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RESEARCH ARTICLE

Study of plant parasitic nematode population density in Cabbage inRangareddy district, Telangana.

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Abstract

Nematode population was studied in cabbage in Rangareddy district, Telangana state, India. Seven important species of plant parasitic nematodes *Meloidogyne*, *Pratylenchus*, *Helicotylenchus*, *Hoplolaimus*, *Heterodera*, *Rotylenchulus* and *Belonolaimus* were identified in soil and root samples of Cabbage based on morphological characters. *Meloidogyne* and *Heterodera* show highest population density whereas *Belonolaimus* shows least population density.

Introduction:-

It has been estimated that around 10% of world crop production is lost as a result of plant parasitic nematode damage (Whitehead 1998). Plant parasitic nematodes are microscopic, as viewed under microscope, the cuticle or body covering of a nematode is transparent allowing the viewing of internal systems. All plant parasitic nematodes have a feeding apparatus known as stylet, they feed on the content of living cells by inserting and sucking the fluid with their stylet (Hussey et al. 2012). The stylet is a direct extension of the nematodes esophagus and functions similarly to a hypodermic needle conducting a flow of effector proteins from the esophagus into the host plant tissues (Hussey 1989). *Meloidogyne* species has a host range that exceeds 3000 plant species (Ehwaeti,Fargette et al. 1999). This survey was conducted to update the information of population density and frequency of nematodes in cabbage crop.

Materials and Methods:-

Soil and root samples of Cabbage were collected randomly in Gandipet area of Rangareddy district. Sampling was done in year wise from 2011 to2014. Soil and root samples were collected in plastic bags with the garden trowel in a depth of 15-30 cm and fastened with rubber band having a proper label inside the bag. Nematodes must alive for the extraction procedure, the samples in polythene bag should not be exposed to the sunlight as the accumulated heat may kill the nematodes. Soil samples were stored at refrigerator at about 10-15 °C and root samples were stored at 4-5 °C (Barker et al.1969). Storage at high temperature may induce microbial decomposition of roots. Extraction of nematodes from soil and root samples were done by using Baermann funnel method (Baermann 1917; Hopper et al.2005), Cobb sieving method (Jenkins,1964) and Direct method. After extraction nematodes were counted by using stereomicroscope and compound microscope at 10X magnification.

Results:-

The statistical analysis was done by using SPSS software to find out the Mean values of nematodes where Means were significantly different at the level of 0.05.

In cabbage 250 g of soil and 15 g of root samples were collected for observation and sampling was done year wise from 2011-2014.

Frequency of Occurrence = Number of samples containing genera
---------- X 100
Number of samples collected (60)

Frequency and population density of nematodes per 250 g of Soil sample of Cabbage2011 – 2014

Table 1

Year	Nematodes	Mean ±SD	% Frequency Occurrence
2011	*Meloidogyne*	41.50±1.291	69.17
	Heterodera	39.75±3.096	66.25
	Hoplolaimus	33.25±2.986	55.42
	Pratylenchus	32.25±1.893	53.75
	Helicotylenchus	30.50±6.608	50.83
	Rotylenchulus	19.00±2.160	31.67
	Belonolaimus	15.00±2.582	25.00

Table 2

Year	Nematodes	Mean ±SD	% Frequency Occurrence
2012	*Meloidogyne*	36.75±2.217	61.25
	Heterodera	33.75±1.708	56.25
	Hoplolaimus	30.25±2.630	50.42
	Pratylenchus	29.25±1.708	48.75
	Helicotylenchus	29.25±4.856	48.75
	Rotylenchulus	19.00±2.160	31.67
	Belonolaimus	13.75±2.500	22.92

Table 3

Year	Nematodes	Mean ±SD	% Frequency Occurrence
2013	*Meloidogyne*	43.25±2.500	72.08
	Heterodera	40.00±2.160	66.67
	Hoplolaimus	30.00±2.944	50.00
	Pratylenchus	29.25±2.754	48.75
	Helicotylenchus	32.50±2.082	54.17
	Rotylenchulus	22.75±2.754	37.92
	Belonolaimus	17.50±2.646	29.17

Table 4

Year	Nematodes	Mean ±SD	% Frequency Occurrence
2014	*Meloidogyne*	41.75±1.708	69.58
	Heterodera	36.00±4.320	60.00
	Hoplolaimus	33.25±3.775	55.42
	Pratylenchus	35.00±4.163	58.33
	Helicotylenchus	25.00±2.582	41.67
	Rotylenchulus	19.25±1.708	32.08
	Belonolaimus	16.00±2.994	26.67

Number of average values taken for mean (N) = 4

Table 5

Average frequency and population density of nematodes in Soil sample of Cabbage 2011 – 2014

Year	Nematodes	Mean ±SD	% Frequency Occurrence
2011-2014	*Meloidogyne*	40.81±3.082	68.02
	Heterodera	37.38±3.810	62.3
	Hoplolaimus	31.69±3.219	52.82
	Pratylenchus	31.44±3.521	52.4
	Helicotylenchus	29.31±4.868	48.85
	Rotylenchulus	20.00±2.582	33.33
	Belonolaimus	15.56±2.780	25.93

*The mean difference is significant at the P≤ 0.05 level.
Mean Density ± Standard Deviation of nematodes per 250 g of soil
Frequency of occurrence (%of samples in which species was found)

Frequency and population density of nematodes per 15 g of Root sample of Cabbage2011 - 2014

Table 6

Year	Nematodes	Mean ±SD	% Frequency Occurrence
2011	*Meloidogyne*	36.00±1.633	60
	Heterodera	33.00±1.414	55
	Hoplolaimus	30.75±1.708	51.25
	Pratylenchus	26.00±3.559	43.33
	Helicotylenchus	29.00±2.582	48.33
	Rotylenchulus	19.75±2.550	32.92
	Belonolaimus	16.00±2.160	26.67

Table 7

Year	Nematodes	Mean ±SD	% Frequency Occurrence
2012	*Meloidogyne*	34.75±1.708	57.92
	Heterodera	30.75±1.708	51.25
	Hoplolaimus	23.25±2.986	38.75
	Pratylenchus	22.50±3.512	37.5
	Helicotylenchus	29.50±6.557	49.17
	Rotylenchulus	16.25±1.708	27.08
	Belonolaimus	12.75±2.754	21.25

Table 8

Year	Nematodes	Mean ±SD	% Frequency Occurrence
2013	*Meloidogyne*	39.50±2.082	65.83
	Heterodera	33.75±2.500	56.25
	Hoplolaimus	28.75±2.217	47.92
	Pratylenchus	27.75±2.217	46.25
	Helicotylenchus	29.75±1.708	49.58
	Rotylenchulus	17.75±3.500	29.58
	Belonolaimus	14.25±4.031	23.75

Table 9

Year	Nematodes	Mean ±SD	% Frequency Occurrence
2014	*Meloidogyne*	34.50±4.796	57.5
	Heterodera	35.00±3.916	58.33
	Hoplolaimus	31.00±2.160	51.67
	Pratylenchus	33.25±2.500	55.42
	Helicotylenchus	21.75±1.708	36.25
	Rotylenchulus	16.75±1.708	27.92
	Belonolaimus	14.75±1.708	24.58

Table 10

Average frequency and population density of nematodes in Root sample of Cabbage

Year	Nematodes	Mean ±SD	% Frequency Occurrence
2011-2014	*Meloidogyne*	36.19±3.291	60.32
	Heterodera	33.13±2.802	55.22
	Hoplolaimus	28.44±3.829	47.4
	Pratylenchus	27.38±4.829	45.63
	Helicotylenchus	27.50±4.789	45.83
	Rotylenchulus	17.63±2.604	29.38
	Belonolaimus	14.44±2.780	24.07

*The mean difference is significant at the 0.05 level
Mean Density ± Standard Deviation of nematodes per 15 g of root
Frequency of occurrence (%of samples in which species was found)

In Cabbage soil sample during the year 2011-2014 (Table 5), the average mean population density of *Meloidogyne* was 40.81, *Heterodera* was 37.38, *Hoplolaimus* was 31.69,*Pratylenchus* was 31.44, *Helicotylenchus* was 29.31, *Rotylenchulus* was 20.00 and *Belonolaimus* was 15.56 per 250 g of soil sample. Year wise mean values (2011-2014) are illustrated in Table 1 to Table 4

In Cabbage root sample during the year 2011-2014 (Table 10), the average mean population density of *Meloidogyne* was 36.19, *Heterodera* was 33.13, *Hoplolaimus* was 28.44, *Pratylenchus* was 27.38, *Helicotylenchus* was 27.50, *Rotylenchulus* was 17.63 and Belonolaimus was 14.44 per 15 g of root sample. Year wise mean values (2011-2014) are illustrated in Table 6 to Table 9.

Discussion:-

This study has revealed that Cabbage was host to a diversity of plant parasitic nematodes. A large number of nematodes were recorded in soil and root samples of Cabbage crop. Nematodes attacked plants show stunted growth, varying degrees of chlorosis, wilting, roots weakened further more and damaged by nematodes are easy prey to many types of fungi and bacteria which invade the roots and accelerate root decay (Seshadri; 1970)(Lambert and Bekal, 2009). *Meloidogyne* nematode species was most common in vegetables (chilli,tomato, brinjal, cabbage, cauliflower) which found in high population density and it can lead to damage total crop(Anwar and MCKenry,2010). Root lesion nematode P*ratylenchus*feeding among cortical tissues and their infections can result in lesions within the rootlet (Dorhout et al; 1991). Other nematodes identified in this survey are *Helicotylenchus, Hoplolaimus, Heterodera, Rotylenchulus* and *Belonolaimus.* These nematodes feed on epidermal root tissues which leads to pruning of root hairs and damage to epidermal root tissues and can reduce the ability of roots to absorb water and nutrients from soil leading to poor growth (Anwar and VanGundy,1989; Maqbool et al,1988).

Conclusion:-

In this study total 7 species of nematodes *Meloidogyne, Pratylenchus, Helicotylenchus, Hoplolaimus, Heterodera, Rotylenchulus* and *Belonolaimus* were identified in cabbage.

It was observed that, in soil and root samples of Cabbage during the year 2011-2014, *Meloidogyne* show the highest nematode population while *Heterodera* was the second highest and *Belonolaimus* show the least population density.

Nematode population observed in these areas was above the threshold level which shows the need of controlling measures. Integrated nematode management (INM) is an economically viable and socially acceptable approach for crop protection.

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