinal qualities, were tested for their nematicidal activities. Aqueous and organic solvent extracts of fresh and freeze-dried leaves, stems, fruit, and roots of these plants were obtained and tested for their actions against *Meloidogyne incognita* juveniles. Most of the extracts of various plant parts had a nematostatic effect on the juveniles. Movement of the juveniles ceased after 12 h and they appeared dead within 24 h of exposure and remained the same for 72 h (duration of the experiment). However, in most cases the juveniles resumed activity when resuspended in distilled water for 24 h. Some extracts were toxic to nematodes.

Rakesh Gupta and Sharma (1995) studied aqueous extracts of *Allium sativum* (0.5, 1 and 5%) were screened for nematicidal activity against the juveniles of *Meloidogyne incognita*. In water high mortality (88%) was recorded after nematodes were exposed to the 5% extract for 24 h; 100% mortality was observed after 72 h. In soil, 100% mortality was observed after exposure to the 5% extract for 48 h. The 0.5 and 1% solutions were more active in the soil than in water.

Polthanee and Yamazaki (1996) reported that a greenhouse experiment was conducted to study the effect of marigold on rice in northeastern Thailand. Marigold treatment (grown and incorporated into soil before planting rice) suppressed nematode root galling and increased rice grain yield by 46% over
the untreated check. The increase in yield might be attributed to a reduction of nematode densities in soil by marigold. In addition, marigold plant material may serve as organic manure and provide nutrients for rice growth.

Hiransalee and Sirithorn (1996) tested the efficiency of crude extracts of 9 edible crops for controlling *Meloidogyne incognita* was evaluated under laboratory and green house conditions. Plant extracts were applied to the soil of potted 5 days old cowpea seedling at 5 days after inoculation with 3000 nematode eggs. One month after treatment, extracts of all plant species, *Ocimum sanctum*, *Ocimum canum*, *Ocimum basillicum*, *Mentha cordifolia*, *Cymbopogon citrates*, *Cymbopogon nardus*, *Alpinia galanga*, *Zingiber officinale* and *Capsicum annum* var. acuminatum could not reduce the root galling of cowpea. However, less root galling was noted in *Ocimum canum*, *Capsicum annum* and *Cymbopogon citrates* treated pots. Extracts of *Ocimum canum* and *Capsicum annum* reduced root infection. Slight decrease in root infection was also observed in treatments with *Ocimum basillicum*, *Alpinia galanga*, *Zingiber officinale*, *Cymbopogon citrates* and *Mentha cordifolia* extracts. *Cymbopogon citrates* extracts reduced egg hatching by about 79.2-98.1%

Sharma (1996) used leaf extracts of *Urtica dioica*, *Ficus dioica*, *Cannabis sativa*, *Ricinus communis*, *Datura Stramonium* and *Lantana camara* at 2, 4 and 6% were tested for their nematicidal action against *Meloidogyne incognita* under in vitro conditions. The water phase experiment showed that a knock down/stunning effect (within 1h exposure) was prevalent over mortality in all the treatments. Within 96 h of exposure, except for *Datura stramonium* and *Cannabis sativa*, there was complete (100%) revival of the nematode population at the 2% dose of all the treatments. *Datura stramonium* was the most effective.
followed by *Cannabis sativa* and *Ficus diocia* in causing a knock down effect/mortality. The soil phase experiment also showed the superiority of *Datura stramonium* and *Cannabis sativa* in reducing the root gall index.

Chandravadana *et al.* (1996) studied twenty-one extracts obtained from 12 plants were screened for nematicidal activity against *Meloidogyne incognita*. The menthol extracts of *Catharanthus roseus* roots and defatted onion seeds, and the essential oil of *Pelargonium graveolens* showed significantly high activity. The methanol extracts of *Gloriosa superba* seeds also showed moderate activity. The chemical nature of the active fractions and their possible use in agriculture are discussed.

Hussaini *et al.* (1996) reported that the effect of water soluble leaf extracts (2g leaves in 5ml water used as stock solution for 1:2-1:8 dilutions) of *Adhatoda vasica, Ageratum conyzoides, Argemone mexicana, Calotropis procera, Catharanthus roseus, Eucalyptus globules, Euphorbia pilulifera, Leucas aspera, Ocimum americanum, Synedrella nodiflora* and *Tagetes erecta* on J2 and egg masses of *Meloidogyne incognita, Meloidogyne javanica* and *Meloidogyne arenaria* was studied. *Tagetes erecta* and *Eucalyptus globules* at all dilutions were very effective in inhibiting egg hatch of the 3 species. *Argemone maxicana* and *Ocimum americanum* were effective against *Meloidogyne javanica* and *Meloidogyne arenaria* and *Ageratum conyzoides, Leucas aspera, Synedrella nodiflora* and *Catharanthus roseus* were effective against *Meloidogyne arenaria* egg masses. Total larval mortality of all species was observed in *Euphorbia pilulifera* extract without any signs of revival on transfer to fresh water for 48 h. *Adhatoda vasica* and *Tagetes erecta* were effective against *Meloidogyne javanica* at 1:2 and 1:4 dilution; and *Calotropis procera* and *Catharanthus roseus* against
Meloidogyne incognita and Meloidogyne arenaria larvae respectively at 1:2 dilution.

Ramakrishnan and Mohandas (1996) reported that all the extracts of Cassava cultivars (M4, H165, and H97) tested, showed high nematicidal action against Meloidogyne incognita in vitro. Rind extract was found to be the most effective plant part tested and H97 was most effective cultivar. As the concentration of extracts and exposure time increased, mortality rate also increased.

Nahar et al. (1996) an investigation was carried out in 3 consecutive year to test the effectiveness of Tagetes sp., poultry manure, pigeon manure, poultry + pigeon manure and mustard oil cake for the management of Meloidogyne incognita on tomato. Amendment of soil with all the organic amendments caused reduction of root-knot severity and improved growth of tomato plants. Mixed application of poultry and pigeon manures gave the best results followed by poultry manure, mustard oil cake, pigeon manure and Tagetes sp.

Al-Sayed et al. (1996) found that three different concentrations of aqueous extracts of 12 medicinal plants were evaluated for their toxicity to juveniles of Meloidogyne incognita. All the extracts had a nematicidal effect against the nematode, which increased by increasing the concentration level and exposure time. Although a mortality rate of 75.3-100% was obtained with most of the extracts, the S/4 concentration of Hyescyamus muticus and Ocimum basilicum had no effect on nematode mortality.
Tabil and Walia (1996) reported that an infectivity of J₂ of Meloidogyne incognita exposed to S (40%w/v) and S/2 concentrations of shoot extracts of Chenopodium album and Chenopodium murale was reduced considerably on tomato roots. Reduction in the number of galls occurred in plants inoculated with J₂ exposed for another 24h in these two concentrations. Prolong exposure of J₂ for another 24h further decreased the number of galls. Soil amendment with powdered shoot of Chenopodium album delayed the invasion of J₂ on tomato roots. Further development up to adult female was not affected by the treatment. However, J₂ of the next generation were recorded in the amendment soil by the 60th day following inoculation, whereas in the unamended soil these were observed after 45 days only.

Walker and Melin (1996) studied that six peppermint (Mentha piperita) and 6 spearmint (Mentha spicata) PI accessions were inoculated with Meloidogyne incognita race 3 and Meloidogyne arenaria race 2 under green house conditions. No galls formed on roots of any of the plants inoculated with 1800 egg/pot. Fewer than two galls per root system formed on three PI accession developed galls inoculated with Meloidogyne arenaria. Whereas none of the spearmint accession was susceptible to this species. Plant dry weights generally were unaffected by infection with root knot-nematodes at these densities. Growing peppermint and spearmint accessions for 8 or 12 weeks in Meloidogyne arenaria infested soil before tomato resulted in 90% reduction of root galls at 50 and 250 mg oil/kg soil. Geraniol, eugenol, linalool and peppermint oils reduced the number of galls caused by Meloidogyne arenaria but decrease in galling caused by Meloidogyne incognita was not significant. Geraniol, linalool and peppermint oil at 1000 and 1500mg were phytotoxic to tomato.
Haseeb and Butool (1996) studied the effect of standard extracts of roots and shoots of 7 species of the family Solanaceae on the mortality and larval hatching of *Meloidogyne incognita* were determined in laboratory experiments. In general, ‘S’ concentration of water extracts of shoots of all the test plants exhibited 100% mortality of the nematode with less effect of root extracts. Larval hatching and nematode mortality were strongly influenced by the concentration of extract, plant species and the duration of exposure.

Abd-Aziz *et al.* (1996) reported that coarsely powdered, dry jojoba (*Simmondsia chinensis*) leaves were extracted in a Soxhlet apparatus with either distilled water or 95% ethanol at 60 day C for 18 h continuously. The crude extract was evaluated for antimicrobial and antinematodal properties by means of *in vitro* tests and electron microscopy. An *in vitro* experiment was also conducted to test the nematicidal effects of the leaf extract on *Meloidogyne incognita* larvae. *In vivo* experiment was conducted on 4-week-old tomato seedling inoculated with 200 *Meloidogyne incognita* larvae. The seedlings were treated with leaf extracts at 0 (control), 10, 20, and 30% concentrations. The number and size of galls on the roots were evaluated to determine effectiveness of the extracts. There was a significant reduction in number and size of galls in treated seedling compared with control, but there were no significant difference between the treatment concentrations.

Onifade and Fawole (1996) studied the efficacy of extracts of some selected plants for the control of *Meloidogyne incognita* and on the growth and yield of Brown cowpea, was evaluated both *in vitro* and under green house conditions. All extracts inhibited nematode hatching and larval survival with percentage inhibition varying from one extract to another. Extracts from
Anarcadium occidentale and Gmelina arborea, were respectively the most and the least nematicidal. Blended extracts with the exception of Gmelina extracts were more effective than the boiled ones. The extracts were not phytotoxic to cowpea rather they induced increase growth vigour and yield by suppressing the populations of Meloidogyne incognita both in the soil as well as in infected cowpea roots. As in in vitro tests the highest and the lowest reductions in nematode numbers were associated with cashew and Gmelina extracts respectively in the green house. Compared to the inoculated control the extracts caused marked reduction in the number of nodules in treated plants.

Tabil and Walia reported that Chenopodium album and Chenopodium murale were studied for their nematicidal potential against concentration (S) of aqueous extracts of shoot of both the species as compared to control (sterile distilled water). The inhibition of hatching decrease with increase in dilution. The juveniles exposed to S or 0.55 concentration of shoot extract of Chenopodium album for 24 h showed 100% mortality, which was irreversible in water. Similar results were obtained with Chenopodium murale extract after 72 h of exposure. However, 40-80% juveniles exposed to Chenopodium murale extract could recover upon transfer to water. Chenopodium album immobilized the juveniles more (55%) as compared to Chenopodium murale (48.6%). The root extracts were not as effective as shoot extracts in immobilizing the juveniles.

D’Addabbo and Sasanelli studied the nematicidal effect of 0.5, 1, 2 and 5% w/w exhausted olive pomace soil amendment after 2, 4 and 8 weeks of decomposition in the soil, was tested on Meloidogyne incognita in vitro and in the glass house. Juvenile emergence was reduced by 30% in leachates from soil
amended with 5% olive pomace, with no difference among various degradation periods. Reproduction of *Meloidogyne incognita* is highest in pomace rate.

Gowda and Gowda (1997) reported that *in vitro* studies were conducted for testing nematicidal properties of neem (*Azadirachta indica*), honge (*Pongamia glabra, Pongamia pinnatae*) and castor (*Ricinus communis*) oil cakes against *Meloidogyne incognita*. The study revealed that all the oil cake extracts killed the larvae significantly at different periods of incubation and dilutions. The neem cake extract was found more effective in killing *Meloidogyne incognita* J2 followed by the honge and castor cake extracts.

Haque *et al.* (1997) studied the soil amendment with *Calotropis procera* leaves at 0.5 and 1.0% w/w significantly reduced the infection of *Meloidogyne incognita* on mung bean (*Vigna radiata*). *Calotropis procera* used at 2% (w/w) was phytotoxic. Combined used of *Paecilomyces lilacinus, Verticillium chlamydosporium* and *Bradyrhizobium* sp. reduced nematode gall formation with a significant increase in plant height. *Calotropis* leaf powder at low dosage (0.5%) increased root nodulation.

Verma *et al.*(1997) reported that application of decomposed composts of neem *Azadirachta indica*, subabul, mustard and water hyacinth, *Eichhornia crassipes* at 25g/ha to nematode damage. However carbofuran at 2.0 kg a.i/ha was more effective then the composts.

Rakesh (1997) studied organic soil application in the form of neem (*Azadirachta indica*) oil, seed cake and dried leaf powder in combination with *Adhatoda vasica, Mentha arvensis* or *Murraya koenigii* extracts caused a significant reduction in the population of *Meloidogyne incognita* on *Hyoscyamus niger* in pot experiments. The most effective application for reducing nematode
population and increasing plant growth was neem cake in conjunction with *Murraya koenigii*. This was followed by neem cake and *Adhatoda vasica* and neem cake and *Mentha arvensis* combinations. These different treatments also inhibited root galling where as higher doses of neem cake alone showed some phytotoxic effect on the growth of the host plant.

Alagumalaj *et al.* (1997) used water extracts of 25g, 50g and 100g leaves of *Origanum vulgare* and tested against *Meloidogyne incognita* around chickpeas. The inverse relationship of extracts of *Origanum vulgare* with the population dynamics of *Meloidogyne incognita* was noticeable.

Deka and Phukan (1997) reported that Castor bean, mustard, neem oil cakes each at 125 g per furrow and 15g per spot application were found to be effective for the management of *Meloidogyne incognita* on tomato and increasing the plant growth. Spot application of castor and mustard cakes was found superior over the furrow application in respect to plant height and yield of tomato.

Rao *et al.* (1997) studied the combination of the use of 5 or 10% aqueous extract of neem cake (*Azadirachta indica*) for seed treatment and soil drenching under field conditions was found as effective as an application of carbofuran at 2kg a.i/ha or neem cake at 2 tonne/ha for the management of *Meloidogyne incognita* on okra.

Poornima and Vadivelu (1997) reported that higher concentrations of organic oil of karanj (*Pongamia pinnata*), neem (*Azadirachta indica*), mahua (*Madhuca longifolia*) and castor (*Ricinus communis*) proved effective in preventing larval penetration and gall production in the roots of tomato infected by *Meloidogyne incognita*. Cakes of these plants also gave significant reduction in
nematode gall numbers. Treatment with oil was effective than soil treatment with cakes in controlling root-knot nematode infection.

Charu and Trivedi (1997) used leaf powders of locally available plants as organic amendments at 1, 2 and 4g doses, 15 days prior to sowing of chickpea. Ten days old seedlings were inoculated with 1000 freshly hatched nematode juveniles and examined after 60 days. The average root and shoot length, dry and fresh weight tended to increase in amended soil. Soil amended with *Calotropis procera* showed the highest increase followed by *Azadirachta indica*, *Lawsonia inermis*, *Ocimum santum* and *Parthenium hysterophorus*. These amendments showed a marked decline in number of root galls, eggs per egg mass and final nematode populations indicating a reduction in severity of disease. The greatest decline was observed in *Calotropis procera* and least was observed in *Jatropha curcas* and *Eichhornia crassipes*.

D'Addabbo *et al.* (1997) studied that when ground olive leaves, fresh and exhausted pomace, raw sewage and a commercial olive based product (Eufert) were incorporated at the rate of 1, 2, 4 and 8% w/w into a sandy soil naturally infested with *Meloidogyne incognita* (32 eggs and juveniles/g soil) in clay pots and planted with 6 week old seedlings of tomato cv. Rutgers. Ground olive leaves and fresh and exhausted olive pomace reduced significantly gall index and nematode reproduction but were highly phytotoxic. Raw sewage enhanced plant growth and Eufert produced moderate effect on the root gall index.

Suresh *et al.* (1997) reported that the experiments were conducted to assess the effects of 25-100% aqueous extracts of fresh leaves of *Parthenium hysterophorus*, *Calotropis gigantea* and *Jatropha curcas* on *Meloidogyne incognita* exposed for 24-72 h. Results indicated that all concentration of
*Calotropis gigantea* inhibited hatching and gave 100% larval mortality at all exposure times, except for the 25% concentration at 24 h. *Parthenium hysterophorus* and *Jatropa curcas* gave 100% mortality and inhibited hatching at 75-100% concentrations at all exposure times but only achieved this at the longer exposure times for lower concentrations. Nematodes failed to penetrate and develop (assessed by gall formation and egg mass production) in chilli (*Capsicum*) plants treated with 50-100%. *Calotropis gigantea* extracts and development was poor at 25%. Development was also inhibited by 75-100% *Parthenium hysterophorus* and *Jatropha curcas* extracts.

Mishra and Pramila (1997) studied in pot experiments the application of sawdust and oil cakes of mustard, *Azadirachta indica, Linum usitatissimum, Madhuca longifolia* and *Ricinus communis* increased growth of soyabean and reduced nematode damage.

Ramakrishnan *et al.* (1997) reported that in greenhouse tests maximum shoot length, fresh and dry shoot weight, root length, fresh and dry root weight and pod yield of okra cv. Pusa sawani, were recorded with the addition of neem (*Azadirachta indica*) cake at 13.5 g/pot, followed by mustard cake at 13.5 g/pot. Maximum reduction in number of *Meloidogyne incognita* females, number of egg per egg mass and soil nematode population were also recorded in soil amended with neem.

Siddiqui and Alam *et al.* (1997) studied using chopped leaves, the greatest reduction in root-knot index was achieved with *Aloe barbadensis* followed by *Madhuca indica, Muchuca longifolia* and *Ruellia tuberosa* with chopped flowers. The greatest reduction was seen with *Ruellia tuberosa* followed by *Amaranthus spinosus* and *Zinnia elegans*.
Ramakrishnan et al. (1997) reported that a study under glass house conditions showed that *Melia azedarach* (80 g/pot) recorded maximum shoot length; fresh shoot weight and pod yield of okra, infected with *Meloidogyne incognita*. The highest reduction in root-knot index and nematode population resulted with maximum dry shoot weight.

Poornima and Vadivelu (1997) used higher concentrations of organic oils of karanj (*Pongamia pinnata*), neem (*Azadirachta indica*), mahua (*Madhuca longifolia*) and castor (*Ricinus communis*) proved effective in preventing larval penetration and gall production in the roots of tomato infected by *Meloidogyne incognita*. Cakes of these plants also gave significant reduction in nematode gall numbers. Treatment with oil was relatively more effective than soil treatment with cakes in controlling root-knot nematode infection.

Charu and Trivedi (1997) used the leaf powders of locally available plants as organic amendments at 1 g, 2 g, and 4 g doses, 15 days prior to sowing of chickpea. Ten-day-old seedlings were inoculated with 1000 freshly hatched nematode juveniles and examined after 60 days. The average root and shoot length, dry and fresh weight tended to increase in amended soil. Soil amended with *Calotropis procera* showed the highest increase followed by *Azadirachta indica*, *Lawsonia inermis*, *Ocimum sanctum* and *Parthenium hysterophorus*. These amendments showed a marked decline in number of root galls, eggs per egg mass and final nematode populations indicating a reduction in severity of disease. The greatest decline was observed in *Calotropis procera* and the least was observed in *Jatropha curcas* and *Eichhornia crassipes*. 
Addabbo and Sasanelli (1997) studied that organic amendments have been shown to exert a suppressive activity on populations of soil inhibiting plant parasitic nematodes. The mechanisms of action of the organic substances are discussed. The suppressive effect of exhausted olive residues, alone or as a component of a complex amendment, on *Meloidogyne incognita* on tomato and *Heterodera carotae* on carrot was investigated in 3 experiments in the greenhouse. Residues of olive alone reduced the reproduction rate of *Meloidogyne incognita* at all the doses tested (5-50g/kg soil), with the maximum suppressive effect at the highest amendment rate. The suppressive action was expressed only after a 4-week degradation period of the residues in the soil. The residue based complex amendment suppressed multiplication of *Meloidogyne incognita* on tomato roots after a 4 week degradation period even at the lowest incorporation rate (15g/kg soil) with no significant difference between the doses tested (5-60g/kg soil). The reproduction rate of *Heterodera carotae* was reduced only by high degradation periods (2, 4 and 8 weeks). The use of organic amendments in the control of plant parasitic nematodes is discussed.

Mareggiani *et al.* (1997) reported an acetonic extracts of *Acacia longifolia*, *Mentha* sp. *Ruta chalenpensis*, *Schinus molle*, *Urtica urens*, *Tagetes patula*, *Melia azedarach* and *Coriandrum sativum* were tested against *Meloidogyne incognita*, comparing their effect with a nematicide and a control. While *Mentha* sp. and *Schinus molle* were not nematicidal, there were significant differences between the control and the 7 remaining extracts. The most effective were *Melia azedarach* (green fruits) *Acacia longifolia* and *Tagetes patula*. 

43
Tabil and Walia (1997) reported that in greenhouse trials, *Chenopodium album* and *Chenopodium murale* were used as dried shoot powders at 2-8 g/kg for amending nursery soil infested with or without *Meloidogyne incognita*. The germination of tomato cv. HS-101 seed was not affected in amended nursery soil. There was a marked increase in fresh weight and seedlings length over the unamended control, which was directly related to the amount of organic matter added. A significant decrease in the number of nematode galls was also recorded on roots in amended soil. The effect was more at the higher doses.

Nogueira et al (1997) used the plant extracts obtained from *Mucuna deeringiana* and *Chenopodium ambrosioides* showed nematicidal activity against *Meloidogyne incognita*. The ethanol/water extract showed the most activity in almost all cases.

Khurma and Archana et al.(1997) reported the seed extracts of *Acacia eburnea, Azadirachta indica, Cassia sp., Parkinsonia aculeate, Sesbania sesban* and *Poinciana regia, Delonix regia* had the highest nematicidal potential against *Meloidogyne incognita* juveniles while maximum potential against *Meloidogyne javanica* was shown by *Acacia eburnea, Casia sp., Melia azedarach, Sesbania sesban* and *Tribulus terrestris* as indicated by strong activity in all concentration. Similarly, *Calotropis procera* and *Sesbania sesban* were the best in preventing egg hatch of *Meloidogyne incognita* and *Calotropis procera*, *Sesbania sesban* and *Chenopodium album* were the most effective against hatch of *Meloidogyne javanica* eggs. *Sesbania sesban* was outstanding in killing juveniles and preventing hatching of both the species.
Khanna (1997) used finely crushed fresh leaves of some wild plants including *Cannabis sativa*, *Ficus dioica*, *Melia azedarach*, *Azadirachta indica* and *Urtica dioica* were mixed in potted soil having tomato transplants inoculated with *Meloidogyne incognita*. Though all the test plant species checked the nematode multiplication the plants treated with *Ficus dioica* and *Urtica dioica* were more vigorous as compared to those treated with *Cannabis sativa*. However plants with *Azadirachta indica* exhibited poor growth when compared with the uninoculated untreated control.

Sosamana et al. (1998) reported that studies were conducted to evaluate the nematicidal properties of water extracts obtained from some commonly available plant leaves against 2nd stage juveniles of *Meloidogyne incognita*. Of the sixteen plants, tested 100% mortality was observed with *Moringa pterygosperma*, *Moringa oleifera* and *Momordica charantia* at 1:5 dilution after 24 hours whereas with *Leucas aspera* 100% mortality was observed only after 48 hours. Hundred per cent mortality of juveniles was observed with *Moringa oleifera* after 72 hours at the 1:10 dilution.

Reshmi and Vijayalakshmi (1998) studied the number of *Meloidogyne incognita* juveniles hatching and penetrating chickpea in petri dish experiments, was adversely affected by the neem seed kernal and seed coat treatments. Achook, Neemark and Nimbecidine neem formulations were also effective but to a lesser degree.

Walker et al (1998) reported that twenty *Sesame indicum* and 4 *Sesame radiatum* accessions in the USDA plant introduction collection were evaluated for reaction to *Meloidogyne incognita* race 3 at two initial egg densities under greenhouse conditions. All *Sesame* accessions produced considerably fewer root galls
than the tomato cv. Rutger. Gall numbers varied slightly among accessions at the higher infestations density with even less variation at lower density. Egg mass indices indicated little reproduction. Seventy percent of the accessions weighed less at the higher egg density than at the lower egg density. All the Sesame accessions tested are resistant to *Meloidogyne incognita* and have the potential for use as rotational crops for suppressing this nematode.

Naik *et al.* (1998) used the extracts of neem *Azadirachta indica* products had no adverse effect on the growth of tomato plants, but significantly decreased the nematode development and reproduction. In general maximum reproduction in galls, egg masses and egg production was recorded in reproduction. In general, maximum reduction in galls egg production was recorded in Nimbeccidine treatmented plants compared with seed kernal and oil cake extracts.

Bomali and Aparajita (1998) reported sawdust, poultry manure, mustard cake and neem cake, *Azadirachta indica*, each at 3 doses (0.5, 1.0 and 1.5% w/w) were found to be effective for the management of *Meloidogyne incognita* on green gram (*Vigna radiata*) and black gram (*Vigna mungo*) under green house conditions. The highest dosage level was found to be the most effective. Poultry manure and neem cake were found to be most effective in reducing galls, egg masses and increasing yield of both green gram and black gram.

Yen *et al.* (1998) used the *Tagetes erecta*, *Tagetes patula* and *Gaillardia picta* cultivars were highly resistant to *Meloidogyne incognita*. The effect of their aqueous and dry powder plant extracts on egg hatching and J₂ mortality of *Meloidogyne incognita* showed a reduction in nematode hatching rate
and J₂ mortality. Intercropping of these antagonistic plants with tomatoes effectively controlled plant nematode diseases in the green house.

Reshmi and Vijayalakshmi (1998) reported that the standard aqueous extracts of 5 neem (Azadirachta indica) based pesticidal formulations (neem seed kernel, neem seed coat, achook, neemark and nimbecidine) were investigated for their toxicity against J₂ of Meloidogyne incognita. All the neem products were toxic with mortality being directly correlated with the concentration of the extracts and the period of exposure, neem seed kernel was the most effective at all concentrations and exposures, and achook was the most effective amongst the commercially available neem pesticides tested.

Verma and Ali (1998) used the organic amendments (250g/m² of oilseed cakes of Madhuca longifolia, neem (Azadirachta indica) and mustard and chopped leaves of Ricinus communis, Calotropis procera, Leucaena leucocephala or Melia azedarach (at 500, 1000 or 1500 g/m²) were incorporated into soil infected with Meloidogyne incognita in Faizabad, India. Soil amendments increased sprout emergence of pointed gourd (Trichosanthes dioica) grown in the infected soil. Of the oil seed cakes investigated neem cake resulted in the highest sprouting and Mudhuca longifolia resulted in the lowest. Chopped leaves decreased infection by Meloidogyne incognita and increased sprouting.

Youdssef and Ali (1998) studied that three species of blue green algae; Anabaena oryzae, Nostoc calcicola and Spirulina sp. were tested against Meloidogyne incognita infecting cowpea cv. Baladi. In single treatments Nostoc calcicola was superior than the other algae treatments in reducing the number of nematode galls and egg masses as compared to the untreated check. In combined treatments, the 3 algae together achieve the highest significant reduction in the
number of galls and egg masses. All the treatments significantly improved plant
growth criteria as measured by fresh and dry weight of shoots and roots and length
of shoots and increased the number of nodules.

Verma and Ali (1998) reported that the pointed gourd (Trichosanthes
dioica) when grown along with 7 marigold varieties, had the lowest gall formation
and egg mass development of Meloidogyne incognita in roots in field trials
conducted in Haliyapur, U.P., India. The highest toxic effect on gall formation
was exhibited by marigold variety saffron spice and the lowest with Yellow Gate.
The lowest reproduction factor (1.02) of Meloidogyne incognita was observed
with saffron spice and the maximum was found in var. FM-561 (1.31) and Yellow
Gate (1.31).

Mani and Al-Hinai (1998) used the aqueous extracts of leaf, root and
rhizosphere soil of harmal, Rhazya stricta, were tested against Meloidogyne
incognita and Pratylenchus jordanensis under controlled conditions. Leaf extract
exhibited ovistatic effect at 12.5 and 25% and ovicidal effect at 50-100%
concentrations against Meloidogyne incognita. Sixty two per cent reduction in egg
hatch was recorded at 100% concentration of leaf extract. Leaf and root extracts
exhibited higher rate of toxicity against second stage juveniles of Meloidogyne
incognita and all stages of Pratylenchus jordanensis than soil extract. The rate of
nematode mortality increased markedly with increased in concentration of leaf
and root extracts from 50 to 100%. Application of chopped leaves of harmal at
2.75 t/ha to an alfalfa field reduced the populations of Pratylenchus jordanensis in
soil and roots.

Kim-Hyeong Hwan et al (1998) reported the nematicidal potential of
some plant extracts, was evaluated for the control of the northern root-knot
nematode, *Meloidogyne hapla* on tomatoes in pots. Extracts of *Tagetes patula*, *Zoysia japonica*, *Rhus sylvestris*, *Rhus chinensis* and *Allium cepa* were tested. Leaf or root extracts were prepared and applied undiluted or diluted to 2, 4, 8 or 16 times with distilled water. Preplanting treatments of extracts were more effective than simultaneous or post planting treatments, and the number of egg masses varied with concentration of plant extract. *Meloidogyne hapla* was less infective when *Tagets patula* was applied 15 days before tomato planting. Leaf or root extracts, of *Tagetes patula* reduced damage by *Meloidogyne hapla* significantly in all treatments. Leaf extract was more effective than root extract the number of egg masses was 2.2 and 5.5 respectively for 5 days pre planting treatment of leaf or root extracts where as 129.4 egg masses were recorded for the control with *Zoysia japonica* the number of egg masses was 87.2 for the control, 21 for the undiluted concentration of leaf extract and 28.4 for a 2 fold dilution. Leaf extracts of *Rhus sylvestris*, *Rhus chinensis* and *Allium cepa* were also very effective against *Meloidogyne hapla*. The number of egg masses following 5-day pre planting treatments of *Rhus sylvestris*, *Rhus chinensis* and *Allium cepa* were 1.6, 1.6 and 6.2 respectively, while it was 193.6 for the control.

Akhtar (1998) studied the various products prepared from neem (*Azadirachta indica*) such as leaf powder, sawdust and oilseed cake and urea were tested for their activities against plant parasitic nematodes (*Hoplolaimus indicus*, *Helicotylenchus indicus*, *Rotylenchulus reniformis* and *Meloidogyne incognita* juveniles), a predatory free living nematode (*Dorylaimus elongates*), nematodes on the growth of chickpea (*Cicer arietinum*) in the field. Soil amendments with these materials resulted in a significant decrease of plant parasitic nematodes as compared to control plots. In contrast, population of predatory and free-living
nematodes increased. Oil cake was most effective, though all the neem products and urea markedly suppressed plant parasitic nematodes. However, leaf powder increased populations of predatory and free living nematodes. All treatments resulted in increased fresh and dry weight and the height and number of pods on chickpea plants.

Vijayalakshmi and Reshmi (1991) reported that the seed treatment of chickpea with neem seed kernel, neem seed coat and the neem extracts Achook, Neemark and Nimbecine at 4 dosages (5-20% w/w) was effective in reducing penetration of second stage juveniles of *Meloidogyne incognita* and nematode multiplication in pot experiments. In general, neem seed kernel, neem seed coat and Achook were effective than Neemark and Nimbecine. Achook at 20% w/w showed maximum efficacy in reducing penetration, while neem seed kernel 20% w/w was the most effective in respect of increasing plant growth and reducing nematode infestation.

Ramakrishan *et al.* (1999) used the leaf extracts of *Azadirachta indica*, *Melia azedarach*, *Calotropis procera*, *Cantharanthus roseus*, *Parthenium hysterophorus* and *Solanum elaeagnifolium* were applied to root-knot nematode larval suspensions containing 20 freshly hatched second stage juveniles. Observations on larval mortality were recorded every 12 hours. All plant extracts showed nematicidal properties. *Azadirachta indica* extracts resulted in the highest mortality (77.2%) followed by *Melia azedarach* (73.3%). Mortalities increased with increasing concentrations of leaf extracts and exposure time.

Joymati *et al.* (1999) tested the effect of aqueous extracts of different parts of *Momordica dioica* (Local name: Lam-Karot) on egg hatching and larval mortality of *Meloidogyne incognita* a major root knot pathogen of several crops.
was examined. Seed extract had the greatest nematicidal activity followed by leaf and stem extracts. Egg hatch was inversely proportional to the exposure time. Mortality rate increased with increasing concentration of the extracts. Invasion of larvae into the root of pea plants also decreased with an increase in concentration of the extracts.

Mc Bride et al. (1999) reported that the incorporation of a rye (Secale cereale) cover crop into the soil prior to planting cotton (Gossypium hirsutum) has been shown to restrict damage caused by Meloidogyne incognita. A greenhouse study was conducted to determine the duration of the effectiveness of rye decomposition in controlling root-knot nematode damage in relation to the time between rye incorporation and cotton planting. Fresh, chopped rye foliage was mixed into pots of soil and root-knot nematode eggs were added to the rye + soil mixture or a non amended soil at 0, 1, 3, 5, 7, 9, 11, 13, 15, 17, 19 and 21 days following rye incorporation. This resulted in a sequence of pots containing nematode eggs exposed to rye at different stages of decomposition. Cotton plants were transplanted into the pots after the addition of nematode eggs and assessed for damage after 28 days of exposure. Although the effectiveness of the rye treatment declined over the 21 days of the incubation, the root-knot nematode populations were significantly reduced by the rye treatment for all planting dates. This suggests that it is not necessary to plant cotton immediately after ploughing in a rye cover crop, thereby providing some flexibility in the cotton planting date, minimizing any associated phytotoxicity to the young cotton plants.

Vijayalakshmi (1999) tested the effect of treatment of chickpea (Cicer arietinum) seed with 20% w/w powdered neem (Azadirachta indica) formulations viz. seed kernel, seed coat, de-oiled cake and Achook, and 5% v/w liquid
formulations viz. Neemark and Nimbedicine on the nematode population growth and grain yield was studied in two field trails in Delhi, India. At the time of harvest, there was a significant reduction in the populations of *Meloidogyne incognita*, *Rotylenchulus reniformis*, *Tylenchorhynchus mashhoodi*, *Helicotylenchus indicus* and *Hoplolaimus indicus* in all the treatments while the saprophytic nematodes multiplied freely in both the trials. All the treatments increased the grain yield significantly. There was a 55-59% reduction in the total populations of plant parasitic nematodes in neem seed kernel with an increase of 126-132% in the gram yield in respective years. Neem cake also reduced the total population of these nematodes to 50% in the trials with increase in the grain yield by 118-120%. Among the commercial formulations Achook caused 40-45% reduction in the total plant parasitic nematode population and 56-70% increase in the grain yield.

Ploeg (1999) studied the effects of preplanted marigold on tomato root galling and multiplication of *Meloidogyne incognita*, *Meloidogyne javanica*, *Meloidogyne arenaria* and *Meloidogyne hapla*, were studied in green house tests. Marigold cultivars of *Tagetes patula*, *Tagetes erecta*, *Tagetes signata* and a *Tagetes* hybrid, all reduced galling and numbers of second stage juveniles in subsequent tomato compared to the tomato-tomato control. All 4 *Meloidogyne spp.* reproduced on *Tagetes signata* cv. Tangerine Gem. Several cultivars of *Tagetes patula* and *Tagetes erecta* suppressed galling and reproduction of *Meloidogyne spp.* on the tomato to levels lower than or comparable to a fallow control. Phytotoxic effects of marigold on tomato were not observed.

Latif *et al.* (1999) used the neem cake and latex of aak (*Calotropis procera*), did not effect germination of cowpea, whereas neem oil delayed and
suppressed it in pot experiments. Neem cake, neem oil and *Calotropis procera* extract effectively reduced root penetration by *Meloidogyne incognita* juveniles, the cake being more effective. *In vivo* application of these extracts to cowpea plants enhanced plant growth variables, reduced root weight and decreased number of galls per plant. The maximum effect was recorded by neem cake followed by neem oil and *Calotropis procera*.

Vijayalakshmi and Rajagopal (1999) reported that the seed treatments with neem based laboratory formulations of neem seed kernel, neem seed coat (seed shell) and neem seed cake at 20% w/w reduced root-knot and reniform (*Meloidogyne incognita* and *Rotylenchulus reniformis*) nematodes multiplication in two important pulse crops, mung bean and chickpea in green house trails. All these treatments reduced major phytonematode species in the field viz. *Meloidogyne incognita*, *Rotylenchulus reniformis*, *Tylenchorhynchus mashhoodi*, *Helicotylenchus indicus* and *Hoplolaimus indicus* in both the crops in trails in 4 sq.m microplots. In either case neem seed kernel was the most effective followed by neem seed cake and neem seed coat (seed shell). There were 78, 67 and 52% reduction in total plant parasitic nematode populations in the mung bean crop and the increase in the grain yield was 74, 58 and 28% in neem seed kernal, neem seed cake and neem seed coat (seed shell) respectively. In the case of chickpea crop, the percentage reduction in the total plant parasitic nematode was 87, 70, and 25 and the increase in the grain yield was 122, 78, and 48 respectively in neem seed kernel, neem seed cake and neem seed coat (seed shell).

Kotova *et al.* (1999) reported that a review of the world literature is presented on the influence of nematicidal plants and preparation on plant parasitic nematodes. The authors own work is summarized which investigated the
efficiency of preparations of *Nasturtium officinale* (Watercress) and 26 other cultivated and wild plants from the middle zone of Russia against root-knot nematode (*Meloidogyne incognita*). The biological efficiency of the preparation from the sap of *Nasturtium officinale* and *Armoracia rusticana* (Horsera dish) against root-knot nematode under heavy infestation was about 40%.

Suhail Anver *et al.* (1999) reported that *Meloidogyne incognita* caused greater reduction in plant growth, chlorophyll content, water absorption capacity of roots and root nodulation of chickpea and pigeonpea and bulk density of pigeon pea stem, than *Rotylenchulus reniformis*. These nematodes inhibited each other in concomitant infections. However, both the nematodes together caused more damage to the test plants than was caused by either of them alone, but it was less than the sum total of the damage caused by them individually. Oil seed cakes of neem/ margosa (*Azadirachta indica*), castor (*Ricinus communis*), mustard (*Brassica campestris*), rocket-salad (*Eruca sativa*) were found to be highly effective in reducing the multiplication of nematodes. Consequently plant growth, the water absorption capacity of the roots, root nodulation and bulk density of woody stem of pigeon pea increased significantly. The test nematodes were found to be less damaging in the presence of *Paecilomyces lilacinus*. The multiplication rate of nematodes was less in the presence of *Paecilomyces lilacinus* as compared to the absence of *Paecilomyces lilacinus*. Damage caused by the nematodes was further reduced when *Paecilomyces lilacinus* was added along with oil cakes. The most effective combination of *Paecilomyces lilacinus* was with neem cake.

Suhail *et al.* (1999) studied an increase in the inoculums level of *Meloidogyne incognita* and *Rotylenchulus reniformis* resulted in a relative decrease in plant growth parameters of chickpea. Consequently water absorption
capability of roots was impaired. *Meloidogyne incognita* caused greater reduction than *Rotylenchulus reniformis* at the same inoculum levels. In concomitant inoculation of *Meloidogyne incognita* and *Rotylenchulus reniformis*, there was greater suppression was less than the sum of the suppression than the same levels of inoculations of the individual species. The multiplication rate of the nematodes decreased as the inoculum levels increased. The results also suggest competition for feeding sites between the two nematode species, the multiplication rate of one species progressively decreased with the increase in the inoculum levels of the other nematode.

Dibakar and Mishra (2000) reported that a pot experiment was conducted to evaluate the efficacy of seed coating with neem seed powder, Achook, Neemark, Neemgold, Field marshal and Nimbecidine (3.5 and 10%) along with 2% carbosulfan, against *Meloidogyne incognita*, *Heterodera cajani* and *Rotylenchulus reniformis* on pigeon pea cv. Prabhat. All treatments were effective in improving shoot and root lengths, fresh and dry root and shoot weight (except 3% nimbecidine and Fieldmarshal) and in reducing root-knot number (except 3% field Marshal and Achook) with 2% carbosulfan being most efficient followed by 10% neem seed powder. When the three nematode species were simultaneously inoculated, the population of *Meloidogyne incognita* was lowest while that of *Heterodera cajani* was highest irrespective of treatment.

Ranjana and Tabassum (2000) tested that the mortality of second stage larvae of *Meloidogyne incognita* after exposure to the aqueous extracts (1.00, 3.12, 6.25, 12.5, 25.0, 50.0 and 100.0%) of *Catharanthus roseus* (Leaf, flower, shoot and root), *Solanum nigrum* (Leaf, shoot and root), *Chenopodium album* (Leaf, shoot and root) and *Argemone maxicana* (leaf and root) for 24, 48 and 72 h
was studied. Extracts from leaves gave higher increase in mortality than extracts from other plant parts. For *Catharanthus roseus*, 100% mortality was obtained with 25, 50 and 100% leaf and flower extracts at 24–72 h exposure and 50 and 100% shoot and root extracts at 72 h exposure, its leaf extract at the lowest concentration gave a larval mortality of 95% for *Solanum nigrum*, 100% mortality was recorded for 50 and 100% leaf and shoot extracts at 24–72 h exposure, 12.5 and 25.0% leaf extract at 72 h exposure and 100% root extract at 48–72 h exposure. For *Chenopodium album*, 100% mortality was obtained with 100% leaf extract at 24–72 h exposure, 100% shoot extract at 72 h exposure as well as 25 and 50% leaf extracts at 72 h exposure. For *Argemone mexicana* similar efficacy was observed in 100% leaf extract at 24–72 h exposure 50% leaf extract at 72 h exposure, and 100% root extract at 72 h exposure.

Vijayalakshmi and Mishra (2000) reported that in a field experiment coating of cowpea seeds with neem seed kernel, neem seed cake, neem coat and Achook at 20% w/w was effective in reducing the population of plant parasitic nematodes (*Meloidogyne incognita, Tylenchulus mashoodi, Hoplolaimus indicus, Basiroilaimus indicus and Rotylenchulus reniformis*) and increasing grain yield significantly. These treatments did not show any adverse effect on the population of saprophytic nematodes. Neem seed kernel as seed coating was more effective than other treatments.

Joymati *et al.* (2000) studied the effect of aqueous extracts of leaves and flowers of *Phlogacanthus thrysiflorus*, were tested against second stage juvenile (*J₂*) of *Meloidogyne incognita in vitro*. Mortility increased with the increase of extract concentration and period of exposure. Flower extract was more
effective than leaf extracts. In pot cultures the trend was similar. Flower powder at 8g/kg soil was most effective in controlling this pest.

John and Hibsey (2000) tested that aqueous neem leaf extract, neem oil and marotti oil from (*Hydnocarpus laurifolia*, *Hydnocarpus pentandus* at different concentrations, were tested as bare root dip treatments for their efficacy in controlling root-knot nematode (*Meloidogyne incognita*) infestation in aubergine. Roots of plants dipped in neem leaf extract for 1h showed significantly better height and number of leaves compared to plants treated with neem and marotti oil. Among the different concentrations of neem leaf extract tested, 6.25 and 25% extracts proved more effective. Significant reduction in gall index was also seen in neem leaf extract treated plants. Higher concentrations of the extract (20 and 50%) significantly reduced the number of egg masses produced. But none of the phytochemicals had any adverse effect on the hatching of the egg masses. All the three phytochemicals, irrespective of the doses reduced population of the nematodes in the soil. An overall assessment of the result established the superiority of neem leaf extract (25%) among the different phytochemicals in checking nematode infestation.

Viyalakshami and Archana (2000) reported the effect of planting neem (*Azadirachta indica*) seedlings with chickpea cv. Pusa 204 in root knot nematode (*Meloidogyne incognita*) infested soil on infestation severity, was investigated in 2 trails. The presence of neem seedlings inhibited the penetration of second stage nematode juveniles (*J₂*) in chickpea roots and restricted root-knot incidence as indicated by the reduction in *J₂* numbers in the first trials and root knot nematode galls in the second.
Yamada et al. (2000) studied that the parasitism of *Meloidogyne incognita, Meloidogyne arenaria, Pratylenchus penetrans* and *Pratylenchus coffeae* was examined on five hybrid sorghum, four graminous plants, guinea grass (*Panicum maximum*), oat, sudangrass (*Sorghum sudanense*), Italian rye grass (*Lolium multiflorum*) and *Crotalaria*. Of all the strains and plants examined, the sorghum strain, SS701 named Tuchitaro was the most effective antagonistic green manure plant for the control of *Meloidogyne incognita* and *Meloidogyne arenaria* but not *Pratylenchus penetrans* and *Pratylenchus coffeae*.

Mennam et al. (2000) reported the effect of extracts of *Datura stramonium* L., *Xanthium strumarium* L., *Urtica urens* L., and *Allium sativum* L. on egg hatching and penetration of *Meloidogyne incognita* and development of tomato plants under laboratory conditions, were determined. All extracts inhibited egg hatching. Penetration of nematodes was suppressed by extracts applied at 10 ml and 20 ml per plant and development of tomato plants was increased. Only garlic extract was phytotoxic to tomato plants.

Nath and Mukherjee (2000) studied the nematicidal potential of aqueous extracts of tubers of medicinal yam, *Dioscorea floribunda* against *Meloidogyne incognita*, was evaluated *in vitro* and *in vivo*. Egg hatching was inhibited by 17.5 to 77.6% at 0.5 to 20% concentrations respectively. Concentrations of the aqueous extracts at 20, 10 and 5% killed 100% juveniles within 2.5, 3 and 4 hr, respectively. Soil amendment with chopped tuber significantly suppressed the root knot development and greatly improved plant growth of tomato as compared with the inoculated control. The plant material possesses strong nematicidal properties, which can be successfully used as per plant nursery treatments.
Ploeg (2000) reported that the effects of amending soil with either roots or tops of tomato or marigold on subsequent tomato growth and infestation by *Meloidogyne incognita* was determined in greenhouse pot experiments. Control consisted of non-amended soil and pre-cropping for 8 weeks with tomato or marigold previously infested with *Meloidogyne incognita*. Amending soil with marigold or tomato tops or roots increased the weight of tomato tops at high *Meloidogyne incognita* inoculum densities. Galling and nematode populations were high when tomato followed tomato, but very low when tomato followed marigold. Galling and final nematode population levels were reduced by all soil amendments but by much less than pre-cropping with marigold for 8 weeks. Although some reduction in nematode infestation can be achieved by amending soil with marigold plant parts, this reduction is not specific to marigold and is unlikely to be of practical use.

D’Addabbo et al. (2000) tested that the nematicidal effect of fresh, exhausted and composted olive pomace and fresh grape pomace at dosages of 10, 20 and 40 t/ha was tested on *Meloidogyne incognita* on cantaloupe in a sandy loam of southern Italy. All treatments caused a significant reduction of nematode population on plant roots and in the soil, but only the highest dosage of grape pomace increased yield.

Leela and Ramana (2000) reported that the nematicidal activity of the essential oil of all spice (*Pimenta dioica* L. Merr.) leaves and its major constituent eugenol was tested against *Meloidogyne incognita*. The essential oil and eugenol exhibited promising nematicidal activity at 660 micro g/ml.

Sabira et al. (2000) tested that the two new constituents, lantanoside (1) and Lantanone (2) and the known compounds linareside (3) and Camarinic acid
(4) were isolated from the aerial parts of *Lantana camara*. Compounds 1, 3 and 4 were tested for nematicidal activity against root-knot nematode, *Meloidogyne incognita* and showed 90, 85 and 100% mortality respectively, at 1.0% concentration. The results were comparable to those obtained with conventional nematicide Furadan or Carbofuran (100% mortality at 1.0% concentration). Structures of the new compounds were elucidated by spectroscopic and chemical techniques.

Vijayalakshmi (2000) reported that aqueous extracts of neem seed, neem cake and achook (Azadiractin at 1500 ppm) as root dip treatments (1.0, 2.5 and 5.0% w/v) were effective in reducing *Meloidogyne incognita* infestation in tomato cv. Pusa Ruby in greenhouse tests.

Umar and Jada (2000) tested that incorporating a mixture of *Parvilia biglobosa* seed extract and goat manure at 30 g/4.5 kg soil, inhibited the growth and development of *Meloidogyne incognita* in pot tests. Mixture of these amendments also supplied nutrients to the soil, which enhanced growth of tomato.

Pandhi and Gunanidhi (2000) reported that *in vitro* studies on hatching and mortality of second stage juveniles of *Meloidogyne incognita* indicated a reduction in hatching and an increase in nematode mortality in treatments with aqueous leaf extracts of seven plant species, *Murraya koenigii* (curry leaf), *Jasminum sambac* (jasmine), *Citrus aurantifolia* (sour orange), *Rauvolfia serpentine* (Patal garuda), *Zizyphus jujuba* (ber), *Hisbiscus rosa-sinensis* (China rose) and *Justicia gandurosa*. Incorporation of powdered leaves of the plants at 3% w/w in soil infested with *Meloidogyne incognita* 3 weeks before transplanting tomato (cv. Pusa Ruby) seedlings reduced nematode infection and increased plant growth in comparison with the control. Although the plant species *Gmelina*
arborea (Gambhar), Madhuca latifolia, Madhuca longifolia (Mahua) and Callistemon lanceolatus, Callistemon citrinus (bottle brush) also possessed nematicidal properties but they adversely affected the growth of tomato plants.

Vijayalakshmi and Mishra (2001) studied the seed coating of pigeon pea (cv. Pusa 85) with powdered neem products viz., seed kernel, seed coat, cake and Achook (R) at 20% w/w and liquid products viz. Neemark (R) and Nimbecidine (R) at 5% v/w significantly reduced pigeon pea cyst nematode (Heterodera cajani) infestation in a pot experiment. In a micro plot field trial (4sq.m plots) also, the same treatments reduced the soil populations of Heterodera cajani and other plant parasitic nematodes present in the field viz., Meloidogyne incognita, Rotylenchulus reniformis, Tylenchorhynchus mashhoodi, Helicotylenchus indicus and Hoplolaimus indicus without disturbing the saprophytic nematodes and increased grain yield. In both trials, neem seed kernel was the most effective while neem cake was either at par or was the next in efficacy. The reduction in phytoparasitic nematodes was 60, 52, 37, 48, 35, 31 per cent in seed kernel, cake, seed coat, Achook (R), Neemark (R) and Nimbecidine (R), respectively and the corresponding increase in the grain yield was 53, 46, 21, 28, 12, and 6 per cent in the field trial.

Muhammad et al. (2001) studied that Meloidogyne incognita eggs were exposed to root extracts of Melia azedarach Linn (Dharek), Azadirachta indica A. Jass (neem), Ricinus communis Linn. (Castor), Datura alba Linn. and Datura metal (datura). Standard root extracts of neem and dharek exhibited 100% inhibition of egg hatching and larval mortality. Egg inhibition and larval mortality decreased with an increase in the dilution of the extracts. Similarly with an increase in exposure time, juvenile mortality was also increased.
Patel and Patel (2001) reported that an investigation was carried out to
test the efficacy of sunn hemp (Crotalaria juncea), periwinkle (Catharanthus
roseus), and French marigold (Tagetes patula) as green manure in the
management of stunt (Tylenchorhynchus vulgaris), root-knot (Meloidogyne
incognita) and reniform (Rotylenchulus reniformis) nematodes in bedi tobacco
(Nicotiana tabacum) nursery. Sebufos (Rugby cadusafos, 5 kg/ha) and soil
solarization with clear LLDPE plastic of 25 micro m for 15 days during summer
were also tested singly as well as in combination with the plants along with
appropriate control. Bedi tobacco cv. Anand 119 was seeded (5kg/ha) in
experimental area. Pooled results for 3 years revealed that all treatments reduced
the nematode population over control. Root-knot disease was significantly
reduced until 63 DAS in the treatments of Sebufos alone and its combinations
with sunn hemp or French marigold and in green manuring of sunn hemp
followed by soil solarization. Economics worked out for two times green
manuring with sunn hemp (seeding in September and February) followed by soil
solarization gave an ICBR of 1:47 and the soil treatment increased transplants by
113% reduced root-knot disease nematode populations at sowing and weeds by
75, 91 and 65% respectively over control.

Kanta et al. (2001) tested that the methanolic leaf extracts and essential
oils of eight plants viz., Callistemon lanceolatus, Callistemon citrinusx,
Cymbopogon winterianus, Eucalyptus sp., Lantana camara, Nerium oleander,
Ocimum basilicum, Ocimum sanctum, Ocimum tenuiflorum and Vitex negundo
were tested in vitro against second stage juveniles of Meloidogyne incognita at
0.5, 0.1 and 0.02 per cent concentration. In plant extracts of Ocimum sanctum,
Cymbopogon winterianus, Eucalyptus sp., Ocimum basilicum and Vitex negundo
100% mortality was observed at 0.5 per cent concentration, where as at 0.1 percent concentration only Ocimum sanctum gave similar results. Essential oils of Ocimum sanctum resulted in 100 per cent mortality even at 0.02 per cent concentration while Ocimum basilicum also was very effective at the same concentration. It is speculated that nematicidal activity in these plants may be due to compounds like terpinen-4-ol in methanolic extracts and linalool in essential oils respectively.

Costa et al,(2001) reported that the influence of plant manure extracts on hatching, motility and mortality of second stage juveniles of Meloidogyne incognita was studied in vitro. Ethyle acetate, hexane, methanol and water were used as solvents to obtain the extracts all of which presented some toxic effect against Meloidogyne incognita, with values in the motility test close to those obtained for aldicarb (50ppm in water). Coffea arabica afforded even better results in the mortality test than aldicarb. For the hatching test, the most active extracts were obtained from Coffea arabica, Chenopodium ambrosioides, Ricinus communis and Ruta graveolens.

Ravindra et al, (2001) studied that the following treatments were evaluated for control of Meloidogyne incognita in an FCV tobacco nursery at Naville during 1991-93: neem cake, pongamia cake, pressmud (a by product of the sugar industry), Pressmud + neem cake, pressmud + pongamia cake, neem cake + carbofuran, pongamia cake + carbofuran, pressmud + carbofuran and carbofuran alone. All the treatments with amendments were significantly superior for seedling emergence, seedlings fresh weight, number of transplantable seedlings and root-knot index as compared to the control. The pressmud + carbofuran treatment significantly improved seedling emergence (49%) as
compared to the control (27%) and yielded a significantly higher number of transplantable seedlings as compared to other treatments. Treatments with amendments recorded a significantly lower root-knot index. Neem cake in combination with carbofuran recorded a significantly lower gall index than the other treatments.

Sukul et al. (2001) tested that ethanol extracts from the funicles of Acacia auriculiformis and the flowering meristems of Artemisia nilagirica were tested in vivo on Meloidogyne incognita. The active principles of Acacia auriculiformis and Artemisia nilagirica were acaciasides and santonin, respectively. The extracts from Acacia auriculiformis reduced the root-knot disease of mulberry, (Morus alba L.) and increased the protein content of its leaves. Artemisia nilagirica extract at ultra high dilutions called cina 200 and cina 1000, reduced the root knot disease and improved the growth of tomato plants. Electronic spectra of cina 1000 and the crude extract, called cina Q showed some similarity in absorbance intensity and spectral pattern. Molecular complexation and charge transfer interaction between the drug and the diluent medium (90% ethano) are thought to be responsible for the spectral pattern and absorbance of cina 1000. The spin lattice relaxation time (T1) of 2H, of OH, CH2 and CH3 of ethanol in cina 1000 showed changed in the rate of tumbling in the relevant parts of the molecule. These physical parameters are though to be responsible for the biological effect of cina 1000.

Muhammad et al. (2001) reported that organic amendments of soil with neem cake, mustard cake, and farmyard manure and poultry manure at 25g/1000g of soil significantly reduced the incidence of Meloidogyne javanica infesting mung bean cv. MNH-92 and increased plant hight and fresh weight of shoot as
compared to control. These treatments significantly reduced the number of galls and number of egg masses per plant. The most effective treatment was neem cake followed by mustard cake.

Chkrabarti and Mishra (2001) reported that a pot experiment was conducted to test whether the nematicidal efficacy of neem products would be improved by splitting its soil application particularly when combined with systemic nematicides against *Meloidogyne incognita* infecting chickpea. It was observed that the root knot galling and build up of nematode population was high suppressed when the neem products were applied in split dose. When they were combined with carbofuran or phorate, the efficiency was much increased. Probably the second dose affects the subsequent generation and there by keeps the crop well protected throughout the growing period. It was suggested to use the split-dose application of neem products even when combined with other management components such as systemic nematicides.

Kumar *et al.* (2001) tested that *in vitro* study on antinematodal properties of *Thevetia nerifolia* Juss. Leaf extract were carried out for the control of root-knot nematode, *Meloidogyne incognita*. Menthol extract was obtained from shed dried leaves of *Thevetia* as a viscous mass which was subsequently re-extracted with three other solvent viz. benzene, chloroform and ethyl acetate. The remaining of the re-extracted material was taken as methanol soluble fraction. Thin layer chromatography was done to obtain similar fractions. Bioassy was carried out with the concentrated extracts. Ethyl acetate was found to be most active extract after 24, 48 and 72 hrs of exposure against root-knot nematode followed by methanol, benzene and chloroform.
Sellami and Zemmouri (2001) reported that a study was conducted to determine the effect of different aqueous extracts from *Tagetes erecta* on the mortality, hatching of *Meloidogyne incognita*. The extracts tested were those obtained from the leaves, flowers, roots and a mixture of the different plant parts. The response of *Meloidogyne incognita* varied with the concentration period of exposure and nature of extracts. The greatest percentage of mortality and inhibition in hatching of *Meloidogyne incognita* juvenile was observed in extracts from the roots and the mixture (62, 71% and 63, 67% respectively). Interculture of *Tagetes erecta* with tomato also reduced the multiplication of *Meloidogyne incognita*.

Ranjana and Rajendra (2001) studied that *in vitro* experiments were undertaken to determine the effectiveness of various dilutions viz., S, S/2, S/4, S/8, S/16 and S/32 of aqueous extracts of bakain, *Melia azedarach* (fruits) Jamun, *Eugenia jumbolana* (*Syzygium cumini*), (fruit and leaves), imli, *Tamarindus indica* (fruits), peepal, *Ficus religiosa* (leaves) and bargad, *Ficus benghalensis* (leaves) in controlling the root-knot nematode, *Meloidogyne incognita*. Percent kill of second stage juvenile (*J₂*) were recorded after 24, 48 and 72 h exposure to each concentration of above treatments. A trend of increasing percent *J₂* kill with decreasing dilutions and increasing time exposure was recorded in all treatments. Among all test plants, the fruit extracts of *Melia azedarach* at its lowest dose (S/32) had extremely effective nematicidal potentials, which exhibited a 67.75% larval mortality after 72 h exposure. A hundred percent juvenile mortality was recorded from the stock solution (S) to the S/8 concentration of *Melia azedarach* (fruit) with S and S/2 concentration of *Tamarindus indica* and *Eugenia jumbolana* (fruits) and only with S concentration of leaf extract of *Eugenia jumbolana*, *Ficus*
bengalensis and Ficus religiosa after 24-72 h exposure. Overall effectiveness in terms of percent nematode kill was highest in Melia azedarach (fruits), Eugenia jumbolana (fruit), Tamarindus indica (fruit), Ficus religiosa (leaves), Ficus benghalensis (leaves), and Eugenia jumbolana (leaves). Fruit extracts of the test plants showed greater efficacy than their leaf extracts.

Uma and Ranjeswari (2001) tested that a pot culture experiment was carried out to study the effect of soil and foliar application of neem extract at two concentrations viz. 10 and 15% on the root-knot nematode, Meloidogyne incognita. Soil application showed higher reduction in nematode population as compared to foliar application. Soil application at 15% recorded minimum number of nematode in soil and root, which were 90 and 90.3% decrease over control, respectively. The gall index was only 1.3 at 15% concentration, whereas it was 5 in untreated control. The plant growth was promoted by soil application of neem leaf extract at 15 per cent followed by 10 per cent concentration. Numbers of pods were 3.8 at 15% while it was nil in control.

Vijayalakshmi and Jeyaraj (2002) investigated the effects of the duration of degradation of 5 neem products (neem seed, seed kernel, seed coat, cake and oil) on second stage juveniles of Meloidogyne incognita infesting tomato cv. Pusa Ruby. In experiment 1, the neem products (0.5 and 7.0% v/w of soil for neem seed kernel, seed coat, and cake and 0.1 and 0.2% v/w of neem oil) were allowed to degrade in pot soils within 0-6 weeks such that the end of the treatment coincided with the day before Meloidogyne incognita inoculation at 2 juveniles/g (inoculation conducted before transplanting of one month old seedlings). In experiment 2, neem products at similar rates were mixed with steam sterilized soil and kept in pots for 4 weeks and watered judiciously. After the treatment, one-
month-old seedlings were transplanted and second stage juveniles of *Meloidogyne incognita* (2L/g of soil) were inoculated. In general, 3-4 weeks of degradation had the most significant effect on juvenile penetration in roots, with longer periods being not so effective. Among the treatments, neem cake and neem seed kernel were most effective against *Meloidogyne incognita*. The variation in rates was not significant.

Vijayalakshmi *et al.* (2002) tested that the three chemicals obtained from neem, viz., azadirachtin, nimbin and salannin reduced the mobility of second stage juveniles of *Meloidogyne incognita* and caused 17.5, 16.8 and 18 per cent mortality, respectively after 48 h. They also decreased penetration of the roots of mung bean seedling to 9, 9.8 and 0.8 per cent respectively compared to 22.8 and 22 in untreated and treated after 7 days. Salannin at 1000 ppm was the most effective causing 76 and 86 per cent immobility; 9 and 18% mortality at 24 and 48 h exposure, respectively and significantly reduced the number of juveniles that penetrated mung bean seedlings (<1J₂ per plant). Azaderachtin and nimbin resulted in more than 50 per cent immobility at 48 h of exposure.

Peterson and Harrison (2002) reported that a green house experiment was conducted to investigate the suppression effect of a nematode resistant *Capsicum chinese* breeding line (PA-426), grown as a companion crop of susceptible pepper or tomato plants, against the root-knot nematode, *Meloidogyne incognita*. One-week-old tomato or pepper seedlings were planted in the center of a 12-litre pot, containing a mixture of 50% pure coarse sand and 50% commercial peat vermiculite mixture. The treatments were comprised of different number of companion plants per pot (0, 1, 2 and 4) and inoculation with the nematode (inoculated and uninoculated). Using 10ml egg suspension (3000 eggs). The
results confirmed previous results indicating that companion planting with nematode resistant plants provides adequate protection to susceptible plant as suggested by reduced galling and increased root dry weight of susceptible plants.

Raina et al. (2002) tested that the nematicidal effect of aqueous extracts from leaves of *Calotropis procera* on second stage juveniles of *Meloidogyne incognita*, *Meloidogyne exigua* and *Tylenchulus semipenetrans* young females of *Rotylenchulus reniformis* was tested in vitro. The lethal concentration 50 (LC 50), obtained by probit analysis ranged between 47.86 and 11.75%, 33.88 and 13.18% and 51.29 and 21.88% of a standard solution to *Meloidogyne incognita*, *Meloidogyne exigua* and *Tylenchulus semipenetrans* respectively. To *Rotylenchulus reniformis* LC50 was only 69.19% obtained at more than 48h. The lethal time 50 (LT50) obtained by probit analysis, ranged between 39 h 49 min., and 3h 48min., 26h 18min. and 6h 10min, and 21h 53m and 8h 8min. to *Meloidogyne incognita*, *Meloidogyne exigua* and *Tylenchulus semipenetrans* respectively. To *Rotylenchulus reniformis* LT50 was 28h 11min obtained with 64% standard solution. Nematode mortality increase with the increase of the leaf extracts concentration and exposure time.

Khan et al. (2002) studied that the extracts from *Azadiracta indica*, *Nicotiana tabacum* and *Eucalyptus citriodora* were tested for their nematicidal effect on *Helicotylenchus indicus*, *Ditylenchus goffarti* and *Pratylenchus thornei* and on growth and yield of Pavon-76 and Mehran wheat cultivars in microplots. All the amendments significantly reduced the population of the nematodes. The average weight of shoots and roots as well as the yield were increased by *Azadirachta indica* treatment. *Nicotiana tabacum* increased the yield in Pavon-76.
Rakesh and Alok (2003) reported that Ashwgandha (*Withania somnifera*) is an important medicinal plant and a major source of alkaloid and steroidal lactones (*Withanolide*), which are regularly used in pharmaceutical industries. Plant growth retardation and gall formation in the root system indicated the presence of root-knot nematodes, which was confirmed as *Meloidogyne incognita* race 2. Green house experiments were conducted to determine the effect of different inoculum levels of *Meloidogyne incognita* on the growth and yield of *Withania somnifera*. Various organic materials (neem compound, *Mentha* distillate, *Murraya koengii*, *Murraya koenigii* distillate, *Artemisia annua* Marc. And vermicompost) and biological control agents (*Glomus aggregatum* and *Trichoderma harzianum*) were tested alone or in combinations for the management of root-knot nematode, *Meloidogyne incognita* on *Withania somnifera*. The results indicated that most of the biological control agents and organic materials alone and in combination were root knot nematode suppressive and enhanced the growth and yield of *Withania somnifera*. The highest root-knot suppression was noticed in vermicompost and *Trichoderma harzianum* combination followed by *Mentha* distillate and *Glomus aggregatum*. Maximum increase in plant yield was noticed when the soil was amended with *Mentha* and *Murraya koengii* distilled waste along with biological control agents.

Wen and Feng (2003) studied the effect of *Cephalotaxus fortunei* on the development of the root-knot nematode, *Meloidogyne arenaria* is studied in *vitro* in the laboratory and green house. Extraction of *Cephalotaxus fortunei* twigs significantly inhibited nematode embryonic and larval development. The powder of dried *Cephalotaxus fortunei* twigs prolonged nematode postembryonic development and significantly reduced the number of female eggs.
Prasad et al. (2003) reported that the effects of seed oils and their esterified products from *Thevetia neriifolia*, *Thevetia peruviana* and *Ricinus communis* (at 1000, 500, 250, 125 and 62.5 ppm; and control concentration) on the mortality of the J2 of *Meloidogyne incognita* and pre-adults of *Rotylenchulus reniformis* were investigated *in vitro*. Esterification of the oils was conducted by mixing 25gm of oils with aqueous KOH and ethyl alcohol. Juveniles were incubated in vials with the test oils for 24, 48 and 72 h (at 30 plus or minus 1°C). *Ricinus communis* oil caused higher mortality of both nematodes compared to *Thevetia neriifolia* oil. Esterification increased the toxic effects of the seed oils on the nematode juveniles and pre-adults, compared to non-esterified oil. Mortality increased with increasing duration of exposure to the oils. In general the seed oil toxicity was lower in *Rotylenchulus reniformis* than in *Meloidogyne incognita*. The highest nematode mortality was observed at 1000 ppm for both plant oils.

Sharma and Patel (2003) reported that experiments were conducted to determine the efficacy of cured leaf extracts (1 and 5%) of bidi (*Nicotiana tobaccum*, cultivars A119, GT5 and GTH 1) and chewing tobacco (*Nicotiana rustica*, cv GC 1) against root-knot nematode (*Meloidogyne incognita* and *Meloidogyne javanica*) egg hatching. All the extracts prevented egg hatching until 216h. During the transfer of egg hatching was recorded except in 5% concentration of GTH 1 and GC 1. A strong ovicidal effect was observed for GT 5, GTH 1 and GC 1.

Nakajima et al. (2004) studied that an activity guided chromatographic purification of the methanol extract of *Argentum conyzoides* using pine wood nematodes *Bursaphelenchus xylophilus* successfully led to the isolation and characterization of the nematicidal compound with a minimum effective dose of
75 micro g/cotton ball. Based on the chemical and spectral properties, the compound was determined to be coumarin. The activity of coumarin derivatives was also investigated.

Saravanapriya et al. (2003) studied a field experiment was conducted in Tamil Nadu, India on tomato to test the efficacy of water extract of some botanicals, namely leaf extracts of Calotropis gigantea, Tagetes erecta and Azadirachta indica and seed extracts of Areca catechu and Citrullus lanatus, against the root-knot nematode, Meloidogyne incognita. The leaf extract of Calotropis gigantea significantly reduced the nematode population both at 45 days after transplanting (87.3%) and at harvest (89.96%) over the control. The same treatment also increased fruit yield by 23.91%.

Al-Banna et al. (2003) reported that the nematicidal activity of methanolic extracts (20g/ml) from twenty Jordanian plant species (Achillea santolina, Anagyris foetida, Artemisia herba-alba, Capparis spinosa, Echinops polyceras, Eruca sativa [Eruca vesicaria], Euphorbia macroclada, Ferula hermonis, Gundelia toumefortii, Hibiscus sabdariffa, Hypericum androsaemum, Lepidium sativum, Mentha piperita, Origanum syriacum, Phlomis brachyodon, Pimpinella anisum, Teucrium polium, Thea sinensis [Camellea sinensis], Trigonella foenum-graecum, Varthemia iphionoides) against two species of root-knot nematodes in vitro was evaluated. Whole plant extract of Hypericum androsaemum showed the highest activity (11% mortality) against Meloidogyne javanica after 24h of incubation. However, leaf extract of Origanum syriacum also increased Meloidogyne javanica mortality markedly a day later, reaching 59 and 82% after 48 and 72 h of exposure respectively. Against Meloidogyne incognita the response of leaf extracts was somewhat different, with leaf extract of
Artemisia herba-alba the most effective causing 22, 51, 54% mortality after 24, 48 and 72h of exposure respectively. With a tenfold concentration (200g/ml) of those plant extracts thought to contain volatile oils, the second stage juveniles (J2) mortality of both nematodes increased after 24 and 72 h of incubation. Nematicidal tests of some volatile oils that are active ingredients of the plants tested revealed that geraniol, thymol, and camphor were the most effective against Meloidogyne javanica J2s, with 91, 60, 56% mortality respectively after 72h of exposure. Cineole, menthol and pinene were not effective against this nematode. Against Meloidogyne incognita J2s, the most effective oil components were carvacol, thymol and geraniol with mortalities of 100, 90 and 74% respectively after 72h of exposure. Cineole was the least effective against Meloidogyne incognita.

Zarina et al. (2003) tested that the soil amendments with leaf extracts of Calotropis procera, Datura fastuosa var. alba and neem (Azadirachta indica) collected from Pakistan significantly reduced root-knot infection caused by Meloidogyne javanica and improved growth of aubergines cv. Pusa purple compared with unamended control. Neem leaf extract showed better results followed by Calotropis procera and Datura fastuosa. Datura fastuosa leaf extract at higher concentration showed maximum plant height, number of leaves, fresh and dry weight of shoot and significantly suppressed the root galls and egg masses/ plant. The growth of plant was proportional to the concentration of leaf extract while it was negatively proportional in case of root-knot development.

Ranjana and Aparajita (2005) reported that the crude extracts of fruit leaves viz., Citrus aurantifolia (lemon); Annona squamosa (custard apple); Psidium guajava (guava); Musa species (banana) and Aegle marmelos (bel) were
obtained by fractionating with organic solvent petroleum ether (60°C-80°C). Juvenile of *Meloidogyne incognita* were exposed to various concentrations viz., 250, 500, 1000 and 2000ppm of plant extracts for 3, 6, 24, 48, and 72h. *Citrus aurantifolia* at 500ppm was sufficient to immobilize more than 50% of the juveniles after 24h, whereas 1000ppm show 100% mortality after 72h, other extracts were toxic at 100ppm showing more than 50% mortality after 24h. Thus, all the extracts had nemtostatic properties and effective against *Meloidogyne incognita* juveniles. LC$_{50}$ value showed that out of five extracts *Citrus aurantifolia* was found to be the most effective.

Ranjana and Lalita (2005) studied that *in vitro* experiments were conducted to know the efficacy of ornamental leaf extracts of *Cantharanthus roseus*, *Callistemon lanceolatus*, *Dandelion* sp. and *Chrysanthemum* sp. in different concentrations (250, 500, 1000 and 2000ppm) for the management of $J_2$ of root-knot nematode, *Meloidogyne incognita*. Extract of *Cantharanthus roseus* and *Dandelion* sp. @ 2000ppm were found most effective followed by *Chrysanthemum* sp. and *Callistemon lanceolatus*. On the basis of LC$_{50}$ values, 250ppm of *Cantharanthus roseus*, 440ppm of *Callistemon lanceolatus*, 860ppm of *Dandelion* sp. and 1550ppm of *Chrysanthemum* sp. were found effective after 24h against $J_2$ of *Meloidogyne incognita*.

Jaspal singh and Tripathi (1995) studied the effect of *Ranunculus sceleratus* L. at different growth stages on its fungitoxicity against the test organism *Fusarium oxysporum* f. sp lentis causing with in *Lens esculenta* (lentil) using poisoned food.

Mishra and Dixit (1978) studied on various antifungal properties of the leaf extract of *Ranunculus sceleratus* L. and found that it was thermostable up to
100°C, retained activity on autoclaving, and remained active up to 15 days at room temperature. It possessed quick fungicidal action, tolerance against heavy fungal inoculum, activity on broad pH range, broad fungicidal spectrum, non-phytotoxicity and non-systemic activity. The extract was lethal at 1:40 dilution and its volatile vapours were also fungitoxic.

Li Haibo (2005) observed the nineteen compounds isolated from *Ranunculus seiboldii* and *Ranunculus sceleratus*, were tested for inhibitory effects on hepatitis B virus (HBV) and *Herpes simplex* virus type-1 (HSV-1). The results showed that apigenin 4'-0-α-rhammopyranoside(1), apigenin 7-0-β-glycopyranosyl-4' -0-α- rhammopyranoside(4), tricin 7-0-β-glucopyranoside(5), tricin(12) and isoscopoletin(18) possessed inhibitory activity against HBV replication. Protocatechinyl aldehyde (19) exhibited an inhibiting activity on HSV-1 replication. It is therefore, suggested that further investigations on these bioactive compounds might be needed to discover and develop new antiviral agents.

Schinella *et al.* (2002) describes the screening of extracts obtained from 18 plants and two fungi used in the Chinese and Mediterranean traditional medicines on epimastigote forms of *Trypanosoma cruzi*. The extracts were tested against epimastigote of *T. cruzi* Bra C15C2 clone *in vitro* at 27 degree C and at a concentration of 250 micro g/ml in axenic culture. *Angelica dahurica, A. pubescens, A. sinensis, Astragalus membranacus, Coptis chinensis, Haplophyllum hispanicum, Phellodendron amurense, Poria cocos, Ranunculus sceleratus* and *Scutellaria baicalensis* showed significant effects against the parasite with a percentage of growth inhibition between 20 and 100% *C. chinensis* and *R. sceleratus* showed the greatest activity with IC<Sub>50</Sub> values of 1.7
micro g/ml for C. chinensis and 10.7 micro g/ml for R. sceleratus extracts did not show cytotoxic effects on rat polymorpho-nuclear cells using 3-(4, 5-dimethylthiazol-2-yl)-2,5-diphenyl terazolium bromide and lactic dehydrogenase assays. These results allowed us to suggest that R. sceleratus and C. chinensis could be a source of new compounds clinically active against T. cruzi.

Bhattacharyya et al. (1993) reported that ether extracts of R. sceleratus diluted with acetone to give 0.05, 1.0 and 5.0% solutions significantly reduced larval activity, pupal wt and pupal emergence of D. melanogaster and completely suppressed the emergence of adults. T. castaneum suffered wt reduction and high mortality on exposure to all extract concentration and non survived longer than 15 and 10 days after exposure to the 1.0 and 5.0% extracts respectively. While the lowest concentration revealed 2 lactones, protoanemonin and anemonin, which may have been responsible for the insecticidal activity demonstrated in the trail. Further lest of R. sceleratus extracts for the control of plant pests, particulary under storage conditions are advocated.

Prieto et al. (2003) reported Ranunculus sceleratus is a widespread species with unique toxicological and pharmacological activities. The present study seeks to assess this species ability both in vitro and in vivo to modulate processes involved in inflammations. To this end, different extracts from the aerial parts of the plant were tested in several models of acute inflammation induced by tetradecanoylphorbol acetate (TPA), arachidonic acid (AA) and carrageenan, as well as in two modets of delayed hypersensitivity induced by oxazolone and dinitrofluorobencene (DNFB). The extracts were also assayed in models of eicosanoid and elastase released by intact cells. When tested in vivo, all of the extracts showed anti-inflammetary or neutral effects. In vitro, non-polar extracts
of this species were able to inhibit eicosanoid production, whereas polar extract enhanced the synthesis of 5 (S)-HETE, LTB₄ and 12(S)-HHTrE. The hypothesis of a “counter-irritant” mechanism of action has thus been proposed and is also discussed.

Cristobal-Alejo et al. (2006) reported that screening of 55 plant extracts against second stage juveniles of *Meloidogyne incognita* was conducted. These extracts were obtained from leaves, stems and roots of 20 native Yucatecan plants, of which 13 species were characterized as endemic. These were *Acalypha gaumeri*, *Ageratum gaumeri*, *Ambrosia hispida*, *Bidens alba*, *Blechum piramidatum*, *Caesalpinia yucalanensis*, *Celea urticifolia*, *Carlowrightia myriantha*, *Croton chichenensis*, *Eugenia yucalanesis*, *Eugenia winzerlingii*, *Furcraea cahum*, *Stenandrium namum*, *Tephrosia cinerea*, *Trichilia arborea*, *Trichilia minuliflora*, *Randia longiloba*, *Randia obcordata*, *Randia standleyana*, and *Vilex gaumeri*. An in vitro nematicidal assay, carried out at 250 and 500 ppm showed that extracts from *Calea urticifolia* leaves and roots, *Eugenia winzerlingii* leaves and *Tephrosia cinerea* stems were the most active against *M. incognita*. The plant extracts were evaluated at 0, 50, 100, 200, 300, 400 and 500 ppm to obtain their median effective dose. Result showed that *Eugenia winzerlingii* leaf extract induced at 300 ppm mortalities of 77% and 84% after 48 and 72 hr, respectively. The activity demonstrated by *Eugenia winzerlingii* was good enough to propose this plant for further studies at greenhouse and field stages to determine its efficacy in soil.