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Prevalence and distribution of root-knot nematode in polyhouse cultivation in Punjab

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ABSTRACT

Protected cultivation is recently picking up in Punjab and elsewhere due to off-season production of crops and high economic returns. The production of crops in polyhouses/net houses is limited by soil borne pathogens. Of the various pathogens affecting vegetable crops root-knot nematode is an economically important pathogen associated with tomato in polyhouses as well as in open cultivation. Surveys were conducted in four districts of Punjab for prevalence and distribution of root-knot nematode. Twenty nine polyhouses were surveyed in these districts of which eighteen were found to be infested with root-knot nematode. In all one hundred and eighteen samples were collected from different sites and of these forty nine were found to be severely infested with root-knot nematode with root gall index (RGI) more than 3. Frequency of occurrence of root-knot nematode in these polyhouses was observed to be 54 per cent.

Keywords: Root-knot nematode; tomato; protected cultivation; polyhouses

INTRODUCTION

Tomato (*Solanum lycopersicum*) is an important vegetable crop grown throughout the world. A number of pathogens attack tomato limiting its production. Of these root-knot nematode is an economically important pathogen of tomato grown under protected conditions and in open. With increase in demand of export-oriented horticultural crops polyhouse cultivation has recently picked up in Punjab and elsewhere in India. Recently there is more stress on cultivation of vegetables under polyhouses/net houses with minimal use of chemicals. Protected cultivation enables farmers to produce vegetables in the off-season under controlled conditions when fresh produce is not available in the market. The protected structure modifies the climatic conditions like temperature, humidity, wind velocity etc along with high soil, water, fertilizer and other inputs use efficiency for growing horticultural crops. Growing of vegetable and flower crops under protected cultivation is receiving huge attention and gaining popularity among farming community across the country in the recent years (Kaur et al 2004, Cheema et al 2004). The total area under plasticulture in India is 19790 m^2, under mulch 5407 m^2, shade net 1781 m^2, plastic tunnel 916 m^2 and under green houses 189 m^2 (Sharma et al 2009).

With the advancement of off-season production on its side in protected cultivation there is disadvantage of increase in problem of soil borne pests and diseases mainly due to continuous growing of same or susceptible crops. In protected cultivation the continuous growing of same crops increases the problem of soil borne pests and diseases (Engindeniz and Engindeniz 2006, Minuto et al 2006). Of the various soil borne pathogens root-knot nematode is an important pathogen associated with tomato cultivation all over the world. Since tomato cultivation is being opted more and more by farmers the present survey was conducted to know the prevalence and distribution of this nematode in Punjab.

MATERIAL and METHODS

Surveys were conducted of polyhouses/net houses of four districts of Punjab viz Ludhiana, Ropar,

Moga and Sangrur in 2015-2016 for root-knot nematode infestation. Soil and root samples were collected from polyhouses/net houses of these places and washed in laboratory in the Department of Plant Pathology for estimation of nematodes. A core soil sample of 250 cc was prepared from each sampling site for estimation of nematodes from it. The plant roots were collected for estimation of nematode infection in roots.

Analysis of soil population was done by Cobb's sieving and decanting technique (Cobb 1918, Schindler 1961). Root galling index was taken on the scale of 0-5 given by Taylor and Sasser (1978). Severity was considered to be higher in those samples where root gall index (RGI) was greater than 3. Frequency of occurrence was calculated by the formula given below:

$$\text{Frequency of occurrence} = \frac{\text{Number of infected samples}}{\text{Total number of samples}} \times 100$$

RESULTS and DISCUSSION

Surveys were conducted in 2015 and 2016 in four districts of Punjab viz Ludhiana, Ropar, Moga and Sangrur for association of nematode problems in polyhouse cultivation of tomato. In all the four districts root-knot nematode was observed to be the predominant nematode.

In total twenty nine polyhouses were surveyed from four different districts of Punjab. In Ludhiana nineteen polyhouses were surveyed of which nine polyhouses were found to be infested. Of the seventy six samples collected from different sites thirty one were found to be infested with root-knot nematode. Maximum frequency of occurrence (66.66%) was observed in Bhaini Sahib where ten of the fifteen sites were found to be infested with root-knot nematode followed by Muskabad and Pangete (Table 1, Fig 1).

Estimation of soil nematode population per 250 cc of soil from different samples revealed that root-knot nematode population in soil ranged from 33-750 in infected samples as depicted in Table 2.

All the samples collected from polyhouses at Aahliwal and Ranke were found to be non-infective with root-knot nematode. Soil population in infested polyhouses in the villages of Ludhiana ranged from 33-433 nematodes/250 cc soil (Table 2). Roots of the tomato plants at six of the sites in Bhaini Sahib were found to be severely infected with root-knot nematode (RGI >3) while in village Muskabad six sites were found to be severely infected (RGI >3).

In Ropar district total twelve samples were collected from three polyhouses of village Sandhuan. The nematode was observed to be associated with all the three polyhouses surveyed in the district. In the twelve samples collected the soil population ranged from 116-666 nematodes/250 cc soil. Of the three polyhouses roots in one of the polyhouses were observed to be severely infested with root-knot nematode (RGI: 4-5).

Survey of district Moga revealed that four polyhouses of village Raoke Kallan in the district were found to be predominantly associated with root-knot nematode. Soil nematode population in one of the

Table 1. Frequency of occurrence of root-knot nematodes in polyhouse cultivation of tomato in four districts

District	Village	Polyhouses surveyed	Crops taken in polyhouses	Crop present	Number of polyhouses infested	Frequency of occurrence (%)
Ludhiana	Bhaini Sahib	III	Cucumber/capsicum/tomato	Cucumber	2	66.66
Ludhiana	Muskabad	IV	Tomato/cucumber	Tomato	2	50.00
Ludhiana	Pangete	II	Cucumber/capsicum/tomato	Cucumber	1	50.00
Ludhiana	Aahliwal	II	Cucumber/tomato	Cucumber	0	Nil
Ludhiana	Ranke	IV	Tomato/cucumber/capsicum	Tomato/capsicum /cucumber	0	Nil
Ludhiana	PAU	II	Tomato/capsicum	Capsicum	2	100.00
Ludhiana	PAU	II	Tomato/capsicum	Tomato	2	100.00
Ropar	Sandhuan	III	Capsicum/cucumber/tomato	Capsicum	3	100
Moga	Raoke Kallan	II	Tomato/cucumber	Tomato	2	100
Moga	Raoke Kallan	II	Tomato/cucumber	Cucumber/tomato	2	100
Moga	Raoke Kallan	I	Capsicum/tomato	Capsicum	1	100
Sangrur	Sandhaur	II	Tomato/cucumber/capsicum	Tomato/capsicum	1	50

Table 2. Root-knot nematode population in soil and root galling index (RGI) of crops in polyhouses surveyed in four districts of Punjab

District	Village/location	Name of farm /farmer	Polyhouses surveyed	Sites sampled	Sites infested	Frequency of occurrence (%)	Soil population /250 cc soil	RGI
Ludhiana	Bhaini Sahib	Namdhari farm	I	5	5	66.66	100-366	2.0-5.0
			II	5	5		183-233	2.0-4.0
			III	5	0		Nil	1.0
Ludhiana	Muskabad	Davinder Singh	I	5	4	50	0-233	1.0-4.0
			II	5	2		0-150	1.0-4.0
			III	5	1		33-66	1.0
			IV	5	3		83-116	1.0-3.0
Ropar	Sandhuan	Jinder singh	I	4	4	100	116-666	3.0-5.0
			II	4	4		116-233	2.0-4.0
			III	4	4		416-466	4.0-5.0
Ludhiana	Pangete	Grewal farm	I	4	3	41.66	166-250	2.0-3.0
			II	4	2		0-183	1.0-3.0
			III	4	0		Nil	1.0
Ludhiana	Ranke	Paramjit Singh	I	5	0	Nil	Nil	1.0
			II	5	0		Nil	1.0
			III	4	0		Nil	1.0
			IV	4	0		Nil	1.0
Ludhiana	Aahliwal	Harjinder Singh	I	4	0	Nil	Nil	1.0
			II	4	0		Nil	1.0
Moga	Raoke Kallan	Jagraj Singh	I	4	4	100	433-583	2.0-5.0
			II	4	4		250-750	3.5-5.0
Moga	Raoke Kallan	Surjit Singh (nursery)	I	4	4		116-333	2.0-3.5
Moga	Raoke Kallan	Sikander Singh	I	4	4		233-346	2.5-4.0
Sangrur	Sandhaur	Teerth Singh	I	5	4	55.55	0-500	1.0-5.0
			II	4	1		0-33	1.0
Ludhiana	PAU	Agricultural engineering farm	I	4	4	75	416-433	4.0-5.0
Ludhiana	PAU	Agricultural engineering farm	II	4	2		216-416	3.0-5.0

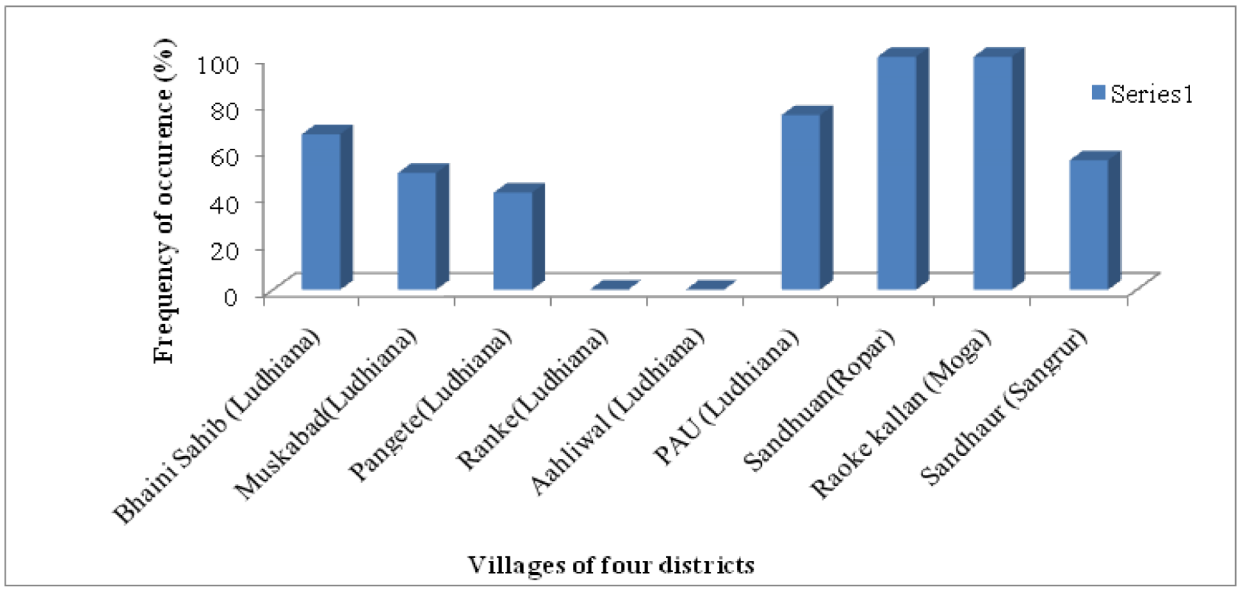

Fig 1. Frequency of occurrence of root-knot nematode in polyhouses in different villages of four districts of Punjab

polyhouses used for nursery raising was observed to be 333 nematodes/250 cc soil. Root gall number in the nursery plants collected from this polyhouse ranged from 2.0-3.5. In all sixteen sites were sampled from Moga district and all were found to be infested with root-knot nematode. Four were found to be severely infested and soil population ranged from 433-750 nematodes/250 cc soil and RGI from 4-5 in severely infested samples.

In Sangrur nine samples were collected from two polyhouses of village Sandhaur of which five were found to be infested indicating 55 per cent frequency of occurrence. Four samples were found to be severely infested and soil population ranged from 33 to 500 nematodes/250 cc soil.

Conclusively the present survey revealed that root-knot nematode was predominantly associated with polyhouse/net house cultivation in Punjab in the districts surveyed. Of the twenty nine polyhouses surveyed in four districts of Punjab eighteen were found to be infested with root-knot nematode. A total of 118 samples were collected from these polyhouses and 64 were found to be infested showing 54 per cent frequency of occurrence. Samples from 49 sites were found to be severely infested with root-knot nematode which might cause significant yield losses in the succeeding crops.

Earlier surveys conducted by Singh and Khanna (2015) also revealed root-knot nematode as a predominant nematode associated with polyhouse cultivation. Further they observed that population ranged from 37-2547/200 cc soil and recorded incidence of 60-100 per cent. Similar results were recorded by Sorribas and Verdejo-Lucas (1994) who conducted the survey in protected as well as open cultivation to determine the abundance and frequency of *Meloidogyne incognita* in Spain. They found that root-knot nematode was present in 22 out of 45 sites sampled (12 green houses and 10 open fields). The present survey revealed that root-knot nematode had been emerging as an economically important pathogen of polyhouse cultivation of Punjab. The raising of nursery in these infected polyhouses becomes one of the reasons for its spread to newer sites leading to multifold problem for farmers in polyhouse cultivation. Present survey also revealed a significant observation that polyhouses which were built on vegetable grown sites were more infested with root-knot nematode than those built on rice-wheat grown fields. Root-knot nematode is emerging as an important problem in polyhouses therefore presently there is urgent need to conduct further studies on management of this nematode.

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