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Effect of Pesticides on the Nematode Pathogenic bacteria, *Bacillus macerans in vitro*

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ABSTRACT

Sensitivity of *Bacillus macerans* Schardinger, 1905, a potent biocontrol agent of root-knot nematode, to different pesticides was tested *in vitro* by filter paper disc method. The pesticides were metham sodium, phorate, aldicarb, carbofuran and formalin representing nematicides and HCH (BHC), endosulfan, malathion, quinalphos and carbaryl representing insecticides and agallol, carbendazim, copper oxychloride, maneb, zineb and ziram the fungicides. *B. macerans* was highly sensitive to metham sodium and formaldehyde with an inhibition zone diameter ranging from 20 to 44 m.m. While aldicarb was slightly inhibitory, phorate and carbofuran were non-inhibitory. All insecticides except quinalphos (1000 ppm only) and carbaryl were non- inhibitory. Among the fungicides tested, the systemic fungicide carbendazim was the safest. Methoxy ethyl mercury chloride, mancozeb, zineb and ziram were toxic to *B.macerans*. These fungicides showed statistically significant increase in inhibition among the different fungicides.

KEY WORDS : *Bacillus macerans*, pesticide compatibility

The spore forming bacterial pathogen, *Bacillus macerans* Schardinger 1905 has recently been found to be a promising biocontrol agent for root-knot nematode, *Meloidogyne incognita* (Sheela and Venkitesan, 1992). The potential of this bacterium in controlling the phytonematode has been experimentally proved but their compatibility or sensitivity to common pesticides has to be asertained before recommending this biocontrol agent for field release in an integrated nematode management programme. Results of a study undertaken, with this objective are presented in this paper.

MATERIALS AND METHODS

Sensitivity of the bacteria to different groups of pesticides (Tables 1 and 2) were tested *in vitro* by filter paper disc method. These discs were placed aseptically over the nutrient agar medium in Petri plates which had been seeded with 24 h old culture of *B.macerans*. Three replicates were maintained. The plates were incubated at 30 ± 2^0 C and the diameter of zone of inhibition was measured.

RESULTS AND DISCUSSION

The result revealed that methamsodium was highly inhibitory to *B.macerans* giving the highest inhibition zone of 43.7 mm (diameter) followed by formaldehyde (32 mm) (Table 1). Phorate and carbofuran were non-inhibitory while aldicarb slightly inhibited the growth of *B. macerans* recording an inhibition zone of 12 mm (diameter) from 24 to 72 h after treatment at 500 and 1000 ppm levels. Since metham sodium and formaldehyde were highly toxic they cannot be recommended for use along with this biocontrol agent. Carbofuran being is highly compatible, can be used beneficially along with *B.macerans* against plant parasitic nematodes. Similar findings have been reported by Brown and Nordmayor (1985) and Maheswari *et al.* (1987).

HCH, endosulfan and malathion were non-inhibitory to the growth of this bacteria. Quinalphos (500 ppm) and carbaryl at 500 and 1000 ppm levels were non-inhibitory upto 48 h of treatment but exposed 72h they showed slight inhibition and the zone of inhibition ranged from 10.5 to 12.0 mm (diameter).

Table 1. ***In vitro*** **sensitivity of** ***B. macerans*** **to insecticides and nematicides**

Nematicides/ Insecticides	ppm	Diameter of inhibition zone in mm at different periods (h)		
		24	48	72
Metham sodium	500	29.7	32.7	35.7
	1000	39.7	43.7	43.7
Aldicarb	500	12.0	12.0	12.0
	1000	12.0	12.0	12.0
Formaldehyde	500	18.3	20.3	21.7
	1000	26.7	29.0	32.0
Quinalphos	500	–	–	10.5
	1000	12.3	13.3	15.7
Carbaryl	500	–	–	10.7
	1000	–	–	12.0

Table 2. ***In vitro*** **sensitivity of** ***B. macerans*** **to fungicides**

Fungicides	ppm	Diameter of inhibition zone in mm at different periods (h)		
		24	48	72
Methoxy ethyl	125	13.33	14.00	14.00
Mercuric chloride	250	14.00	14.67	15.00
(Agallol)	500	16.33	17.00	16.00
	1000	22.33	23.67	24.00
	2000	25.00	25.00	26.33
Copperoxychloride	125	–	–	–
(Blitox)	250	–	–	–
	500	–	–	13.00
	1000	–	–	18.33
	2000	–	–	21.00
Mancozeb (Dithane M 45)	125	15.33	16.00	16.00
	250	15.67	16.00	16.00
	500	16.00	16.50	17.00
	1000	18.00	17.00	17.67
	2000	19.00	20.00	20.33
Zineb (Dithane Z 78)	125	10.67	11.00	11.00
	250	12.00	13.14	13.67
	500	14.00	15.00	16.00
	1000	15.00	16.00	18.17
	2000	15.67	16.00	20.00
Ziram (Thiride)	125	12.00	12.00	13.00
	250	15.33	16.33	17.00
	500	16.33	17.14	17.33
	1000	20.67	22.33	23.00
	2000	24.33	26.00	26.00
CD (0.05)		0.85	0.80	0.44

Quinalphos at 1000 ppm level showed slight inhibition initially and the zone of inhibition increased from 12.3 to 15.7 mm (diameter) in 24 and 72h of treatment.

Among the fungicides tested, carbendazim was the safest followed by copper oxychloride (Table 2). Copper oxychloride was non-inhibitory to the growth of *B. macerans* at 125

and 250 ppm levels. At 500, 1000 and 2000 ppm levels it inhibited the growth 72 h after treatment and the inhibition was statistically significant and was highest at 2000 ppm level. The manganese-based dithiocarbamate fungicide mancozeb inhibited the growth of *B. macerans* from 125 ppm onwards and increased significantly with dose and period of exposure. The mercuric fungicide methoxy ethyl mercury chloride was highly toxic to this pathogen and the diameter of inhibition zone ranged from 13.33 to 26.33 mm at different doses and periods of exposure. The zinc - based dithiocarbamate fungicides zineb and ziram were inhibitory to the growth of the bacteria and the diameter of inhibition zone ranged from 10.67 to 26.0 mm and the zone of inhibition increased statistically with increase in dose and period of exposure (Table 2).

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