J. Exp. Zool. India Vol. 18, Supplement 1, pp. 59-62, 2015 *ISSN 0972-0030*

IN VITRO EFFICACY OF FUNGICIDES AGAINST SOME VIRULENT PLANT PATHOGENS

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ABSTRACT : The aim of the present study was to check the efficacy of five fungicides at different concentrations in laboratory conditions for the management of five virulent fungal phytopathogens. The results revealed a degree of growth inhibition at different concentrations like 50,100,200 and 300 ppm. Even at lowest tested concentration (50ppm) of Dithane and Ridomil has competed inhibited the growth of *C. lunata* and bavistin has absolute inhibition for *R. solani*.

Key words : Fungicides, phytopathogen, growth inhibition.

INTRODUCTION

Variety of pests like bacteria, fungi, viruses, nematodes and insects attack the crop at various stages of their life cycle and cause huge loss in the production. Plants are constantly exposed and threatened by a variety of pathogenic microorganisms present in their environments. Diseases caused by plant pathogenic fungi significantly contribute to the overall loss in crop yield worldwide (Savary *et al*, 2006; Montesinos, 2007). Soil-borne fungal diseases are among the most important factors limiting the yield of many economically important plants, resulting in serious economic losses (Hoda *et al*, 2011). Several soil-pathogens attack roots and shoots of plants, causing damping-off or root-rot (Elad *et al,* 1982; Thomasho, 1996). Since, there is a limitation land for cultivation purposes, and increase demand of plant produce, the intensive uses of pesticides fungicide are being employed by farmers to overcome the increasing demand. It has been estimated that more than 800 million people in the developing countries are deprived of adequate food supplies and nearly 10% of food is lost due to plant diseases (Hewitt, 2000; Strange and Scott, 2005). Plant diseases are mostly controlled by the use of chemical pesticides and in some cases by cultural practices (Agrios, 1988; Cook, 1993). Fungicide treatments are essential for maintaining healthy crops and reliable high-quality yields. They form a key component of integrated crop management and their effectiveness must be sustained as long as possible (Brent and Hollomoneith, 2007). They have been used for an ancient time to protect plants against disease attack by fungi, mainly to protect cereal seeds and grape-vines. The more recent fungicides are generally used in relatively small amounts, because of their more potent action against plant pathogens (Brent and Hollomoneith, 2007). Certain protective fungicides although hazardous to environment are still used for the control of fungal diseases (Nwankiti *et al*, 1990; Vaish and Sinha, 2003). Likewise, use of pesticides of plant origin have been suggested by some workers as alternative to synthetic chemicals in order to counter the potential hazardous effect on the environment associated with the use of synthetic chemicals (Amadioha and Obi, 1999; Ejechi and IIondi, 1999; Singh *et al*, 1997; Amadioha, 2000). Chemical fungicides are commonly used successful-ly for control various plant disease such as of *Rhizoctonia* root-rot of pea (Khan *et al*, 1998). In comparison to other plant parasites, fungi cause the greatest impact with regard to diseases and crop production losses. Fungal infections are one of the major causes of post harvest rots of fresh fruits and vegetables whether in transit or storage. They cause significant economic losses in the commercialization phase and are rendered unfit for human consumption (Janardhana *et al*, 1999 and Marin *et al*, 1999).

In the present study, five fungicides (Dithane M-45, Ridomil, Captaf, Blue Copper, Bavistin) were evaluated at different concentrations to study their efficacy in the management of five known phytopathgens (*Alternaria solani, Alternaria zinniae, Fusarium oxysporum, Rhizoctonia solani, Curvularia lunata*) in laboratory conditions. All of the selected pathogens have wide host range and cause considerable loss in agriculture crops.

Proceeding of the *National Seminar on Current Trends in Biological Sciences; Advances and Challenges* organised by Dept. of Zoology, Janta College, Bakewar, Etawah; 13-14 December 2014

MATERIALS AND METHODS

Potato Dextrose Agar (PDA) was used as medium for sub-culturing of pathogens and experimentation. Five fungicides *viz.*, Dithane M-45, Ridomil, Captaf, Blue Copper, Bavistin were evaluated against five selected phytopathgens *viz. Alternaria solani*, *Alternaria zinniae, Fusarium oxysporum, Rhizoctonia solani* and *Curvularia lunata* by food poisoning technique. Fungicides were added to molten PDA just before pouring from the common stock solution to get final concentrations of 50, 100, 200, 300 ppm respectively. The PDA plates amended with fungicides and inoculated aseptically with selected pathogen by transferring five mm diameter agar disc from fresh cultures and the unamended media plates served as control. Inoculated Petri dishes were incubated at 25±1°C and radial growth of pathogens was measured in all treatments after three days of incubation and compared with control. The percent growth inhibition of pathogen was estimated by following formula:

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

Where, I = Percent growth inhibition

C = Colony diameter in control

T = Colony diameter in treatment

The data was recorded in triplicates and subjected to statistical analysis and conclusions were drawn on the basis of analysis of variance. The calculated value of F was compared with the tabulated values at 5% level of significance for an appropriate degree of freedom.

RESULTS AND DISCUSSION

All of the tested fungicides inhibited the growth of pathogens at variable rates over to their respective controls. Despite of pathogen, the percent growth inhibition increased with the concentration of fungicides (Table 1). Dithane had recorded absolute growth inhibition of *C. lunata* at all tested concentrations and in case of *A. zinnia* 82.89% growth inhibition had been recorded at 50 ppm and 100% inhibition on higher concentrations. The growth of *R. solani* was also restricted 74.26% at 50 ppm followed by 85.15% at 100 ppm and complete inhibition on higher concentrations. While in case of *F. oxysporum* and *A. solani*, variable growth inhibition of

Table 1 : *In vitro* growth inhibition of phytopathogens by fungicides.

Fungicide	Conc. of fungicide (ppm)	Growth inhibition (%) by fungicide				
		A. solani	***A. zinniae***	***C. lunata***	***R. solani***	***F. oxysporum***
Dithane	50	37.50	82.89	100.00	74.26	71.10
	100	33.33	100.00	100.00	85.15	72.24
	200	45.83	100.00	100.00	100.00	74.90
	300	50.00	100.00	100.00	100.00	76.05
SEm± = 2.33, CD (p=0.05)= 6.97						
Captaf	50	17.39	27.40	75.00	81.20	54.79
	100	28.26	56.16	78.33	82.00	78.72
	200	34.78	57.53	81.94	83.20	81.38
	300	43.48	65.75	83.89	84.00	83.24
SEm± = 2.00, CD (p=0.05)= 6.01						
Bavistin	50	15.83	16.67	3.00	100.00	76.01
	100	15.42	20.83	19.50	100.00	100.00
	200	21.67	23.61	25.00	100.00	100.00
	300	29.17	26.39	33.50	100.00	100.00
SEm± = 2.54, CD (p=0.05)= 7.62						
Ridomil	50	77.55	39.47	100.00	33.19	39.89
	100	79.59	48.68	100.00	44.68	44.15
	200	85.71	59.21	100.00	60.85	60.11
	300	100.00	69.74	100.00	69.36	65.43
SEm± = 1.20, CD (p=0.05)= 3.59						
Blue copper	50	74.71	6.76	35.83	2.13	6.25
	100	80.59	17.57	100.00	23.40	11.56
	200	100.00	47.30	100.00	39.57	15.63
	300	100.00	60.81	100.00	44.68	18.75
SEm± = 1.97, CD (p=0.05)= 5.92						

33.33-76.05% had been recorded at the different concentrations of Dithane. Captaf had also restricted the selected pathogens at variable rates. At 300ppm conc. maximum of 84.00% growth inhibition was recorded against *R. solani,* followed by *C. lunata* (83.89%), *F. oxysporum* (83.24%), *A. zinnia* (65.75 %) and *A. solani* (43.48%). Bavistan has restricted complete mycelia growth of *R. solani* on all tested concentrations and growth of *F. oxysporum* at 100 ppm and above concentrations. But it was comparatively less effective against other pathogens. At 300ppm conc., it had exerted 33.50% growth inhibition of *C. lunata*, followed in case of *A. solani* (29.17%) and *A. zinnia* (26.39%) respectively. Ridomil had recorded complete growth inhibition of *C. lunata* at all tested concentrations and variable response towards other pathogens. At 300ppm of conc., 100% growth inhibition was recorded for *A. solani* followed in case of *A. zinnia* (69.74%), *R. solani* (69.36%), *F. oxysporum* (65.43%). Blue copper had also inhibited the growth of all pathogens. Complete growth inhibition was recorded at 100ppm against *C. lunata* and at 200 ppm for *A. solani*. While for other pathogens maximum growth inhibition of 60.81% was recorded for *A. zinnia*, followed by *R. solani* (44.68%) and *F. oxysporum* (18.75%), respectively.

All fungicides tested in the laboratory significantly reduced pathogen development when compared with the control. Chemical control measures have been tested and found effective in the control of diseases (Ogundana and Denis, 1981; Plumbley, 1985). Captan and Benomyl have been used successfully against several seed-borne fungi under laboratory and field condition (Goulart, 1992). The fungicide Banodenil and Pentachloronitobenzene (PCNB) were found effective in delaying on set of southern blight of apple seedling and root rot and in slowing disease progress (Conway *et al*, 1996). *In vitro* tests do not always accurately predict the performance of fungicides in the field (Everett and Neilson, 1996; Everett *et al*, 2005). Therefore, experiments were planned to test the efficacy of these fungicides in field conditions with selected host species.

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