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Efficacy of fungicides for the management of sheath rot disease in rice under *in vitro* and *in vivo* conditions

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ABSTRACT

Sheath rot of rice is caused by Sarocladium oryzae. In this study seven fungicides were tested against S. oryzae. Maximum inhibition of radial growth was recorded at 500 ppm of hexaconazole, tebuconazole, tricyclazole and propiconazole. Comparative efficacy of fungicides on sheath rot was tested under field condition. Hexaconazole 5% SC (Contaf) treatment followed by Tebuconazole 250 EC (Folicur) , Carbendazim 50% WP (Bavistin), Propiconazole 25 EC (Tilt), Saaf (Carbendazim 12% + Mancozeb 63% wp) and Mancozeb 75% WP (Indofil M-45) treatment significantly reduced the sheath rot intensity and increased the grain yield.

Key words: : *Sheath rot, rice, chemical control*

Rice is one of the most important staple food crops in the world, with China and India being the lead producing countries. Major rice growing States of India are West Bengal, Uttar Pradesh, Punjab, Bihar, Tamil Nadu, Madhya Pradesh and Chhattisgarh. Chhattisgarh State is popularly known as "rice bowl of India" because maximum area is covered under rice during wet season and contribute for major share in national rice production. Rice is known to suffer from biotic and abiotic stresses. Rice in general and irrigated rice is the target of attack by over 100 species of insects and diseases. Pest and disease accounts for the crop losses to the extent of 30 to 40 percent. Chhattisgarh State is the most congenial for rice cultivation as well as also for diseases. Several diseases were reported in rice and among them blast, bacterial blight, sheath rot, sheath blight and brown spot are most important for this State causing considerable economic yield losses.

Sheath rot caused by *S. oryzae (Sawada)* Games and Hawksworth has become a serious problem in most of the rice growing area of the country. In India, Agnihothrudu (1973) recorded this disease for the first time and later several workers reported the disease from different parts of the country (Ghuffran, *et al.*, 1980). In Chhattisgarh Thrimurty *et al.* (1980) found that *S. oryzae* was associated with sheath rot infected panicles of rice and the incidence in some popular rice varieties increased the number of chaffy grains in infected panicles than healthy ones.

Sheath rot has gained the status as a major disease of rice (Reddy and Ghosh, 1985) and yield losses varies from 9.6 to 85% depending on the weather conditions during the crop growth period (Phookan and Hazarika, 1992). Naeimi *et al,* (2003) also reported that the sheath rot occurs in most rice-growing regions of the world and usually causes yield losses ranging from 20 to 85%. Hence, the present investigation was undertaken to find out the effective fungicides available against the disease.

The present studies were conducted in the laboratory of Department of Plant Pathology, IGKV, Raipur (Chhattisgarh) and the *in vivo* studies were carried out during wet season 2011 at the Plant Pathological Experimental Site, IGKV, Raipur, Chhattisgarh.

Efficacy of new and commonly available fungicides on the growth of *S. oryzae* was evaluated by using poisoned food technique. The seven fungicides were taken and approximately 20 ml of PDA medium

was poured in each petri plate for each fungicidal treatment.

The PDA plates without fungicides were served as control. After solidification of the medium, each petri dish was inoculated with 7 mm disc of 7 days old culture of *S. oryzae*. The plates were incubated at 28 ±2ºC. Three replications were kept for each treatment along with untreated (control) treatment. The observation for mycelial growth were recorded at every 5 days interval up to 15 days of the inoculation. These fungicides were tested for their inhibitory action against the pathogen at the concentration level of 500 ppm. The percent of inhibition was calculated by using the above procedure.

The percent inhibition was calculated as per the following formula described by Vincent (1947).

Inhibition (%) = C-T/C × 100

Whereas,

C = Diameter of the fungus colony (mm) in control plate.

T = Diameter of the fungus colony (mm) in treated plate.

Field experiment was carried out during wet season 2011 at Plant Pathological Experimental Site, IGKV, Raipur, Chhattisgarh. Susceptible rice cultivar Sawrna was taken. General agronomical practices were followed for cultivation of experimental plots. There were 8 treatments i.e. Hexaconazole 5 % SC (Contaf) , Propiconazole 25 EC (Tilt), Tricyclazole 75% WP (Beam), Carbendazim 12% + Mancozeb 63% wp (Saaf), Tebuconazole 250 EC (Folicur), Mancozeb 75% WP (Indofil M-45), Carbendazim 50% WP (Bavistin) including untreated (control) for each replication.

Disease intensity was recorded at maturity of the crop in 0-9 scales by following the procedure of Standard Evaluation System of International Rice Testing Programme (IRRI, 1980). Randomly 20 panicles of each treated plot were selected for taking the observations. The observation for disease intensity, percent disease intensity over control and yield kg/ha were also recorded for each treatment at maturity of the crop.

The disease symptoms were observed as grayish brown lesion with dark brown margin on the upper most leaf sheath at booting to heading stage of the rice crop. Severe infection causes entire or parts of young panicles to remain with the sheath. Unemerged panicles rot and florets turned-sown to dark brown. Infested panicles and grains are stenile, shriveled, partially or unfilled and discoloured. The seven fungicides i.e. Carbendazim 12% + Mencozeb 63% wp (Saaf), Tricyclazole 75% WP (Beam), Hexaconazole 5 % SC (Contaf), Carbendazim 50% WP (Bavistin) , Propiconazole 25 EC (Tilt) , Tebuconazole 250 EC (Folicur) and Mencozeb 75% WP (Indofil M-45) were assessed *in-vitro* to find out the most effective inhibitor of *S. oryzae* at 500 ppm level by poison food technique. Complete inhibition of mycelia growth was recorded by Hexaconazole 5% SC (Contaf), Tricyclazole 75% WP (Beam), Propiconazole 25 EC (Tilt) and Tebuconazole 250 EC (Folicur) treatments where as the minimum mycelia growth of 17.07mm were recorded in treatment with Carbendazim 50% WP (Bavistin). The *in vitro and in vivo* study of Venkateswarlu *et al.,* 2004; Thapak *et al.,* 2003 and Anonymous 2010 are confirmatory with the above findings.

The result indicated that the foliar spray of Hexaconazole 5 SC (Contaf) treatment was found highly effective in reducing the disease intensity (45%) and recorded in 44.89% decrease of sheath rot disease over control. Treatment with Hexaconazole 5 SC (Contaf) was also statistically on par with Tebuconazole 250 EC (Folicur), Carbendazim 50% WP (Bavistin), Propiconazole 25 EC (Tilt), Saaf (Carbendazim 12%+ Mancozeb 63%), Mancozeb 75% WP (Dithan M-45) treatment. The highest grain yield was also recorded in Hexaconazole 5 SC treatment followed by Carbendazim 50% WP (Bavistin), Tricyclazole 75% WP (Beam), Propiconazole 25 EC (Tilt), Tebuconazole 250 EC (Folicur) and Carbendazim 12%+ Mencozeb 63% WP (Saaf) treatment, respectvely (Fig. 1) (Table 1).

The result obtained under the *in-vivo* condition in the study clearly revealed that all the tested fungicides significantly reduced the disease intensity over control and increased the grain yield of rice. Among all the fungicides the Hexaconazole 5 %SC (Contaf) treatment was highly effective in reducing the sheath rot intensity and was statistically at par with Tebuconazole 250 EC (Folicur) and Carbendazim 50% WP (Bavistin) (Fig. 2 and 3) (Table 2). Findings of several reports are in agreement with the present findings as they had reported

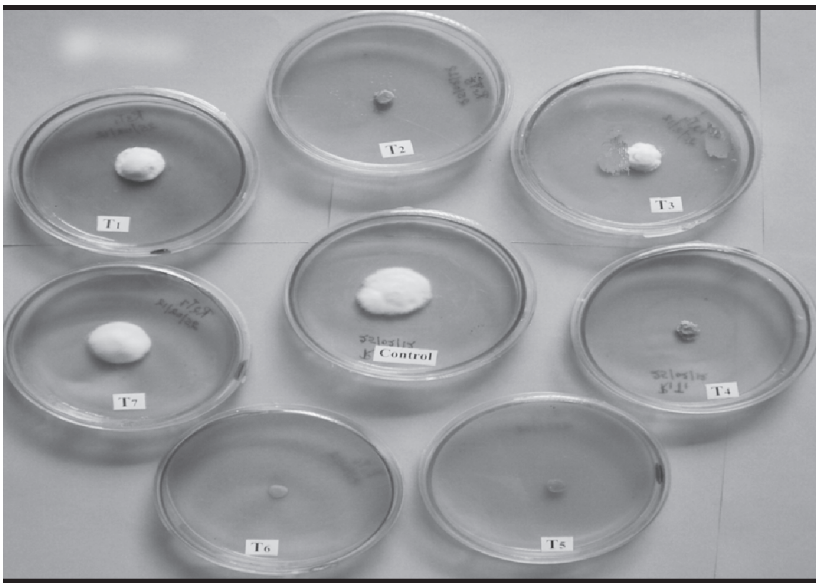

Fig. 1. Evaluation of fungicides against S. *oryzae* (500ppm)

T_1: Carbendazim12% + Mancozeb 63% wp (Saaf), T_2: Tricyclazole 75 WP% (Beam), T_3: Hexaconazole 5 %SC (Contaf), T_4: Cardendazim 50 %WP (Bavistin), T_5: Propiconazole 25 %EC (Tilt), T_6: Tebuconazole 250 EC (Folicur), T_7: Mancozeb 75% WP (Indofil M-45); T_8: Control

Table 1. Evaluation of fungicides against *S. oryzae* (500ppm)

Treatment No.	Treatments	Mycelial growth (mm) *	% Inhibition over control
T_1	Carbendazim12% + Mancozeb 63% Saff	23.50	25.46
T_2	Tricyclazole 75% WP (Beam)	-	100
T_3	Hexaconazole 5 SC (Contaf)	-	100
T_4	Carbendazim 50% WP (Bavistin)	17.07	45.86
T_5	Propiconazole 25 EC(Tilt)	-	100
T_6	Tebuconazole 250 EC(Folicur)	-	100
T_7	Mancozeb 75% WP(Dithan M-45)	25.53	19.02
T_8	Control	31.53	-
S Em±		0.69	
CD (P<0.05%)		2.08	

*Average of three replications

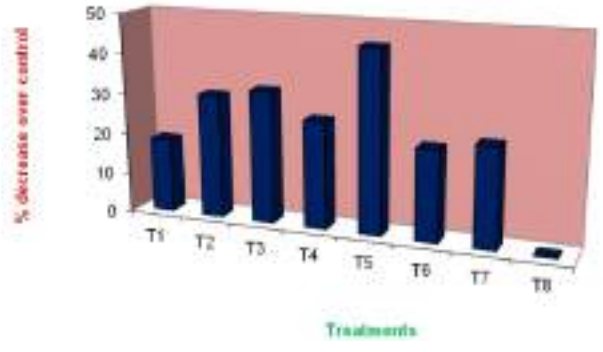

Fig. 2. Efficacy of the fungicides for the control of sheath rot of rice

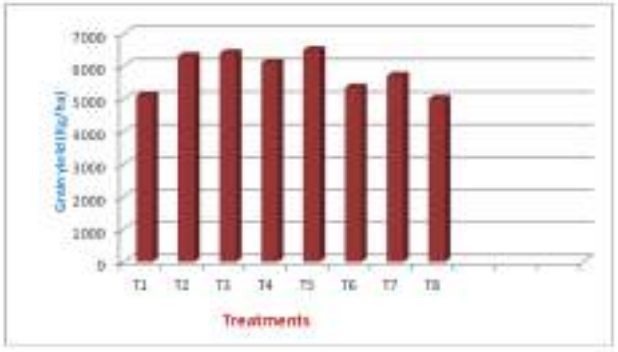

Fig. 3. Efficacy of the fungicides on grain yield

Table 2. Efficacy of commercially available fungicides for the management of sheath rot of rice under field condition

Treatment No.	Treatments	Dosage/liter of water	Disease intencity (%)*			% decrease over control	Grain yield (kg ha^{-1})
			10 DAI[a]	20 DAI	30DAI[b]		
T1	Carbendazim(12%)+ Mancozeb 63% wp (Saaf)	1.5 g	13.33(3.7)	46.66	66.66(61.19)	18.36	5100.00
T2	Tricyclzole 75% WP (Beam)	0.06 ml	11.66(3.47)	48.33	56.66(54.49)	30.61	6310.00
T3	Cardendazim 50 % WP (Bavistin)	2.0 g	11.66(3.47)	38.33	55.00(53.19)	32.64	6400.00
T4	Propiconazole 25 EC (Tilt)	1.0 ml	8.33(2.94)	45.00	60.00(56.59)	26.52	6112.00
T5	Hexaconazole 5 % SC (Contaf)	2 ml	6.66(2.64)	33.33	45.00(46.76)	44.89	6500.00
T6	Tebuconazole 250 EC (Folicur)	1.5 ml	6.66(2.64)	35.00	63.33(58.94)	22.44	5350.00
T7	Mancozeb 75% WP (Indofil M – 45)	2 g	10.00(3.17)	48.33	61.66(58.22)	24.49	5700.00
T8	Control	-	15.00(3.89)	61.66	81.66(72.21)	-	5000.00
	SEm±		0.32	2.87	4.57		291.22
	CD (P<0.05%)		0.99	8.72	13.62		833.34

*Average of three replications.
[a]Figures in parentheses show square root transformation.
[b]Figures in parentheses show arcsine transformation.

the efficacy of Hexaconazole 5 % SC (Contaf) and Carbendazime 50% WP (Bavistin) against sheath rot of rice (Venkateswarlu and Venkateswarlu 2004; Karamkar *et al*., 1992, Vidhyasekaran and Lewin 1987, Anonymous 2009).

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