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Evaluation of some Genotypes of Aromatic (Joha) Rice for its Resistance and Susceptibility against Sheath Rot Disease based on Physiological Parameters

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Abstract—*20 genotypes of aromatic (Joha) rice were screened against sheath rot disease caused by Sarocladium oryzae on the basis of disease rating score (0-9 scale) (IRRI 1996). One genotype from each score was selected to estimate certain physiological parameters viz. Phenol, Total protein, Starch, and Total Soluble sugar (TSS) content by following the standard protocols. With the highest content of phenol and total protein and lowest content of TSS and starch content found in highly resistant cultivar, the results revealed that these physiological parameters are may directly related with resistance and susceptibility of the rice cultivars.*

Keywords*: Aromatic (Joha) rice, Sarocladium oryzae, Physiological parameters*

1. INTRODUCTION

Rice is a predominant staple food for billions of people in the world, covering 9% area of the Earth's arable land. Asia accounts for over 90% of the total rice production in the world, out of which 85% of the rice is directly used for the human consumption, rice can be grown in different environments, bearing different characteristics which makes variety popular in one region of the world than the other. Rice can be short, medium, or long in grain size, some varieties of rice are aromatic, waxy and non waxy with different colour like black, brown, white, purple, and red which are cultivated in India. Among the common rice cultivars of Assam, aromatic rice of this region enjoys top position in popularity. Aromatic rice of Assam is the unique rice under Sali (winter rice) traditionally known as 'Joha'. This class of rice has high demand in domestic market. It is very popular due to its inherent aroma. Despite its low yield potential, this cultivar is grown for its high market and social value and is much in demand for export. The area under Joha rice is however nominal owing to its poor yielding ability. Sheath rot of rice caused by *Sarocladium oryzae* (Sawada) Games and Hawksworth has gained the status of a major disease in rice Reddy and Gosh, (1985) and yield loss varies from 9.6-85% depending on weather condition during the crop growth period Phookan and Hazarika, (1992). This disease was first reported in rice from Taiwan by Sawada (1922) and was subsequently reported from different rice growing ecosystems of world. Agnihothrudu (1973) first time reported this disease from different parts of the country. Based on this information the present investigation was undertaken to identify the resistant genotype/cultivar based on the physiological parameter as a donor gene for the development of HYV against Sheath rot disease of rice.

2. MATERIALS AND METHODS:-

The main aim of the study was to estimate certain physiological parameters viz. Phenol, Total soluble protein, Starch, and Total Soluble sugar (TSS) content that may be responsible for the resistance and susceptibility of the genotypes that were screened against sheath rot of rice.

2.1. Screening of rice genotypes:

Twenty aromatic rice germplasms viz., Badshabhog, Boga Joha, Maniki madhuri, Boga jalsi, Goalporiya Joha I, Govind bhog Joha, Koli Joha, Kon Joha I, Kola Joha I, Kon bogi Joha, Kalgira Joha, Krishna Joha, Kamini Joha, Tulasi Joha, Manipuri Joha, Ronga Joha I, Rampal Joha, Jalsai Joha, Keteki Joha and Bokul Joha were collected from germplasm collection centre, RARS Titabar (Assam) and screened against sheath rot disease. The collected germplasms were sown in field and each genotype was maintained in rows with 20×20 cm spacing and 2 replications were maintained for each genotype. The recommended dose of fertilizer NPK was

applied @ 60:20:40kg/ha and the soil moisture content at 15-30 cm was regularly maintained. The fungus from the axenic culture of isolate was inoculated in the healthy rice plants of different genotypes at booting stage by grain insertion method as described by Estrada *et al.,* (1979). The observation on disease appearance from each entries was recorded by selecting 10 plant tillers were selected randomly and percent disease severity of varietal reactions was calculated and rated on the basis of SES 0-9 scale (IRRI 1996) (Table A.1&2). After screening and one genotype from each score i.e., Keteki Joha from Highly resistant (HR), Koli Joha from Resistant (R), Ronga Joha I from Moderately Resistant (MR), and Krishna Joha from Susceptible (S),(Table 1) were selected for estimation of above mentioned physiological parameters was carried in the dept. of Plant Pathology, Assam Agricultural University, Jorhat.

2.2. Estimation of phenol content

The estimation of total phenol content was done by following the standard protocol given by Singleton (1999). The absorbances of the ethanolic extracts were recorded at 650nm against reagent blank. A standard curve was prepared using different concentrations of catechol and the phenol content was calculated from this curve.

2.3. Estimation of Total Soluble Protein content

The total soluble protein content was estimated by using method of Lowry *et al*., (1951). The absorbance of acetone extract was recorded at 570 nm against reagent blank. Standard curve was prepared with a graded concentration of bovine-serum albumin (BSA) and total protein content was calculated from this curve.

2.4. Estimation of Total Soluble Sugar (TSS) and Starch content

Total soluble sugar was determined according to the method described by Yemm and Willis (1954). The absorbances of the ethanolic extracts were recorded at 630nm against reagent blank. A standard curve was prepared using different concentrations of glucose and the TSS content was calculated from this curve. For starch estimation similar procedure is followed with perchloric acid extraction and the glucose values were multiplied by a factor 0.9 to get starch content. (Table 2)

3. RESULTS AND DISCUSSION:

The experiment revealed that the phenol content was maximum in Keteki Joha (HR) (6.4mg/g dry weight) followed by Koli Joha (R) (5.7mg/g dry weight). Whereas, the minimum phenol content was recorded in Krishna Joha (S) (2.4mg/g dry weight).Similar trend was observed in total soluble protein content where maximum in, Keteki Joha (HR) (9.2mg/g dry weight) and minimum in Krishna Joha (S) (3.7mg/g dry weight). But the maximum TSS and Starch content was found in Krishna Joha (S) (40.2mg/gm and 37.4 mg/g dry weight respectively) and minimum content was present in Keteki Joha (HR) (9.7 mg/g and 29.3 mg/g dry weight respectively). The results conclude that the maximum content of phenol and protein and minimum content of starch and TSS might be responsible for resistance of aromatic rice against Sheath rot disease. The results in accordance with this findings Yashoda *et al*.,(2000). also reported that amount of phenol was high in IET 7564 which is resistance variety against false smut disease of rice, similarly the results was also supported by the findings of Gawande and patil (2004) the finding indicates that the pathogen use more sugar for establishment in the host and decrease the photosynthesis in susceptible genotypes as compared to resistant genotypes, similarly Pathak *et al*.,(2015),also reported that total soluble sugars were lowest in resistant genotypes ML-713 and TM-96-2 while, maximum in highly susceptible genotype ML-5 before and after infection in mung bean genotypes, against powdery mildew. Therefore, it may be concluded that Phenol, Total soluble protein, Starch, and Total Soluble sugar (TSS) and their accumulation pattern may decide the degree of resistance against Sheath rot disease of rice.

Table A, 1): Disease severity Scale *SES* (IRRI, 1996)

Scale	Severity	Reaction
0	No incidence	Immune
1	1 Less than 1%	HR
3	1-5%	R
5	6-25%	MR
7	26-50%	S
9	51-100%	HS

Table A, 2) Scale grade Description

0	No lesion/ spot on flag leaf sheath
1	Spots visible on the tillers upon very careful examination (less than 1% flag leaf sheath area covered).
3	Spots visible on the tillers upon careful examination (1-5% flag leaf sheath area covered).
5	Spots easily visible on the tillers (6-25% flag leaf sheath area covered).
7	Spots present on almost whole the tillers parts (26-50% flag leaf sheath area covered).
9	Spots very common on whole the tillers parts (51-100% flag leaf sheath area covered) death of plants common, reduced severe yield loss.

Table 1: Varietal reactions of aromatic rice varieties against sheath rot disease of rice

Score	Disease reaction	Total	Aromatic Variety
0	**Immune**	**0**	**No**

1	HR	8	Boga jalsi, Boga Joha, Maniki madhuri Joha, Goalporiya Joha I, Bokul Joha, Tulasi Joha, Manipuri Joha ,Keteki Joha
3	R	3	Govind bhog, Kon Joha I, Koli Joha,
5	MR	5	Kola Joha I, Kalgira Joha, Rampal Joha, Ronga Joha I, Kon bogi Joha
7	S	4	Kamini Joha, Badshabhog, Jalsai Joha, Krishna Joha ,
9	HS	0	No

Table 2: Variation in physiological parameters in resistance to susceptible genotypes

Germplasm	Phenol (mg/g dry weight)	Total soluble protein (mg/g dry weight)	Starch (mg/g dry weight)	Total Soluble sugar (mg/g dry weight)
Keteki Joha (HR)	6.4	9.2	9.7	29.3
Koli Joha (R)	5.7	7.6	11.7	30.6
Ronga Joha-I (MR)	4.3	5.3	13.75	32.4
Krishna Joha (S)	2.4	3.7	37.4	40.2

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