Short Communication

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Intensity of Phytonematodes in Citrus Orchards of North West Frontier Province and Their Control Through Indigenous Nematicides

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Among several other pests attacking citrus plants, citrus nematodes *Tylenchulus semipenetrans* is one of the important pests widely spread in all the citrus growing areas of the country responsible for the citrus decline. It incurred damages to citrus industry to the extent of 60-80% in a country like United States. The losses in Pakistan and other developing countries may be far greater. Heavy population of plant parasitic nematodes were recovered in association with citrus roots and its rhizophere in Punjab (Anwar and Sarwar 1981). In Pakistan the causal agent of citrus decline has been reported from all the four provinces by Brown (1962). Recently a survey of citrus growing areas in NWFP & Taxila (Punjab) was conducted to evaluate the nematode fauna and their intensity around the roots vicinity of citrus trees. *Hoplolaimus columbus, Hoplolaimus pararobustus, H indicus, Helicotylenchus multicinctus, H indicus, Tylenchus semipenetrans* and *Aphelenchus avenae* were found to be attacking the roots of citrus plants (Calabratta 1995; Elekcioghu 1995) as presented in Table 1.

During these investigations termite species *Odentotermis obevus and Heterotermis indicola* were also found in association with the nematodes. Moreover preventive and control measures are also taken in consideration so as to over come the losses incurred by nematodes and to enhance the productivity of the citrus trees (Reddy *et al* 1996, Nakhla *et al* 1998). This study deals with the control aspects through indigenous nematicides.

During the survey of Taxila (Heavy Complex Campus), Nowshera, Mardan, Malakand, Charsadda and Kohat forty one soil samples were collected around the citrus plants upto a depth of 15-22.5 cm. The samples were processed

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Table 1
List of nematodes associated with citrus plantation

S.No.	Locality	Nematode species	No. of nematodes
1.	Texila	*Hoplolaimus columbus*	340/100 ml of soil
		H. indicus	297/100 ml of soil
		H. pararobustus	306/100 ml of soil
		Helicotylenchus multicinctus	280/100 ml of soil
		H. indicus	370/100 ml of soil
		Saprophytic Nematodes:	
		Eudorylaimus spp.	260/100 ml of soil
		Aprocelaimellus obscusus	500/100 ml of soil
		Discolaimus major	450/100 ml of soil
2.	Noshera	*Helicotylenchus indicus*	700/100 ml of soil
		Saprophytic Nematodes:	
		Rhabditis terricola	550/100 ml of soil
		Psilenchus hilarulus	150/100 ml of soil
		Mylonchus sigmiturus	200/100 ml of soil
3.	Mardan	*Helicotylenchus multicinctus*	500/100 ml of soil
		Hoplolaimus indicus	250/100 ml of soil
		Saprophytic Nematodes:	
		Mylonchulus sigmaturus	300/100 ml of soil
		Rhabditis terricola	200/100 ml of soil
		Psilenchus hilarulus	350/100 ml of soil
4.	Malakand	*Helicotylenchus indicus*	650/100 ml of soil
		Neosilenchus spp.	360/100 ml of soil
		Non parasitic Nematodes:	
		Longidorus spp.	250/100 ml of soil
		Mylonchulus spp.	160/100 ml of soil
5.	Turnab	*Hoplolaimus* sp.	250/100 ml of soil
		Helicotylenchus sp.	600/100 ml of soil
		Tylenchulus semipenetrans (Larvae)	341/100 ml of soil
		Saprophytic nematodes:	
		Mylonchulus sp.	200/100 ml of soil
		Aporcelaimellus sp.	150/100 ml of soil
6.	Charsadda	*Hoplolaimus* sp.	250/100 ml of soil
		Helicotylenchus sp.	550/100 ml of soil
		Tylenchulus semipenetrans (Larvae)	273/100 ml of soil
		Saprophytic nematodes:	
		Aporcelaimellus sp.	150/100 ml of soil
		Mylonchulus sp.	300/100 ml of soil
		Neosilenchus sp.	500/100 ml of soil
		Rhabditis sp.	200/100 ml of soil
7.	Kohat	*Helicotylenchus* sp.	500/100 ml of soil
		Hoplolaims sp.	200/100 ml of soil
		Tylenchulus semipenetrans (Larvae)	360/100 ml of soil
		Free living nematodes:	
		Neosilenchus sp.	450/100 ml of soil
		Eudorylaimus sp.	400/100 ml of soil
		Mylonchulus sp.	200/100 ml of soil
		Hoplolaimus sp.	350/100 ml of soil
		Helicotylenchus sp.	300/100 ml of soil
		Aphelenchus avenae.	100/100 ml of soil
		Rhabditis sp.	300/100 ml of soil
		Trypla sp.	150/100 ml of soil
		Aporcelaimellus sp.	100/100 ml of soil

Table 2
Effect of Tenekil-M and Carbofuran on the number of nematodes parasitising *Citrus aurentifolia* after six months of treatments

S.No.	Parasitic nematode	Percent reduction in nematode numbers over control after six months				
		Carbofuran		S.E.(A)	Tenekil-M	S.E.(B)
1.	*Hoplolaimus columbus*	20	(6.66)	1.887	20(6.66)	1.887
2.	*H. pararobustus*	8	(4.00)	0.400	10(5.00)	0.500
3.	*H. indicus*	20	(11.11)	0.937	19(10.00)	0.949
4.	*Helicotylenchus multicinctus*	5	(1.66)	0.236	5(1.66)	0.236
5.	*H. indicus*	10	(4.00)	0.424	20(8.00)	0.849
6.	*Tylenchulus semipenetrans*	6	(6.24)	0.054	4(5.00)	0.224
7.	*Aphelenchus avenae*	10	(20.00)	1.828	6(10.00)	0.730
	Total	79	(5.80)	0.776	84(6.17)	0.768

S.E.: Standard Error.

for recording the population of various phytonematodes by improved Baermann's technique. The nematodes were identified under stereoscopic microscope just after killing. Fifteen earthen pots of 50 cm diameter were filled with 15 kg infested soil collected from the root vicinity of the diseases plants of *Citrus aurantifolia* and farmyard manure (3:1). Nursery plants of *Citrus aurantifolia* were transplanted singly in these pots. Watering was done daily. Tenekil-M was applied at the rate of 5 ml/pot and Furadan (Carbofuran) 5 g/pot one week after transplanting. Each treatment was replicated five times. Five pots were taken as control. Experiment was terminated after six months and soil samples were analysed by above mentioned method.

Results of survey work are given in Table 1. Results of control experiments indicate that application of Tenekil-M and Carbofuran significantly improved plant growth and adversely affected the rate of nematode multiplication. In Tenekil-M treated plants the percent reduction was 84 and in Carbofuran treated plants it was 79.

Furadan (carbofuran) is a FMC product and extensively used as pesticide in Pakistan. Tenekil-M which is also called Petkolin is a registered pesticide for use against sugarcane *Pyrilla* and sucking insects of cotton (Ashrafi *et al* 1976) later Ahmad *et al* (1973) and Khan and Naqvi (1978) found it effective in controlling plant parasitic nematodes. Khan *et al* (1984) used Tenekil-M in the dres-sing of banana rhizomes against plant parasitic nematodes with good results. Qamar *et al* (1985) used it against nematodes parasitizing chillies while Khan *et al* (1986) obtained significant increasing in banana production by the use of Tenekil. Gul *et al* (1991), used Tenekil-M in com-parison with other compounds for control of *Melo-idogyne javanica* on Tobacco and Okra. Tenekil-M is a polychlorinated petroleum hydrocarbon developed after extensive studies by the biologist of PCSIR Laboratories Complex, Karachi. Being an indigenous pesticide it is readily available, Tenekil-M has a good case as nematicide which is technoeconomically feasible and may be used in the agriculture of Pakistan for the control of pathogenic nematodes and termites. Cost benefit ratio has been calculated and Tenekil-M is available in the market.

Key words: Nematodes, Tenekil-M, Furadan, Control.

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