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A SURVEY OF INFECTED TOMATO PLANTS BY ROOT- KNOT NEMATODES, *MELOIDOGYNE* SP. IN FATHEHABAD, AGRA (U.P.) INDIA

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ABSTRACT

We have conducted survey of vegetable fields infested by root-knot nematodes on tomato plants from various regions of Uttar Pradesh. In this paper we are presenting the results of the survey conducted over more than two years in cropping season of tomato plants in Fatehabad. In our study we have examined more than 600 root samples to ascertain the nematode prevalence in a particular area. The purpose of this study is to access the distribution of root-knot nematodes and their incidence on tomato plants.

Figure : 00 References : 06 Table : 01
KEY WORDS : Fathehabad, *Melodogyne* sp., Nematodes, Parasitism

Introduction

Root knot nematodes are reported from all terrains of all ecosystems. These animals have been reported from various places on earth. Although *M. incognita* and *M. javanica* is quite common in hotter areas. The other species of *Meloidogyne*, *M. arenaria* is quite suited to cooler climatic conditions. High incidence of the root-knot disease on tomato plants is partly due to its survival on collateral host in seasons when the main plants are not available in the field. Since the inoculmn of the disease is available all throughout the year, the rate of infection is quite high in vegetable plants surveyed. Root-knot nematodes are serious pathogens of the particularly vegetable plants. The damage caused by these nematodes has been estimated to be around $157 billion worldwide.

Nematodes are found almost in all agriculture land on earth. Most of crops infected in plant –parasitic nematodes. These nematodes have been reported from almost all crops grown in agriculture field or nursery[5]. Root-knot nematodes are among the world *Meloidgyne* sp. is an important group of plant-parasitic nematodes. *Meloidogyne* is an endo-parasitic nematodes dwells in almost all crops worldwide[3].

There are several species of root –knot nematodes reported from different parts of the world, but the major damage to crops are mainly attributed to its four species *M.incognita,M.javanica*, *M.areanaric* and *M.hapla*. Due to their unique ability to survive on several plants and apomictic type of reproduction, root–knot nematodes have a wide host range. Tomato, *Lycopersicon esculentum* is

TABLE-1: Summary of survey conducted on root-knot nematode damage in tomato crops in Fatehabad.

S. No	Place	No of plants observed	Galling Index category	Category Average no of knot/plant	Average number of nematode/ knot dissected	Plant physiog-nomy
1	Fatehabad	130	5	630 (55)	12(34)	Stunted
2	Shamsabad	110	5	488 (49)	08(27)	Healthy
3	Salempur	135	6	876(56)	11(23)	Yellowish
4	Madayna	125	6	965(71)	18(32)	Healthy
5	Firozabad Road	110	6	1057(53)	21(10)	Healthy

an important vegetable crop grown through the world. Tomato is reported to be infected by various plant pathogen including root–knot nematodes.

Root-knot nematode juvenile upon locating a suitable host root , using its stylet punctures the root parenchyma cell and gets an entry into plant interior, once inside the plant the secretions from the nematode esophageal gland add in further the process of parasitism. There are two sub-ventral and one large dorsal esophageal gland that occur within the nematode esophagus. The role of these gland secretions are being studied now at the molecular level to find out the secret making a nematode a parasite[1]. Due to continuous probing and stylet thrusting coupled with gland secretion , a group of parenchyma cells within the roots starts dividing. The DNA of these few cells undergoes endorse duplication and a large amount of the DNA is formed due to which the activity of these cells also increase. These cell starts acting as sink cell for the nematode and these supply the nutritional demand of the developing nematode. These cells later take the role of transfer cell. Due to high cytoplasm activity, these cells get hypertrophied on the surface of root a knot-like structure is formed. These specialized cells are called giant cell[2].

Surveys of vegetable fields was conducted that showed infestation of root-knot nematodes on tomato crops from various regions of Uttar Pradesh.

Material and Method

We are presenting the results of the survey conducted over two year in cropping season of tomato crops in Fatehabad, Agra. In our study we have examined more than 600 root samples to examine the nematode prevalence in a particular area. The purpose of this study was to estimate the distribution of root–knot nematodes and their incidence on tomato crop.

Sampling Procedure

We have followed the standard methods of sampling the infected plants were uprooted carefully and were kept in poly bags and were brought back in lab for further processing and analysis. All roots were washed in slow running water to remove the soil particles and then these were kept in fresh water inside a tray. The damage by the root–knot nematode was accessed by means of looking at the deformity caused by the nematode to the root of the plants. This was then divided into category 1-5 depending upon the level of infection. Very little galling on root were given score 1, little more than category 1 was given the category 2. Severe infection came under category 3 and 4 . Very severe infection came under category

5. A Category was also given as 0 where there was no galling seen on root system. This can also be seen as -0 =no galling 2- less than 25% galled root, 3= 25-50% galled root , 4= 51-75% galled roots and 5= more than 75% galled root[4].

Culture of Nematodes

Infected tomato plant nematodes collected from root samples from each places was maintained on the nematodes susceptible variety of tomato (*Lycopersicon esculentum*). To maintain the pure culture of the nematode population, single egg mass were picked up from the infected root and hatched separately in distilled water at room temperature. Egg mass were picked from the infected root using the forceps (sigma) and then were put on kimwipes paper that was laid over a wire gauge and a petri dish with water. This setup was covered with another petri plate to avoid water evaporation .The setup was then placed in an incubator at 28^0C for 16 hours. Next day the water in lower petri plate was examined using microscope. Water from each petri plate containing hatched active juveniles was poured in tomato plants and then maintained for subsequent experiments. The infection was allowed to go for 45 days and then these were sub-cultured to raise enough number of nematodes for subsequent studies[6].

Observation

Number in parentheses indicates the number of plant and number of knot dissected from the studied plant materials. A result of this survey indicates that tomato is very susceptible to root-not nematode infection. As seen (Table-1) the tomato crop is grown in Fatehabad, root-knot nematodes infect this crop. The galling index category indicates that the extent of damage is really a serious problem for tomato grower as the damaged crop will be of no use to farmers economically. While dissecting the knots from these plants, we found that there are more than 10 females in each of the knot dissected which further adds that tomato crops is particularly susceptible to root-knot nematode infection.

Although it has already been observed that tomato crops (not all) have potential and dominant gene for nematode resistance. This gene is named as Mi gene indicating the name of pathogen against which this gene confers the resistance, *Meloidogyne incognita*. The biggest problem with this gene is that it does not work at temperatures beyond 28° C. Although we have not yet confirmed whether the plant observed had the Mi gene in them or not. Work in author's laboratory is in progress to determine the presence of Mi gene in these plants using PCR technology. Results of this survey can also be used as an advisory to farmers who indent to take only a particular variety of crops in their field but they are unaware of the damage that is happening underground. Another important point, that this survey revealed that the soil type have a significant influence on extent of damage caused by the root-knot nematode. In Fatehabad area the soil is sandy loam type which favors the damage caused by the root-knot nematode. Another reason which we found for this damage is the use of Pusa Ruby variety of the tomato by most the growers. This variety of tomato although high yielding but is very susceptible to root-knot nematode infection.

Conclusion

As we begin to understand the complex nature of this parasite and associated damage caused by the root-knot nematode, a combination of strategies must be put on use to contain the damage caused by this tiny worm. Several tools and strategies need to be combined such as crop-rotation, cover crops, planting resistant varieties of the intended crop, and destroying the rouge materials carefully, using nematode resistant germplasm. Recent developments in field of molecular plant nematology have opened new vistas in field of plant nematology.

Now we are able to genetically engineer the plants at will and also the efforts are underway to transform the nematode like *C. elegans* in an aim to get more information from this nematode. Biotechnology has offered an unparallel approach to conventional methods in nematode control. Recent demonstration of RNAi with plant-parasitic nematodes particularly root-knot nematodes have shown the great promise that this technique hold for future[6]. In brief, a baggage of many techniques will be required to understand the biology of *Meloidogyne incognita* and will help us in designing the novel control strategies.