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RESEARCH ARTICLE

TOXICITY OF FUNGICIDES ON *FUSARIUM SOLANI* CAUSING DRY ROT OF ELEPHANT FOOT YAM

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Abstract

Present study was designed to explore the effect of fungicides on *Fusarium solani* causing dry rot of elephant foot yam. Altogether ten isolates of F. solani. from different localities belonging to districts of Maharashtra and Karnataka states were examined for their sensitivity to benomyl. There was quite a large variation in Minimum Inhibitory Concentrations (MICs) of benomyl against *Fusarium solani* both in vitro as well as in vivo. MIC in vitro ranged from 25 to 100ppm while in vivo it ranged from 15 to 80ppm. The isolate Fs-9 from Bidoor was more sensitive (25 ppm) on agar medium. The isolate Fs-3 from Jawalethar was highly resistant (100 ppm) on agar medium. In in vivo experiments, MIC of sensitive isolate Fs-9 was 15 ppm and that of resistant isolate Fs-3 was 80 ppm.

INTRODUCTION

Fungides perform a big role in controlling plant diseases and help farmers to take a good yield. The number of crops and crop diseases treated, the range of chemicals available, the area and the frequency of their exercise, and the efficiency of treatments, have increased a great deal, more than ever since the second world war. But frequent use of fungicides can lead to the development of resistance in the pathogen. It has generally comes out as a response to repeated use of the fungicide, or to repeated use of another fungicide which is related to it chemically and/or biochemically through a common mechanism of antifungal action. Cases of development of fungicide resistance in plant pathogenic fungi are reported by several workers in India (Reddy et al., 1979; Pan and Sen, 1980; Gangawane and Saler, 1981; Gangawane and Reddy, 1988; Annamalai and Lalithakumari,1987, 1990; Waghmare, 1991; Arora et al., 1992; Gangawane and Kamble, 1993; Gangawane and Kamble, 2001; Jagtap and Kamble, 2007, Apte and Kamble, 2008, Waghmare and Kamble, 2009; Ramteke and Kamble, 2010 and Khandare, 2012).

Elephant foot yam [Amorphophallus paeoniifolious (Dennst.) Nicolson] is a tropical tuber crop belonging to family Araceae. It is a crop of Southeast Asian origin. It grows in wild form in the Philippines, Malaysia, Indonesia and Southeast Asian countries. In India, it is cultivated in Andhra Pradesh, West Bengal, Gujarat, Kerala, Tamil Nadu, Maharashtra, Uttar Pradesh, and Jharkhand. It has been attacked by many fungal pathogens of which *Fusarium solani* causing dry rot of yam is the major fungal pathogen which causes significant loss. This pathogen is controlled by using Benomyl, but there is possibility of development of benomyl resistance in the pathogen. The aim of the present study was to study the variation in the Minimum Inhibitory Concentration values of the pathogen and find out the resistant strain of F. solani causing dry rot of yam.

MATERIALS AND METHODS

Collection of Diseased Samples: Field surveys were carried out for the collection of diseased samples of yam from different localities of Maharashtra and Karnataka State. The samples were brought to the laboratory in clean,

sterilized polyethylene bags. Isolation of the pathogen from these samples was attempted within 24 hrs. after collection. The infected diseased samples were cut into small pieces and superficially sterilized by 70% ethyl alcohol. These were then placed aseptically on to sterilized Czapek Dox agar medium provided with 30ppm streptomycin in petriplates. The colonies arising on the plates were identified with the help of relevant mycological literature (Barnett and Hunter, 1972; Subramanian, 1971) as *Fusarium solani* (Mart.) Sacc.

Isolation of the Pathogen: A total of ten isolates of *Fusarium solani* were obtained in pure form and tested for their pathogenicity as per Coch's Postulates. These isolates were maintained at 4°C in test tubes for further use.

Preparation of Test Fungicide: Benomyl (50% WP) was selected to evaluate its effect on the pathogen. The required dilutions of that fungicide were prepared by taking the active ingredient (a.i.). The actual quantity of formulae product used in the study was calculated by considering the percentage of active ingredient (50%) in the product.

Determination of MIC values:

In vitro: Food poisoning technique (Dekker and Gielink, 1979) was employed to test the sensitivity of *Fusarium solani* to benomyl. Plates were prepared in triplicates using Czapek Dox agar medium with different concentrations of benomyl. Discs of size 8 mm diameter of fungal cultures were taken from an actively growing colony and placed upside down on the agar surface. The plates were then incubated at 26±3°C in the dark and radial growth of the fungus was measured at different intervals. Plates without benomyl were treated as control. The concentration at which minimum growth of the fungus is observed is considered as the MIC value for each isolate.

In vivo: For in vivo studies, healthy yam corms were surface sterilized with 70 % alcohol and 8 mm well (15 mm deep) was prepared on it. Different concentrations of benomyl were poured into the wells. The same corms were inoculated next day with mycelial suspension of Fusarium solani. The wells were closed with cylindrical tissues. These corms were covered with moist paper towels and incubated at 26±3°C in dark. Corms treated with sterile distilled water served as control. Diameter of infected portion was measured after 8 days of inoculation.

RESULTS AND DISCUSSION

The results are given in the table1 and 2. There was quite a large variation in Minimum Inhibitory Concentrations (MICs) of benomyl against *Fusarium solani* both in vitro as well as in vivo. MIC in vitro ranged from 25 to 100ppm while in vivo it ranged from 15 to 80ppm. The isolate Fs-9 from Bidoor was more sensitive (25 ppm) on agar medium (Plate-3). The isolate Fs-3 from Jawalethar was highly resistant (100 ppm) on agar medium. In in vivo experiments, MIC of sensitive isolate Fs-9 was 15 ppm and that of resistant isolate Fs-3 was 80 ppm.

Table 1. Sensitivity of *Fusarium solani* isolate to benomyl (In vitro).

Isolate	Concentration of Benomyl	Days and growth per mm							
		1	2	3	4	5	6	7	8
Control	0ppm	09.33	19.00	30.66	39.66	52.66	60.66	71.67	90.00
Fs-1	70ppm	00.00	00.00	00.00	07.33	08.00	08.33	09.00	09.33
Fs-2	40ppm	00.00	00.00	07.00	07.33	07.33	08.00	08.66	09.66
Fs-3	100ppm	00.00	00.00	00.00	07.00	07.00	07.66	08.00	08.00

Fs-4	56ppm	00.00	00.00	00.00	08.00	08.66	10.33	12.33	12.33
Fs-5	65ppm	00.00	00.00	00.00	08.00	08.33	10.00	10.66	11.66
Fs-6	35ppm	00.00	00.00	07.66	08.33	08.66	10.00	10.33	11.66
Fs-7	50ppm	00.00	11.00	11.66	12.33	13.00	13.00	14.00	14.00
Fs-8	80ppm	00.00	00.00	00.00	07.00	07.00	07.66	09.00	09.33
Fs-9	25ppm	00.00	00.00	07.33	08.00	08.00	09.00	09.33	10.66
Fs-10	30ppm	00.00	00.00	07.00	07.33	08.00	08.66	09.33	10.00

Table:2. Minimum inhibitory concentration (MIC) of benomyl against different isolates of *Fusarium solani* causing dry rot of yam.

Sr. No.	Isolate	Locality	MIC in ppm^{-1}	
			In vitro	In vivo
1	Fs-1	Chandgad	70	60
2	Fs-2	Pargad	40	35
3	Fs-3	Bidoor	100	80
4	Fs-4	Shankarpura	56	50
5	Fs-5	Danassama	65	45
6	Fs-6	Muthinikoppa	35	25
7	Fs-7	Kelavali	50	40
8	Fs-8	Upale	80	60
9	Fs-9	Jawalethar	25	15
10	Fs-10	Miland	30	25

Variation in the sensitivity of isolates of different pathogens has been reported by many workers for various pathogens against different fungicides. Wada et al. (1990) reported variation in MIC values of Pefurazoate for Fusarium moniliforme, causal agent of Bakanae disease of Rice. The MIC values of Pefurazoate for F. moniliforme were ranging from 0.78 to 12.5ppm. The range of tolerance of Phytophthora infestans causing late blight of potato to metalaxyl at Nilgiri hills of Southern India was 50 to 900 ppm (Arora et al. 1992). Amini and Sidovich (2010) carried out a study on the effects of fungicides on F. oxysporum f. sp. lycopersici causing wilt of tomato. They found that Prochloraz and bromuconazole were the most effective fungicides against the pathogen both in vitro and in vivo, followed by benomyl and carbendazim.

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