

Geographical Distribution and Frequency of Occurrence of Root-Knot Nematodes in Punjab–Pakistan

HAFEEZULLAH KHAN AND RIAZ AHMAD

Department of Plant Pathology, University of Agriculture, Faisalabad-38040, Pakistan

ABSTRACT

A survey of root-knot nematodes (*Meloidogyne* spp.) in the Punjab Province of Pakistan was conducted. A total of 1217 samples of root and rhizospheric soil from 47 species of plants were collected from 346 localities of 34 districts of the Province. Out of the 1217 samples collected, 498 samples were found to be infested with root-knot nematodes as visible galls. *Meloidogyne incognita* was the most widely distributed species as it was found in all the 34 districts. *Meloidogyne javanica* was the next common species. The frequency of plant infection by root-knot nematodes varied a great deal in 34 districts of the Punjab. The plant samples of Faisalabad district revealed the maximum frequency (76%) of nematode infection.

Key Words: Survey; Root-knot nematode; Root and Soil samples; Herbacious annual; Perennial plants

INTRODUCTION

In Pakistan, the root-knot nematode problem is more damaging than in developed countries, because the country has tropical and sub-tropical regions, where the climate is suitable for nematode activity throughout the year. Sandy soils in warm irrigated areas favor nematode infestation. The availability of susceptible perennial crops and continuous crop culture of susceptible annuals in the same field often aggravate the disease problem. The information on the damage of field crops by root-knot nematodes is meager in Pakistan, especially in the Province of the Punjab. Hence, studies were planned to be conducted about the geographical distribution and frequency of occurrence of this nematode in the Punjab by determining its association with various annuals and perennial plants.

MATERIALS AND METHODS

Soil and root samples were collected from herbaceous annual and perennial plants from 34 districts of the Punjab, Pakistan. The following 47 host plants were surveyed: Alfalfa, Barley, Bittergourd, Bottlegourd, Cabbage, Cauliflower, Carrot, Chickpea, Chilli pepper, Cotton, Citrus, Cowpeas, Cucumber, Egg plant, Garlic, Guava, Lentil, Lettuce, Maize, Millet, Mustard, Mint, Mulberry, Mung, Muskmelon, Oat, Okra, Onion, Potato, Pumpkin Squash, Peas, Radish, Rice, Rose, Red Clover, Sorghum, Soybean, Spinach, Sugarcane, Sunflower, Sweet orange, Squash, Sponge gourd, Tobacco, Tomato, Wheat and Watermelon. The annual herbaceous plants were uprooted as whole plant (with roots) from soil with the help of a spade. The aerial portion of the plants was

excised and soil removed from roots. The roots were placed in polyethylene bags. All the bags were tied and labelled.

Sampling from the perennial plants was carried by digging the soil near the base of Trunk upto 37-60 cm deep till fine roots appeared. The soil and root samples were collected from this depth, bagged, labelled and brought to the laboratory. One hundred gram of soil and roots from each sample were processed for the isolation of nematodes. Nematodes were extracted using Whitehead and Hemming Trays, and Sieves methods. The number of nematodes recovered from soil and roots of each sample was determined by using a counting dish. For quantitative assessment of second stage Juvenile nematodes in the infested roots, the stained and cleaned roots were cut into 1 cm pieces and using forceps, put into a 7 cm vial. The roots were immersed in sufficient amount of water and macerated by a laboratory homogenizer for 20-30 seconds, depending on the age of the roots. Water was added to this suspension and a 2 ml aliquot was taken by pipette for counting. The number of juveniles per root system was determined from counts of four replicates. The species of *Meloidogyne* were determined by studying the perinneeal patterns of mature female, the head shape and stylet morphology of males and morphology of juveniles.

RESULTS AND DISCUSSION

Of the 1217 samples, 498 were found infested with root-knot nematodes in all the 34 districts. *Meloidogyne incognita* was the most widely distributed species as it was found in all the districts followed by *M. javanica* found in 22 districts. *M. hapla* was found from only

Rawalpindi (Murree). District wise frequency of plant infection has been presented in Table I.

Table I. Plant infection with root-knot nematodes

Districts	Samples analysed (No.)	Nematode infected No. (%)
Faisalabad	135	102(76)
Toba Tek Singh	75	41(55)
Sahiwal	65	34(52)
Sargodha	64	32(50)
Jhang	63	30(48)
Multan	37	16(43)
Sheikhupura	25	10(40)
Qasur	39	15(38)
Khanewal	50	19(38)
Vehari	40	15(37)
Pakpattan	27	10(37)
Okara	41	15(37)
Lodhran	55	20(36)
Bahawalnagar	35	12(34)
Bahawalpur	47	16(34)
Lahore	30	10(33)
Hafizabad	36	12(33)
Sialkot	31	10(32)
Rahim Yar Khan	32	10(31)
Khanewal	29	9(31)
Gujranwala	36	11(30)
Gujrat	14	4(29)
Khushab	28	8(29)
Mianwali	22	6(27)
Muzaffargarh	23	6(26)
Bhakkar	16	4(25)
D.G. Khan	12	3(25)
Layyah	17	4(23)
Rajanpur	15	3(20)
Chakwal	15	3(20)
Rawalpindi	20	3(15)
Mandi Bahaudin	14	2(14)
Jhelum	18	2(11)
Attock	11	1(9)

The frequency of infection was maximum (76%) in Faisalabad and minimum (9%) in Attock. It was 5, 52, 50, 48, 43 and 40% in Toba Tek Singh, Sahiwal, Sargodha, Jhang, Multan and Sheikhupura, respectively. The nematode infection ranged from 31-38% in Kasur, Khanewal, Vehari, Pakpattan, Okara, Lodhran, Bahawalpur, Lahore, Hafizabad, Sialkot and Rahim Yar Khan. It ranged from 23 to 30% in Gujranwala, Gujrat, Khushab, Mianwali, Muzaffargarh, Bhakkar, D.G. Khan and Layyah; and 23-30% in Rajanpur, Chakwal, Rawalpindi, Mandi Bahaudin and Jhelum. Three species viz., *M. incognita*, *M. javanica* and *M. hapla* were found associated with several crop plants. The species of root-knot nematodes recorded in the current study are considered to be the most common species (Taylor *et al.*,

1982) and *M. incognita* has been ranked first by these authors with respect to its geographical distribution and host range. In the present survey too, *M. incognita* was found more widely spread than the other three species. On global basis, *M. incognita* has been reported to constitute about 47% of the total root-knot nematodes population (Sasser & Carter, 1985) and in the present study, the occurrence of this species was found to be 85.10%. This variance may be attributed to soil characteristics and climate of this particular study area. In the other parts of Pakistan, such as Karachi and Sindh too, *M. incognita* has been found to dominate over the other species (Ahmad & Saeed, 1981).

These findings indicate that root-knot nematodes cause extensive damage to agricultural production of the province. The natural hosts of *M. incognita* during this study numbered 40, as compared to 25 for *M. javanica*. *M. hapla*, however, was in the similar order of distribution as generalized by Sasser and Carter (1985). *M. hapla* was recovered from Rawalpindi district and Murree locality having cool climate. Present results are in conformity with those of Sasser and Carter (1985) and Taylor *et al.* (1982) who regarded *M. hapla* as a cool climate species. Brown (1962) was probably the first authority who reported the wide spread occurrence of *M. javanica* and *M. incognita* on banana, papaya, sugarcane, cabbage and other plant species from Karachi, (Sindh), Faisalabad, Multan (Punjab) and Peshawar (NWFP). This information was fragmentary and too scanty. Present work constitutes a comprehensive account of distribution and occurrence of root-knot nematodes in the Punjab.

REFERENCES

- Ahmad, M.M. and M. Saeed, 1981. Studies on root-knot nematodes in Pakistan. *Proc. 3rd. Res. Plant Conf.* on root-knot nematodes (IMP, Region VI, Jakarta, Indonesia, pp. 115).
- Brown, K.F., 1962. A survey of some plant parasitic nematode problems in Pakistan. *Report of the visiting Nematologist*, Shell International Chemical Co. Ltd. 9.
- Sasser, J.N. and C.C. Carter, 1985. Overview of the International *Meloidogyne* project 1975-1984. In: Sasser, J.N. and Carter, C.C. (Eds.), *An Advanced Treatise on Meloidogyne Vol. I. Biology and control*. North Carolina State University and United States Agency for International Development.
- Taylor, A.L., J.N. Sasser and L.A. Nelson, 1982. Relationship of climate and soil characteristics to geographical distribution of *Meloidogyne* spp. in agricultural soils. Dept. Plant Path. N.S. State University and US Agency. Int. Dev. Raleigh, NC. pp. 565.

(Received 04 July 2000; Accepted 20 August 2000)