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ORIGINAL ARTICLE

Identification and Management of Plant Parasitic Nematodes Associated with Walnut (Juglans Regia L.) in Abbottabad

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ABSTRACT

Purpose: Phytonematodes known as the hidden enemies of plants and crops are potential pest of walnut trees in Abbottabad, KP Pakistan.

Methods: Soil samples from walnut trees were collected from different localities were processed by using Bearmann funnel techniques. Several nematode species were identified including Meloidogyne incognita, Helicotylenchus dihystera, Psilenchus hilarulus, Tylenchus sp. and Helicotylenchus vulgaris.

Findings & Practical implication: Management of plant parasitic nematodes by using castor oil cakes (8kg/tree), cow dung (8 kg/tree) and duck manure (8kg/tree) showed that population was declined after application. Plant growth and yield was also improved. Data plotted in histogram graphs and t-test showed that p values were found significant.

Conclusion: The mean and S.D values of initial population, 3 month, 6 month and 12 month for castor oil cakes are 116 ± 1.2, 84 ± 1.0, 60 ± 1.0, 42 ± 0.6, for cow dung 127 ± 5.7, 110 ± 2.4, 87 ± 2.4, 73 ± 1.3 and for duck manure 108 ± 2.4, 92 ± 1.0, 69 ± 0.5, 45 ± 1.0.

Keywords: Phytonematodes, walnut, castor oil, cow dung, duck manure.

INTRODUCTION

Nematoda is prehistoric and geographically diverse phylum of moulting organisms. Their size ranged from 0.2 mm 6 mm. They are found in many habitats including on and within host plant and animals [1]. Nematodes are diverse and plentiful included many parasitic species [2]. Phytonematodes are potential pests of trees and plants including crops. They cause damage to the tree by destroying roots and plant internal structure and therefore resulting in poor plant growth and yield loss.Walnuts are round nut fruits of walnut trees and are found in different localities of Pakistan. Walnut had kernel in the center which is rich in many nutrients. Walnut is medically very important as it has both free and antioxidants and antioxidants bound to fiber. Many research workers worked on the identification and management of the nematodes by using organic amendments [3-12].

Different organic amendments were used including different manures, different oil cakes, biochar and plant extracts throughout the world. Management of phytonematodes by using organic amendments is important economically as well as environmentally. They are environment friendly and easily available in local selected areas.

MATERIALS AND METHODS

Samples collection: Soil samples from different localities of Abbottabad which are habitat of walnut trees were collected by digging around the tree trunk up to 1.5 feet.

Samples preparation: Samples were then processed by using Bearmann funnel technique and pant parasitic nematodes collected were fixed in TAF (Triethylamine formaldehyde) after killing. After 24hrs, TAF was removed and 1.25 Glycerin was added and placed in autoclave for 48h at 50°C-54°C. Permanent slides were prepared and identification was done.

Keeping in view the economic importance of phytonematodes, management was done by using organic amendments including castor oil cakes, cow dung and duck manure at the rate of 8kg/tree. Their effect was studied after 3, 6 and 12 months by collecting samples and subsamples from treated and untreated trees. Collected samples were processed by Bearmann funnel technique and were observed under stereoscope microscope for nematode population. Data was compared to study organic amendments effect on the phytonematodes population.

RESULTS AND DISCUSSION

Different plant parasitic nematodes were identified from different localities of Abbottabad. Identified nematodes include phytonematodes from different genera. These included Meloidogyne incognita,Helicotylenchus dihystera, Psilenchus hilarulus, Tylenchus sp.and Helicotylenchus vulgaris. It showed that nematodes are damaging walnut trees in different localities of Abbottabad and therefore it resulted in economic loss and yield loss with poor tree growth. Most important nematode identified is Meloidogyne incognita which is a root knot nematode and cause severe damage to the walnut trees and other associated plants and crops. It resulted in the root structure damage which leds to abnormal root function. Presence and absence of the identified nematodes in localities is shown in the table given below. In the table. 1 (+) sign shows the presence while (–) sign shows the absence of the nematode.

Table 1: Table showing absence/presence of parasitic nematodes in DistrictAbbottabad

Localities					
Nematodes	Jhangi	Sheikh-ul-Band	Nawanshehr	Kakul	Ghari Pana
Helicotylenchus dihystera	+	+	-	-	+
Helicotylenchus vulgaris	-	-	-	-	-
Meloidogyne incognita	-	+	-	-	+
Tylenchus sp.	-	-	+	-	-
Psilenchus hilarulus	-	-	-	+	+

Management done by applying castor oil cakes, cow dung and duck manure showed that nematode population was declined as a result of these amendments. Data showed that amendments had effect on the plant parasitic nematode population just after 3 months of application. Nematode population was reduced and

further declined after 6 and 12 months. Comparison between treated and untreated trees clearly indicated the difference between nematode population before and after amendments.

Data plotted in histograms graphs show that organic amendments were found effective against plant parasitic nematodes and t-test was applied on the data. It showed that p values for castor oil, cow dung and duck manure was found significant. Mean and standard deviation values for initial population, 3 Month, 6 Month and 12 Month were calculated are shown in the tables 2, 3 and 4 given below.

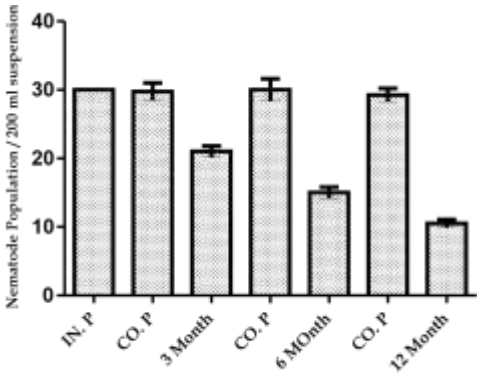

Fig. 1: Histogram graph showing the effect of Castor Oil Cakes on nematode population in Abbottabad IN.P= Initial Population, CO.P= Controlled Population

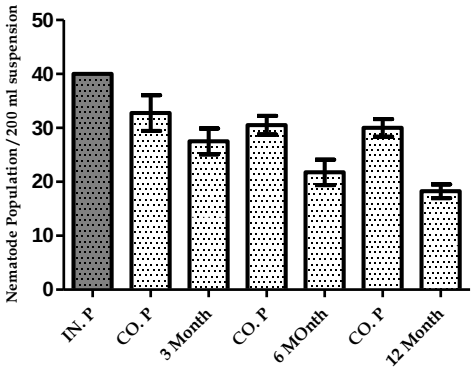

Fig. 2: Histogram graph showing the effect of Cow Dung on nematode population in Abbottabad IN.P= Initial Population, CO.P= Controlled Population

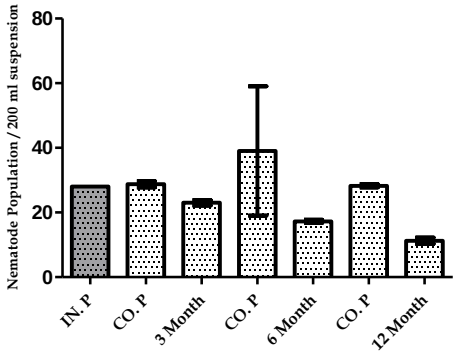

Fig. 3: Histogram graph showing the effect of Duck Manure on nematode population in Abbottabad IN.P= Initial Population, CO.P= Controlled Population

Table 2: t-test values of effect of Castor Oil Cakes on Nematode population

IN.P (Initial Population)	3 Month	P Value	6 Month	P Value	12 Month	P Value
116 ± 1.2	84 ± 1.0	0.000	60 ± 1.0	0.000	42 ± 0.6	0.000

Table 3: t-test values of effect of Cow Dung on Nematode population

IN.P (Initial Population)	3 Month	P Value	6 Month	P Value	12 Month	P Value
127 ± 5.7	110 ± 2.4	0.062	87 ± 2.4	0.005	73 ± 1.3	0.005

Table 4: t-test values of effect of Duck Manure on Nematode population

IN.P (Initial Population)	3 Month	P Value	6 Month	P Value	12 Month	P Value
108 ± 2.4	92 ± 1.0	0.011	69 ± 0.5	0.002	45 ± 1.0	0.001

Nematodes identified belong to different families. Helicotylenchus dihystera, Psilenchus hilarulus, Tylenchus sp.and Helicotylenchus vulgaris are fungal feeders while Meloidogyne incognita is a root-knot nematode. From the identified nematodes Helicotylenschus dihystera and Helicotylenchus vulgaris belong to the genus Helicotylenchus and family Hoplolaimidae [13]. Several species of Helicotylenchus are stern parasites of different crops and trees [14]. They are found worldwide in almost all types of habitats as they can survive in different conditions. Walnut trees were found damaged because of Helicotylenchus sp. infestation. The infestation of Helicotylenchus dihystera resulted in poor plant height as reported by Kim et al, 2014 in case of their study on tomatoes [15]. They observed declined plant height as a result of the infestation. Another specie of Helicotylenchus reported from Jhangi of Abbottabad was Helicotylenchus vulgaris. It is also a spiral nematode and a fungal feeder. Although it was not found a true pathogen for trees and plants including walnut trees but it can resulted in adverse effects on the associated plants. Alison and Spaull in 1982 reported the effect of H. vulgaris on the sugar beet yield and plant height. They observed that because of the presence of H. vulgaris yield of sugar beet was not improved even after treating with aldicarb. Therefore H. dihystera and H. vulgaris are found damaging for walnut trees in Abbottabad [16].

Psilenchus hilarulus and Tylenchus sp. are fungal feeders from family Psilenchida [17]. Psilenchus hilarulus were reported from Sheikh-ul-bandi and Kakul while Tylenchus sp. was reported from Nawanshehr. In the same way Psilenchus hilarulus also affect the root system of the walnut trees. The roots were pierced with stylets and juveniles and adult start feeding on the root epidermis resulting in damage to the plant growth to some extent. Psilenchus hilarulus reported from Kakul and Sheikh ul bandi had adverse effects on the walnut trees like other fungal feeders. Khan and Islam reported Psilenchus hilarulus and Meloidogyne species associated with date palms in Balochistan in 2004 [18]. Tylenchus sp. develops feeding sites in the epidermis tissues of the roots and their juveniles start feeding on root tissues. As a result of nematode damage, the infected root system became unable to absorb nutrients and water necessary for normal growth. Dieback, yellowing of foliage and leaf are due to young root decay and poor root development [19].

Meloidogyne incognita was reported from Nawanshehr and Ghari Pana. Meloidogyne, belong to a family Heteroderidae and commonly known as root knot nematode [20]. It is one of the most important plant parasitic nematode specie as it causes great damage to the plant and ultimately results in yield loss. Afshar et al, 2014 stated that infestation of M. incognita and M. javanica resulted in reduced main shoot length and galls were observed on the roots of the olive plants. This directly had adverse effects on the plant yield. Meloidogyne species associated with walnut trees resulted in destruction of root cells to a great extend [21].

Organic amendments applied for the nematode management showed that they are effective against plant parasitic nematodes associated with walnut trees. Recorded data clearly

illustrates that they have profound effects not only against nematode population but also on tree growth. Castor oil cakes and cow dung were found more effective as compared to the duck manure. Histogram graphs and mean S.D values showed the difference between treated and untreated trees nematode population. Nematode population was reduced just after the application of 3 month and further declined occur after 6 and 12 month respectively. It was similar to the findings of the Akhtar and Mehmood (1996) observations about neem and castor cakes that in declining nematode population both were successful with other amendments [22]. The findings about cow dung were similar as they observed that cow dung not only had good result on plant growth but also effective against plant parasitic nematodes. In ANOVA p value were also found significant for all amendments which showed that organic amendments are helpful in controlling plant parasitic nematodes.

Plant health was also improved as a result of organic amendments. As organic amendments are environment friendly and natural products therefore their decomposition resulted in the release of many nutrients nitrogen, sulfur, magnesium, potassium and phosphorous important for plant and trees including walnut trees.

CONCLUSION

It was concluded from the above study that phytonematodes are damaging walnut trees in Abbottabad and therefore resulting in economic and yield loss with poor plant growth. Organic amendments are helpful in managing plant parasitic nematodes and due to their eco-friendly nature they are highly recommended as compared to the nematicides. Organic amendments not only reduced phytonematodes but also had good results on plant growth and yield.

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