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RACE IDENTIFICATION OF PYRICULARIA ORYZAE (MAGNAPORTHE GRISEA) ISOLATES FROM DIFFERENT RICE GROWING AREA OF CHHATTISGARH USING DIFFERENT HOST DIFFERENTIALS

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ABSTRACT
Rice (Oryza sativa L.) is one of the most important cereals of the world and is consumed by 50% of the world population (Luo et al., 1998). Rice blast disease incited by the fungus Pyricularia oryzae is considered as a major limiting factor in the global rice production because of its wide distribution and destructiveness under favourable conditions its cause severe yield losses upto 80-100%.The relativity of P. oryzae isolates were examined that represent the wide collection of races from Chhattisgarh. In pathological variability studies, isolates were evaluated on eight (8) host differentials along with susceptible check HR-12. High variation of virulence was found in isolates on blast differentials. A total of 14 races were detected among 15 isolates. Based on leaf blast severity, P. oryzae isolates were grouped into 14 pathogenic races. The most frequently occurred isolate was IA (10 isolates) followed by IB (2 isolates) and IC, ID, IG (1 isolate).

KEYWORDS: Rice blast, race, host differentials and isolate.

INTRODUCTION

Rice (Oryza sativa L.) is one of the most important staple food that feed more than half of the world's population (Luo et al., 1998).Rice provides 20% of the world's dietary energy supply followed by wheat and maize accounts 19% and 5% respectively. Rice blast is caused by P. oryzae C. [synonym P. grisea (Sacc.) the anamorph of Magnaporthe grisea (Hebert) Yaegashi and Udagawa], a filamentous ascomycetes fungus infecting more than 50 hosts and it is one of the most destructive and wide spread disease (Jia et al., 2000).The disease results in yield loss as high as 70-80% (Ou, 1985).Pathogenic variability in the target production area is a prerequisite for identifying genotypes with a stable resistance to the variable pathogen populations. It is important from an ecological, epidemiological and breeding perspective to know how genetic diversity is maintained and how new, well-adapted complex races arise in the pathogen population. In case of rice blast, there are several site-specific differential sets and an international differential set have been developed (Atkins et al., 1967; Ling and Ou, 1969; Ou, 1972 and Bonman et al., 1986). At present rice blast is distributed approximately in 85 rice growing countries throughout the world. In India it was first reported in Thanjavur delta of Tamil Nadu in 1919 (Padmanabhan, 1965). The disease is also a major problem in major rice growing area of Chhattisgarh. The blast fungus can attack more than fifty other species of grasses. It causes disease at seedling and adult stage on the leaves, nodes and panicles. Rice blast fungus, Pyricularia grisea from two weed hosts Digitaria ciliaris and D. marginata and pathogenicity was confirmed on cross inoculation to rice plants. By inoculating on the international blast differentials the race of weed hosts was found to be identical to the race (IC – 12) which infects rice plant (Srinivas prasad et al., 1998).

1. MATERIAL AND METHODS

Fifteen monosporic cultures of P. oryzae representing different agro-climatic zones of Chhattisgarh were used to study their virulence pattern on eight rice differential hosts and one susceptible (HR-12) as check (Karthikeyan et al., 2013) (Table 1).

2.1 Inoculum preparation and Inoculation

Stored cultures of P. oryzae were revived and multiplied by sub-culturing on OMA medium for sporulation. After 14 days of incubation at 28°C, 15Petri plates (90 mm) of each P. oryzae isolate were washed each with 20 ml of sterile distilled water to produce spore suspension. Mycelium was filtered out with a double-layered muslin cloth. The concentration of the conidial suspension was adjusted to 1×10^5 conidia ml^{-1} using a haemocytometer. Spore suspension was sprayed on 14 days-old-seedlings using a hand operated atomizer. All the inoculated seedlings were incubated at 25°C with >95% RH. Leaf blast reaction of each isolate was recorded 15 DAI using a progressive 0-9 disease scoring scale (IRRI, 1996).

Blast differential lines exhibiting reaction types R were considered as resistant, while those showing reaction types S were considered as susceptible. Isolates were classified into different pathogenic groups using resistance factors.

2. RESULTS AND DISCUSSION

The eight (8) international host differentials were screened against 15 isolates of P. oryzae collected from different agro climatic regions of Chhattisgarh under glasshouse conditions at ICAR-IIRR, Hyderabad to monitor and identify the virulence and races of the pathogens. The host differentials produced a varying degree of reactions ranging from resistant to susceptible for fifteen (15) isolates of the pathogen. Typical blast symptoms were developed on all the susceptible differentials where a sun-inoculated control plants were free from infection. The differentials showed different reactions to the isolates of the pathogen in the 0-9 point scale as shown in the Table 1 and Figure 1 (Materials and Methods) designated by IRRI (1996).

The primary aim of this study was to examine the relativity of a collection of P. oryzae isolates that represent the large collection of races from Chhattisgarh states. Among the fifteen isolates, 15races (IA-48, IA-30, IA-14, ID-16, IA-8, IB-55, IA-46, IC-16, IA-40, IA-64, IG-2, IA-46, IB-32, IA-124 and IA-93) were detected (Table 4.4 and 4.5). Most frequently occurred race was IA (10 isolates) followed by IB (2 isolates) and IC, ID, IG (1 isolate) (Table 2).

The races i.e., IA-48, IA-30 and IA-14 were found in Bastar region, ID-16, IA-8, IB-55, IA-46, IC-16, IA-40, IA-64, IG-2 and IA-124 were found in Dantewada, Narayanpur, Kanker, Dhamtari, Janjgir-Champa, Bilaspur, Gariyabandh, Balrampur and Surajpur, IB-32, IA-93 and IA-46 were found in Surguja district. IA-48, IA-30, IA-14, ID-16 and IA-8 races were found at Bastar Plateau Zone, IB-55, IA-46, IC-16, IA-40 and IA-64 races were found in Chhattisgarh Plains Zone and IG-2, IA-46, IB-32, IA-124 and IA-93 races were found in North Hills Zone. (Table 3).It may be concluded that the races of P. oryzae identified in the present investigation may be virulent, irrespective of their distribution in different geographical locations as evidenced by the occurrence of blast in moderate to severe form in all the selected villages in the Chhattisgarh. Further, frequency of distribution of the race(s) prevalent in particular area was also influenced by the rice variety. Similar observations were made by Correa et al. (1993) who stated that M. grisea expressed its virulence spectrum irrespective of geographical location.

The fifteen isolates were highly aggressive on Raminad Strain-3 and Zenith followed by Usen, Sha-Tiao-Tsao and NP-125. Least aggressive on Kanto followed by Caloro and Dular (Table 2).There was significant variation observed among the races for disease severity. The transition zone comprised of variable races groups IA and IB which may be due to wide host genetic base observed in Bastar Plateau, Chhattisgarh Plains and North Hills Zones.

These results are coincided with the finding of many of the workers (Srinivas prasad et al.,1998; Singha and Maibangsa, 2003;Muralidharanet al., 2004; Karthikeyan et al., 2013 and Tanaka et al., 2016).

3. CONCLUSION

The primary aim of this study was to examine the relativity of P. oryzae isolates that represent the wide collection of races from Chhattisgarh. A total of 15races (IA-48, IA-30, IA-14, ID-16, IA-8, IB-55, IA-46, IC-16, IA-40, IA-64, IG-2, IA-46, IB-32, IA-124 and IA-93) were detected among 15 isolates (Table 4.8 and 4.9). The most frequently occurred isolate was IA (10 isolates) followed by IB (2 isolates) and IC, ID, IG (1 isolate).

4. AKNOWLEDGEMENT

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Table 1. Host differentials in pathogenic variability

S. No.	International host Differentials
1	Raminad str. 3
2	Zenith
3	NP – 125
4	Usen
5	Dular
6	Kanto 51
7	Shia – tiao – tsao
8	Caloro
Susceptible Check	HR-12

Table 2 Disease reaction of Pyricularia oryzae isolates on eight host differentials

S.No.	Isolates	BL-12 Raminad strain-3	BL-13 Zenith	BL-14 NP-125	BL-15 Usen	BL-16 Dular	BL-17 Kanto	BL-18 Sha-tiao-tsao	BL-19 Caloro	Check HR-12	Reaction	Race
1	PO-CG-02	S	S	R	S	R	R	R	R	S	5R:4S	IA-48
2	PO-CG-10	S	S	S	R	R	R	S	R	S	4R:5S	IA-30
3	PO-CG-12	S	S	S	S	R	R	S	R	S	3R:6S	IA-14
4	PO-CG-18	R	R	R	S	R	R	R	R	S	7R:2S	ID-16
5	PO-CG-19	S	S	S	S	S	R	R	R	S	3R:6S	IA-8
6	PO-CG-20	R	S	R	R	S	R	R	S	S	5R:4S	IB-55
7	PO-CG-25	S	S	R	S	R	R	S	R	S	4R:5S	IA-46
8	PO-CG-34	R	R	S	S	R	R	R	R	S	6R:3S	IC-16
9	PO-CG-35	S	S	R	S	S	R	R	R	S	4R:5S	IA-40
10	PO-CG-36	S	S	R	R	R	R	R	R	S	6R:3S	IA-64
11	PO-CG-37	R	R	R	R	R	R	S	R	S	7R:2S	IG-2
12	PO-CG-42	S	S	R	S	R	R	S	R	S	4R:5S	IA-46
13	PO-CG-43	R	S	S	R	R	R	R	R	S	6R:3S	IB-32
14	PO-CG-48	S	R	R	R	R	S	R	R	S	6R:3S	IA-124
15	PO-CG-56	S	R	S	R	R	R	S	S	S	4R:5S	IA-93

Table 3 Races of rice blast fungus P. oryzae prevailing in different agro climatic zones of Chhattisgarh

Agroclimatic Zone	Districts	Isolates	Reaction	Race
ZONE-I	Bastar	**PO-CG-02**	5R:4S	IA-48
		PO-CG-10	4R:5S	IA-30
		PO-CG-12	3R:6S	IA-14

	Dantewada	**PO-CG-18**	7R:2S	ID-16
	Narayanpur	**PO-CG-19**	3R:6S	IA-8
	Kanker	**PO-CG-20**	5R:4S	IB-55
	Dhamtari	**PO-CG-25**	4R:5S	IA-46
ZONE-II	Janjgir-Champa	**PO-CG-34**	6R:3S	IC-16
	Bilaspur	**PO-CG-35**	4R:5S	IA-40
	Gariyabandh	**PO-CG-36**	6R:3S	IA-64
	Balrampur	**PO-CG-37**	7R:2S	IG-2
		PO-CG-42	4R:5S	IA-46
ZONE-III	Surguja	**PO-CG-43**	6R:3S	IB-32
		PO-CG-48	6R:3S	IA-124
		PO-CG-56	4R:5S	IA-93

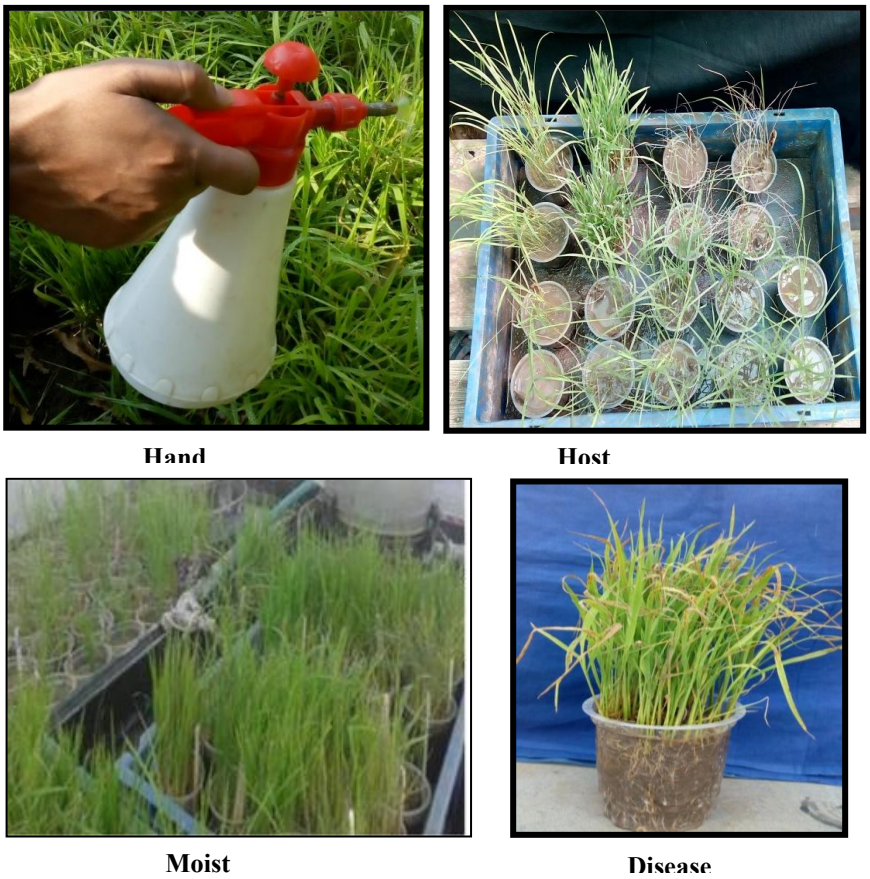


Fig. 1. Variability studies of P. oryzae Isolates on host differentials