Population analysis of the genera buildup on some commercially important vegetable crops grown in Kashmir Valley

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Abstract In order to list the genera buildup on *Brassica oleracea* (Cauliflower), *Capsicum frutescens* (Chillies), *Spinacia oleracea* (Spinach) and *Phaseolus vulgaris* (Farash bean) a general survey was carried in the summer season of 2013. On examining the soil samples as well as root samples of Cauliflower *Boleodorus*, *Psilenchus*, *Helicotylenchus*, *Merlinius*, *Aglenchus* and *Filenchus* were encountered with their absolute density of 18, 31, 34.5, 35, 35 and 31.5 %. On Chillies, *Tylenchus*, *Helicotylenchus*, *Psilenchus*, *Pratylenchus* and *Hirschmaniella* with their absolute frequency of 86, 96.6, 100, 100 and 96.6 % respectively were collected. Among these five genera recorded on Chillies the Relative prominence value of 16 % is lowest for *Psilenchus* and 26.7 % for *Helicotylenchus*. *Merlinius*, *Psilenchus*, *Aglenchus*, and *Boleodorus* were encountered on examining the soil and root samples of Spinach during the period of study. *Boleodorus* was met with the highest percentage of frequency of 90 % as well as

highest proportion of absolute density of 37 % and lowest value of 24 % in case of *Merlinius* and *Psilenchus*. Soil samples as well as root samples of Farash bean, *Aglenchus*, *Tylenchus*, *Hirschmaniella*, *Helicotylenchus* and *Psilenchus* were encountered with their absolute density of 27, 19.5, 33, 33 and 35.4 %. The absolute frequency of 100 % was found in *Tylenchus* with the lowest frequency of 70 % in *Helicotylenchus*. Among the genera recorded on Farash bean relative prominence value happened to be highest in *Hirschmaniella* with the value as 23.6 % and lowest on *Tylenchus* with the value of 14.2 %.

Keywords Population analysis · Tylenchida · Kashmir Valley · *Brassica oleracea* · *Capsicum frutescens* · *Spinacia oleracea* · *Phaseolus vulgaris*

Introduction

Growing recognition that nematode populations can respond in predictable ways to ecosystem disturbance has led to suggestions that nematode community composition or life history indices thereof can be used as sensitive indicators of ecosystem change. Nematodes happen to be an important group of invertebrates that inhabit marine, freshwater as well as terrestrial environments, forming a diverse phylum Nematoda, these are the parasites of animals and of plants. Nematodes cause severe damage to the field crops. They utilize directly or indirectly, the living material of plants as sources of nutrition and often as habitat and sites for reproduction. They utilize chemical activity of bacteria, which hydrolyze carbohydrates, split proteins, cellulose and other organic substances of plant origin. The phytophagous nematodes are common pests of vegetable crops and its yield loss is often due to their high

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densities. These small worms are equipped with a protrusible hollow stylet which is thrust into plant tissues for obtaining nutrition after the dissolution of the cell contents.

Materials and methods

During the summer of year 2013 an intensive survey of plant parasitic nematodes affecting various vegetable crops was conducted in Srinagar city of Kashmir valley. A total of 50 each of soil and root samples were collected from the hosts. Composite root and soil samples were drawn from plants individually at 0–15 cm depths. A composite root sample of 1 g from the plants were taken and observed for nematode population. Similarly, a composite soil sample of 200 g was processed for nematode assay by decanting and sieving followed by the modified Baermann funnel technique. The root sample more thoroughly washed in running tap water finely chopped and thoroughly mixed and the nematode population in root was estimated by traction through maceration by using a kitchen blender. Nematodes collected from soil samples were killed in hot water and later fixed in 4 % formaldehyde solution. Nematode population as estimated by using a stereoscope microscope. Plant parasitic nematodes were identified up to genus level by using standard monograph. The absolute frequency absolute density and prominence value of the nematodes was calculated by using following formula.

$$\text{Absolute frequency} = \frac{\text{Number of samples containing a genus}}{\text{Total Number of samples collected}} \times 100$$

$$\text{Absolute Density \%} = \frac{\text{Density of the genus}}{\text{Total No. of samples collected}} \times 100$$

$$\text{Prominence value} = \text{Absolute density} \times \sqrt{\text{Absolute frequency}}$$

Table 1 Community analysis of plant parasitic nematodes associated with *Brassica oleracea* (Cauliflower)

Genus	AF (%)	RF (%)	RD (%)	AD (%)	RPV (%)	MI
<i>Boleodorus</i>	93.3	18	10	18	10	39
<i>Psilenchus</i>	76.6	14.8	16.6	31	15.7	78
<i>Helicotylenchus</i>	93.3	18.0	18.5	34.5	19	72
<i>Merlinius</i>	80	15	19	35	18.4	87
<i>Aglenchus</i>	83.3	16	18.8	35	18.5	84
<i>Filenchus</i>	90	17.4	17	31.5	17.3	69

Mean Intensity

$$= \frac{\text{Number of individuals of a genus collected}}{\text{Number of infected hosts with that genus.}}$$

Abbreviations used :

AF = Absolute frequency,
 RF = Relative frequency,
 RD = Relative Density,
 AD = Absolute density,
 RPV = Relative prominence value,
 MI = Mean Intensity.

Results and discussions

On examining the soil samples as well as root samples of Cauliflower *Boleodorus*, *Psilenchus*, *Helicotylenchus*, *Merlinius*, *Aglenchus* and *Filenchus* were encountered with their absolute density of 18, 31, 34.5, 35, 35 and 31.5 % (Table 1; Fig. 1). The absolute frequency of 93.3 % was found in *Boleodorus* and *Helicotylenchus* with the lowest frequency of 76.6 % in *Psilenchus*. Among the genera recorded on Cauliflower relative prominence value happened to be highest on *Helicotylenchus* with the value as 19 % and lowest on *Boleodorus* with the value of 10 %.

The present study revealed that the Tylenchid genera buildup on Chillies were *Tylenchus*, *Helicotylenchus*,

Fig. 1 Graphical presentation of various ecological parameters of different genera on *Brassica oleracea* (Cauliflower)

Fig. 2 Graphical presentation of various ecological parameters of different genera on *Capsicum frutescens* (Chillies) **Table 2** Community analysis of plant parasitic nematodes associated with *Capsicum frutescens*

Genus	AF (%)	RF (%)	RD (%)	AD (%)	RPV (%)	MI
<i>Tylenchus</i>	86.6	18	22	27	21	63
<i>Helicotylenchus</i>	96.6	20	26.6	33	26.7	66
<i>Psilenchus</i>	100	20	15.7	19.5	16	39
<i>Pratylenchus</i>	100	20	16.4	20	17	39
<i>Hirschmaniella</i>	96.6	20	19	23	19	48

Psilenchus, *Pratylenchus* and *Hirschmaniella* with their absolute frequency of 86, 96.6, 100, 100 and 96.6 % respectively. *Psilenchus* and *Pratylenchus* appeared in most of the samples collected with 100 % frequency (Table 2; Fig. 2). Population of *Helicotylenchus* happened to be highest with the absolute density and mean intensity of 33 % and 66 respectively. Among these five genera recorded on Chillies the Relative prominence value of 16 % is lowest for *Psilenchus* and 26.7 % for *Helicotylenchus*.

Merlinius, *Psilenchus*, *Aglenchus*, and *Boleodorus* were encountered on examining the soil and root samples of Spinach during the period of study. *Boleodorus* was met with the highest percentage of frequency of 90 % as well as highest proportion of absolute density of 37 % and lowest

Table 3 Community analysis of plant parasitic nematodes associated with *Spinacia oleracea* (Spinach)

Genus	AF (%)	RF (%)	RD (%)	AD (%)	RPV (%)	MI
<i>Merlinius</i>	70	21.4	20.5	24	18.8	66
<i>Psilenchus</i>	80	24.4	20.9	24	20.5	60
<i>Aglenchus</i>	86.6	26.5	27	31.5	27.5	72
<i>Boleodorus</i>	90	27.5	31.5	37	33	81

Table 4 Community analysis of plant parasitic nematodes associated with *Phaseolus vulgaris* (Farash bean)

Genus	AF (%)	RF (%)	RD (%)	AD (%)	RPV (%)	MI
<i>Aglenchus</i>	86.6	20	18.5	27	18.6	63
<i>Tylenchus</i>	100	23	13	19.5	14.2	39
<i>Hirschmaniella</i>	96.6	22.2	22	33	23.6	66
<i>Helicotylenchus</i>	70	16	22	33	20	93
<i>Psilenchus</i>	80	18.4	23.8	35.4	23.1	87

value of 24 % in case of *Merlinius* and *Psilenchus*. The mean intensity value of the said genera are respectively 66, 60, 72 and 81 (Table 3; Fig. 3).

On examining the soil samples as well as root samples of Farash bean (Table 4; Fig. 4) *Aglenchus*, *Tylenchus*, *Hirschmaniella*, *Helicotylenchus* and *Psilenchus* were

Fig. 3 Graphical presentation of various ecological parameters of different genera on *Spinacia oleracea* (Spinach)

Fig. 4 Graphical presentation of various ecological parameters of different genera on *Phaseolus vulgaris* (Farash bean)

encountered with their absolute density of 27, 19.5, 33, 33 and 35.4 %. The absolute frequency of 100 % was found in *Tylenchus* with the lowest frequency of 70 % in *Helicotylenchus*. Among the genera recorded on Farash bean relative prominence value happened to be highest in *Hirschmaniella* with the value as 23.6 % and lowest on *Tylenchus* with the value of 14.2 %.

The present results in regard with the biodiversity of the tylenchid nematodes on this host is in good conformity with the work of other researchers over different parts of the world. A general survey of plant parasitic nematodes associated with Sweet potato in Niger was carried out by (Haougui et al. 2011) whose results validate the present variables. (Bhattacharya et al. 2012) who studied the biodiversity of plant parasitic nematodes of Cashew Plantations in Tripura, India have listed the similar results. Plant parasitic nematodes associated with vegetables growing greenhouses in south eastern Anatolia region, Turkey were studied by Tan and Kilic (2012) depicting sort of similar results. (Fotedar and Mahajan 1972; Fotedar and Handoo 1977; Kaul 1985; Manjrekar and Talgeri 1969; Mahajan 1973a, b) results conform well with the present results.

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