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Efficacy of fungicides and resistance inducing chemicals against sheath blight of rice

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Fungicides GFT-10 (S-methyls,s-diphenyl phosphorothioate) and folicur along with three resistance inducing chemicals — ferric chloride, dipotassium hydrogen phosphate and salicylic acid were tested for their capability to suppress rice sheath blight under green house conditions. Folicur was found better than GFT-10 showing low disease incidence and greater lesion height reduction. Among resistance inducing chemicals dipotassium hydrogen phosphate showed greatest disease reduction. However all the chemicals applied as foliar spray reduced the sheath blight disease.

Key words : *Rhizoctonia solani,* sheath blight, rice, fungicides

INTRODUCTION

Sheath blight caused by *Rhizoctonia solani* Kuhn is a threat to rice cultivation in different agro-climatic conditions. Losses due to disease are reported to be upto 50 per cent (Rajan 1987; Roy, 1993). Paracer and Chahal (1963) reported this disease from India for the first time. Most of the fungicides like benomyl, carbendazim, chloroneb, captafol, mancozeb, zineb, edifenphos, IBP, Thiophanate, CGA 64250, carboxin etc. have been found effective for the control of above disease under field conditions (Bhaktavatsalam *et al.,* 1977; Dash and Panda, 1984; Kannaiyan and Prasad, 1979; 1984). Out of these, benomyl, carbendazim, edifenphos and IBP have been extensively used for the control of disease in India (Roy, 1993). Although both biotic and abiotic agents have been reported to induce resistance in rice, chemicals are possible the best candidates (Rathmell, 1984; Kessmann *et al.,* 1994) because they are easy to formulate and handle and are less sensitive to the environment than biological inducers (Steiner and Schonbeck, 1995). The chemicals reported as resistance inducers are cupric chloride, ferric chloride, cyclohexamide, sodium malonate (Sengupta and Sinha, 1987), dipotassium hydrogen phosphate, salicylic acid (Manandhar *et al.,* 1998). In the present study one new organophosphorus compound and one triazole group compound (folicur) along with three resistance inducing chemicals have been evaluated against sheath blight of rice.

MATERIALS AND METHODS

A new chemical GFT-10 (S-methyls,s-diphenyl phosphorotrthioate) was prepared by the reaction of sodium salt of thiophenol with o-methyl-phosphoro dichloride thioate by the method reported by Gupta and Roy (1991). The other fungicide taken was folicur (Tebuconazole-Triazole group). Besides these two fungicides, three resistance inducing chemicals viz., ferric chloride, dipotassium hydrogen phosphate and salicylic acid were also tested against sheath blight in glass house conditions. The test were carried out on rice variety Pusa Basmati-1 in earthen pots (35 cm). The concentrations used were 100 and 250 ppm for GFT-10 and folicur (25 per cent) respectively. For resistance inducing chemicals the concentrations used were 10, 25, 50 mM for salicylic acid, ferric chloride and dipotassium hydrogen phosphate respectively. Lower concentratin of salicylic acid and ferric chloride was used because the higher concentration (750 mM) is reported to cause damage to rice plants (Manandhar *et al.,* 1998). In total, eight treatments

(4 for fungicides and 4 for resistance inducing chemicals), three replications and five plants/ replicatin were used during the present studies. A standard fungicide carbendazim was used for comparison along with control (water only). Inoculation with *Rhizoctonia solani* were carried out at maximum tillering stage with colonized typha leaf pieces (Bhaktavatsalam *et al.*, 1978). These typha pieces were placed between the central region of rice plant, 5-10 cm above the water level. Twenty days after inoculations sheath blight lesion height was assessed by Standard Evaluation System (SES) for rice (IRRI, 1980).

RESULTS AND DISCUSSIONS

In vivo, GFT-10 showed 54.8 per cent disease incidence at 100 ppm as against 72.9 per cent in control (only water) showing a disease reduction of 18.1 per cent. The infected height was also reduced by 11.9 per cent. The other fungicide folicur (25 per cent) at 250 ppm showed 10.0 per cent disease incidence as against 72.9 per cent in control showing a disease reduction of 75.1 per cent. Lesion height was also reduced to 12.2 per cent (Table 1). Carbendazim used as standard fungicide for comparison at 1000 ppm resulted in 8.0 per cent disease showing a disease reduction of 64.9 per cent. Lesion height was also reduced to 12.2 per cent.

Table 1 : Efficacy of new chemicals against sheath blight or rice.

Chemicals	Concentration (ppm)	Disease incidence (per cent)	Disease reduction (per cent)	Lesion height reduction (per cent)
GFT-10	100	54.8 (47.75)	18.1	11.9
Folicur	250	10.0 (18.4)	62.9	12.2
Bavistin	1000	8.0 (16.4)	64.9	12.2
Control		72.9	—	—

CD at 5% = 3.39

Besides this, three resistant inducing chemicals viz., dipotassium hydrogen phosphate, ferric chloride and salicylic acid when applied as foliar spray reduced the sheath blight disease. The lowest disease incidence of 43.7 per cent (disease reduction 34.3 per cent) was observed by dipotassium hydrogen phosphate at 50 mM as against 78.0 per cent in control. The number of infected tillers were 21.9 per cent as against 51.0 per cent in control (Table 2).

Table 2 : Efficacy of resistance inducing chemicals against sheath blight or rice.

Chemicals	Concentration (mM)	Disease incidence (per cent)	Disease reduction (per cent)	Infected tillers reduction (per cent)
Salicylic acid	10	54.7 (47.7)	22.3	24.4
Ferric chloride	25	57.8 (50.0)	20.2	31.8
Dipotassium hydrogen phosphate	50	43.7 (41.4)	34.3	21.9
Control		78.0	—	—

CD at 5% = 5.93

According to Gupta and Roy (1993) GFT-10 exhibited a very good fungicidal activity against *Rhizoctonia solani* (ED 50=26 ppm). This compound was also found effective agains *Pyricularia grisea, Rhizoctonia bataticola,* and *Pythium aphanidermatum* (Gupta and Roy, 1991 ; 1993). Similar results were observed for IBP and edifenphos at 50 ppm by Dash and Ponda (1984). Kannaiyan and Prasad (1979) reported a good control of sheath blight of rice by these two similar organo-phosphorus compounds at 0.2 per cent concentration. Ishikawa and Morita (1993) reported S,N-diaryl thiophosphoroamidates as effective fungicide against sheath blight and blast of rice. Although both biotic and abiotic agents have been reported to induce resistance in rice, chemicals are possibly the best candidates (Rathmell, 1984 ; Kessmann *et al.*, 1994), because they are easy to formulate and handle, and less sensitive to the environment than biological inducers (Kuc, 1995; Steiner and Schonbeck, 1995). There are many resistance inducers like cupric chloride, cycloheximide, pchloromercuribenzoate, sodium malonate (Sengupta and Sinha, 1987). The resistance inducing chemicals which are used in present studies, were found to be effective for blast disease (Manandhar *et al.*, 1998). Ferric chloride was reported to be a phytoalexin inducer in rice against *Pyricularia oryzae* (Sengupta and Sinha, 1987). The present study demonstrates that three resistance inducing chemicals were able to quite substantially suppress sheath blight disease.

However, much research is still needed before any commercialization of the inducers may take place. It is of course, important to thoroughly study any toxic effects of the inducers on the environment, including phytotoxic effects, cost of using the inducers also needs to be considered. If these problems are solved and a large scale production can be commenced, the cost of such new disease control agents may turn out of compare favourable with existing conventional fungicides.

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