



Status of root knot nematode (*Meloidogyne* spp.) in polyhouses and awareness level of the farmers on the nematode problems in Himachal Pradesh

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Abstract

A study was carried out (2006-2016) on the incidence of root knot nematode (*Meloidogyne* spp.) in major crops being grown in polyhouses in Himachal Pradesh. It was revealed that 83.10 per cent of polyhouses are infested with this nematode. The severity of the nematode was found maximum in cucumber followed by carnation, tomato and sweet pepper and increased with the advancement of growth stages in all the crops under investigation. The 77.50 per cent of nurseries were found to be infested with root knot nematode. It was found that 40.44 per cent of the growers have awareness about the nematode as pest in their polyhouses.

Key words: Root knot nematode, polyhouse, awareness level, nursery.

Growing of vegetable and ornamental crops under protected environment is becoming popular in Himachal Pradesh by taking the advantage of diverse climate and off season. Further, small land holdings, field work associated drudgeries and increased cost of cultivation with low yields and rain fed conditions in most of the areas of State is attracting educated youth to adopt this technology for quality produce and high returns per unit area. As a result, more and more area under protected cultivation is being added every year. Presently, state is having more than 300 ha area under polyhouse cultivation (Sharma *et al.* 2015).

The protected environment provides congenial microclimate for the multiplication of various biotic stresses including plant parasitic nematodes. The root knot nematodes (*Meloidogyne* spp) are sedentary endoparasites and are among the most damaging agricultural pests attacking a wide range of crops (Sahebani and Hadavi 2008), especially vegetable crops, causing dramatic yield losses mainly in tropical and sub tropical agriculture (Kiewnick and Sikora 2006).

In Himachal Pradesh, preliminary observations during the year 2005, revealed root knot nematode as the most predominant. So it was planned to work out the incidence of this nematode in major crops (tomato, cucumber, sweet pepper and carnation) being grown in polyhouses and also in the nurseries being raised in polyhouses. Since knowledge of the farmers with respect to nematodes is limited, so it

was also planned to assess their awareness level with respect to nematodes.

Materials and Methods

The studies were carried out during the year 2006-16 by carrying out random survey in various polyhouse crops from time to time. The study comprised four parts. In the first part, number of polyhouses having root knot nematode infestation was worked out. For this, root samples were collected from 326 polyhouses from different districts of Himachal Pradesh (Table 1). The roots were examined critically for the presence of nematode galls either with naked eyes or with the help of a hand lens. In the second part of the study, root system of 3 plants per polyhouse was examined to know the severity of nematode infestation at different stages of the crops and the Root Knot Index (RKI) was calculated as per the following rating scheme: 1= No incidence, 2= 0 - 25 % root system galled, 3 = 26- 50 % root system galled, 4 = 51- 75% root system galled, 5 = 76- 100% root system galled. In the 3rd part of study, 3-5 seedlings (tomato/brinjal/sweet pepper) were uprooted gently from the nurseries being raised by the farmers in the polyhouses and brought to laboratory. The roots were cut into small bits (about one cm long) and stained in boiling lactophenol containing 0.1 per cent acid fuchsin. After washing excess of stain in water, the roots were put into lactophenol for overnight and examined under stereozoom

microscope for taking root knot nematode count. In the 4th part of the study, 120 growers were interviewed in different districts (Table 7) of the state for knowing their awareness level with respect to plant parasitic nematodes.

Results and Discussion

It can be seen from Table 1 that the number of polyhouses infested with root knot nematode varied from 72.73 (in district Chamba) to 92.31 (in district Sirmour) per cent in different districts of Himachal Pradesh with mean of 83.10 which can be considered as very high. In general, it was observed that in newly started polyhouses, infestation was low which increased with the advancement of crop stage. In some of the older polyhouses, higher incidence of root knot nematode was recorded in the crops with poor crop stand or even failure. In some of the polyhouses, nematode galling was found to be associated with the rotting symptoms indicating the interaction of nematode with other microorganisms.

In tomato, RKI in different districts at S-I, S-II and S-III ranged from 1.67 to 2.44, 2.11 to 3.11 and 2.89 to 3.67, respectively (Table 2). The mean RKI of all the crop stages was found to range between 2.30 & 2.89 in different districts of the state.

In cucumber, data were recorded in seven districts in 48 polyhouses. The RKI in this crop in different districts was found between 1.89 & 3.00, 2.44 & 4.00 and 2.94 & 4.56 at S-I, S-II and S-III, respectively (Table 3). The mean of RKI in different districts ranged from 2.69 (in district Chamba) to 4.28 (in district Mandi).

In sweet pepper, 51 polyhouses were analysed in seven districts and were found to have RKI between 1.55 & 2.11, 1.67 & 2.67 and 1.78 & 3.33 at S-I, S-II and S-III, respectively (Table 4). RKI mean of different crop stages ranged from 1.71 in district Bilaspur to 2.67 in district Mandi.

In carnation, RKI at S-I, S-II and S-III was found to be between 1.78 & 3.00, 2.33 & 3.67 and 2.78 & 4.67. The mean RKI was found to be highest in district Bilaspur which has maximum number of acreage under carnation in Himachal Pradesh. In all the crops, with the advancement of crop stage, RKI was found to increase (Table 2 to 4).

From the scanning of literature, it appears that information on the incidence of root knot nematode with respect to crop stages of tomato, cucumber, sweet pepper and carnation is not available in any of the state in India. Besides these major crops, farmers are also taking various filler crops such as peas, cabbage, coriander etc. from time to time. The preliminary survey of these crops shows that all

these crops are also susceptible to the root knot nematode in polyhouses. In most of the polyhouses, farmers are taking the same crop season after season continuously in view of their marketing prospects which is resulting in increase in nematode build up and thereby heavy losses. Chandel (2010) estimated 11 per cent losses in tomato in polyhouse which was four year old. The present findings can be supported from the earlier findings of Engindeniz & Engindeniz (2006) and Minuto *et al* (2006) who reported that continuous growing of same crop increases problem of soil borne pests and diseases including plant parasitic nematodes.

Another major activity of the polyhouse farmers is the production of nurseries for their own use as well as for the supply to the local growers. The observations as presented in Table 6 show that out of 40 nurseries in seven districts of Himachal Pradesh, 31 (77.50%) were found to be infested with root knot nematode with mean population (per plant) ranging from 4.00 (district Bilaspur and Mandi) to 8.25 (district Una). This implies that major source of spread of root knot nematode must be through nursery. Presently, there is no policy either at state farm universities or in the department of Agriculture (Himachal Pradesh) for the certification of nurseries. However, fruit plant material is being regulated under 'Himachal Pradesh Fruit Nurseries Registration Act 1973'. So far 726 nurseries have been registered under this Act, out of which 632 nurseries are in private sector and the balance of 94 nurseries in public sector (www.hpagrisnet.gov.in/hpagris/horticulture). There is need to map out these nurseries for the status of plant parasitic nematodes.

The data in Table 7 show that the number of growers having awareness about nematodes ranged from 25.00 per cent (in districts Chamba and Sirmour) to 54.29 per cent (in district Bilaspur) with mean of 40.44 per cent in nine districts. So there is need to educate the growers on various pests and diseases including nematodes. During survey, it was also observed that majority of farmers have started polyhouse cultivation without any training which has resulted in either poor crops or even failure. In order to overcome this problem, Government of Himachal Pradesh has made it mandatory for the farmers to undergo short training of 3-4 days before the start of polyhouse and the subsidy cases are being recommended only if the farmer have the certificate of training attended either in Agriculture or Horticulture University. It is likely that awareness level of the growers will definitely go up in the times to come.

Table 3. Root knot index (RKI) in cucumber at different crop stages in polyhouses

District	RKI at days after transplanting			Mean RKI
	20 (S-I)	21-40 (S-II)	>60 (S-III)	
Bilaspur	2.00 (3)	3.22 (3)	4.45 (3)	3.22
Hamirpur	1.89 (3)	2.78 (3)	4.44 (3)	3.04
Kangra	2.67 (3)	2.89 (3)	4.56 (3)	3.37
Una	3.00 (3)	3.89 (3)	4.56 (3)	3.82
Mandi	-	4.00 (3)	4.56 (3)	4.28
Chamba	-	2.44 (3)	2.94 (3)	2.69

Data in parentheses are the number of polyhouses surveyed, Total number of polyhouses surveyed = 48, S= Crop stage

Table 4. Root knot index (RKI) in Sweet pepper at different crop stages in polyhouses

District	RKI at days after transplanting			Mean RKI
	50 (S-I)	51-100 (S-II)	>100(S-III)	
Bilaspur	1.67 (3)	1.67 (3)	1.78 (3)	1.71
Hamirpur	1.55 (3)	2.11 (3)	2.77 (3)	2.14
Kangra	1.78 (3)	2.57 (3)	3.00 (3)	2.45
Una	2.11 (3)	2.67 (3)	3.11 (3)	2.63
Kullu	1.84 (2)	2.17 (2)	2.84 (2)	2.28
Mandi	2.00 (3)	2.67 (3)	3.33 (3)	2.67

Data in parentheses are the number of polyhouses surveyed, Total number of polyhouses surveyed = 51, S= Crop stage

Table 5. Root knot index (RKI) in carnation at different crop stages in polyhouses

District	RKI at days after transplanting			Mean RKI
	60 (S-I)	61-150 (S-II)	>150 (S-III)	
Bilaspur	3.00 (3)	3.56 (3)	4.67 (3)	3.74
Hamirpur	1.89 (2)	3.67 (2)	4.33 (3)	3.30
Una	2.83 (2)	3.17 (2)	4.17 (2)	3.39
Chamba	1.78 (3)	2.33 (3)	2.78 (3)	2.30

Data in parentheses are the number of polyhouses surveyed, Total number of polyhouses surveyed = 31, S= Crop stage

Table 6. Incidence of root knot nematode in polyhouse grown nurseries (tomato/brinjal/sweet pepper) in Himachal Pradesh

District	Number of nurseries		Population mean (range) per plant
	Surveyed	Infested	
Bilaspur	7	5	4.00(2-6)
Hamirpur	5	4	5.50(4-9)
Kangra	14	9	4.00 (2-8)
Solan	3	3	5.33 (2-10)
Una	4	4	8.25 (6-12)
Mandi	3	3	4.00 (3-4)
Chamba	4	3	7.00 (6-7)

% nurseries in polyhouses infested with root knot nematode= 77.50

Table 7. Awareness level of the farmers with respect to nematode problems in protected cultivation in Himachal Pradesh

District	Farmers	
	Interviewed	Aware of nematode problems (%)
Bilaspur	35	54.29
Hamirpur	20	45.00
Kangra	26	46.15
Solan	7	57.14
Sirmour	4	25.00
Kullu	7	28.57
Chamba	4	25.00
Mandi	7	42.85
Una	10	40.00
Mean=		40.44

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