



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(7): 3507-3509
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www.thepharmajournal.com
Received: 13-04-2022
Accepted: 16-05-2022

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Prevalence of root knot nematode (*Meloidogyne incognita*) in bell pepper in and around Bengaluru under protected cultivation

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Abstract

A survey was undertaken on the prevalence of root knot nematode in Bell pepper (*Capsicum annuum* L.) in and around Bengaluru. The maximum population of *M. incognita* (364/200cc soil) was recorded in GKVK, Bengaluru. The maximum population of *M. incognita* was recorded in root samples collected from GKVK, Bengaluru (97/5 g root). The least soil and root population was recorded at chatradahalli village of Devanahalli taluk.

Keywords: Capsicum, bell pepper, meloidogyne incognita, polyhouse, protected cultivation

Introduction

Bell pepper (*Capsicum annuum* L.) belongs to the family Solanaceae, and is grown in several parts of the world. It is believed to be native of Tropical South America (Shoemaker and Teskey, 1995) [11]. The domesticated peppers could be broadly classified into sweet and hot types based on the level of pungency. The bell pepper (*Capsicum annuum* var. *grossum*) is also commonly known as sweet pepper, Capsicum or green pepper. It differs from common hot pepper in size and shape of the fruits, capsaicin content and usage. Bell pepper is one of the highly remunerative vegetables cultivated in most parts of the world especially in temperate regions of Central and South America and European countries, tropical and subtropical regions of Asian continent.

Bell pepper is susceptible to many diseases caused by fungi, bacteria and nematodes. Among nematodes, root-knot nematode *Meloidogyne incognita* significantly reduces the yields of bell pepper (Huang *et al.*, 2000, Rao *et al.*, 2002a, b) [4, 7, 8]. Surveys were also showed that this nematode is widespread in most of the bell pepper growing areas of India (Rao *et al.*, 2002a, b) [7, 8].

Kim (1987) [6] reported nine genera of plant parasitic nematodes from 61 fields continuously cropped with bell pepper in three provinces of Korea Republic. Among these, *Meloidogyne* was most common with infestation rate as high as 85 per cent in Eviseaegi, 75 per cent in Inshil and 48 per cent in Jungwon.

Deshmukh *et al.* (1990) [3] conducted a survey to study, nematodes associated with tomato, aubergines, chilli and okras in the guna district of Madhya Pradesh, which revealed the prevalence of 11 genera of plant parasitic nematodes with different population densities. Further, they also noted the occurrence of *Helicotylenchus dihystra* with tomato roots in high numbers but were moderate in aubergines and low in chilli and okra. However, *M. incognita* was found in high levels in the first three crops but had moderate levels in okra and Aubergines had high populations of the genus *Scutellonema*.

A survey of vegetable crops in nine districts of Agra and Bareilly of Uttar Pradesh showed that 50 per cent of fields were infested with *Meloidogyne* spp. (Khan *et al.* 1994) [5]. Among these species, *Meloidogyne javanica* was most frequently encountered species followed by *Meloidogyne incognita* and *M. arenaria*. Among the vegetable crops, aubergines and cucumbers were the most affected crops followed by tomato, Capsicum and okra. Of the four races of *M. incognita* detected, race-2 was the most predominant followed by race-1, race-3 and race-4, whereas in *Meloidogyne arenaria* population only race-2 found.

Material and Methods

A polyhouse survey was conducted in major bell pepper growing areas in and around Bengaluru district under protected cultivation during the year 2014-15 to study the occurrence

of different plant parasitic nematodes in bell pepper growing polyhouses. During the survey, bell pepper plants in polyhouses showing uneven patches with yellowing; stunted growth and root galling were observed. The infection caused stunted growth of plants with yellowing and drying up of leaves, galling on roots. The plants in infested patches dried up early during the moisture stress. Such plants were selected for sampling. Soil and root samples from 5 to 10 spots were collected randomly with the aid of shovel in the root zone of standing bell pepper crop. Later, a composite sample of 200 cc soil and 5 g roots were put in a polythene bag with proper labeling. Soil sample of 200 cc was washed thoroughly and processed using combined "Cobb's sieving and Baermann's funnel method" (Ayoub, 1977) [1]. Nematode populations in 5 g of roots were estimated by root incubation method (Ayoub, 1977) [1]. After incubation for 48 hours, the suspension was made up to 200 ml, out of which 10 ml was pipetted out and used for counting root knot nematode. Nematodes counted were finally estimated to 5 g roots.

Identification of Root-Knot Nematode Species

The roots infested with root-knot nematode were washed. The females were dissected out from well-developed galls of the root under stereo-binocular microscope and transferred to petriplate containing water. The posterior portion of the female was cut with a perennial pattern-cutting knife (Taylor and Netscher, 1974) [12] and the body contents were cleaned. Cleaned posterior portion of the female was further trimmed and transferred to drop of glycerine on a clean microscopic slide. A coverslip was placed on it, sealed with nail polish and observed under stereo-binocular microscope. The species confirmation was done based on the perennial pattern as described by Chitwood (1949) [2].

Results and Discussion

A preliminary survey was carried out to study the occurrence of major plant parasitic nematodes associated with bell pepper crop growing in and around Bengaluru district. The presence of major plant parasitic nematodes was assessed and the results are presented in Table 1 and 2. The data on survey revealed that in 20 samples analysed, *Meloidogyne incognita* was predominant with a maximum total soil population of 2017 followed by spiral nematode, *Helicotylenchus* spp. (169), lance nematode, *Hoplolaimus* (34) and root lesion nematode, *Pratylenchus penetrans* (44).

The analysis of soil samples from the bell pepper growing areas of in and around Bengaluru district under protected cultivation revealed that the maximum soil population of *Meloidogyne incognita* (364/200 cc soil) was recorded at Bengaluru as compared to other places followed by Byatha of Nelamangala (280/200 cc soil), Ethamakalahalli of chikkaballapura (149/200 cc soil) and Hesaragatta of Nelamangala (248/200 cc soil) The least population was recorded at Chapparadalli of Devanahalli (14/200 cc soil) (Table1 and 2).

The root samples collected from the rhizosphere of bell pepper growing fields of different places in and around Bengaluru district under protected cultivation were analyzed for nematode population. The samples revealed *Meloidogyne incognita* as a predominant nematode with a maximum total root population (741) followed by *Helicotylenchus* (61) lance

nematode, *Hoplolaimus* (32) and root lesion nematode, *Pratylenchus penetrans* (17).

The maximum root population of *Meloidogyne incognita* (97/5 g of root) was recorded in Bengaluru, Byatha of Nelamangala (96/5 g of root), Ethamakalahalli of chikkaballapura (93/5 g of root) and Hesaragatta of Nelamangala (91/5 g of root) The least population was recorded at Chapparadalli of Devanahalli (4/5 g of root) (Table1 and 2).

However, the frequency of occurrence of *Meloidogyne incognita* was maximum compared to *Helicotylenchus* which indicating the predominance of *Meloidogyne incognita* among different genera of plant parasitic nematodes in bell pepper growing areas in and around Bengaluru district under protected cultivation

. The present results are in conformity with the findings of survey made by Kim (1987) [6], Deshmukh *et al.* (1990) [3], Khan *et al.* (1994) [5], Aly Khan *et al.* (2000) and Rao (2004) [9] who have reported occurrence of plant parasitic nematodes like root-knot and spiral nematodes with *Meloidogyne* spp. being predominant affecting bell pepper, chilli and other solanaceous crops in Korea, India (U.P, M.P, Karnataka, Tamil Nadu) and Pakistan causing significantly yield losses in bell pepper production.

Table 1: Population of *Meloidogyne incognita* in soil and roots of capsicum rhizosphere under protected cultivation

Taluk	Location	Population of <i>Meloidogyne incognita</i>	
		Soil/(200 cc)	Roots (/5 g)
Bengaluru			
	GKVK	364	97
	Total	364	97
Doddaballapura			
	Madagondanahalli	103	33
	Tubagere	76	26
	Manasi	42	18
	Huskur	103	54
	Hosalli	32	8
	Total	353	139
Devanahalli			
	Vishwanathapura	198	67
	Boodihal	203	88
	Chapparadahalli	14	4
	Harohalli	115	43
	Total	530	202
Chikkaballapura			
	Ethamakalahalli	249	93
	Manchanabele	173	39
	Mavalli	186	49
	Nelamakalahalli	235	72
	Total	843	227
Nelamangala			
	Hesaraghatta	248	91
	Byatha	280	96
	Mudhure	100	10
	Total	628	199
Anekal			
	Chandapura	127	39
	Avalalli	51	16
	Arehalli	28	9
	Bukkasagara	69	38
	Total	275	102
	Grand total	2017	741

Table 2: Population of other plant parasitic nematodes associated with the rhizosphere of capsicum under protected cultivation

Taluk	Location	<i>Helicotylenchus dihystrera</i>		<i>Hoplolaimus indicus</i>		<i>Pratylenchus penetrans</i>	
		Soil (/200 cc)	Root (/5 g)	Soil (/200 cc)	Root (/5 g)	Soil (/200 cc)	Root (/5 g)
Bengaluru							
	GKVK	09	06	06	03	-	-
	Total	09	06	06	03	-	-
Doddaballapura							
	Madagondanahalli	10	04	02	-	04	02
	Tubagere	08	04	-	03	01	-
	Manasi	06	02	-	02	-	02
	Huskur	08	02	04	-	02	01
	Hosalli	03	01	03	02	01	-
	Total	35	13	16	07	08	05
Devanahalli							
	Vishwanathapura	10	04	07	03	04	01
	Boodihal	08	04	04	02	-	-
	Chapparadahalli	10	03	02	-	-	-
	Harohalli	06	03	03	01	02	01
	Total	34	14	16	06	06	02
Chikkaballapura							
	Ethamakalahalli	14	07	07	05	05	03
	Manchanabele	13	06	10	-	07	03
	Mavalli	9	-	6	1	-	-
	Total	36	13	23	06	12	06
Nelamangala							
	Hesaraghatta	12	06	04	01	02	01
	Byatha	09	03	06	02	1	-
	Mudhure	06	02	04	02	04	02
	Total	27	11	14	05	07	03
Anekal							
	Chandapura	07	03	06	02	04	-
	Avalalli	05	-	03	01	-	-
	Arehalli	01	01	-	-	-	-
	Bukkasagara	15	-	07	02	03	01
	Total	28	04	16	05	07	01
	Grand Total	169	61	90	32	44	17

Acknowledgement

We are thankful to the AICRP (Nematode) section, Department of Plant Pathology, University of Agricultural Sciences, GKVK campus, Bengaluru, for the research facilities provided for carrying out this study.

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