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CHEMICAL CONTROL OF *FUSARIUM SOLANI*, THE INCITANT OF ROOT-ROT OF EGGPLANT (*SOLANUM MELONGENA* L.)

SUCHETA HUNDOO and R. S. DWIVEDI
Centre of Advanced Studies in Botany, Banaras Hindu University, Varanasi-221005, India.

Seven fungicides viz., Capatan, Emisan-6, Foltaf, Jkstein, Kavach, Shield-75 and Vitavax were screened for their toxicity to *Fusarium solani in vitro*. Four of these fungicides viz., Captan, Emisan-6, Jkstein and Kavach were evaluated in the green-house for their effectiveness to control root-rot of eggplant seedlings caused by F. solani. Jkstein showed strong *in vitro* activity completely inhibiting the linear growth of the pathogen at 25 µg/ml, followed by Emisan-6(100 µg/ml). Shield-75 was least effective in checking the growth where as all other fungicides checked the linear growth considerably. In green house studies in pot condition, the best protection against *F. solani* was given by Kavach (66.6%), followed by Jkstein (63.3%).

Keywords : Chemical Control; Fungicides; Root-rot; *Fusarium solani*.

Fungi of the genus *Fusarium* are cosmopolitan plant pathogens and soil saprophytes (Van Elten, 1978; Kuhlman, 1982; Desjardins *et al.*, 1989). *Fusarium solani* is a versatile and ubiquitous root pathogen affecting a wide variety of host plants. Different fungicides have been used to control *F. solani* by different workers, (Abdel-el-Rehim *et al.*, 1987; Dhrub Singh, 1988; Mishra and Rath, 1988 and Bansal and 2Siradhana, 1990. Root-rot of eggplant (*Solanum melongena* L.) incited by *F. solani* is a serious disease, which causes extensive losses through the death of plants.

Present investigations have been undertaken to test the relative efficacy of some new and old fungicides *in vitro* and in green house against root-rot of eggplant so as to find effective control measures.

F. solani was isolated from affected eggplant seedlings (cv. black long). After proving the pathogenicity, the stock culture was maintained on potato dextrose agar (PDA) for subsequent studies.

In vitro Growth Inhibition by Fungicides

Seven fungicides viz., Captan, Emisan-6, Foltaf, Jkstein, Kavach, Shield-75 and Vitavax were screened for their toxicity against *F. solani* by poisoned food technique (Grover and Moore, 1962) using PDA medium. Stock solution of each fungicide (1000 µg a.i./ml) was prepared by dissolving the required amount of fungicide in sterilized distilled water (if water soluble) or in 25% acetone (if water insoluble). The concentrations (a.i) evaluated were 25, 50, 100 and 200 µg/ml. Three replicate plates were used for each concentration. Each dish was centrally inoculated with one mycelial disc (5mm diameter) of actively growing culture of *F. solani*. Dishes were incubated at 25± 11°C for a week and the linear growth of *F. solani* was measured in two directions at right

right angles to each other. The average of three replicates was taken as the diameter of the developing colony in mm. The level of growth inhibition was calculated by the formula:

$$I = \frac{C - T}{C} X\ 100$$

C - The

where I = % inhibition,

C = growth of control (in mm),

T = growth of the treated (in mm).

Greenhouse studies

Inoculum for artificial soil infestation was prepared by growing the pathogen on sterilized and moist oat grains. Three weeks old oat cultures were air-dried for three days, ground and stored in a refrigerator. Soil was air-dried, sieved through 2 mm mesh screen, moistened and autoclaved twice at 15 lb/inch^2 for 30 minutes.

All treatments were given in 13 cm, diameter earthenware pots. *F. solani* inoculum was mixed thoroughly with the soil at the rate of 0.5% (w/w), moistened to 20% (w/v) and the pots were filled with the infested soil. All pots were incubated at room temperature for 48 hrs for proper infestation of the soil.

Four fungicides viz., Jkstein, Captan, Emisan-6 and Kavach were selected for greenhouse evaluation at three concentrations viz., 1, 2 and 3 mg/g (w/w). The chemicals were mixed thoroughly with previously infested soil. Eggplant seeds (cv black long) were surface sterilized with 0.1% $HgCl_2$ for 1 min and washed several times with sterilized distilled water. Ten seeds treated at the desired rate or untreated (control) were sown in soil. Pots with soil and inoculum and without any fungicide served as control. Soil was kept moist by repeated watering, when necessary. Observations for healthy seedlings were made after 30 days of sowing and percent disease control was calculated.

Analysis of variance was applied to the data obtained to test for significance. The individual comparisons were made according to Newman Keul's Multiple range test.

In Vitro Studies : It was observed that Jkstein was best fungicide to show complete inhibition of linear growth of *F. solani* in vitro at 25µg/ml, followed by Emisan-6, Kavach, Foltaf, Vitavax, Captan and Shield- 75 (Table 1). Control plates had a mean radial growth of 48 mm after 7 days of incubation. It was also observed that growth inhibition of *F. solani* was directly proportional to the concentration of chemicals.

Greenhouse Studies : The percent disease control was calculated for each fungicide at each concentration after 30 days of sowing (Table 2). In general, all fungicides gave some degree of control whereas disease incidence was 100% in the inoculated, non-treated pots. Three mg/g concentration was found to be significantly superior (P=0.05) as compared to other concentrations in protecting the seedlings from root-rot (Table 2) When the fungicides were compared for

TABLE 1

***IN VITRO* EFFECT OF FUNGICIDES ON THE GROWTH OF *FUSARIUM SOLANI*.**

Fungicides	Chemical name	Growth inhibition (%)			
		Concentration (µg/ml)			
		25	50	100	200
Captan	N-(trichloromethylthio)-4-cyclohexane -1, 2-dicarboximide.	37.7	51.1	53.3	64.4
Emisan 6	Ethyl mercuric chloride	42.2	55.5	64.4	100.0
Foltaf	Captafol	62.2	64.4	66.6	73.3
Jkstein	Methyl-1-2-benzimidazole carbamate	100.0	100.0	100.0	100.0
Kavach	Chlorothalonil	51.1	62.2	73.3	75.5
Shield-75	Mancozeb	24.4	26.6	28.8	37.5
Vitavax	5, 6-dihydro-2-Methyl-1, 4-oxathin-3-Carboxanilide	44.4	53.3	55.4	64.4

TABLE 2

CONTROL OF ROOT-ROT OF EGGPLANT INCITED BY *FUSARIUM SOLANI* AFTER 30 DAYS OF SOWING BY DIFFERENT FUNGICIDES

Fungicides	Healthy seedlings (%)		
	Concentation (mg/g)		
	1	2	3
Captan	26.6^{aA}	36.6^{aA}	40.0^{aA}
Emisan-6	16.6^{aA}	33.3^{aAB}	33.3^{aB}
Jkstein	40.0^{bA}	50.0^{aAB}	63.3^{bB}
Kavach	23.3^{aA}	40.0^{aB}	66.6^{bC}

In vertical columns means, followed by similar small letters and in horizontal rows followed by similar capital letters do not significantly differ from each other at (P = 0.05) according to Newman Keul's multiple range test. Small letters represent defference of means among different treatments whereas capital letters represent difference of means among the different concentrations of individual fungicides.

their efficiency to control root-rot by calculating the average percent disease control over all concentrations for each fungicide, significant variations among all the treatments were observed with only Jkstein at 1 mg/g concentration. At 2 mg/g concentration, no significant difference was observed among all the fungicides. At 3 mg/g concentrations, no significant variation between Captan and Emisan-6, Jkstein and Kavach was observed while both Jkstein and Kavach were significantly superior (P=0.05) to Captan and Emisan- 6.

When individual fungicides were compared for their over all performance at different concentrations, it was observed that Kavach showed significant

variations at 1, 2 and 3 mg/g concentrations, whereas at all the three concentrations, no significant difference was observed with Emisan-6 and Jkstein. However both these fungicides were significantly superior (P=0.05) at 3 mg/g concentration when compared with 1 mg/g concentration. Significant variations in disease control was not observed with Captan at all the three concentrations. Although all the fungicides gave some degree of protection against root-rot of eggplant, but Kavach (a new fungicide) was found to be highly significant (P=0.05 and P=0.01) in protecting the seedlings.

The performance of fungicides Jkstein, Kavach and Captan in protecting the eggplant seedlings against root-rot in greenhouse corresponded to some degree with their in vitro activity against mycelial growth of *F. solani*. The fungicides that exhibited excellent efficacy against root-rot also possessed strong activity against *F. solani* growth *in vitro*. Thus, in the case of Jkstein and Kavach, a strong in vitro effect can directly explain the *in vivo* potency for successful disease control. On the other hand, despite strong *in vitro* activity against *F. solani*, Emisan- 6 performed poorly in protecting the seedlings against root-rot in greenhouse. It may be attributed to the fact that there are several obvious differences between the soil and Petridish system (Baker and Cook, 1974). The constant environment of the Petridish does not compare to the fluctuating temperature and moisture states in the soil. Other abiotic factors such as pH are different. Secondary interaction may also affect population of non-target soil micro-organisms interacting with the activity of fungicide. Greater disease control with Jkstein, Kavach and Captan occurred as concentration was increased. This suggested that degree of protection depends upon the applied level (Allam *et al.*, 1969). In our studies, Jkstein and Kavach were found to be most effective against *F. solani*, therefore, they can be used to improve plant population and should be considered as management tools for reducing root-rot disease of eggplant.

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