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Survey Paper

INCIDENCE OF PHYTOPARASITIC NEMATODES IN VEGETABLE CROPS GROWN UNDER PROTECTED CULTIVATION IN HIMACHAL PRADESH

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Abstract: The faunistic survey was conducted to determine the status of phytoparasitic nematodes associated with vegetable crops (French bean, cucurbits, tomato, crucifers and potato) under polyhouse conditions. About 81 polyhouses from 52 localities of different districts of Himachal Pradesh were surveyed. Study revealed the presence of different genera of plant parasitic nematodes viz. *Meloidogyne* species, *Pratylenchus* species, *Helicotylenchus* species, *Mesocriconema* species, *Tylenchorhynchus* species and *Hoplolaimus* species. Out of these nematodes *Meloidogyne incognita* was predominant with population range (37-1200/200cc soil) followed by *Helicotylenchus dihystera* (28-832/200cc soil), *Pratylenchus coffeae* (20-360/200cc soil) and *Mesocriconema xenoplax* (30-260/200cc soil) respectively. Crop wise analysis depicts that above discussed nematode species were most prevalent in tomato, cucurbits and capsicum. *M. incognita* was found to be most alarming. Diversity and dynamics of nematodes were also observed in tomato based crop sequences. The tomato-cabbage-cowpea and tomato-cucumber-mustard were found to have maximum suppressive effect on *M. incognita*.

Himachal Pradesh described by the ancients as 'Dev Bhoomi' is situated in the heart of Himalayas in the northern part of India. It has a geographical area of 55.67 lakh hectares by professional surveys. Important crops grown in the state are cereals- maize, wheat, rice, pulses, oilseed crops, variety of vegetables like tomato, cucurbits, brinjal, capsicum and fruits. The maximum area under vegetables apart from potato and ginger accounts for pea and tomato. Productivity of tomatoes is quite high i.e. 34,645 kg/ha (Anonymous, 2013). HP government is promoting farming inside modern greenhouses to improve earning potential of farmers in state especially during harsh winters. The protected environment provides suitable and congenial microclimate fot the multiplication of various plant pathogens such as nematodes, insects, diseases etc. The enormous economic damage to plants by their root

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feeding and interaction with other organisms renders the plants further vulnerable to other biotic and abiotic stresses. In view of damage potential of these tiny hidden enemies of crop plants, an urgent need is felt for initiating coordinated efforts at national level pertaining to nematode distribution, assessment of crop lossess and for developing nematode management technologies (AICRP Nematology IARI) During preliminary survey, some polyhouses in H.P. were observed to be severely infested with major plant parasitic nematode genera viz. *Meloidogyne*, *Pratylenchus*, *Helicotylenchus*, *Mesocriconema* and *Tylenchorhynchus*. Considering the adverse effects of the pesticidal approach to nematode control, there is hardly any choice left for growers to reduce the nematode population in crop fields. The cropping sequence has a major role to play in the management of phytonematode problems in economic crops under a sustainable production system. The present studies were planned with the objectives to map out the incidence of phytoparasitic nematodes and effect of cropping sequence in diversity and dynamics of plant parasitic nematodes.

Keywords: *Meloidogyne* species, *Pratylenchus* species, *Helicotylenchus* species, *Mesocriconema* species, *Tylenchorhynchus* species and *Hoplolaimus* species

Materials & Methods

During the survey period (2013-14) soil and root samples were collected from different (81) polyhouse crops of eight districts of Himachal Pradesh. The samples were collected from the crops which were at least in flowering stage. The samples were analysed by cobb's decanting and sieving technique followed by schindler's modification for nematode population (Townshend, 1963). Roots were stained with acid fuchsin and transferred into lactophenol solution to observe sedentary endoparasitic nematodes. The frequency of occurrence and population density was determined per 200cc soil or 5g roots. Prominence value (PV = Population density X √frequency of occurrence/100) were calculated for important nematode species in soil and root sample. Information regarding crop history grown during one year at the same location was obtained from the farmers.

Results and Discussion

Survey results of phytoparasitic nematodes associated with different polyhouse crops in different districts of HP are detailed in Table 1. It can be revealed from the table that 81 polyhouse growing various crops (French bean, tomato, cucurbits, crucifers, capsicum and potato) were surveyed in eight districts. Four major species of plant parasitic nematodes were found to be most prevalent i.e. *M. incognita*, *H. dihystera*, *P. coffeae* and *M. xenoplax*. Out of these four nematode species *H. dihystera* and *M. incognita* were found with varying

frequency of occurrence in almost all the crops. The population density of *M. incognita* in different districts ranged from 37-2547 juveniles/200cc soil (incidence recorded-60-100%). Likewise, population density of *H. dihystera*, *P. coffeae* and *M. xenoplax* ranged from 28-832/200cc soil (incidence recorded- 50-80%), 35-360/200cc soil (incidence recorded- 50-70%) and 30-260/200cc soil (incidence recorded- 40-50%) respectively.

Cropwise distribution of plant parasitic nematodes associated with polyhouse crops is given in Table 2. This table reveals that *M.incognita*, *H.dihystera* and *P.coffeae* were found to be most prevalent in three major crops i.e. tomato, cucumber and capsicum. Population density of root knot nematode ranged from 28-20,000 in tomato crop followed by 11-573 and 28-490 in cucumber and capsicum respectively. Similarly population density of *H.dihystera* ranged from 16-715 (tomato) 28-912 (cucumber) and 25-880 in capsicum. Likewise population density of *P.coffeae* ranged from 19-269, 15-795 and16-220 in all the respective crops.

Table 3 revealed the frequency of occurrence, mean population density and prominence value of major phytoparasitic nematodes recorded from tomato, cucumber and capsicum. All above discussed nematode are reported to be economically important in polyhouse cultivation (Johnson *et al*.,2006, Sharma *et al*.,2007; Khanna & Jyoti, 2004). Qualitative and quantitative analysis of major plant parasitic nematodes in greenhouse crops (Sweet pepper, carnation, cucurbits, tomato and cauliflower) was done by Chandel *et al*. 2010 have also been documented.

During survey period diversity and dynamics of nematodes were also observed in tomato based crop sequences in which tomato-maize-tomato and tomato-mustard-tomato were found to have maximum suppressive effect on *M. incognita* as shown in Table 4. Mojtahedi *et al.* (1993) also found suppression of nematodes in soil by using mustard and other *Brassica* crops. In West Bengal, the population of *M.incognita* was enhanced by the jute in the rice-jute-vegetable crop sequence but incorporation of mustard in the sequence reduced the soil nematode population (Khan and Banerjee 2003). Siddiqui and Alam (2001) proved that fallow-cauliflower-sorghum-coriander and sorghum-wheat-horsegram-turnip were beneficial in reducing the *M. incognita* and *R. reniformis* populations. Jain *et al*. (2002) also found okra-wheat-fallow-okra as most effective to reduce root-knot nematode. The okra-rice-tomato enhanced the nematode population.

Table 1. District wise analysis of nematodes with population range and %incidence

District	Crops	Nematodes (population range & % incidence			
		M. incognita	***H. dihystera***	***P. coffeae***	***M. xenoplax***
Kangra	F.bean	37-118 (60%)	31-262(28%)	60-128 (32%)	84-112 (50%)
	Tomato	-	185-260(42.8%)	-	94-230 (28.5%)
	Cucumber	65-120(71.4%)	28-198 (60%)	120-232 (50%)	35-70 (50.2%)
Bilaspur	Tomato	800-2547 (64%)	350-590(62.2%)	60-220(62.5%)	83-224(48.5%)
	Cauliflower	140-250(71.5%)	450-762(41.6%)	32-150(33.3%)	-
	Capsicum	500-620(57.2%)	165-320(65%)	-	69-82(28%)
Mandi	Tomato	52-360(53.3%)	164-400(50%)	32-60(75%)	-
	Pakchoi	90-318(25%)	292-350(22.2%)	-	-
	Ch.Sarson	32-40(28.5%)	132-456(62%)	-	130-260(42.5%)
	Squash	68-420(66.5%)	65-150(58.3%)	30-58(55.5%)	33-46(34%)
Hamirpur	Tomato	218-563(41.5%)	136-225(57%)	20-56(57.2%)	-
	Capsicum	460-830(54.5%)	120-292(67%)	-	83-135(45%)
	Cucumber	128-272(80%)	31-83(55.5%)	210-264(76%)	30-95(60%)
	Cauliflower	76-129(75%)	43-290(50%)	-	64-89(37.5%)
Solan	Potato	-	46-120(53.3%)	-	-
	Capsicum	188-473(70%)	54-300(28.4%)	26-180(50%)	34-112(35%)
	Tomato	185-660(62.5)	220-282(50%)	69-230(48.3%)	50-96(44%)
	Cucumber	67-120(45%)	31-125(38.4%)	88-125(56%)	-
Kullu	Cabbage	-	100-262(41%)	150-200(65%)	200-345(56%)
	Tomato	350-426(80%)	120-189(62.3%)	70-100(33.3%)	-
	Bittergourd	1000-1200(100%)	240-530(75.5%)	136-400(77%)	69-110(69%)
	Cucumber		440-832(50%)	-	122-145(59%)
Sirmour	Tomato	100-660(62.5%)	-	75-130(50%)	75-124(54%)
	Coriander	100-255(46.5%)	250-838(75.5%)	-	-
Shimla	Capsicum	175-336(75%)	429-525(67.1%)	135-540(55%)	50-76(22.4%)
	Tomato	89-112(62.3%)	52-133(59%)	62-130(66%)	105-232(42.4%)

*Figures in parenthesis indicates the percent occurence

Table 2. Cropwise analysis of nematodes associated with major polyhouse crops in HP

Crop	Localities	*Meloidogyne*	*Helicotylenchus*	*Pratylenchus*
Tomato	Arki	80-285	92-205	45-456
	Mattansidh	38-275	29-75	83-269
	Jukhala	145-200	40-250	-
	Ranital	77-104	46-295	-
	Virta	102-290	16-290	67-130
	Jachh	46-740	23-157	48-220
	Nagrota	28-320	49-300	19-145
	Malan	-	37-212	52-122
	Jogindernagar	175-200	66-84	49-66
	Daddor	-	50-72	60-212
	Karenji	4000-2000	-	28-150
Cucumber	Mattansidh	11-573	60-912	110-795
	Ranital	22-46	75-450	15-86
	Darang	38-323	28-205	81-100
	Luhara	42-570	296-300	-
Capsicum	Kothiduara	29-80	140-880	26-47
	Dhundhan	73-99	150-340	16-202
	Koita	66-450	25-70	-
	Jukhala	30-350		43-220
	Dugha	28-490	69-130	-

Table 3. Frequency of occurrence, mean population density and prominence value (PV) of important nematodes recorded from Tomato

	Nematodes	**Frequency of occurence**	**Mean population density**	**Prominence value**
Tomato	*Meloidogyne incognita*	68%	132	10.9
	Helicotylenchus dihystera	66%	438	29.7
	Pratylenchus coffeae	29.4%	79	4.25
Cucumber	*Meloidogyne incognita*	62.3%	56	4.40

	Helicotylenchus dihystera	55.5%	200	14.8
	Pratylenchus coffeae	32%	135	7.63
Capsicum	*Meloidogyne incognita*	44.4%	130	8.62
	Helicotylenchus dihystera	76%	550	47.9
	Pratylenchus coffeae	56.4%	95	7.10

Table 4. Tomato crop sequences with other crops

Locality	**Rotation**	**Population range & %incidence of *M.incognita* in 200cc soil**
Namhol	Tomato-Fallow-Tomato	450-2000 (72.3%)
	Tomato-Cabbage-Cowpea	32-220 (66.5%)
	Tomato-Cucumber-Mustard	78-250 (53%)
Kharyana	Tomato-Fallow-Tomato	300-673 (66%)
	Tomato-Mustard-Tomato	26-98 (44.2%)
	Tomato-Maize-Tomato	32-55 (58%)
Narchala	Tomato-Fallow-Tomato	335-460 (69%)
	Tomato-Cabbage-Bittergourd	98-236 (73%)
Dhanotu	Tomato-Fallow-Tomato	190-310 (57.3%)
	Tomato-Fallow-Mustard	77-138 (61.2%)

References

[1] Chandel Y.S. Kumar S., Jain R.K. & Vashisth, S. 2010. An analysis of nematodes problems in greenhouse cultivation in Himachal Pradesh and avoidable losses due to *Meloidogyne incognita* in tomato. *Indian Journal of Nematology* **40**(2): 198-202.

[2] Jain R.K. 2002. Influence of different cropping sequences on population and incidence of root-knot nematode (*Meloidogyne javanica*). p. 84–87.

[3] In: Proceedings of National Symposium on Biodiversity and Management of Nematodes in Cropping Systems for Sustainable Agriculture. Jaipur, India, November 11–13 2002, 267 pp.

[4] Johnson N., Kumar S.B., Rajendran G. & Ramakrishnan S.2006. Nematodes of cut flowers in Tamil Nadu India. *Indian Journal of Nematology* **36**:276-278.

[5] Khanna, A.S. & Jyoti, J.2004. Pathogenecity of *Meloidogyne incognita* on gladiolus and carnation. *Current Nematology* **14**:75-78.

[6] Khan M.R., Banerjee S. 2003. Dynamics of root-knot nematode, *Meloidogyne incognita* under a sequence of different crops in West Bengal. Indian J. Nematol. **33** (1): 73–74.

[7] Mojtahedi H., Santo G.S., Wilson J.H. 1993. Managing *Meloidogyne chitwoodi* on potato with rapeseed as green manure. *Plant Dis*. **77** (1): 42–46.

[8] Siddiqui M.A., Alam M.M. 2001. Integrated management of the root-knot and reniform nematodes with cropping sequences and ploughing. *Arch. Phytopathol. Plant Protect*. **33** (5): 415–430.

[9] Sharma H.K., Pankaj & Singh, Balraj.2009. Protected cultivation and nematode problem. *Indian Journal of Nematology* **39**:1-8.