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STUDIES ON THE EFFECT OF SOME SYSTEMIC COMPOUDS ON *ACROCYLINDRIUM ORYZÆ* IN RELATION TO THE CONTROL OF SHEATH ROT DISEASE OF RICE

By

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Efficacy of six systemic compounds (*viz.*, benomyl, MBC, vitavax, kitazin, DDVP and aureofungin) were tested on spore germination and mycelial growth of *Acrocylindrium oryzæ*, a causal organism of sheath rot disease of rice. Different doses of the aforesaid compounds were more or less inhibitory to growth and germination but MBC was most effective at a very low concentration (5μg/ml). Foliar spray with different concentrations of benomyl, MBC and vitavax also showed that MBC was most effective (50μg/ml) against sheath rot disease. Next to MBC, vitavax could be used as foliar spray.

INTRODUCTION

Sheath rot disease of rice is becoming increasingly destructive in India and other South-Eastern Countries of Asia. *Acrocylindrium oryzae* a causal organism of the disease was described by Sawada in 1922 from Formosa. Although Gams and Hawksworth (1975) have proposed a new name *Sarocladium oryzae* W. Gams & D. Hawksw. for *A. oryzae* Swada, controversy among Mycologists regarding nomenclature has not yet been resolved. In india sheath rot disease was reported by Amin *et al.* in 1974. The rot usually occurs on the uppermost leaf sheath enclosing the young panicle (Plate I). Sometimes oblong or irregular brown spots appear on the leaf sheaths or lamina. The young panicles are forced to remain enclosed within the leaf sheaths or emerge partially. In severe cases the panicles rot completely and the rice grains turn deep brown in colour and become chaffy. Since this disease affects one of the most important crops of India and since relatively little work has been done on the control of this disease it was

considered worthwhile to study the effect of some common systemic compounds on the growth and germination of the causal agent as well as on the development of sheath rot disease.

Materials and Methods

For spore germination test the method described by Purkayastha and Chattopadhya (1975) was adopted.

To study the effect of fungicides on mycelial growth, poisoned food technique (Nene, 1971) was followed with modifications. Richards solution (g/l distilled water – 50 gm sucrose, 10 gm KNO_3, 5 gm KH_2PO_4, 2.5 gm $MgSO_4$, $7H_2O$, 0.02 gm $FeCl_3$) was used as the basal medium and the appropriate quantity of the desired systemic compound was added to the sterilized medium before inoculation. The concentrations of systemic compound used were calculated on the percentage of active ingredient. Six systemic compounds *viz.*, benomyl [Methyl – 1 –, (butyl carbamoyl) – 2 – benzimidazole carbamate] ; kitazin [0,0 – Disopropyl – s – benzyl thiophosphate] ; MBC [Methyl – benzimidazole – 2 – YL Carbamate] ; DDVP [2 – 2, Dichlorovinyl – 0 – dimethyl phosphate] ; aureofungin, vitavax [2, 3 – dihydro – 5 – carbaxanilido – 6 – methyl – 1, 4 – oxathiin] were used in this investigation. Each Erlenmeyar flask containing 50 ml of medium was inoculated with a 3 mm agar block with 4-days-old mycelia of *A. oryzae* and incubated for 10 days at 30±1°C and diffused light. The mycelia were collected at the end of incubation period, dried for 96 hrs at 60°C and weighed.

For field experiment two susceptible, high-yielding rice cultivars (Jaya and TN 1) were grown in earthenware pots (25 cm in diam) containing non-infested soil compost (soil : cattle manure : : 1 : 1) and kept under ordinary conditions of day light and temperature (26 – 34°C) of the experimental garden of the Department. Four concentrations (1, 10, 50 and 100μg/ml) of benomyl, MBC and vitavax were applied separately to plants as foliar spray 3 and 7 days before inoculation. Only the flag-leaf sheath of each plant (10-week-old) was inoculated with 1 ml of spore suspension (4×10^6 spores/ml) and covered with moist polythene bag for 48 hr with a view to allow appropriate humid condition during the initial stage of infection. The disease intensity was assessed after 1, 2 and 3 weeks of inoculation. The necrotic spots on the leaf sheath were graded into four groups *viz.*, very small, small, medium and large with respective values 0.25, 0.5, 1 and 2 assigned to them in order to give an approximate idea of their relative sizes. The values 0.25, 0.5, 1 and 2 were given to spots denoting approximate diameters (upto 1 mm, upto 2 mm, upto 4 mm and more than 4 mm respectively). Disease index (D.I.) was expressed as the product of the score for the type of spots and the number of spots. The results represented are average of 12 plants.

Results and Discussion

Six systemic compounds were tested on the germination and germ tube growth of *A. oryzae* following the method as described earlier. It was found that 10 p.p.m vitavax, 50 p.p.m of either aureofungin or MBC, 100 p.p.m of benomyl or kitazin and 200 p.p.m of DDVP completely inhibited spore germination of *A. oryzae* (Table 1). The results were more or less similar when aureofungin, vitavax and DDVP were tested on mycelial growth of the pathogen. But other three compounds *viz.*, benomyl, kitazin and MBC showed different results. The mycelia were found to be more sensitive than the spores to benomyl and MBC because 10 p.p.m benomyl and 5 p.p.m MBC completely inhibited mycelial growth (Table 2). On the other hand, 200 p.p.m kitazin was necessary for total inhibition of mycelial growth while 100 p.p.m inhibited spore germination. The differential responses of mycelia and spores to systemic compounds are not uncommon in other fungi as reported by Clemons and Sisler (1971) and Gottlieb and Kumar (1970).

Table 1. *Effect of different concentrations of fungicides on spore germination and germ tube growth of* Acrocylindrium oryzæ

Systemic compounds	Treatment conc. (p.p.m)	% of germination*	Average germ tube length (μm)**
Benomyl	10	10.86	12.82
	50	3.21	3.20
	100	0	0
	Control***	68.32	28.80
Kitazin	10	39.47	17.55
	50	17.77	5.51
	100	0	0
	Control	60.82	28.50
MBC	1	18.75	12.75
	10	4.86	3.75
	50	0	0
	Control	65.00	30.27
DDVP	10	62.02	30.25
	50	53.33	21.00
	100	25.60	12.00
	200	0	0
	Control	70.20	34.70
Aureofungin	1	42.51	19.50
	10	5.75	4.75
	50	0	0
	Control	68.00	34.80
Vitavax	0.1	17.15	7.05
	1	2.75	1.75
	10	0	0
	Control	67.25	32.20

* 450-500 spores counted/treatment
** 50 germ tubes measured
*** Sterile distilled water.

Table 2. *Effect of different concentration of fungicides on the mycelial growth of* Acrocylindrium oryzæ

Systemic compounds	Treatment conc. (p.p.m)	Dry weight of mycelium (mg.)
Benomyl	0.1	308.33
	1	220.25
	5	42.33
	10	0
	Control**	382.00
Kitazin	0.1	325.66
	1	312.33
	10	291.66
	100	25.00
	200	0
	Control	380.33
MBC	0.1	168.66
	1	77.33
	5	0
	10	0
	Control	382.00
DDVP	10	307.33
	50	224.66
	100	143.00
	200	0
	Control	380.00
Aureofungin	0.1	218.00
	1	154.12
	10	26.00
	50	0
	Control	382.25
Vitavax	0.01	133.20
	0.1	57.00
	1	29.15
	10	0
	Control	384.23

* After 10 days of incubation. 3 replicates/treatment.

** Basal medium (Initial adjusted *p*H 5.6)

Table 3. *Effect of foliar spray of different fungicides on the development of sheath rot disease of rice*

Systemic fungicides	Treatment conc. (p.p.m)	Disease index/plant*					
		CV. Jaya			CV. TN-1		
		7 days	14 days	21 days	7 days	14 days	21 days
	Control**	4.25	5.15	6.75	4.70	5.25	6.85
	1	3.50	3.85	4.80	3.81	4.15	4.95
Benomyl	10	2.15	2.75	3.00	2.53	2.98	3.05
	50	0.85	1.00	1.55	1.04	1.30	1.75
	100	0	0	0	0	0	0
	Control	4.16	5.00	6.50	3.70	4.54	6.15
	1	3.20	3 51	4.25	2.10	2.85	4.05
MBC	10	1.60	2.35	2.72	1.40	1.98	2.17
	50	0	0	0	0	0	0
	100	0	0	0	0	0	0
	Control	4.16	5.00	6.50	3.70	4.54	6.15
	1	2.60	3.08	4.70	1.95	2.38	4.20
Vitavax	10	1.20	1.85	2.00	0.98	1.58	2.25
	50	0	0	0.75	0	0	1.00
	100	0	0	0	0	0	0

* 12 plants/treatment
** Distilled water.

It is clear from this study that the phosphate compounds such as kitazin and DDVP were not as effective in reducing mycelial growth of *A. oryzae* as benzimidazole compounds (benomyl and MBC) and oxathiin compound (vitavax). It was also noted that in presence of sublethal concentration of benzimidazole compounds the conidia produced swollen and disrorted and sometimes branched germ tubes.

On the basis of laboratory screening, 3 compounds (*viz.*, vitavax, MBC and benomyl) were selected for foliar spray under field conditions. The results are given in Table 3. It is evident from the results that MBC at 50 p.p.m concentration is most effective in controlling sheath rot disease. Vitavax may also be used for similar purpose.

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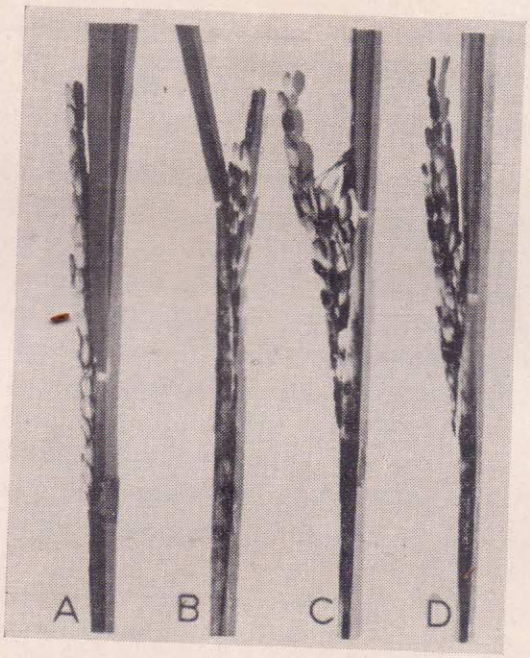
EXPLANATION OF PLATE

Plate I

Fig. A. Healthy leaf sheath of rice.
Figs. B-D. Infected leaf sheath of rice.



On *Acrocylindrium*

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