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RESPONSE OF *FUSARIUM MONILIFORME* - THE CAUSAL ORGANISM OF BAKANAE DISEASE OF RICE AGAINST DIFFERENT FUNGICIDES

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ABSTRACT

Bakanae disease is becoming a serious threat to basmati production and had been reported to cause 20-50% loss in total production. Bakanae disease is caused by *Fusarium moniliforme* Sheldon. In the present investigation seven fungicides were evaluated *in vitro* condition for management of *Fusarium moniliforme*. Result was indicated that, carbendazim cent percent inhibited to pathogen growth at all concentration (1000ppm, 500ppm, 100ppm and 10ppm). All other systemic fungicides such as hexaconazole, tabuconazole and thiophanate completely inhibited the pathogen at 100ppm, 500ppm and 1000ppm but at 10ppm they inhibited pathogen growth 75.28%, 97.78% and 57.64% respectively. All other non systemic fungicides likes mancozeb, propineb and thiram were found less effective and at 1000ppm these inhibited pathogen growth as 45.67%, 57.40% and 46.53% respectively. Thus, the present study demonstrated the use of systemic fungicides have the good inhibition potential against *Fusarium moniliforme*.

INTRODUCTION

Rice is an important cereal crop and growing all over the world. Rice grows in India is primarily divided into Basmati rice and Non-Basmati rice. India is the major producer and exporter of basmati rice to the world. Rice production is very much effected by many biotic and abiotic stresses. Among the biotic stress, fungal diseases have important role in reduction the yield of rice. Bakanae (Foot rot) is one of them that is emerging problem as major disease of rice. Bakanae disease is caused by *Fusarium moniliforme* Sheldon and the pathogen was later identified as *F. fujikuroi* Nirenberg. The teleomorph stage of *F. moniliforme* is known as *Gibberella fujikuroi* Sawada (Nirenberg, 1976). The teleomorph, *Gibberella fujikuroi*, has been reported on rice in China, Japan and Taiwan (Sun, 1975). The fungus produces gibberellins and other secondary metabolites such as carotenoids, bikaverin and fusarin, which directly affect the growth of rice, plants (Ilija *et al.,* 2009). The fungus produces giberrellin hormone which causes elongation of plant (Nyvall, 1999). The pathogen is widely distributed through the world and has wide host range (Kazempour, 2007). Precise information on losses caused by Bakanae disease 15% was reported in India and 40-50% in Japan (Pavgi and Singh, 1964). The most visible symptoms on rice plant of *F. fujikuroi* are seedling elongation, foot rot, seedling rot, grain sterility, and grain discoloration (Ou, 1985). Seed treatment with fungicide such as thiram has been used for management of Bakanae disease (Suzuki *et al.,* 1985). After the emergence of pathogen resistance to these fungicides, ipoconazole has become the major fungicide to control the disease (Kumazawa *et al.* 2000). In present investigation, commonly available fungicides were tested *in vitro* to known their toxicity on the pathogen because these may be important component in integrated disease management programme.

MATERIALS AND METHODS

Present investigation on *in vitro* evaluation of different fungicides against *Fusarium moniliforme* causing Bakanae disease of rice was carried out in the department of plant pathology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut and Uttar Pradesh.

Seven fungicides were tested *in vitro* against *F. moniliforme* by food poison technique (Nene and Thapliyal, 1971). Required amount of fungicide was added in sterilized potato dextrose media to obtain 10ppm, 100ppm, 500ppm, and 1000ppm concentration in the conical flask. Fungicide was mixed in potato dextrose media by shaking the flask prior to pouring in sterilized Petri plates. The medium was allowed to solidify and then 3 mm discs from seven days old culture of *F. moniliforme* was placed in centre of each Petri plate. Control was maintained without any treatment. Three replications were maintained for each concentration for every tested fungicide. Inoculated plates were incubated at 28 ± 1°C in BOD incubator. Observations were recorded on radial growth of test pathogen at regular interval. Percent inhibition over control was calculated by the following formula given below (Vincent, 1947).

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

where,

I = Percent inhibition of fungal growth

C = Radial growth in control

T = Radial growth of treated petridish

RESULTS AND DISCUSSION

The seven fungicides namely tabucanazole, thiophanate, carbendazim, hexaconozole, mancozeb, thiram and propineb were tested *in vitro* against the pathogen by the food poison technique at the 10 ppm, 100 ppm, 500 ppm, and 1000 ppm concentration. Table 2 and Fig. 1 indicates the results of different fungicides on pathogen at different concentrations.

It was recorded that at 10 ppm concentration, carbenbazim completely inhibited the growth of pathogen followed by tabuconazole (97.78%), hexacanazole (75.28%) and thiophanate (57.64%) while Mancozeb, thiram and propineb expressed minimum growth inhibition that is 0.97, 1.84 and 0.73 respectevly. Tabuconazole, thiophanate, and hexacanazole shown complete inhibition of pathogen growth at 100ppm while mancozeb, propineb and thiram shown inhibition as 5.91, 10.26 and 4.93 respectively. At the 500ppm mancozeb inhibited the growth of pathogen 41.86% followed by propineb, 20.51% and thiram 4.71%. Growth inhibition at 1000ppm was observed 45.67, 57.40 and 46.53 in case of mancozeb, propineb and thiram respectively. Previous studies also found that systemic fungicide are best for management of Bakanae disease in laboratory as well as in field. Biswas and Das (2002) tested the fungicides at 0.2% and found that, carbendazim and benomyl significant reduce Bakanae disease incidence and percentage tiller infection, and increase in yield. Titone *et al*. (2004) found that, fungicide like carbendazim, mancozeb, iprodione + triticonazole and carboxin + thiram reduced the Bakanae disease incidence by 80 and 40% under laboratory and field conditions respectively. Taskeen-un-Nisa *et al*. (2011) tested the efficacy of carbendazim, hexaconazol, bitertanol, myclo- butanil, mancozeb, captan and zineb against *Fusarium oxysporum* and found that, the maximum inhibition in mycelial growth was observed in the hexaconozole at 1000 ppm followed by other fungicides at the same concentration. Kapadiya (2013) tested the systemic and non systemic fungicides against the *Fusarium solani in vitro* condition and found that among the systemic fungicide tebuconazole and carbendazim gave cent percent growth inhibition.

In the conclusion we suggested that use of chemical compounds may be the important component for management of Bakanae disease of rice. The present finding demonstrated the all systemic fungicides (tabucanazole, thiophanate, carbandazim, hexacanazole) as effective component in integrated disease management.

Table 1: Fungicides tested against the *F. moniliforme*

Fungicides	Chemical composition
Tebuconazole	(RS)-1-p-chlorophenyl-4, 4-dimethyl-3-(1H-1,2,4-triazol-1-ylmethyl) Pentan-3-ol
Carbendazim	Methyl benzimidazol-2-ylcarbamate
Thiophanate	Diethyl4,4-(o-henylene)bis (3- thioallphanate
Hexaconazole	2-(2, 4-dichlorophenyl)-1-(1H-1, 2, 4-triazol-1-yl) hexan-2-ol
Mancozeb	Manganese ethyl bisdithiocarbamate
Propineb	zinc propylenebisdi thiocarbamate
Thiram	Tetramethyl thiuram Disulfide

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Table 2: Colony radial growth and percent inhibition of *F. moniliforme* on different fungicides

Treatment	10ppm *Average Colony diameter (mm.)	Percent inhibition (%)	100ppm *Average Colony diameter (mm.)	Percent inhibition (%)	500ppm *Average Colony diameter (mm.)	Percent inhibition (%)	* Average Colony diameter (mm.)	1000ppm Percent inhibition (%)
Tabucanazole 5% SC (Raxil)	2.00	97.78	0.00	100	0.00	100	0.00	100
Carbendazim 50% WP (Agrizim)	0.00	100	0.00	100	0.00	100	0.00	100
Thiophanate Methyl 70% WP (Prism)	38.12	57.64	0.00	100	0.00	100	0.00	100
Hexacanazole 5E (Cartaf)	22.24	75.28	0.00	100	0.00	100	0.00	100
Mancozeb 75% WP (Indosal M-45)	89.12	0.97	84.68	5.91	52.32	41.86	48.89	45.67
Propineb 70% WP (*Antracol*)	89.34	0.73	80.76	10.26	71.54	20.51	38.34	57.4
Thiram (Thiram)	88.34	1.84	85.56	4.93	85.76	4.71	48.12	46.53
Control	90	0.00	90	0.00	90	0.00	90	0.00
C.D. at 5%	0.556		0.462		0.341		0.35	

*Means of three replication

T_1- Tabucanazole, T_2- Carbendazim, T_3- Thiophanate, T_4- Hexacanazole, T_5- Mancozeb, T_6- Propineb, T_7- Thiram, T_8- Control

Figure 1: evaluation of fungicides against growth of *F. moniliforme (In vitro)*

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