MOBILITY OF JUVENILES OF ROOT-KNOT NEMATODE (MELOIDOGYNE JAVANICA) THROUGH SOIL AMENDED WITH NEEM (AZADIRACHTA INDICA A. JUSS) PRODUCTS

Javed Nazir, M. Inam-ul-Haq and S. Aleem Khan
Department of Plant Pathology, University of Agriculture, Faisalabad.

Neem crude products like leaves, cake and seed and a refined product viz aza significantly reduced the mobility of juveniles within treated soil. Among the crude products neem leaves were more toxic to juveniles as compared with neem cake and seed. The refined product, aza also significantly reduced the mobility of juveniles. It was observed that by increasing the dose of aza, the mobility of juveniles was reduced correspondingly.

**Key words:** Root-knot nematodes, *Meloidogyne javanica*, neem, Azadirachta indica, aza, botanical nematicides.

INTRODUCTION

Plant-parasitic nematodes are major pests in many countries of the world particularly in the tropics and sub-tropics, where they are recognised as the cause of serious yield losses on a wide range of crops (Bridge and Page, 1980). Of the 50 % of potential crop losses caused by pests, 12.3 % is estimated to be caused by nematodes and more of this damage is in the developing than developed countries (Sasser and Freckman, 1986). Among the plant parasitic nematodes, root-knot nematodes *Meloidogyne* spp., are economically the most important plant parasitic nematodes in the world, limiting agricultural productivity and quality (Sasser, 1979; Sasser and Carter, 1985). Average yield losses due to root-knot nematodes on a global scale are estimated to be about 5% and are much larger in developing countries in the tropics and subtropics (Taylor and Sasser, 1978). The nematodes occurring in tropical and subtropical areas tend to cause more damage than temperate root-knot nematodes (Mai, 1985). Root-knot nematodes can be a major production constraint on land, which is continuously cultivated with successions of nematode susceptible hosts, and where currently available nematodes control practices are ineffective, uneconomic or inappropriate for low input agriculture (Gowen and Channer, 1988).

Movement is a prerequisite to invasion and any inhibition to such movement will affect the population dynamics of the nematode. The importance of nematode movement is related to localised activities near the host plant rather than to the spread of nematodes over a large distance. The hatched larvae must reach and penetrate the root tip of its host to complete its life cycle. The hatched juveniles move through the soil in a moisture film covering the soil particles. There are many factors, which affect the survival of juveniles within soil. At low temperature and high moisture the mobility of juveniles is reduced therefore the food reserves are not depleted.

In order to reduce the populations of root-knot nematodes, several strategies such as the application of nematicides, use of resistant varieties, crop rotation and cultural practices or combinations of these methods are available that may suppress the nematodes.

The importance of neem from plant-protection point of view was recognised by middle of the 20th century. Systematic study of use of neem products against plant parasitic nematodes started in 1960s in India, from where most of work has been reported. Early investigations were mainly with neem cake obtained after extraction of oil from seeds. An old age practice in some parts of India involves the use of neem cake as manure. It contains organic matter and plant nutrients like N, P, and K. Taking this practice as a base early investigator studied the effect of neem cake as soil amendment against plant parasitic nematodes in the soil.

Khanna (1991), Kathirvel et al., (1992), Mojumder and Mishra (1991 b) and Mishra and Prasad (1973) all observed that water soluble fractions of neem were found to be toxic to root-knot nematodes and reduced their ability to infect host roots. They further observed that amendment of soil with neem could affect the movement of juveniles within soil. Work was done in a very simple way and however not much work has been done in determining the mechanism involved in the nematicidal action of neem.

Keeping in view the importance of neem as nematicides two types of neem products i.e. crude (leaves, cake and seed) and refined i.e. aza were used in this experiment. The objective of this experiment was to see whether neem productas reduce the vigour of root-knot nematode juvenils within soil.
MATERIALS AND METHODS

Soil (John inns No 2) was air dried in glasshouse and it was passed through mm sieve. Soil was amended with finely grounded with neem leaves, seeds and cake (passed through 2mm sieve) @3% whereas Azadirachtin (10%) was amended @ 25, 50, 100, and 500mg/100g soil. Using plastic bag individually mixed in these treatments. After moistening the plastic pots were kept in incubator at 28°C. Next day freshly hatched J2s (collected within 48hrs) were put in each pot @1000 (contained in 2ml.). Each treatment was replicated 3 times.

Table 1. Effect of neem’s crude products and its commercial seed extract Aza(10%) on the mobility of J2s.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>01 day</th>
<th>02 days</th>
<th>04 days</th>
<th>06 days</th>
<th>total</th>
<th>% recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neem’s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>leaves</td>
<td>0.0</td>
<td>8.00</td>
<td>13.88</td>
<td>0</td>
<td>21.88</td>
<td>2.19</td>
</tr>
<tr>
<td>cake</td>
<td>44.4</td>
<td>2.77</td>
<td>11.11</td>
<td>2.77</td>
<td>61.05</td>
<td>6.11</td>
</tr>
<tr>
<td>seed</td>
<td>5.5</td>
<td>11.1</td>
<td>11.1</td>
<td>2.77</td>
<td>30.51</td>
<td>3.05</td>
</tr>
<tr>
<td>Aza 10% @ mg/100g of soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>283.1</td>
<td>119.2</td>
<td>38.77</td>
<td>8.33</td>
<td>449.40</td>
<td>44.94</td>
</tr>
<tr>
<td>50</td>
<td>244.2</td>
<td>108.16</td>
<td>72.22</td>
<td>2.77</td>
<td>427.35</td>
<td>42.74</td>
</tr>
<tr>
<td>100</td>
<td>283.3</td>
<td>16.63</td>
<td>0.00</td>
<td>0.00</td>
<td>299.93</td>
<td>29.99</td>
</tr>
<tr>
<td>500</td>
<td>180.5</td>
<td>10.83</td>
<td>16.5</td>
<td>11</td>
<td>218.83</td>
<td>21.88</td>
</tr>
<tr>
<td>control</td>
<td>380.3</td>
<td>124.83</td>
<td>80.5</td>
<td>30.55</td>
<td>616.18</td>
<td>61.62</td>
</tr>
<tr>
<td>SED</td>
<td>55.56</td>
<td>22.84</td>
<td>10.50</td>
<td>11.16</td>
<td>64.59</td>
<td></td>
</tr>
<tr>
<td>Probability</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Data are means of 3 replications

After one day the soil in each pot was mixed thoroughly so that to aerate the nematodes and some amount of water was added. This infested soil was put on mini whitehead trays to isolate the J2s. Second stage J2s were collected from the lower tray at various time intervals i.e. one, two, four and six days. During the period of isolation each time the level of water was maintained so that it must be touching the bottom of upper tray. After collecting J2s were sink for over night, then the excess water was piped out up to level of 40ml. In all the replications of all the treatments, then level in each replication was made upto 50ml. From every replication 3 aliquots of 2ml were assessed. All the J2s (dead or living) were counted. Then total numbers of nematodes in 50ml were counted.

RESULTS AND DISCUSSION

Results revealed that all the treatments were effective in reducing the mobility of juveniles through soil. It was observed that neem leaves proved to be more effective followed by seed, cake, 500, 100, 50, 25mg aza and control. The crude neem products were more effective as compared with refined neem product i.e. aza. Among the crude products neem leaves were more effective in reducing the mobility of juveniles. Some treatments proved to be suppressive in the beginning but loose their effect later on. In case of cake during first 24hrs (one day) there was some recovery of J2 but later on it was reduced whereas in case of seed and leaves it was little bit increased. In case of aza at 25, 50 and 100mg during first 24hrs there was maximum recovery but later on it was much reduced in case of 100mg aza. But in 500mg during first 24 hrs was moderate recovery of J2s although it was reduced later on but even though some J2s were recovered. But in 100mg after 4 days there was 0% recovery. This shows that at high dose of Aza the J2s were suppressed but later on some J2s were released of its effect. The immobility or probably the death of nematodes was probably due to the additive effects i.e. lack of oxygen and the toxicity of neem products. The oxygen may be depleted by other micro-organism.

Nematicidal action of neem products is not only due to the compounds present within the neem product viz; nimbidin and thionimone (Khan et al., 1974) but also due to other by products viz: ammonia, formaldehyde, phenols, and fatty acids produced during decomposition of neem products. Possibly the narcotic effect of neem products was due to by-products released during decomposition. The nematostatic behaviour of neem compounds is similar to carbamate oxamyl. These products disrupt the transport signal in the neuro-system by inhibition of acetylcholinesterase an enzyme essential in the breakdown of acetylcholin,
Mobility of juveniles of root-knot nematode

which is the transmitter substance for the signals to the muscular system. The result is that acetylcholin accumulates, which results in convulsion, paralysis and finally death (Elskamp et al., 1974).

REFERENCES


Khan, A. M., M. M., ALAM,. and R., Ahmad,. 1974. Mechanism of the control of plant parasitic nematodes as a result of the application of oil-cakes to the soil.