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PRELIMINARY STUDIES ON THE POPULATION OF PHYTONEMATODES WITH BETLEVINE (*PIPER BETLE*) AND THEIR CONTROL BY INDIGENOUS NEMATICIDE

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Two nematicides *viz.* Furadan and Tenekil-M were tested for their efficacy against phytoparasitic nematodes i.e. *Helicotylenchus indicus, H. digonicus, Hoplolaimus indicus, Rotylenchus reniformis* and *Longidorus siddiqui* that are attacking betlevine. After 16 weeks of the experiments the number of these nematodes was reduced in treated plots than control. Tenekil-M was found to be a good nematicide. The nematicide is indigenous and economical for betlevine industry.

Key words: Plant parasitic nematodes, Furadan, Tenekil-M.

Introduction

Betlevine (*Piper betle* L) is an economically important crop of Pakistan. Approximately 30% of population of Sind is habitual of using Pan (local name) and still its popularity is increasing in young generation day by day. Federal Bureau of Statistics reported that an amount of Rs. 53.854 million during 1989-90 had been spent for its import from Sri Lanka, Bangladesh, Thailand and India (Anon 1990). In view of the popularity of *Piper betle* in the local market it may be assumed that the above figure must have increased at least by 5% recently. The climate of Sind (Pakistan) is good for its cultivation but certain pests limit its growth affecting the size and quality of the leaves. Besides other pests *viz.* bacteria, fungi, insects etc. nematodes cause tremendous losses to *Piper betle* industry specially the attack of stylet-bearing nematodes i.e. *Helicotylenchus indicus, Rotylenchulus reniformis* and *Meloidogyne species* has been observed as a limiting factor in its cultivation (Maqbool *et al* 1992). These nematodes on infestation (*Meloidogyne spp.*) produce galls which later block the passage of water and minerals resulting in choking of the whole root system. Jagadale *et al* (1985) proved the pathogenicity of *Meloidogyne incognita* in betlevine. Jagadale *et al* (1985) controlled root knot nematodes on betlevine with the use of systemic Diazinon, a promising nematicide while Venkata Rao *et al* (1972) observed no conclusive results of DDT against root knot nematodes. Sivakumar and Marimuthu 1986a & b) observed the population dynamics of phytoparasitic nematodes associated with the betlevine. They tested the efficacy of different organic amendments against phytonematodes in betlevine. Sundaraju and Suja (1986) noted the occurrence of *Radopholus similis* in betlevine. Keeping in view the above facts, the nematologists of PCSIR undertook this problem and conducted a limited survey in Karachi and adjoining areas of Karachi so as to understand the magnitude of the disease and to find out its control measures.

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Materials and Methods

Twenty six *Piper betle* farms in and around Karachi were surveyed. Forty-seven soil samples collected from the rhizospheres and the roots of diseased plants were brought to Nematology Laboratory and kept at 4°C in refrigerator. The soil samples were processed through Cobbs gravity method (Cobb 1918) and then by improved Baermann's method (Christe and Perry 1951) for the isolation of nematodes. Nematodes were counted as 5 ml aliquots counting dish bearing 5 mm square marks on its outer surface.

Permanent slides were made by slow evaporation method in glycerine (Thorne 1961). For this purpose the required nematodes were killed by gentle heat and fixed in TAF for 24 h then the specimens were transferred to 1.5% glycerine in syracuse watch glass. To prevent the growth of moulds a trace of copper sulphate was added. The nematodes in 1.5% glycerine were placed in desiccator for slow evaporation for a period of 15 days. During this period, at intervals, more glycerine (1.5%) was added to continue the process of slow evaporation. After two weeks the specimens were picked by a hair picker and transferred in pure glycerine. Permanent slides were made in pure glycerine and sealed with the zut cement. Then these slides were studied under high power microscope and nematodes were identified up to species level. Control experiment was set up for the evaluation of nematicidal properties of an indigenous nematicide Tenekil-M (Polychlorinated Petroleum Hydrocarbon) formulated in PCSIR Labs., Karachi. It was tried in comparison with Furadan (Carbofuran), a standard nematicide of F.M.C. Earthen pots of 30 cm diameter

Table 1
Mean (±SD) of various nematodes in different nematicides

Nematode fauna	Tenekil-M		Furadan		Control
	0.5 ml pot^{-1}	1.0 ml pot^{-1}	0.5 g pot^{-1}	1.0 g pot^{-1}	
1. *Helicotylenchus indicus*	(26.50 ± 7.50)	(25 ± 16.4)	(23.49 ± 8.2)	(20.6 ± 11.6)	(42 ± 23.7)
2. *Helicotylenchus digonicus*	(31.00 ± 7.5)	(23.5 ± 3.36)	(22.4 ± 11.4)	(19.9 ± 13.00)	(36.7 ± 24.0)
3. *Hoplolaimus indicus*	(40.50 ± 12.5)	(30.4 ± 12.3)	(22.8 ± 12.6)	(21.5 ± 11.3)	(36.9 ± 24)
4. *Rotylenchulus reniforms*	(23.10 ± 6.12)	(18.4 ± 7.4)	(17.5 ± 7.4)	(16 ± 10.4)	(28 ± 5.6)
5. *Longidorus sidiqui*	(13.30 ± 3.52)	(12 ± 2.6)	(11.2 ± 3.2)	(9.8 ± 3.2)	(32 ± 4.08)
Average length of stem (m)	1.8 (1.5 ± 0.24)	2 (1.56 ± 0.39)	1 (0.733 ± .20)	1.5 (1.33 ± 0.12)	0.8 (0.70 ± 0.10)
Average number of leaves	(17.6 ± 2.62	(48.6 ± 1.24)	(13.6 ± 1.24)	(16.3 ± 1.24)	(8.3 ± 1.52)
Average wt. of leaves (g)	(90 ± 8.16)	(135 ± 12.4)	(35 ± 10.8)	(60 ± 16.3)	(27.6 ± 2.05)

Each value is an average of three replicates.

were filled with infested soil collected from rhizosphere of infected plants during survey of *Piper betle* growing areas around Karachi. Initial nematode population was counted. Fifteen pots were prepared, Tenekil-M was applied in dose of 0.5 ml pot^{-1} and 1 ml pot^{-1} whereas Furadan, 0.5 g pot^{-1} and 1 g pot^{-1}. Each treatment consisted of three replicates and three pots were taken for control. After 10 days of treatment healthy *Piper betle* plants of nearly the same age (one in each pot) were transferred. Final nematode population was calculated. Average length of stem, number and weight of the leaves were noted.

Results and Discussion

Two nematicides were used (Tenekil-M and Carbofuran) for controlling nematode population in betlevine and also to assess the efficacy of various doses of these nematicides. Furadan & Tenekil-M significantly reduced the population of *Helicotylenchus indicus, H. digonicus, Hoplolaimus indicus, Rotylenchus reniformis* and *Longidorus siddiqui.* After sixteen weeks of treatment more significant results were observed in case of Carbofuran. When Carbofuran was applied at a rate of 1 g pot^{-1}, tabulated value = 2.44 at P.05 and calculated value = 7.44 at P.05. When Carbofuran was applied at 0.5 g pot^{-1} the population of nematodes was reduced. The calculated value was 7.00 and tabulated value 2.447 at 0.05p. The calculated value of 't' was greater than tabulated value. This situation has clearly indicated that Carbofuran is significant in both doses in reducing the population of parasitic nematodes. Average length of the stem of betlevine is longer as compared to control (Furadon = 1.33 ± 0.70 : control = 0.70 ± 0.10). Number and weight of the leaves is also greater than in control. In case of Tenekil-M two doses were applied in pots i. e. 0.5 ml pot^{-1} and 1 ml pot^{-1}. When the dose was 0.5 ml pot^{-1} after 16 weeks of treatment, calculated value of 't' was 2.900 whereas tabulated value = 2.44 at 0.05 P. Higher calculated value showed the efficacy of compound being significant. When Tenekil-M was applied 1 ml pot^{-1}, calculated value of 't' was higher than tabulated one (calculated value = 3.7 ; tabulated value = 2.44 at P.05) clearly indicating that the compound is more significant. Average length of stem (1.56 ± 0.39 m) and weight of leaves, (90 ± 8.16 grams) are greater than in control. When a comparison was made between two compounds (Tenekil-M & Carbofuran), Carbofuran was more significant than Tenekil-M. Qamar *et al* (1985) have also showed that Tenekil-M is significant like Carbofuran when applied in prescribed doses.

As is clear from Table 1, the population of plant parasitic nematodes was low in Tenekil-M and Carbofuran treated plants in comparison to control. This state of reduced stress on plants due to low intensity of nematosis showed that the nematodes induced disease favourably affected the plant health as was expressed in term of increased length of stem, number and weight of leaves in comparison to control. These results provided strong evidence of use of Tenekil-M in controlling nematosis in *Piper betle* plants. The number and weight of leaves in Tenekil-M treated plants was much better than Carbofuran. Gul *et al* (1991) used Tenekil to control *Meloidogyne javanica* on tobacco and Okra in comparison with other compounds and observed about 124% increase in the yield of tobacco leaves and 25% in Okra fruits. Being an indigenous pesticide and readily available, Tenekil has a nematicidal potential which is technico-economically feasible and may be used in agriculture for the control of parasitic nematodes.

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