Research Article

Evaluation of prevalence and incidence of citrus slow decline disease in citrus orchards in district Layyah

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Abstract

An assessment was accomplished, to evaluate the prevalence and incidence of *Tylenchus semipenetrans* (Cobb.) in district Layyah, in the year 2016. A total of 180 soil and root samples were collected from 60 localities of district Layyah in Pakistan. The analysis revealed that 46.67% of the samples were infested with the nematode. Maximum infestation (61.67%) was recorded in tehsil Chobara followed by Layyah (43.34%) and Karor lal-eesan (31.67%), respectively. In tehsil Chobara nematode in soil ranged from 1,102 to 11,070 per kg of soil and number of females ranged from 274 to 1,202 per gram of root followed by tehsil Layyah and Karor lal-eesan ranged from 918 to 10,430 and 1,018 to 9,854 and females per gram of root ranged from 168 to 857 and 120 to 990 respectively. This information is useful to create awareness about the citrus slow decline disease and for its rapid precautionary measures.

Keywords: Citrus decline; *Tylenchus semipenetrans*; Soil samples; Population dynamics

Introduction

During the last few decades, citrus industry has become the largest component of agriculture in Pakistan. Citrus is grown over 199,000 hectares in Pakistan and its average yield is about 2.36 million tonnes. Average production of citrus is approximately 12.78 tons ha⁻¹, whereas it is possible to get the yield about 18-20 tons.ha⁻¹ [1]. Pakistan stands at 14th position as citrus producer in the world (Source: FAOSTAT). There are

various biotic factors which are responsible for reduction in yield like viruses, fungi, nematodes and bacteria. Nematodes infect crops and are responsible for losses of billions of dollars annually [2]. About 50-90% citrus orchards have been infected with *Tylenchus semipenetrans* in USA [3].

In Pakistan citrus is mainly produced in tropical and sub-tropical areas [4]. The Punjab province is the major producer of this important fruit by sharing 94% and 96%

of the total area and production, respectively [5]. Citrus slow decline causing 10-30% losses in citrus trees and therefore considered as a threatening disease [6]. In the survey, 44.44 to 61.12% infestation were reported from different areas of Sargodha [7]. Similar incidence were reported by Khanzada *et al.* from different citrus producing areas of Punjab [8]. The infestation of nematode up to 64.93% observed in citrus orchards [9].

In 1913, Cobb [10] discovered *Tylenchus semipenetrans* as the causal organism of citrus slow decline disease. Neal [11] studied the relationship between *Tylenchus semipenetrans* and citrus trees for the first time. In Pakistan *Tylenchus semipenetrans* was reported in Faisalabad in 1968. The major objective of this study was to appraise the existence and occurrence of *Tylenchus semipenetrans* in Layyah district.

Materials and methods

During February to June 2016, survey was completed by selecting citrus orchards at various localities in all tehsils of district Layyah (tehsil chobara, tehsil krur laleesan and tehsil layyah). Samples from 180 different sites were taken from selected orchards of district Layyah. The samples after collection from each orchard were labeled and kept at 10 °C in plastic bags to avoid drying and were processed within seven days. An assessment of J₂s in given sample was made by opting improved Whitehead and Hemming tray method and were counted using counting dish. Identification of *Tylenchus semipenetrans* carried out on the basis of perinneal pattern [12] Assessment of number of females of *Tylenchus semipenetrans* was done by taking one gram of roots along with 20 ml solution of sodium hypochlorite (10%) and were blended in blender for the period of 45 seconds. Volume of suspension was increased by adding distilled water. The suspension was passed through sieves (325

mesh size) into a beaker where females were collected and counted.

The parameters were examined by using formulae given below.

Disease Prevalence (%) = No. of orchards infected/ Total no. of orchards inspected × 100

Disease Incidence (%) = Number of infected plants / Total number of plants × 100

Results and discussion

The detailed results of investigation of the whole survey of soil and root samples of all citrus orchards are described in Table 1. It is understandable from the given set of information that total 46.67% infestation with *Tylenchus semipenetrans* was recorded in the citrus orchards of whole district (84 out of 180 samples). Utmost infestation with *Tylenchus semipenetrans* was observed in tehsil Chobara (61.67%), whereas, citrus orchards of tehsil Karor-laleesan bare minimum infestation (31.67%). Percentages of orchards having nematode infestation in tehsil Layyah were 43.34%.

As for as the population dynamic of *Tylenchus semipenetrans* in soil is concerned, it ranged from 1,102 to 11,070 kg⁻¹ of soil in tehsil Chobara, 918 to 10,430 kg⁻¹ of soil in tehsil Layyah and 1,018 to 9,854 kg⁻¹ of soil in tehsil Karor-laleesan (Table 1). The data regarding number of females gram⁻¹ of root is given in Table 1. Results revealed that citrus orchards contained females ranged from 274 to 1,202 gram⁻¹ of root in tehsil Chobara, 168 to 857 gram⁻¹ of root in tehsil Layyah and 120 to 990 gram⁻¹ of root in Karor-laleesan.

The manifestation of *Tylenchus semipenetrans* was observed in Layyah district for exploiting the interaction of *Tylenchus semipenetrans* with citrus slow decline disease. The orchards were targeted randomly from various sites of Layyah district and 5 to 20 years old orchards were selected. Total 180 samples were examined.

Survey results showed that maximum *Tylenchus semipenetrans* occurrence was in tehsil Chobara (46.67%), Layyah (43.34%), and minimum prevalence was in Karor-laleesan (31.67%). The survey confirms the occurrence of *Tylenchus semipenetrans* in Layyah district. It was first reported in citrus trees in Californian in 1912 and was described later [11]. In USA, 90-95% of orchards were infested with *Tylenchus semipenetrans* [13]. Parvaiz *et al.* [7] arranged a survey during 2002 reported 54% infestation of citrus nematode from Sargodha district. In the present survey, nematode density and females of roots varied in different areas. A number of factors affected *Tylenchus semipenetrans* density and invasion, including soil texture, temperature, host variety, pH, soil depth, age, nutrients status and moisture. Reproductive rates of different races of nematode obviously varied with rootstock [14]. The population of *Tylenchus semipenetrans* will increase at temperature

20-31°C with maximum density at 25°C and very slow development at the extremes [15]. *Tylenchus semipenetrans* are the most important soil borne pathogens of citrus orchards [16]. Scientists had recorded the relationship between the increase in root rot disease and the occurrence of the *Tylenchus semipenetrans* on citrus rootstocks [17, 18]. *Tylenchus semipenetrans* can be found in any soil texture, but greatest damage occurs in shallow, poorly drained soils with organic matter contents from 2-3% [19].

Conclusions

The information received from the survey conducted in district Layyah confirmed the presence of citrus nematode in citrus orchards. The local environment and soil are also suitable for its growth. Moreover, farmers are totally unaware about this lethal pathogen. The results of this study will help the researcher and pest controlling authorities to develop strategies to control this pathogen in order to enhance citrus production in Layyah.

Table 1. Incidence and infestation of citrus nematode causes citrus slow decline disease in citrus orchards

S.No	Tehsil Chobara			Tehsil Layyah			Tehsil Karor Laleesan		
	<i>Tylenchus Semipenetrans</i>	No. of females	Pop. Dyna./kg Soil	<i>Tylenchus Semipenetrans</i>	No. of females	Pop. Dyna./kg Soil	<i>Tylenchus Semipenetrans</i>	No. of females	Pop. Dyna./kg Soil
1	+	571	11070	-	0	0	+	762	9210
2	+	235	10341	+	823	10430	+	84	2376
3	-	0	0	+	857	10192	+	951	9854
4	+	1005	10960	+	628	9812	+	428	8621
5	+	1077	9872	-	0	0	-	0	0
6	-	0	0	-	0	0	-	0	0
7	-	0	0	-	0	0	-	0	0
8	+	981	8976	-	0	0	+	760	8940
9	+	328	7823	-	0	0	+	482	7200
10	-	0	0	-	0	0	-	0	0
11	-	0	0	-	0	0	+	125	4720
12	-	0	0	+	376	7236	+	38	1348
13	-	0	0	+	59	1231	-	0	0
14	-	0	0	+	76	918	+	990	9726
15	+	274	1200	+	134	1678	-	0	0
16	+	128	1243	-	0	0	-	0	0
17	+	321	1700	+	629	7892	+	623	8720
18	+	279	1102	+	813	8539	+	4810	6120

19	-	0	0	+	723	9163	-	0	0
20	-	0	0	+	830	8102	-	0	0
21	+	88	2490	-	0	0	-	0	0
22	-	0	0	-	0	0	-	0	0
23	+	218	3000	+	432	7901	+	3672	7381
24	-	0	0	-	0	0	-	0	0
25	+	497	10596	-	0	0	-	0	0
26	+	561	10210	+	527	9256	+	56	2372
27	-	0	0	-	0	0	-	0	0
28	+	622	10906	-	0	0	-	0	0
29	-	0	0	-	0	0	-	0	0
30	+	558	10208	-	0	0	-	0	0
31	-	0	0	-	0	0	-	0	0
32	+	600	8092	+	689	10100	+	104	4209
33	+	168	2691	+	785	8734	+	309	7102
34	+	203	3370	+	328	8657	+	327	5620
35	+	286	4496	-	0	0	-	0	0
36	-	0	0	-	0	0	-	0	0
37	+	423	6210	-	0	0	+	310	4430
38	+	479	7109	-	0	0	+	672	7108
39	+	568	6807	-	0	0	-	0	0
40	-	0	0	+	263	6745	+	751	6102
41	-	0	0	-	0	0	-	0	0
42	-	0	0	-	0	0	-	0	0
43	+	216	2008	-	0	0	-	0	0
44	+	627	8526	-	0	0	+	669	8120
45	+	772	8701	-	0	0	+	304	6620
46	+	97	3798	+	172	2019	+	98	6209
47	+	705	9601	+	238	4973	+	41	2681
48	+	804	7723	-	0	0	-	0	0
49	+	165	2869	-	0	0	-	0	0
50	+	119	2654	-	0	0	-	0	0
51	+	510	6781	-	0	0	-	0	0
52	-	0	0	-	0	0	-	0	0
53	-	0	0	-	0	0	-	0	0
54	+	1202	11002	-	0	0	-	0	0
55	+	1190	10934	-	0	0	+	37	1906
56	+	708	9238	-	0	0	+	119	3730
57	-	0	0	-	0	0	-	0	0
58	+	1075	10213	-	0	0	-	0	0
59	+	821	7249	-	0	0	+	810	9103
60	-	0	0	-	0	0	+	892	9854

Author's contributions

Conceived and designed the experiments: HM Aatif, TA Yasir & CMS Hanif. Performed the experiments: T Abbas, A Wasaya & SP Lali. Analyzed the data: AW Baloch & SK Abbas. Contributed reagents/materials/ analysis tools: HM Aatif & TA Yasir. Wrote the paper: HM Aatif, TA Yasir & A Wasaya.

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