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Incidence of Citrus nematode, *Tylenchulus semipenetrans* Cobb 1914 in Sweet orange (*Citrus sinensis* Osbeck) orchards in Marathwada region of Maharashtra, India

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Abstract: Sweet orange orchards in central India were surveyed during the year 2006-20011for the occurrence and incidence of citrus nematode, *Tylenchulus semipenetrans* (Cobb) 1914. Roots and soil samples collected from different locations were analyzed for the nematode infection and infestation. The results showed 64.6% samples were positive for Citrus nematode. Maximum infection (81.6%) was recorded in Jalna district followed by Aurangabad, Beed and Hingoli showing 77.10%, 64.60% and 62.40% infection, respectively. This study established the presence of citrus nematode in the Sweet orange orchards of central India.

Keywords: *Sweet orange,* Tylenchulus*, Infection.*

INTRODUCTION

Citrus is being sown in more than 125 countries in the belt within 35 latitude north and south of the equator (Duncan and Cohn, 1990). Citrus is commonly known as tropical plant but can be successfully grown in semiarid regions where winter and summer temperature fluctuates between 4°C and 50°C. The climate of central India is very conducive for the successful production of Sweet orange (*Citrus sinensis* Osbeck). In central India the yield of sweet orange is very low due to attack of many parasitic and non-parasitic diseases.

Numerous nematode species have been reported associated with the citrus rhizophere (Singh, 1997; Bamel and Sonkar, 2012). However, few of them have been found to be of economic

importance. Among these, citrus nematode *Tylenchulus semipenetrans* (Cobb) has been recognized as one of the greatest threat throughout the world which limits production of citrus under a wide range of environmental and edaphic conditions (Bamel and Sonkar, 2013).

The Citrus nematode, *T. semipenetrans,* associated with slow decline of citrus is a universal problem including India. In the main citrus producing regions of the United States, the nematode infests from 50% to 60% of the citrus orchards in California and Florida to as much as 90% in Texas and Arizona. Similar statistics have been reported worldwide (Heald and O'Bannon, 1987). Citrus nematode was first reported in India at Aligarh in 1961 (Siddiqi, 1961). In citrus plantings, symptoms development progress slowly with the buildup of nematode population (Cohn and Minz, 1965).The characteristic symptoms associated with highly infested trees were poor root development showing brownish discoloration, chlorosis, shedding of terminal leaves and fruits of reduced size. Copper and Zinc deficiency symptoms are more pronounced in attacked trees (Van Gundy and Martin, 1961). Keeping in view the importance and seriousness of the problem in citrus growing areas of central India, the present survey was conducted to ascertain the occurrence and extent of citrus nematode.

MATERIALS AND METHOD

Extraction of Nematodes from Soil

Soil and root samples from different symptomatic and asymptomatic plants from 38 locations of different districts in central India were collected from up to 30 cm depth. Samples were taken at a distance of 60 to 90 cm away from the tree trunk. From each orchard randomly five trees were selected. Samples were collected from each tree, mixed thoroughly, and a composite sample of 500 g was taken. The soil along with the feeder roots was collected in polythene bags and brought to the Nematology Laboratory, CCRI, Nagpur for further analysis. Juveniles were extracted from the soil as per Cobb's sieving and decanting technique followed by Modified Baermann Funnel Technique for nematode extraction. The number of nematodes recovered from the soils of each sample was counted under the stereo zoom microscope by using a counting dish.

Extraction of Nematodes from Roots

Feeder roots were washed under tap water carefully to remove soil particles and blotted dry. One gram of fresh feeder roots were placed in a blender and 20 ml of 10% sodium hypochlorite solution was added. Volume was increased by up to 200 ml by adding water and blended for three to four minutes. The roots were washed in tap water and stained in acid fuchsine lactophenol. The roots were then washed in glycerol and distilled water (1:1) to remove excess stain and then the number of females were counted under the stereo zoom microscope.

RESULTS AND DISCUSSION

Nematode Infestation

The results of analysis of soil and root samples are given in Table 1.The table shows that 1099 out of 1700 samples were infested with citrus nematodes showing 64.64% infestation. Maximum samples (81.66%) were found infested with the nematode in Jalna district.

Table I Infestation of Citrus Nematode (Tylenchulus semipenetrans) in central India

District	No. of orchards	No. of trees sampled	Soil and root samples	Infested	Non-infested	% infestation
Beed	10	50	250	167	83	66.6
Hingoli	9	45	225	145	80	62.4
Aurangabad	8	40	200	158	42	77.1
Jalna	8	40	200	163	37	81.6
Parbhani	9	45	225	140	85	62.2
Nanded	6	30	150	83	67	55.5
Total	50	250	1250	856	394	64.6

Table I shows that the infestation of the citrus nematode is 50% or more in all the mandarin growing areas of central India. This also reflects the fact that citrus decline in central India is not solely caused by root invading fungi and Citrus greening bacteria. Thus the importance of Citrus nematode *Tylenchulus semipenetrans* with context to Citrus decline cannot be ignored in central India. Survey of citrus nurseries in India revealed 75% infestation of citrus nematode (Mani *et al.*, 1988). Nematode populations in soil and number of females in roots are given in Table II. The citrus nematode population both in soil and roots was highest in Jalna districts. In district Aurangabad nematode larvae in soil ranged from 1,995-16,120 per kg of soil and number of females ranged from 515 to 1,644 per gram of root. Similarly, nematode population in soil and female per gram of root were recorded for other districts.

TABLE II Citrus Nematode (*Tylenchulus semipenetrans*) population in soil and roots

Nematodes	Districts					
	Aurangabad	Jalna	Hingoli	Beed	Parbhani	Nanded
Larvae/ kg soil	1,995-16,120	2,515-21,651	2,070-20,855	3,256-14,145	1200 - 9,775	1,177-8,679
Females/ g root	515-1,644	475-1,922	290-1880	521-1,814	270-1,650	130-1,110

Perhaps the dieback problem in central India was mainly due to the ignorance of the farmers who thought it a nutritional deficiency. This resulted in an increase in the population of the nematodes in soils. However, inability of the extension department and research institutes to diagnose the problem in time and educate the farmers about the nature of the disease cannot be denied.

The present survey confirms the occurrence and extent of citrus nematode in the six districts of central India. Only few orchards were found free of the citrus Nematode infestation. The nematode population and number of females per gram of root varied in different districts. This is because nematode population densities that suppress tree growth and yield are influenced by several factors including aggressiveness of the nematode population, soil characteristics, susceptibility of the rootstock, presence of other pathogens and groove management practices (Duncan and Cohn, 1990). Tree age has also marked effect on population size and distribution of the nematode (Below *et al.,* 1986).

The difference in the population of female juveniles per gram of plants and per kilogram of soil may also be due to moisture and temperature levels at different stations. The nematode is sensitive to extreme moisture deficits but population

development occurs across the normal range of agricultural soils (Van Gundy and Martin, 1964). Similarly population increases between temperature of 20-31°C with maximum development at 25°C and very slow development at the extremes (O'Bannon *et al.,* 1966). Davis (1984) reported that nematode population peaked in April and declined to the lowest levels in August and September.

The present survey confirms the presence of citrus nematode in the Sweet orange growing areas of central India and suggests further intensive surveys and measures to control the nematode.

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