

PROTECTION OF RICE PLANTS AGAINST *CORTICIUM SASAKII*

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The sheath blight disease of three cultivars of rice plants (namely Jaya, Ratna and Mahsuri) caused by *Corticium sasakii* was studied. Mahsuri cv. was found to be more resistant than the other two cultivars although all the cultivar were susceptible to the disease. However by preinoculating with a mild race of *C. sasakii*, resistance could be induced in all three cultivars against a virulent race of the pathogen.

INTRODUCTION

The sheath blight disease of rice plants caused by *Corticium sasakii* is one of the major diseases of rice in West Bengal. Iboton (1985) has reported that along with local varieties IR 8, IR42 and IR32 are resistant to *C. sasakii*. Manuel *et al.* (1985) have also found that ASD-5 and ASD-11 varieties are resistant to sheath blight in Tamil Nadu. However, all the varieties are found to be susceptible to the disease in West Bengal. From the available literature it has been observed that rice plants could be induced to become resistant against fungal diseases (Sinha and Trivedi, 1969, 1972; Sinha and Das, 1972; Sinha and Bandyopadhyay, 1974; Cartwright *et al.*, 1980; Sinha and Hait, 1982; Cha *et al.*, 1982; Purkayastha *et al.*, 1983), but no work has so far been done with *C. sasakii*. In the present investigation an attempt has been made to induce resistance in rice plants against a virulent race of *C. sasakii* by preinoculating the rice plants by a mild race of the same.

MATERIALS AND METHODS

Two races, one virulent and the other less virulent (mild race) of *C. sasakii* were used. Both the races were isolated from rice plants collected from the field of Rice Research Station, Chinsurah West Bengal. Both the races were grown on PDA medium (50 ml in 250 ml Erlenmeyer flask) and sclerotia of 10-day-old culture were used as inoculum at the rate of two sclerotia per inoculation.

Three cultivars of rice, Ratna, Jaya Mahsuri, were grown in 15 cm earthenware pots in garden soil under a fertility level of 80-40-40 kg ha of NPK. Rice seeds were sterilized by treating in 1% sodium hypochlorite for 5 min followed by several washes

with sterilized distilled water before sowing. After thinning there were only three plants in each pot.

The cultivars were inoculated at panicle bearing stage (Hashioka, 1951) at second leaf sheath from the top (Chien *et al.*, 1969) by inserting two sclerotia in between sheath and stem of each plant with the help of a sterilized forceps. The plants were inoculated with both the races (virulent and mild) and also in one set inoculated with mild race or sterile distilled water 5 days earlier. After inoculation the plants were kept in closed polythene moist chamber for 24h at 25° to 30°C to facilitate infection.

Observations on the disease development were recorded by noting lesion length, vertical and horizontal spread on the 10 day after inoculation following the method of Manian and Manibhusanrao (1980). Results are expressed as mean of 30 plants in each treatment, three in each ten pots.

In order to assess the accumulation of antifungal substance in and around the inoculated areas, each disease spot was excised from its surrounding areas. The samples were pooled, weighed and ground in a mortar and pestle with sand and ethanol. The homogenate was centrifuged and the residue was extracted three times more with fresh ethanol. All experimental supernatants were combined and dried under reduced pressure at 40°C. The residue was dissolved in 40% chloroform in ethanol and used for further experimental uses (Cartwright and Langcake, 1980).

Antifungal bioassays were done in order to determine the antifungal toxicity of host substances in liquid media following the technique described by Skipp and Bailey (1976). A suspension of sclerotia of *C. sasakii* was prepared using the liquid media (Rice extract, Potato dextrose agar, Malt extract) and used for the bioassay studies. Slide bioassays were carried out using water and Czapek-Dox media. All media are sterilized at 121°C for 15 min.

RESULTS

The data in Table 1 showed that protection was evident in all the cultivars of rice plants when the rice plants were preinoculated with mild race 5 days earlier than the challenge inoculation with the virulent race. In this case also protection was manifested more pronouncely in cv. Mahsuri than the other two cultivars.

The data in Table 2 showed that antifungal substances were present in more amount in cv. Mahsuri than the other two cultivars. The accumulation of antifungal substances was more in cv. Mahsuri than the other two cultivars when preinoculated by mild race and subsequently challenged by the virulent race of *C. sasakii*. The presence of these antifungal substances were responsible for the resistant reactions shown by the preinoculated plants.

Table 1: Effect of mild race inoculation on induction of resistance in three cultivars of rice plants to a challenge inoculation with a virulent race of *C. sasakii*

Cultivars	Treatment	Leaf sheath area covered by lesion (%)			
		0-10	10-40	40-7	> 75
Ratna	MR	86	14	0	0
	MR/V	89	11	0	0
	W/W	100	0	0	0
	W/V	0	0	16	84
	V	0	0	2	98
Jaya	MR	78	16	6	0
	MR/V	62	38	0	0
	W/W	100	0	0	0
	W/V	0	3	8	89
	V	0	0	4	96
Mahsuri	MR	64	28	8	0
	MR/V	4	82	12	2
	W/W	100	0	0	0
	W/V	2	4	16	78
	V	0	0	32	68

Mr, Mild race ; V, Virulent race ; W, Water.

Determined after 10 days after the final or second inoculation.

Leaf sheath tissues with > 75% damage usually became dead 9-12 days after the second inoculation.

Table 3. Production of antifungal substances in leaf sheath of rice plants under different treatments

Treatments	Antifungal substances ($\mu\text{g/g}$. fresh tissue) ^a		
	Ratna	Jaya	Mahsuri
Normal	6.10	8.82	17.26
Mild race	20.10	22.12	36.24
Mild race/Virulent race	25.22	26.28	42.26
Water/Water	6.06	8.84	17.28
Water/Virulent race	8.1	10.20	22.16
Virulent race	9.12	10.18	22.20

^a Concentration of μg per g. fresh weight of leaf sheath tissue of rice plants.

Determined after 10 days of second inoculation.

The data in Table 3 clearly indicated that there was profound toxicity effect of the antifungal substances of rice plants on the sclerotial germination of *C. sasakii*. ED_{50} values for the antifungal substances varied from 3.2 to 5.3 $\mu\text{g/ml}$. The minimum concentration causing immediate arrest and disruption of hyphal contents varied from 19.8 to 24.8 $\mu\text{g/ml}$. Such data showed fungistatic characteristics.

Table 3. Toxicity of antifungal substances towards the germination of sclerotia of *C. sasakii* in bioassay media

Bioassay	Media	Antifungal substances	
		ED 50 ^a	MLD ^b
Sclerotial germination	Water	4.9	23.2
	PD	3.2	21.0
	RE	5.3	20.6
	ME	4.4	24.8
Slide	Water	4.9	19.8
	CD	5.1	21.3

RE, Rice extract medium; PD, Potato dextrose medium; ME, Malt extract medium; CD, Czapek-Dox medium.

^a Concentration ($\mu\text{g/ml}$) causing 50% inhibition.

^b Minimum concentration ($\mu\text{g/ml}$) causing immediate arrest and disruption of hyphal contents.

DISCUSSION

In determining the importance of any antifungal substances in disease resistance it is desirable to relate its toxicity *in vitro* and *in vivo*.

The antifungal substances produced in rice plants appeared to be particularly very active as ED₅₀ values are found to vary between 3.2 to 5.3 $\mu\text{g/ml}$ which is quite good in comparison to some of the most active antifungal substances (phytoalexins) known so far. The role of phytoalexins in disease resistance of rice plants has been reported by Cartwright and Langcake (1980) and Cha *et al.*, (1982). The data of the present investigation also found to tally with the previous reports.

It is also clear from the present observations that effective mechanisms of resistance (or induced resistance) may be expressed in rice plants apparently susceptible to *C. sasakii* by eliciting the resistance mechanisms by preinoculation with a mild race of the pathogen. Similar observations have also been reported by Kuc and his coworkers (Kuc and Preisig, 1984; Kuc and Rush, 1985; Bell *et al.*, 1984; Cramer *et al.*, 1985) for other plants and also for rice (Sinha and Bandyopadhyay, 1974; Sinha and Hait, 1982). It is also apparent that some types of resistance may not be determined by the presence or absence of a resistance gene but rather the ability to express the resistance mechanisms quickly. In view of this findings presented here, the study is worthy of further investigation to elucidate the biochemical basis of these induced resistance mechanisms manifested by the three cultivars of rice plants.

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