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TESTS OF CHEMICAL SEED TREATMENT FOR CONTROL OF SORGHUM DOWNY MILDEW INCITED BY *PERONOSCLEROSPORA SORGHI*

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ABSTRACT

In a study on chemical control of sorghum downy mildew incited by Peronosclerospora sorghi (Weston and Uppal) Shaw, none of the tested fungicides were effective, as a dry seed treatment, against conidial and oosporic infections of the pathogen. In contrast, soaking of seeds with aureofungin 67 ppm a.i. (Aureofungin-sol 30% W/W), metalaxyl 0.2% a.i. (Apron 35 WS) metalaxyl-Ziram 0.2% a.i. (Ridomil ZM, 280 FW) and carboxin 0.1% a.i. (Vitavax 75 WP) for 2 hr effected complete control of the disease. But, metalaxyl, metalaxyl-Ziram, carboxin and not aureofungin significantly inhibited the germination of seeds. According to this study, aureofungin is superior to other selected fungicides from the standpoint of downy mildew control and seed germination. The result was confirmed by a repeated experiment.

Sorghum downy mildew (SDM) incited by **Peronosclerospora sorghi** (Weston and Uppal) Shaw, is a highly destructive disease of sorghum (**Sorghum bicolor** (L.) Moench) in tropical and subtropical less developed countries. The disease was first reported in India by Butler (1907) and subsequently from various sorghum growing countries (Anon., 1976). Recently, the author (unpublished) estimated 30.5% yield loss due to SDM in Tamil Nadu. Treatment of dry seeds with various fungicides decreased the incidence of downy mildew (Schwinn 1978, Venugopal and Safeeulla, 1978). But, in Tamil Nadu, dry seed treatment was not very effective in controlling this disease especially under high inoculum pressure. The present study was therefore aimed to evolve suitable method of control against sorghum downy mildew.

MATERIALS AND METHODS

Effect of dry seed treatment on conidial and oosporic infections : The seed of highly susceptible sorghum cultivar DMS 652 was treated separately with various fungicides viz., mancozeb (Dithane M-45 75 WP) 2 g per kg of seed; captan (Captan 50 WP) 4 g per kg; carboxin (Vitavax 75 WP) 2 g per kg; metalaxyl (Apron 35 WS) 6 g per kg; thiophanate methyl (Topsin-M 75 WP) 2 g per kg and aureofungin (Aureofungin-Sol 30% w/w) 1 g per kg, in a seed treating drum for 10 minutes. Untreated seed served as control.

In one set of experiment, the treated seeds were kept 24 hours in a moist

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chamber for germination and then artificially inoculated with conidia of the fungus by sandwich method (House, 1985). The germinated seeds were incubated between two systemically infected sorghum leaf pieces at 20°C in a dark humid chamber for 24 hours. They were then sown in earthenware pots containing 20 kg of sterile soil. In another set of experiment, the treated seeds were directly sown in earthenware pots containing oospore inoculum. Before sowing, ten g of one year ole oospore inoculum was mixed in a earthenware pot containing 20kg sterile soil and allowed for natural weathering for six months. In each treatment, 100 seedlings (10 seedling per pot) with four replications were maintained. The percentage of disease incidence was recorded from two-leaf stage onwards.

The percentage of germination of 100 seeds from each treatment was assessed in room temperature (25 ± 3° C) by Roll Towel Method (ISTA 1976). The treatments were replicated four times.

Effect of seed soaking on conidial and oosporic infection : The fungicides viz., mancozeb (Dithane M 45 75 WP) 0.15% a.i., captan (Captan 50 WP) 0.10% a.i., thiophanate methyl (Topsin M 75 WP) 0.15% a.i., metalaxyl-Ziram (Ridomil-ZM 280 FW) 0.20% a.i., carboxin (Vitavax 75 WP) 0.10% a.i., ziram (Cuman L. 27% w/w) 0.10% a.i., metalaxyl (Apron 35 WS) 0.20% a.i., and aureofungin (Aureofungin-sol 30% w/w) 67 ppm a.i., were dissolved in sterile distilled water to get desired concentration. Hundred-gram seed of DMS 652 was soaked in fungicidal solutions separately or in sterile water (control) for two hours and then shade-dried for 12 hours.

For conidial infection, the treated seeds were germinated in a moist chamber and artificially inoculated with conidia of the fungus by sandwich method. For oosporic infection, the treated seeds were sown directly in earthenware pots containing 10 g oospore inoculum. Necessary populations and replications were maintained as in previous experiment. The disease incidence was recorded from two-leaf stage onwards. The effect of these treatments on seed germination was also studied by Roll Towel Method.

RESULTS AND DISCUSSION

Dry seed treatment was not effective to control conidial and oosporic infection of **P. sorghi** (Table 1). The ineffectiveness of dry seed treatment on this pathogen forced us to take up seed soaking method. Seed soaking with selected fungicides was very effective in controlling **P. sorghi** infections (Table 2). Although metalaxyl (0.2% a.i.,), metalaxyl-Ziram (0.2% a.i.) and carboxin (0.1% a.i.) gave complete protection against conidial and oosporic infections, these fungicides significantly reduced the germination of seeds. Interestingly, aureofungin (67 ppm a.i.) which was very effective in controlling the downy mildew was not inhibiting to seed germination.

The oospores of **P. sorghi** survive in soil for many years (Rangaswami, 1972). At the time of seedling emergence the oospores germinate and infect the seedling directly (germ tube) or indirectly

TABLE 1 : Effect of dry seed treatment on SDM

Treatment	Qty of fungicide/ kg of seed	Conidal infection (%)	Oospore infection (%)	Seed germination (%)
Mancozeb	2g	100 (90.00)	48.38 (44.07)	99.73 (87.88)
Captan	4g	100.00 (90.00)	48.55 (44.16)	99.63 (88.24)
Carboxin	2g	99.50 (87.14)	48.65 (44.23)	99.40 (86.32)
Metalaxyl	6g	99.18 (85.50)	56.93 (43.38)	98.40 (89.36)
Thiophanate methyl	2g	98.93 (84.24)	47.18 (43.24)	99.96 (84.74)
Aureofungin-Sol	1g	96.70 (82.22)	57.63 (43.64)	99.10 (82.81)
Control	-	100.00 (90.00)	48.20 (43.95)	99.45 (86.59)
CD (p=0.05)		NS	NS	NS

NS = Not Significant Figures in parentheses are angular transformed values

TABLE 2 : Effect of seed soaking on SDM

Treatments	Concentration of fungicides (a.i)	Conidial infection (%)	Oospore infection (%)	Seed germination (%)
Mancozeb	0.15%	62.28 (52.85)	58.18 (49.75)	94.88 (76.97)
Captan	0.10%	76.60 (61.94)	59.45 (50.45)	92.98 (74.68)
Thiophanate methyl	0.15%	79.15 (63.79)	59.33 (52.65)	74.95 (60.02)
Metalaxyl-ziram	0.20%	0.00 (0.76)	1.50 (6.28)	16.03 (23.49)
Carboxin	0.10%	0.00 (0.76)	2.52 (13.68)	24.03 (29.16)
Ziram	0.10%	83.50 (66.56)	58.98 (50.00)	18.30 (25.32)
Metalaxyl	0.20%	0.00 (0.76)	1.00 (4.44)	70.68 (57.29)
Aureofungin	67 ppm	0.00 (0.76)	0.00 (0.76)	95.20 (77.88)
Control	-	95.48 (80.75)	63.00 (62.57)	97.65 (81.27)
CD (p=0.05)		2.49	5.90	10.29

Figures in parentheses are angular transformed values

(conidia). The seed treatment was therefore resorted to prevent early infection. According to earlier reports dry seed treatment with metalaxyl was very effective in controlling sorghum downy mildew (Exconda and Molina, 1978) Schwinn, 1978; Venugopal and Safeeulla, 1978). However, the present study showed that all fungicides tested including metalaxyl as a dry seed treatment were ineffective against **P. sorghi**. In contrast, soaking method of seed treatment with aureofungin, metalaxyl, metalaxyl-Ziram and carboxin completely prevented the pathogen entry. But seed germination was inhibited by 29.4%, 84.0% and 76.0% with metalaxyl, metalaxyl-ziram and carboxin respectively over control. There are reports of detrimental effects on germination and seedling growth following seed treatment with relatively high rates of metalaxyl (Williams, 1984). The antifungal antibiotic aureofungin has been known to control many diseases including those caused by Mastigo mycotina fungi (Singh, 1978).

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