EFFICACY OF PHYTOTHERAPEUTIC SUBSTANCES AGAINST ROOT-KNOT NEMATODE 
MELOIDOGYNE INCognITA CUCUMERINUM AFFECTING CUCUMBER IN POLYHOUSE UNDER PROTECTED CULTIVATION 

Jaydeep Patil*, Goel S R and Saroj Yadav 

Department of Plant Protection, School of Agriculture LPU, Phagwara, Punjab Department of Nematology, College of Agriculture, CCS HAU Hisar 125004 Haryana, India

ABSTRACT

A pot experiment under polyhouse conditions was carried out to manage the root knot nematode, Meloidogyne incognita by using different botanicals, viz., neem, aak, castor leaves and neem seed kernel powder @ 20 and 30 g/kg soil along with chemical as well as untreated checks. Soil was autoclaved and infested with root-knot nematode (1000 J/ kg soil). Chopped leaves of these phytherapeutic substances were incorporated to the potted soil treatment wise and a waiting period of ten days was given before sowing of cucumber seeds. The results revealed that all plant growth parameters of cucumber improved while the nematode reproduction factors were suppressed significantly in case of all phytherapeutic substances and chemical checks as compare to untreated inoculated check. However, higher dose (30 g/ kg) was significantly more effective as compared to the lower dose (20 g/ kg soil). Among phytherapeutic substances, A. indica seed kernel powder were found to be most effective in suppressing galling (44) and final population in soil (143) followed by neem, castor and aak leaves as compare to untreated inoculated check.

INTRODUCTION

Root-knot nematodes are cosmopolitan in distribution, occur in soil and are rarely seen. In India, growing of horticultural crops in polyhouses under protected cultivation is becoming very popular among the farmers throughout the country. Large number of polyhouses is being erected in Haryana under the ages of National Horticulture Mission to grow short duration crops. Cucumber (Cucumis sativus L.) is widely cultivated crop in the gourd family Cucurbitaceae grown all over the world due to a good source of vitamins, minerals, fiber and roughages. It is a creeping vine that bears cylindrical fruits that are used as culinary vegetables. Many different varieties are traded on the global market but there are three main varieties of cucumber: slicing, pickling, and burpless. Within these varieties, several different cultivars have emerged. The cucumber is originally from Southern Asia, but now grows on most continents. Though in the polyhouses, crops are grown under protected conditions, yet the crops are not protected even under protected conditions. Polyhouse cultivation involves intensive cultivation of crops, optimum use of fertilizers and frequent use of irrigation, but continuous growing of the same crop with high day temperature and relative humidity within the greenhouse, polyhouse and low tunnel along with poor plant hygienic conditions inside and outside the greenhouse increase problem of soil borne pests and diseases including plant parasitic nematodes (Minuto et al., 2006) which results in the availability of ideal conditions for the growth and multiplication of these pests.

Plant-parasitic nematodes are recognized as major agricultural pathogens and are known to attack plants and cause crop losses throughout the world. Root-knot nematode is the most damaging plant-parasitic nematode (Barker, 1985). Under polyhouse cultivation crops, are attacked by a number of pests and diseases including nematodes which interfere with the successful cultivation under protected conditions. Among the nematodes, root-knot nematode (Meloidogyne spp.) is the most damaging under polyhouse conditions, parasitizing almost all the polyhouses crops. Though, yield loss due to this nematode is difficult to predict, approximate yield loss due to this nematode has been predicted by many authors in various crops. The intensive growing of vegetable crops in greenhouses promotes for their reproduction. The applied chemical products
are not always with adequate effectiveness and often their use cause serious ecological problems. New ecological alternative methods are tried to be found. In this aspect, studies for establishment of the nematicide effect of different biological agents. Plant species and parts antagonistic to Meloidogyne spp. are leaves and flowers of marigold (Tagetes sp.), leaves, roots and seeds of neem (Azadirachta indica), and leaves and seeds of chinaberry (Melia azadirach) (Rath et al., 2007). The present study was carried out to evaluate the nematocidal efficacy of leaves of these antagonistic plants as soil amendments against root-knot nematode (Meloidogyne incognita) at various dosages.

MATERIALS AND METHODS

Source and identification of root knot nematode associated with cucumber

Inoculum of root knot nematode was obtained from the nematode infected cucumber at farmer’s field in Hisar Haryana, India. Root knot nematode egg masses were extracted from the roots of the cucumber. For the extraction, galled roots of the plants were collected and washed in water to remove the adhering soil particles and the protruding egg mass in the galls were collected under microscope with the needle. The collected egg masses were placed in distilled water for hatching. After 24 - 48 h, the entire eggs were hatched into juveniles and the freshly hatched juveniles were inoculated into one-month old tomato plants cv. Hisar lalit, planted in 5 kg mud pots filled with sterilized pot mixture at one juvenile per g soil (5000 juveniles / pot). After 30 days of inoculation of nematodes into tomato plants, eggs were extracted from tomato roots with the above mentioned procedure and used for the interaction studies. Meanwhile, root knot nematode females collected from the tomato roots were processed for perineal pattern to confirm the species of root knot nematode associated with the plant.

Experimental procedure

Experiment was conducted in polyhouse (26.7±3) °C, 73.5%±11% Relative Humidity and 9.18 kPa in earthen pots (18 cm diameter) filled with a mixture of autoclaved sandy loam soil (sand 70%, silt 22% and clay 8%, pH 7.5). Autoclaved soil would be infested with root-knot nematode @ 1000 j2/kg soil. The experiment was conducted in pots (1 kg capacity) containing infested soil. Root-knot nematode was inoculated carefully adding the at the root zone of the plants, as described above. Each pot would be infested with root-knot nematode (1000 j2/kg soil) and treated with (carbofuran at 1 mg a.i./ kg soil, Bavistin at 1 mg a.i./ kg soil, neem (Azadirachta indica) Aak (Calotropis procera), castor leaves and neem seed kernel powder @ 20 and 30 g/kg soil). Chopped leaves of the phytotherapeutic substances was incorporated to the potted soil treatment wise. A waiting period of ten days was given before sowing for decomposition of phytotherapeutic substances. After ten days each pot would be sown with cucumber cv sania seeds @ 5 as per treatment and also maintain untreated check. Uninoculated pots and nematode inoculated pots served as controls. One plant per pot was retained after 30 days. Each treatment was replicated four times in a completely randomized block design during the months of April to June, 2015 in the polyhouse under protected conditions and watered daily so that each pot as per requirement.

Recording of data

Evaluations were performed 60 days after sowing. Measurements were made on the Plant growth parameters (shoot length, fresh and dry shoot and root weight). Observations were made on the root population of nematode viz., Number of galls per plant Number of egg masses per plant. Nematode population in soil was processed as per the sieving method of Cobb’s sieving and decanting technique (cob, 1918) followed by Modified Baermann’s funnel technique (Schneider, 1951) for estimation of nematode population in soil. Treatment means were compared and critical differences (CD) was calculated at P=0.05 to test for significant differences between treatments (T).

RESULTS AND DISCUSSION

Data presented in shows that the effect of various treatments on plant growth parameters viz. shoot length, fresh and dry weights of shoot and root, weights of cucumber plant improved while the nematode reproduction factors were suppressed significantly in case of all phytotherapeutic substances and chemical checks as compare to untreated inoculated check. However, higher dose (30 g/kg) was significantly more effective as compared to the lower dose (20 g/kg soil). Data (Table 1) indicated that shoot length in all the treatments was significantly better over untreated inoculated checks viz., nematode alone (83.7 cm).

### Table 1: Effect of phytotherapeutic substance on plant growth parameters and Meloidogyne incognita in cucumber

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Shoot length (cm)</th>
<th>Dry Shoot weight (g)</th>
<th>Dry root weight (g)</th>
<th>Number of galls per root</th>
<th>Number of egg masses per root</th>
<th>Final nematode population</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1: Neem leaves @ 20 g/pot</td>
<td>135.4</td>
<td>15.5</td>
<td>3.8</td>
<td>56 (7.3)</td>
<td>54 (7.5)</td>
<td>162 (12.7)</td>
</tr>
<tr>
<td>T2: Neem leaves @ 30 g/pot</td>
<td>143.3</td>
<td>20.0</td>
<td>5.5</td>
<td>48 (6.5)</td>
<td>43 (6.9)</td>
<td>149 (12.2)</td>
</tr>
<tr>
<td>T3: Aak leaves @ 20 g/pot</td>
<td>133.6</td>
<td>14.6</td>
<td>3.4</td>
<td>58 (7.5)</td>
<td>56 (7.6)</td>
<td>164 (12.8)</td>
</tr>
<tr>
<td>T4: Aak leaves @ 30 g/pot</td>
<td>141.8</td>
<td>19.3</td>
<td>5.2</td>
<td>50 (6.8)</td>
<td>45 (7.1)</td>
<td>156 (12.5)</td>
</tr>
<tr>
<td>T5: Castor leaves @ 20 g/pot</td>
<td>129.0</td>
<td>13.5</td>
<td>3.3</td>
<td>60 (7.6)</td>
<td>57 (7.7)</td>
<td>167 (12.9)</td>
</tr>
<tr>
<td>T6: Castor leaves @ 30 g/pot</td>
<td>139.8</td>
<td>18.3</td>
<td>4.8</td>
<td>53 (6.9)</td>
<td>48 (7.3)</td>
<td>158 (12.5)</td>
</tr>
<tr>
<td>T7: Soil treatment with NSKP @ 20 g/pot</td>
<td>140.6</td>
<td>17.3</td>
<td>4.5</td>
<td>55 (7.2)</td>
<td>52 (7.4)</td>
<td>160 (12.6)</td>
</tr>
<tr>
<td>T8: Soil treatment with NSKP @ 30 g/pot</td>
<td>154.0</td>
<td>23.0</td>
<td>6.0</td>
<td>44 (7.3)</td>
<td>40 (6.6)</td>
<td>143 (12.0)</td>
</tr>
<tr>
<td>T9: Carbofuran @ 0.1 g/pot</td>
<td>186.7</td>
<td>25.5</td>
<td>8.8</td>
<td>36 (6.2)</td>
<td>38 (6.0)</td>
<td>123 (11.0)</td>
</tr>
<tr>
<td>T10: Drenching with Bavistin @ 2 g/l water</td>
<td>126.3</td>
<td>10.3</td>
<td>3.6</td>
<td>82 (7.4)</td>
<td>55 (9.0)</td>
<td>223 (14.9)</td>
</tr>
<tr>
<td>T11: untreated check (inoculated)</td>
<td>83.7</td>
<td>5.6</td>
<td>1.7</td>
<td>453 (16.2)</td>
<td>263 (21.3)</td>
<td>828 (28.7)</td>
</tr>
<tr>
<td>T12: untreated check (uninoculated)</td>
<td>110.2</td>
<td>13.9</td>
<td>2.9</td>
<td>0 (1.0)</td>
<td>0 (1.0)</td>
<td>0 (1.0)</td>
</tr>
<tr>
<td>CD @ 5% level</td>
<td>0.881</td>
<td>0.256</td>
<td>0.213</td>
<td>0.074</td>
<td>0.060</td>
<td>0.046</td>
</tr>
</tbody>
</table>

SEM
Among the various treatments, maximum shoot length (154 cm), dry shoot weight (23 g) and dry root weight (6 g) was observed in neem seed kernel powder (NSKP) @ 30 g per kg soil followed by neem leaves @ 30 g per kg soil as compare with untreated inocolated check. *A. indica* seed kernel powder were found to be most effective in suppressing galling (44), number of egg masses per root (40) and final population in soil (143) followed by neem, castor and aak leaves as compare to untreated inocolated check. (Table1).

Results showed significant suppression of both *M. incognita* by *A. indica* seed kernel powder. Significant suppression of nematode multiplication by *A. indica* seed kernel powder was due to its capability of altering root exudates, which could alter nematode behavior and suppress nematode population in root system (Oostendorp and Sikora, 1989). Although chemicals viz. carbofuran showed a significant effect in increase of growth parameters and in suppression of the root knot nematode, these can be replaced to some extent by *A. indica* seed powder avoid the hazards of chemicals.

**Acknowledgment**

The author is thankful to Department of Science and Technology Government of India (INSPIRE Fellowship) for providing financial assistance during the course of this research work.

**References**


Rather MA, Ahmad F and Siddiqui M A. 2007. Bio-efficacy of some botanical extracts for the management of root-knot nematicides may also be killed while feeding on root tissues by the systemic action of these nematicides when they are absorbed by the plant roots and translocated in the plant system (van Berkum and Hoestra, 1979). Abuzar (2003) found similar effectiveness of carbofuran in suppressing *M. incognita* on *Abelmoschus esculentus*. To cope with this, *A. indica* seed kernel powder may be applied. It is clear from the results that besides chemicals *A. indica* seed powder were sufficiently effective against nematode, this may be due to presence of active principles and toxic chemicals in *A. indica* seed powder (Abuzar and Haseeb, 2009; Abuzar and Haseeb, 2010).

Cucumber is highly susceptible to *M. incognita* as indicated by severity in root-knot development, nematode population densities and growth suppression in the inoculated control. Our results indicate that carbofuran is most effective among the treatments in improving plant growth and reducing *M. incognita* population densities in soil. Carbofuran impairs nematode neuromuscular activity by inhibiting the function of the enzyme acetyl cholinesterase resulting in reduced movement and ability of invasion and multiplication (Evans, 1973; Wright, 1981). The nematodes may also be killed while feeding on root tissues by the systemic action of these nematicides when they are absorbed by the plant roots and translocated in the plant system (van Berkum and Hoestra, 1979). Abuzar (2003) found similar effectiveness of carbofuran in suppressing *M. incognita* on *Abelmoschus esculentus*. To cope with this, *A. indica* seed kernel powder may be applied. It is clear from the results that besides chemicals *A. indica* seed powder were sufficiently effective against nematode, this may be due to presence of active principles and toxic chemicals in *A. indica* seed powder (Abuzar and Haseeb, 2009; Abuzar and Haseeb, 2010).

Cucumber is highly susceptible to *M. incognita* as indicated by severity in root-knot development, nematode population densities and growth suppression in the inoculated control. Our results indicate that carbofuran is most effective among the treatments in improving plant growth and reducing *M. incognita* population densities in soil. Carbofuran impairs nematode neuromuscular activity by inhibiting the function of the enzyme acetyl cholinesterase resulting in reduced movement and ability of invasion and multiplication (Evans, 1973; Wright, 1981). The nematodes may also be killed while feeding on root tissues by the systemic action of these nematicides when they are absorbed by the plant roots and translocated in the plant system (van Berkum and Hoestra, 1979). Abuzar (2003) found similar effectiveness of carbofuran in suppressing *M. incognita* on *Abelmoschus esculentus*. To cope with this, *A. indica* seed kernel powder may be applied. It is clear from the results that besides chemicals *A. indica* seed powder were sufficiently effective against nematode, this may be due to presence of active principles and toxic chemicals in *A. indica* seed powder (Abuzar and Haseeb, 2009; Abuzar and Haseeb, 2010).

Results showed significant suppression of both *M. incognita* by *A. indica* seed kernel powder. Significant suppression of nematode multiplication by *A. indica* seed kernel powder was due to its capability of altering root exudates, which could alter nematode behavior and suppress nematode population in root system (Oostendorp and Sikora, 1989). Although chemicals viz. carbofuran showed a significant effect in increase of growth parameters and in suppression of the root knot nematode, these can be replaced to some extent by *A. indica* seed powder avoid the hazards of chemicals.

**Acknowledgment**

The author is thankful to Department of Science and Technology Government of India (INSPIRE Fellowship) for providing financial assistance during the course of this research work.

**References**


How to cite this article: