Mycopath (2011) 9(1)**:** 9-11

Reaction of rice genotypes to brown spot disease pathogen *Cochliobolus miyabeanus* under drought conditions

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Abstract

Cochliobolus miyabeanus is the causal agent of rice brown spot disease, responsible for significant economic losses. The best way out to overcome the disease is the development of resistant lines. In present studies a set of 31 rice genotypes was evaluated in field against brown spot disease under low water application conditions. The experiment was conducted at National Agricultural Research Centre, Islamabad during 2011. The crop was sown by dibbling in a non-replicated experimental design using the susceptible line as check. The check entry was repeatedly sown after two test entries. The disease data were recorded on 1-9 rating scale. The reaction of various lines to brown spot was quite divergent depending upon the genetic resistant of genotypes. The disease severity ranged from 1 to 9. The susceptible check was badly hit by disease and scored 9. The lines HHZB, IR80416-B-32-3, IR84677-34-1-B and HHZ11-Y6-Y1-Y1 were found to be highly resistant against brown spot by scoring 1. It was interestingly noted that all the late lines did not show any symptoms of disease while all the medium and early maturing lines have shown response against disease. In view of present investigation, it may be suggested that above 4 resistant lines may be brought forward and involved in rice breeding program for development of brown spot resistant lines.
Keywords: Brown spot disease, *Cochliobolus miyabeanus*, rice.

Introduction

Rice (*Oryza sativa* L.) is most important cereal crop of Pakistan, which is extensively cultivated in Punjab, Sindh, some parts of Balochistan and Khyber Pakhtoon Khaw provinces. Besides, other factors the diseases are considered as major barriers for higher productivity of rice. The brown spot disease of rice caused by *Cochliobolus miyabeanus* is severe problem of rice under dry conditions. Pathogen of rice brown spot feeds on the rice and many other field crops causing severe losses in fodder and grain yield. In rice the pathogen infects the coleoptiles (causes blighting), leaves (with oval, dark brown to purplish-brown spots) and rigorous damages the photosynthetic activities and ultimately kills the leaf. It has been documented that rice cultivation under aerobic conditions resulted in 27.5% yield reduction over flooded rice due to brown spot disease (Patel *et al.,* 2010).

The severity of brown spot disease can be managed through development of resistant lines (Mew *et al*., 1991; Bonman *et al.,* 1991). The economic analysis suggests that modern varieties with disease resistance contribute 7% to 10% yield gain in rice production (Evenson *et al.,* 1998). The screening of aerobic rice for disease resistant lines under irrigated conditions may be misleading as the disease sternness is not hostile and belligerent under such conditions. Therefore, the rice germ plasm must be screened under drought conditions especially for brown spot disease which is harsher under aerobic conditions.

Savary *et al*. (2000) conducted field survey and reported that among many diseases occurring in rice fields, sheath blight and brown spot account for the highest yield losses. Hossain and Kulkarni (2001) screened, 265 germ plasms accession of rice against *Pyricularia oryzae* based on the reaction of entries. They identified eight genotypes possessing resistant to leaf blast, 18 genotypes resistant to neck blast, 138 genotypes were moderately resistant to leaf blast and 82 genotypes moderately resistant to neck blast. Saha (2004) reported that rice line HR-12 showed susceptibility to *P. oryzae*, whereas line Rasi and IR-64 exhibited resistant and moderately resistant reaction against blast disease, respectively. Prevalence of resistance against rice blast pathogen is more common in coarse as compared to fine germ plasm lines of rice (Ghazanfar *et al*., 2009). The present studies was therefore, designed on 31 rice genotypes to be evaluated against brown spot disease of rice under low water application environment.

Materials and Methods

The experiment was conducted at National Agricultural Research Centre, Islamabad. Pakistan. Thirty one diversified exotic lines of rice

received from IRRI, Philippine, were evaluated against brown spot disease under rainfed conditions. The trial was conducted in a non-replicated (augmented) design. The crop was sown through dibbling (three seeds per hill during June, 2011). Each entry was planted in three rows plot measuring 6 meters in length. IR83140-B-28-B the susceptible lines were frequently planted after two test entries as check for comparison. Row to row and plant to plant spacing was 20 cm. The crop was maintained under low water application conditions. All other cultural practices like weeding, irrigation and application of pesticides etc were carried out uniformly in all the treatments. The weedicide clover was used to control the weeds in experiment. During initial 30 days, the crop was kept under well irrigated conditions to have good crop stand. After one month the crop was either given light irrigation to keep the soil wet and/or suspended the irrigation during rainy days. The disease data were recorded on 1-9 rating scale at panicle completion stage following the standard procedure (Table 1).

Table 1: The Standard procedure adopted for recording Brown Spot disease in rice.

Score	Category	Symptom on Brown Spot disease
1	Highly resistant	0% Plant infested
3	Resistant	6-10% Plant infested
5	Moderately resistant	21-40% Plant infested
7	Susceptible	61-80% Plant infested
9	Highly susceptible	100% plant infested

Results and Discussion

The data regarding the reaction of various rice genotypes against brown spot disease are given in Table 2. The results revealed that disease severity ranged from 1 to 9 on rating scale. Among various lines, ten lines scored 1 and showed no or less than 5% disease symptoms.

It was interestingly noted that all the late maturing lines have shown resistance against brown spot. The lines i.e. SACG-7, JH-15-1-1-1, HUA565, WEED TOLERANT and HHZ5-SAL9-Y3-Y1 were late in flowering as well as in maturity. The lines HHZB-SAL9-DTI-Y1, IR80416-B-32-3, IR84677-51-1-B and HHZ-5-SAL9-Y3-Y1 were highly resistant in true sense as they showed normal maturity. Fourteen lines were found resistant against the disease as they scored 3. Among these fourteen lines HUA564, IR84675-7-3-2-B-B and HHZ11-SAL6-Y1-Y1 were again late and showed resistance against the disease. The leaves of all the late lines remained green with no disease sign on them. The proper resistance against *C. miyabeanus* was shown by the lines, HZSSAL-10-DTI-DTI, IR83140-B-11-B, HHZ-HY-11-Y3-DTI, IR785-97-56-1-2, RSP-2, IR83142-B-49-B, HHZ5-Y3-SAL3-DTI, RSP-1, IR84678-25-5-B and IR84677-51-1-B. The results further revealed that five lines namely, IR77080-834-1-1, IR83140-B-36-B, IR83142-B-36-B, IR83142-B-21-B and HHZ9-DTI-SAL-2-DTI have shown moderately resistance. One line IR83140-B-32-B susceptible and two lines (including check) remained highly susceptible against the brown spot disease. Mayee and Datar (1986) categorized the rice germ plasm in to different categories depending upon the reaction to *P. oryzae.* They observed eight genotypes resistant to leaf blast by recording 1 grade, 18 genotypes resistant to neck blast, 138 genotypes moderately resistant to leaf blast and 82 genotypes moderately resistant to neck blast. Similar studies were conducted earlier by various workers and wide variation in response of genotypes against *P. oryzae* has been observed (Castano *et al.*, 1990; Nagaraju *et al.*, 1991). Saha (2004) reported that line HR-12 showed susceptibility to *P. oryzae* and IR-64 exhibited moderately resistant and Rasi exhibited resistant reaction as observed in the present study. Patil *et al.* (2010) reported that yield losses depend on the host plant resistance, pathogenic variability and environmental conditions. They further concluded that aerobic rice causes 27.5% reduction in yield over flooded rice due to high disease incidence. They further suggested that brown spot disease can be managed through development of resistant lines.

Hossain and Kulkarni (2001) and Castano *et al.* (1990) have also reported variability in rice germ plasm in response to various diseases. They also categorized rice germ into different groups ranging from highly susceptible to highly resistant against various rice diseases. Saifullah *et al.* (1991) and Nagaraju *et al.* (1991) have also showed significant variability in rice genotypes against diseases.

In the present investigations, the lines showing resistance against brown spot disease can be utilized as a source of resistance for breeding disease resistant lines of rice. Moreover, the late genotypes besides producing lower yields have also confusing behaviour due to ambiguous response against diseases.

It is, therefore, also recommended that late maturing genotypes must be exposed to moisture stress at preflowering stage to create conducive conditions for disease development and spread for proper screening against brown spot disease of rice.

Table 2: Reaction of various rice genotypes against ***Cochliobolus miyabeanus)*.**

Designation	Disease reaction on 1-9 rating scale.	Days to Maturity	Designation	Disease reaction on 1-9 rating scale.	Days to Maturity
IR77080-834-1-1	5	126	RSP-1	3	120
IR83140-B-28-B	9	120	HHZ9-DTI-SAL-2-DTI	5	124
IR83142-B-8-8-B	9	122	IR83-141-B-18-B	3	122
HHZSSAL-10-DTI-DTI	3	123	HUA564	3 (Late)	125
IR83140-B-11-B	3	123	SACG-7	1 (Late)	126
IR83140-B-32-B	7	121	JH-15-1-1-1	1(Late)	126
HHZB-SAL9-DTI-Y1	1	120	HUA565	1 (Late)	126
IR83140-B-36-B	5	123	WEED TOLERANT	1(Late)	125
IR83142-B-36-B	5	121	IR84677-51-1-B	1	124
IR83142-B-21-B	5	120	HHZ-5-SAL9-Y3-Y1	1	123
HHZ-HY-11-Y3-DTI	3 (Late)	124	IR84678-25-5-B	3	120
IR785-97-56-1-2	3 (Late)	125	IR84677-51-1-B	3	124
IR80416-B-32-3	1	124	HHZ5-SAL9-Y3-Y1	1(Late)	130
RSP-2	1 (Late)	140	IR84675-7-3-2-B-B	3 (Late)	123
IR83142-B-49-B	3	121	HHZ11-SAL6-Y1-Y1	3 (Late)	131
HHZ5-Y3-SAL3-DTI	3	123			

References

Azzam O, Chancellor TCB, (2002). The biology, epidemiology, and management of rice tungro disease in Asia. *Plant Dis*., **86**: 88-100

Bonman JM, Estrada BA, Kim CK, Ra CK, Lee EJ, (1991). Assessment of blast disease and yield losses in susceptible and partial resistant rice cultivars in two irrigated and low land environments. *Plant Dis*., **75**: 462-466.

Castano JB, Amril D, Syahril, Zaini Z, (1990). Upland rice genotypes resistant to blast disease in west Sumatra. *Int. Rice Res. News lett*., **15**: 11-12.

Chen HS, Wang, Ahang Q, (2002). New gene for bacterial blight resistance in rice locatedon chromosome 12 identified from Minghui 63, an elite restorer line. *Phytopath*., **92**: 750-754.

Evenson RE, (1998). The economic value of genetic improvement in rice. In: Dowling NG, Greenfield SM, Fischer KS (eds). Sustainability of Rice in the Global Food System. Manila: International Rice Research Institute. 303-320 pp.

Ghazanfar MU, Habib A, Sahi ST, (2009). Screening of rice germ plasm against Pyricularia oryza the cause of rice Blast disease. *Pak. J. Phytopath.*, **21**: 41-44.

Hossain MM, Kulkarni S, (2001). Field evaluation of fungicides, neem based formulations and biological agents against blast of rice. *J. Maharashtra. Agric. Univ*., **26**: 148-150.

Mew TW, (1991). Disease management in rice. CRC Handbook of Pest Management. 2nd Ed.Vol. III. D. Pimentel and A. A. Hanson, eds. CRC Press, Boca Raton. 279-299 pp.

Mayee CD, Datar VV, (1986), Phytopathometry, Marathawada Agric. Uni. Parbhani, 26-27 p.

Nagaraju VHC, Devaiah BM, Seshadri VS, Naidu BS, (1991). Evaluation of rice genotypes for blast and sheath rot resistance in hilly regions of Karnataka. *Mysore J. Agric. Sci*., **25**: 139-141.

Ogawa T, Yamamoto T, Khush GS, Mew TW, (1991). Breeding of near-isogenic lines of rice with single genes for resistance to bacterial blight pathogen (Xanthomonas campestris pv. oryzae). *Jap. J. Bree*., **41**: 523-529.

Patel DP, Das A, Munda GC, Ghosh PK, Bordoloi JS, Kumar M, (2010). Evaluation of yield and physiological attributes of high-yielding rice varieties under aerobic and flood-irrigated management practices in mid-hills ecosystem. *Agric. Water Manage.*, **97**: 1269-1276.

Saha S, 2004, Behaviour of rice varieties against leaf blast disease in rainfed upland conditions of West Bengal. *J. Mycol. Pathol. Res*., **42**: 205-206.

Savary S, Willocquet L, Elazegui FA, Castilla NP, Teng PS, (2000). Rice pest constraints in tropical Asia: Quantification of yield losses due to rice pests in a range of production situations. *Plant Dis*., **84**: 357-369.